A GUIDE TO MATHEMATICS

(U.C.E) 1990 – 2019

MODEL PAPERS

U.C.E QUESTIONS

AND

ANSWERS

MATHEMATICAL TABLES

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CONTENTS

UNIT 1

1.1 Number system

a). Natural numbers

$N = \{1, 2, 3\ldots\}$

b). Whole numbers:

The set of whole numbers = $\{0, 1, 2\ldots\}$

c). Integers:

$Z = \{\ldots\ldots\ldots, -2, -1, 0, 1, 2 \ldots\}$

d. Positive integers:

$Z^+ = \{1, 2, 3 \ldots\}$

e. Negative integers:

$Z^- = \{\ldots\ldots., -3, -2, -1\}$

f. Even numbers:

The set of even numbers = $\{2, 4, 6, \ldots\ldots\}$

g. Odd numbers:

The set of odd numbers = $\{1, 3, 5, \ldots.\}$

h. Prime numbers:

The set of prime numbers = $\{2, 3, 5, \ldots\ldots\}$

i. Rational numbers:

The set of rational numbers =

ARITHMETIC

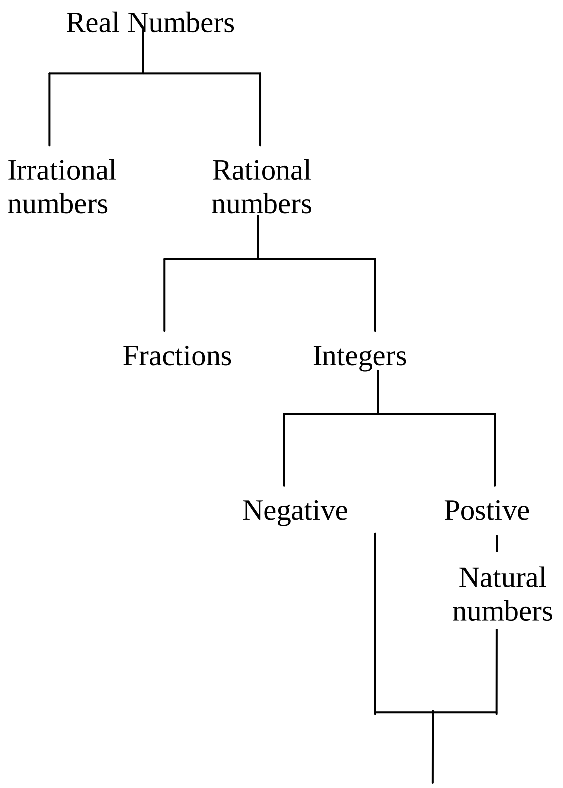
$$Q = \{\frac{a}{b}, a, b \in Z, b \neq 0\}$$

Some examples of rational numbers are $\frac{3}{2}, \frac{1}{2}, 4\frac{2}{5}$ and $\frac{6}{1}$. These numbers can be expressed in form $\frac{a}{b}$, where a and b are integers and $b \neq 0$.

j. Irrational numbers:

An irrational number cannot be expressed in the form of $\frac{a}{b}$, where a and b are integers and $b \neq 0$. It is a non recurring infinite decimal whose value cannot be found exactly. $\sqrt{2}$, $\sqrt{5}$ and π are examples of irrational numbers.

k. Real numbers:



All the numbers described above are real numbers.

1.2 Factor

A factor is any one of two or more whole numbers which are multiplied together to form a product.

e.g. 1, 2, 3, and 5 are factors of 30.

2, x, y and z factors of 2xyz.

1.3 Vulgar and decimal fraction

A Vulgar fraction is simple fraction with integer numerator and denominator. A vulgar fraction of $0.25 = \frac{25}{100} = \frac{1}{4}$.

A decimal fraction is a fraction expressed in tenths, hundredths and so on. A decimal fraction of $\frac{3}{5}$ = 0.6.

1.4 Ratio:

a. The relation in quality between two or more quantities of the same kind and in the same units can be expressed as a ratio.
b. A ratio of a to b can also be written as
(i) a : b
(ii) $\frac{a}{b}$, where $b \neq 0$ and $a, b \in Z^+$.
(c). A ratio has no units.

1.5 Percentage

(a).. A percentage is a fraction with a denominator of 100. *X* percent. Written as x % is equal to $\frac{x}{100}$.
(b). Multiply a fraction by 100% to convert it to a percentage. $\frac{3}{4}$ is equivalent to

$$\frac{3}{4} \times 100\% = 75\%$$

(c). Percentage profit $= \frac{\text{profit}}{\text{cost price}} \times 100\%$

d. Percentage loss $= \frac{\text{loss}}{\text{cost price}} \times 100\%$

e. Percentage discount

$$= \frac{\text{usual price} - \text{selling price}}{\text{usual price}} \times 100\%$$

1.6 Direct and inverse proportion

a. Two qualities are directly proportional to each other if the increase or decrease of one quality will yield proportional increase or decrease respectively. E.g. Increase in water pressure as divers venture deeper into the ocean.
b. Two qualities are inversely proportional to each other when it is proportional to the reciprocals of the second quantity
E.g. More labourers reduce the time required to complete a construction project.

1.7 Square roots and reciprocals

a. Square of x $= x^2$
b. Square root of x $= \sqrt{x}$.
(c). (i) Reciprocal of x $= \frac{1}{x}$.
(ii) Reciprocal of $\frac{x}{y} = \frac{y}{x}$

1.8 Approximation and estimation of error

a. Approximation

The precision or accuracy of a number is indicated by the number of significant figures.
(i) All non-zero digits are significant. E.g. 345.2 (4 significant figures)
(ii) Zeros between non – zero digits are significant. E.g. 60.05 (4 significant figures.
(iii) In a decimal, zeros before the first non-zero digit are not significant whereas zeros after, are significant e.g 0.023 (2 significant figures)
(iv) In a whole number, the final zeros may or may not be significant; it depends on how the estimation is made.
b. Estimation of error
(i) Errors in a calculation can be minimized using the estimation method.
e.g. Estimate, correct to two significant figures, the value of $30.02 \times 19.99 - 78.23$

$$= 30.0 \times 20.0 - 78.2$$
$$= 521.8$$
$$= 520$$

(ii) Error is the difference between the true value and the measured value.

(iii) Percentage error $= \frac{\text{error}}{\text{true value}} \times 100\%$

1.9 Greatest and smallest values

If $a \leq x \leq b$ and $c \leq y \leq d$ where $a, b, c, d \in R^+$, then $x_{min} = a$, $x_{max} = b$, $y_{min} = c$ and $y_{max} = d$.

(i) $(x + y)_{max} = x_{max} + y_{max}$
$(x + y)_{min} = x_{min} + y_{min}$
(ii) $(x - y)_{max} = x_{max} - y_{min}$
$(x - y)_{min} = x_{min} - y_{max}$
(iii) $(xy)_{max} = x_{max} \times y_{max}$
$(xy)_{min} = x_{min} \times y_{min}$
(iv) $\left(\frac{x}{y}\right)_{max} = \frac{x_{max}}{y_{min}}$
$\left(\frac{x}{y}\right)_{min} = \frac{x_{min}}{y_{max}}$

1.10 Decimal places:

To correct a number to *n* decimal places, the digit in the $(n + 1)^{th}$ decimal place must be considered.
(i) If it is greater than or equal to 5, add 1 to the digit in the n^{th} decimal place e.g. 0.365 = 0.37 (correct to 2 decimal places)
(ii) If it is less than 5, just write the number up to the n^{th} decimal place.
e.g. 4.234 = 4.23 (correct to two decimal places)

1.11Standard form (scientific notation):

A number expressed in the form A x 10^n, where $1 \leq A \leq 10$ and n is an integer, is in the standard form.
e.g. 2700 = 2.7 x 10^3.

1.12 Scales and maps:

The linear scale 1 ……. n for a map means that a distance of 1 cm in the map represents an actual distance of n cm on the ground. The area scale for a map with linear scale 1 : n is given by 1^2 ….. n^2.

1.13 Profit and loss

a. Profit = selling price – cost price
b. Loss = Cost price – selling price
c. Selling price = cost price + profit
= List price – discount

1.14 Simple interest and compound interest

a. **Simple interest**

The interest (I a principal (P) at an interest rate R% per annum for a period of T years in given as

$$I = \frac{PRT}{100}$$

b. **Compound interest**

If the interest earned after a certain period is added to the old principal to become the new principal for the next period of time, this new interest earned is termed compound interest.

1.15 Money

Singapore \$ 1 = 100 cents
(S\$1 = 100cts)
British £ 1 = 100 pence
(1 = 100p)

1.16 Mass:

1kg = 1000g
1g = 1000mg
1 tonne = 1000kg

1.17 Length:

1m = 100cm
1km = 1000m

1.18 Area

$1m^2 = 100^2cm^2 = 1000cm^2$
$1km^2 = 1000^2m^2 = 1000000cm^2$
$1 \text{ hectare} = 100^2m^2 = 10000m^2$
$1km^2 = 1000m = 1000cm^2$

1.19 Volume

$1m^3 = 100^3cm^3 = 1000000cm^3$
$1km^3 = 1000^3m^3 = 1000000000m^3$
$1 \text{ litre} = 1000m\ell = 1000cm^3$

1.20 Density

The density of a substance is the mass per unit volume of the substance.

$$\text{Density} = \frac{\text{mass}}{\text{volume}}$$

The units of density are g/cm^3 and kg/m^3.

1.21 The Celsius (Centigrade) scale of temperature

Formula for converting Fahrenheit into Centigrade: $C = \frac{5}{9}(F - 32^o)$

Formula for converting Centigrade into Fahrenheit:

$F = \frac{9}{5}C + 32^o$

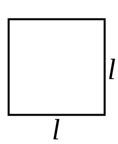
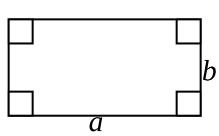
1.22 Speed

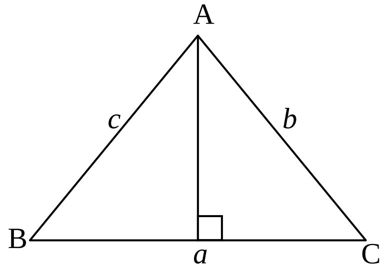
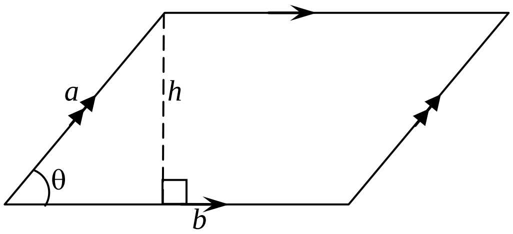
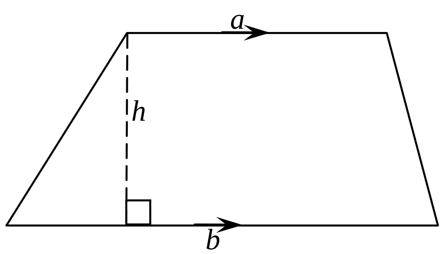
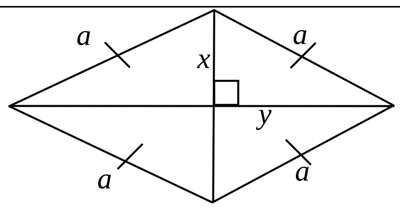
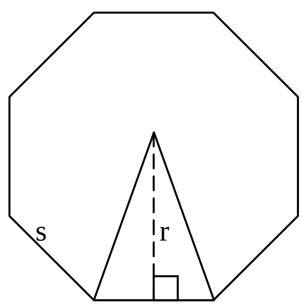
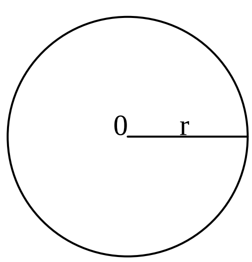
(a). Speed $= \frac{\text{distance}}{\text{time}}$

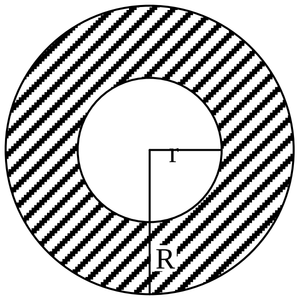
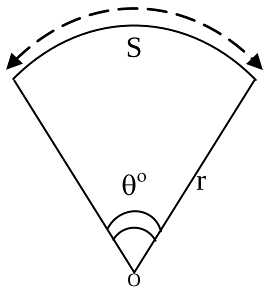
(b). Average speed $= \frac{\text{total distance travelled}}{\text{total in time taken}}$

UNIT 2
MENSURATION

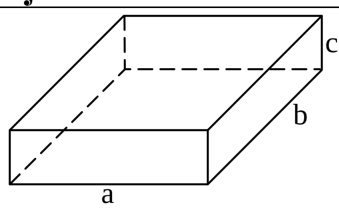
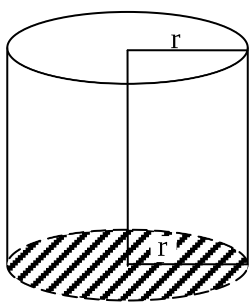
2.1 Mensuration of plane figures

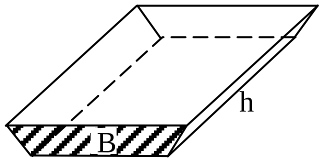
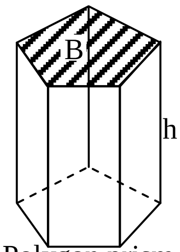
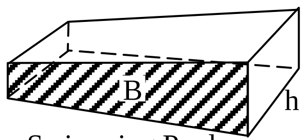
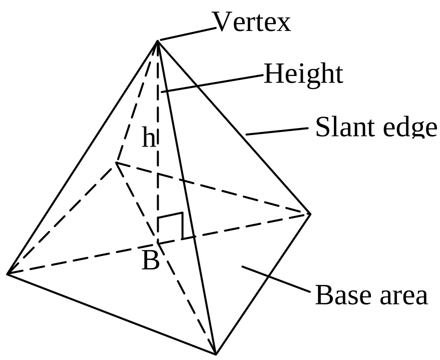
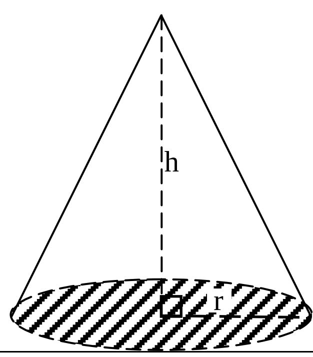
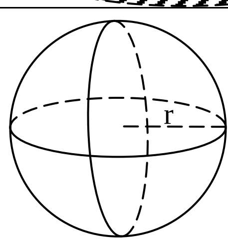
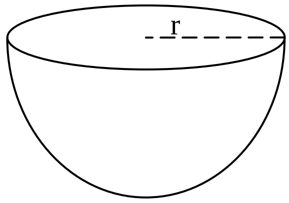
Figure	Diagram	Formula
Square		Area $= l^2$ Perimeter $= 4l$
Rectangle		Area $= a \times b$ Perimeter $= 2(a + b)$
		Area $= \frac{1}{2} a \times h$ Area $= \sqrt{s(s-a)(s-b)(s-c)}$

<table>
<tr><td>Triangle</td><td></td><td>Where s $= \frac{1}{2}(a+b+c)$
Area $= \frac{1}{2}$ a × b × c × sinC
$= \frac{1}{2}$ b × c × sinB
$= \frac{1}{2}$ b × c × sinA
Perimeter = (a + b + c)
= 2s</td></tr>
<tr><td>Parallelogram</td><td></td><td>Area = b × h
= a × b × sin θ
Perimeter = $2(a + b)$</td></tr>
<tr><td>Trapezium</td><td></td><td>Area $= \frac{1}{2}(b + c) \times h$</td></tr>
<tr><td>Rhombus</td><td></td><td>Area = $\frac{1}{2} x \times y$, where x and y are the diagonals
Perimeter = 4a</td></tr>
<tr><td>Regular Polygon</td><td></td><td>Area = $\frac{1}{2}$ × perimeter × apothem
= $\frac{1}{2}$ × p × r
= $\frac{1}{2}$ n × s × r where n is the number of sides and s is the length of a side</td></tr>
<tr><td>Circle</td><td></td><td>Area = πr^2
Circumference = $2\pi r$</td></tr>
</table>

Annulus		Area $= \pi R^2 - \pi r^2$ $= \pi(R^2 - r^2)$
Sector		Arc length s $= \dfrac{\theta}{360^0} \times 2\pi r^2$ Area $= \dfrac{\theta}{360^0} \times \pi r^2$ $= \dfrac{1}{2} r \times s$ Perimeter $= \dfrac{\theta}{360^0} \times 2\pi r + 2r$

2.2 Mensuration of solid objects.

Cuboid		Volume = $a \times b \times c$ Area $= 2(a \times b + b \times c + a \times c)$
Cylinder		Volume $= \pi r^2 \times h$ Curved surface $= 2\pi r \times h$ Area $= 2\pi r \times h + 2\pi r \times h$ $= 2\pi r\ (h + r^2)$

Prism	 Trench  Polygon prism  Swimming Pool	Volume = area of cross-section × length = B × h
Pyramid	 	Volume = $\frac{1}{3}$ B × h
Cone	 	Volume = $\frac{1}{3}\pi r^2 \times h$ Curved surface = $\pi r \times \ell$ Area = $\pi r \times \ell + \pi r^2$ = $pr(l + r)$
Sphere	 	Volume = $\frac{4}{3}\pi r^3$ Area = $4\pi r^2$
Hemisphere	 	Volume = $\frac{2}{3}\pi r^3$ Curved surface = $2\pi r^2$ Area = $3r^2$

UNIT 3.
ALGEBRA

3.1 Indices

Rule 1: $a^m \times a^n = a^{m+n}$

Rule 2: $\dfrac{a^m}{a^n} = a^{m-n}$

Rule 3: $(a^m)^n = a^{m \times n}$

Rule 4: $a^m \times b^m = (a \times b)^m$

Rule 5: $\dfrac{a^m}{a^m} = \left(\dfrac{a}{b}\right)^m$

Rule 6: $a^{-m} = \dfrac{1}{a^m}$

Rule 7: $a^o = 1$

Rule 8: $a^{\frac{1}{m}} = \sqrt[m]{a}$

Rule 9: $a^{\frac{m}{n}} = \sqrt[n]{a^m}$

3.2 Factorization

a. By finding common factors

e.g Factorise $4xy + 2xz$

$4xy + 2xz = 2x(2y + z)$

[2x is the common expression in the two terms]

b. By regrouping the terms

e.g Factorise

$x^2 - xy - 2x + 2y$

$x^2 - xy - 2x + 2y = x(x - y) - 2(x - y)$

$= (x - 2)(x - y)$

c. By using some useful algebraic identities

$a^2 + 2ab + b^2 = (a + b)^2$

e.g $x^2 + 6xy + 9y^2 = (x + 3y)^2$

$a^2 - 2ab + b^2 = (a - b)^2$

e.g $25x^2 - 10xy + y^2 = (5x - y)^2$

$a^2 - b^2 = (a - b)(a + b)$

e.g $4x^2 - 9y^2$

$= (2x - 3y)(2x + 3y)$

d. By inspection

e.g Factorize $3x^2 + 4x + 1$

$3x^2 + 4x + 1 = (3x + 1)(x + 1)$

3.3 Solving quadratic equations

a. By factorization

e.g. Solve the equation

$x^2 - 17x + 72 = 0$

$x^2 - 17x + 72 = 0$

$(x - 8)(x - 9) = 0$

$(x - 8)$ or $(x - 9) = 0$

$x = 8$ or $x = 9$

b. By the Quadratic Formula

The general quadratic equation is $ax^2 + bx + c = 0$.

Its solution is given by the formula;

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

e.g Solve the equation

$2x^2 + 5x - 3 = 0$

$a = 2, b = 5, c = -3$

$$x = \frac{-5 \pm \sqrt{5^2 - 4 \times 2 \times (-3)}}{2 \times 2}$$

$$= \frac{-5 \pm \sqrt{49}}{4}$$

$= -3$ or 0.5

c. **By completing the square**

The following are the steps involved in solving the quadratic equation

$ax^2 + bx + c = 0$

(i) Divide the whole equation by *a* to make the coefficient of x^2 one.

(ii) Transfer the constant term $\frac{c}{a}$ to the right – hand side of the equation.

(iii) Halve the coefficient of x and add the square of the result to both sides of the equation.

(iv) Take the square roots both sides.

(v) Solve the value of x

e.g. Solve the equation

$2x^2 + 5x + 3 = 0$

$2x^2 + 5x + 3 = 0$

$$x^2 + \frac{5x}{2} + \frac{3}{2} = 0$$

$$x^2 + \frac{5x}{2} = -\frac{3}{2}$$

$$x^2 + \frac{5x}{2} + \left(\frac{5}{4}\right)^2 = -\frac{3}{2} + \left(\frac{5}{4}\right)^2$$

$$\left(x + \frac{5}{4}\right)^2 = \frac{1}{16}$$

$$x + \frac{5}{4} = \pm\frac{1}{4}$$

$x = -1$ or $x = -1\frac{1}{2}$

3.4 Solving simultaneous equations

a. By elimination method

e.g Solve the simultaneous equations

$3x + 2y = 10$ (1)

$2x - y = 2$ (2)

(1) + 2 x (2)

$3x + 2y + 4x - 2y = 10 + 4$

$7x = 14$

$\therefore x = 2$

b. **By substitution method**

e.g Solve the simultaneous equations

$3x + 2y = 10 \quad (1)$

$2x - y = 2 \quad (2)$

Rearrange (2):

$y = 2x - 2 \quad (2a)$

Substitute (2a) into (1):

$3x + 2(2x - 2) = 10$

$3x + 4x - 4 = 10$

$7x = 14$

$\therefore x = 2$

Substitute x = 2 into (2a)

$y = 2(2) - 2$

$\therefore \underline{y = 2}$

3.5 Solving linear inequalities

(a). Properties of

(i) If $x > y$ and $y > z$, then $x > z$.

(ii) If $x > y$ and a is any number, then $x + a > y + a$ or $x - a > y - a$

(iii) If $x - y$ and $a > 0$, then $ax > ay$ or $\frac{x}{a} < \frac{x}{a}$

[Note: when both sides of the inequality is multiplied or divided by a negative number. The sign of the inequality has to be reversed.]

b. Inequalities are solved the same way as equations except for the point mentioned in part (iv).

3.6 Changing the subject of a formula

The subject of a formula is the variable which is written explicitly in terms of other variables. e.g Make *x* the subject of the formula

$\frac{1}{x} + \frac{2}{y} = 5$

$\frac{y+2x}{xy} = 5$

$y + 2x = 5xy$

$5xy - 2x = y$

$x(5y - 2) = y$

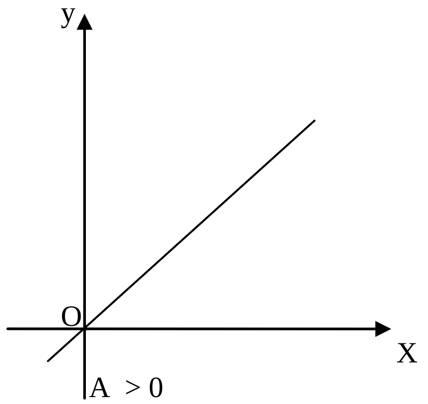
$x = \frac{y}{5y-2}$

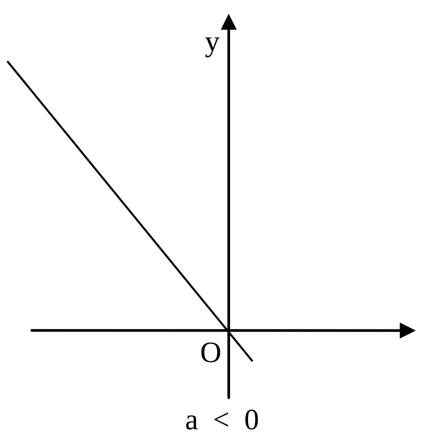
UNIT 4
GRAPHS

4.1 General curves

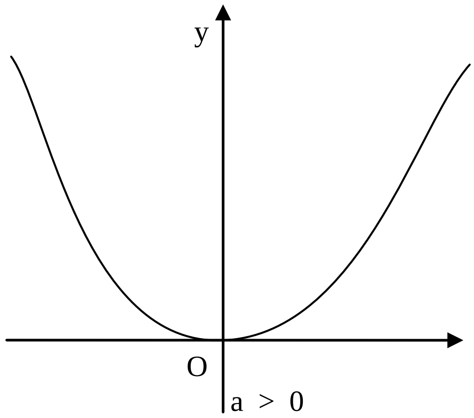
The following are graphs of $y = ax^{-n}$, where *a* is a constant and n = ± 1, ± 2 and ± 3.

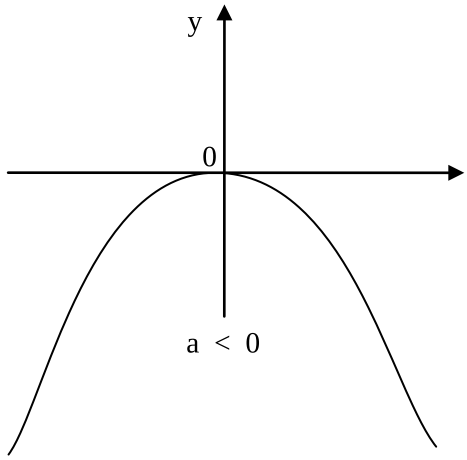
Graphs of y = *ax*



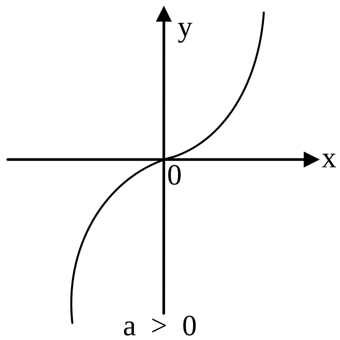


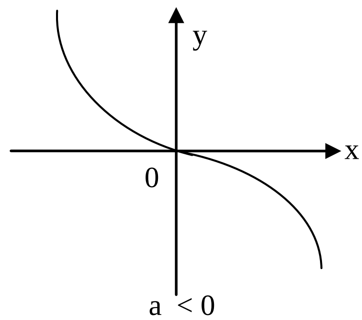
Graphs of $y = ax^2$



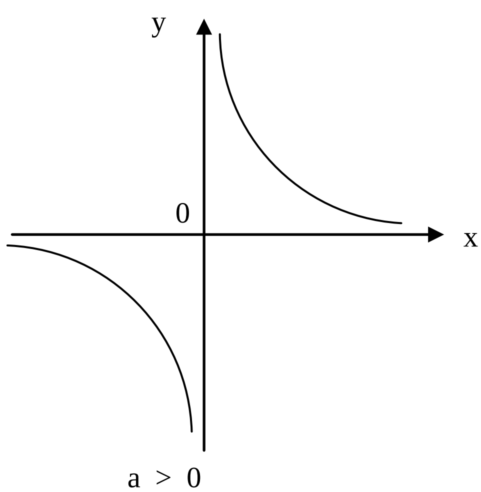


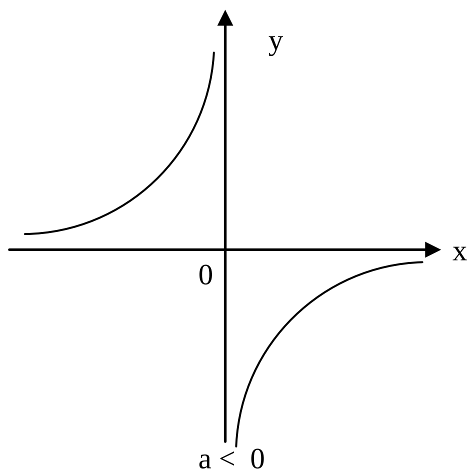
Graphs of $y = ax^3$



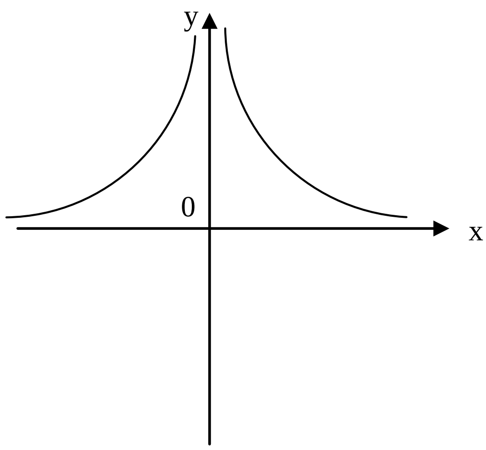


Graphs of $y = \dfrac{a}{x}$

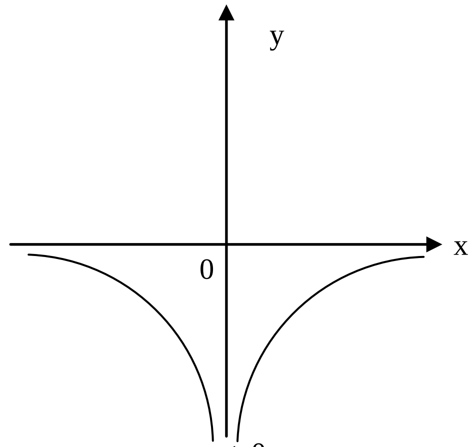




Graphs of $y = \dfrac{a}{x^2}$



a > 0



a < 0

4.2 Graphical solution of equations

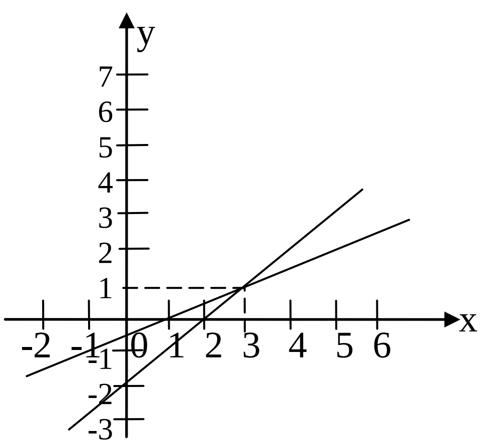
The solution of any pair of simultaneous equations can be read from the graphs of the equations at the point(s) of intersection.

a. Simultaneous linear equations

e.g. Solve the simultaneous equations

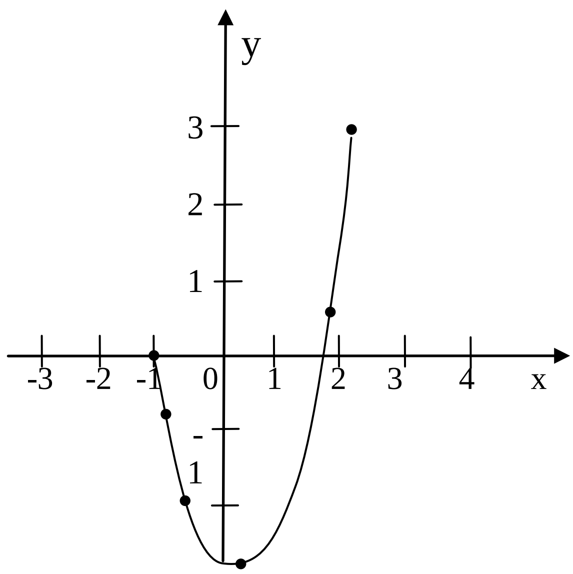
$y = x - 2$ and $y = \frac{1}{2}x - \frac{1}{2}$

Graphically. The intersection point, (3, 1), is the solution, giving $x = 3$, $y = 1$.



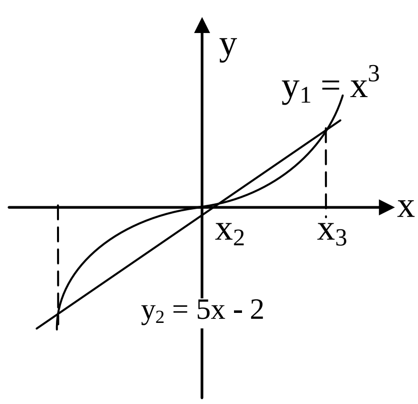
b. Quadratic equations

e.g. Given the curve $y = 2x^2 - x - 3$, solve $2x^2 - x - 3 = 0$. The solution is at the points of intersection between the curves and the x-axis.



c. Cubic equations

e.g. Given the curve $y = x^3$ and the straight line $y = 5x - 2$, solve $x^3 - 5x + 2 = 0$. The solution is at the points of intersection.



4.3 Simple directand inverse variation :

a. Direct variation

$y \alpha x$ is read as "y varies as x" or " y varies directly as x" or "y is proportional to x". An equation $y = kx$ can be formed where k is a constant.

b. Inverse variation

$y \;\alpha\; \frac{1}{x}$ is read as "y varies inversely as x" or "y inversely proportional to x ". An equation $y = \frac{k}{x}$ can be formed, where k is a constant.

4.4 Co-ordinate Geometry:

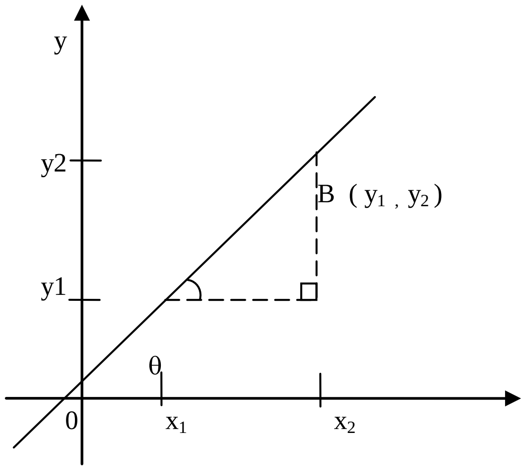
a. Gradients of straight lines

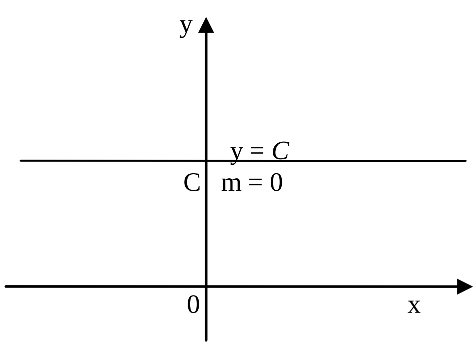
(i) The gradient m of the line joining any the points A(x_1, y_1) and B(x_2, y_2) is given by

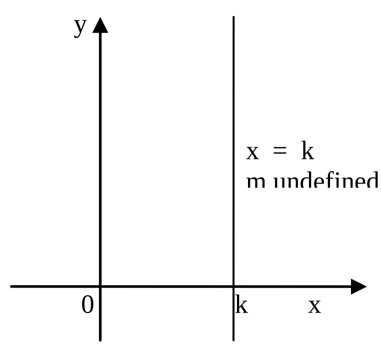
m = tan θ

$= \dfrac{y_2 - y_1}{x_2 - x_1}$

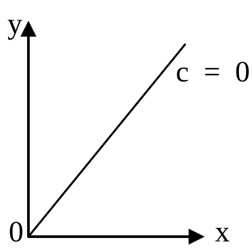
(ii) The following are some common straight line graphs and their gradients

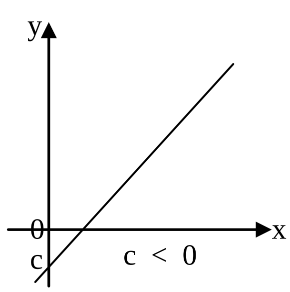


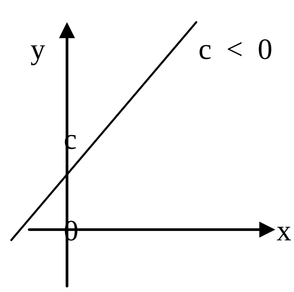




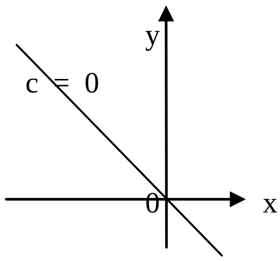
When m > 0, the straight line "climbs" from left to right.

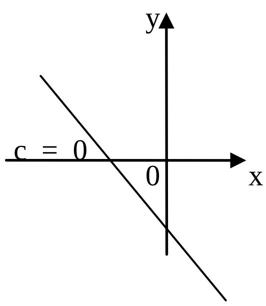


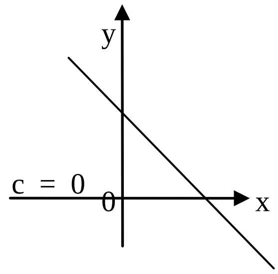




When m < 0, the straight line "dips" from left to right







b. Equations of straight lines

(i) The equation of a straight line with gradient m and y- intercept c is
$y = mx + c$.

(ii) The equation of the straight line passing through the points
(x_1, y_1) and (x_2, y_2) is given by

$$\frac{y - y_1}{x - x_1} = \frac{y_2 - y_1}{x_2 - x_1}$$

(iii) The equation of a straight line with a gradient m passing through the point (x_1, y_1) is given by $(y – y_1) = m(x – x_1)$

c. Mid-points

The mid-point of the line joining two points (x_1, y_1) and (x_2, y_2) is $\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$

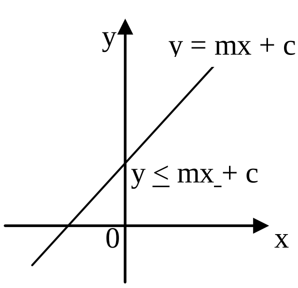
d. Distances between points

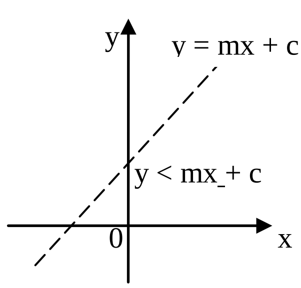
The distance between any two points
A(x_1, y_1) and B(x_2, y_2) is given by AB = $\sqrt{(x_2 - x_1)^2 (y_2 - y_1)^2}$.

4.5 Inequalities

The solution of two or more simultaneous inequalities is represented by the un-shaded region of the graph.
Three important points must be noted for inequalities represented graphically.
(i) Unwanted regions should be shaded.
(ii) Broken lines are used for strict inequalities, < or >, to show that points on them are not included.
(iii) Continuous lines are used for equalities, =, ≥ or≤, to show that points on them are included.

4.6 Graphical representation of linear inequalities





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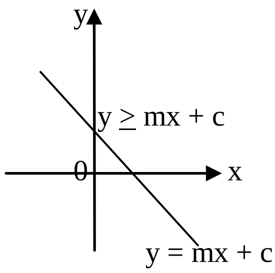
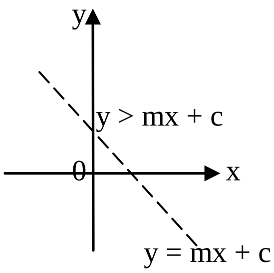
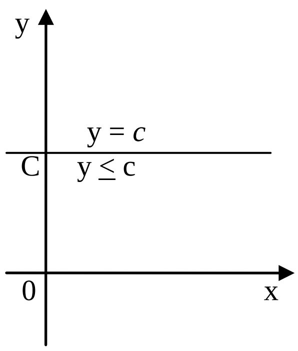
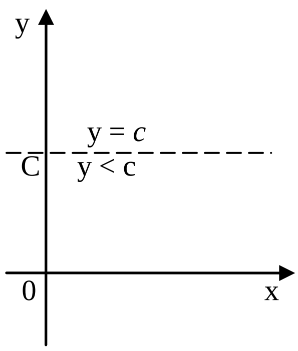
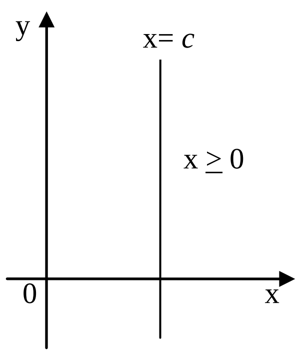
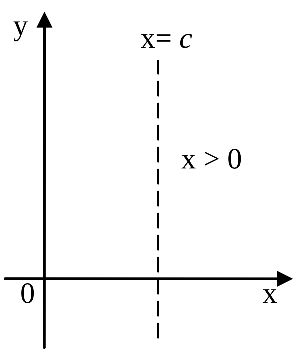


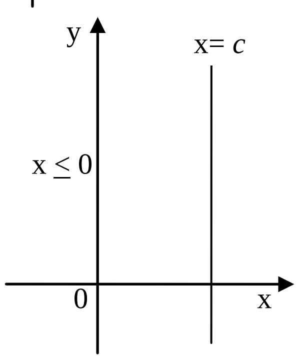


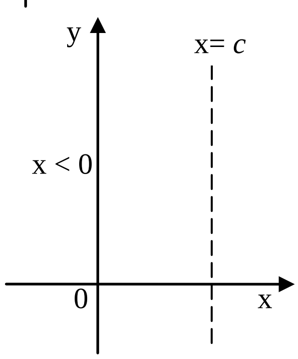












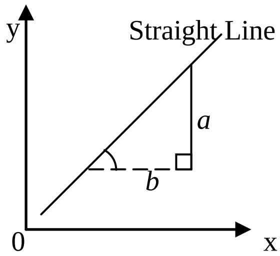
4.7 Rate of change:

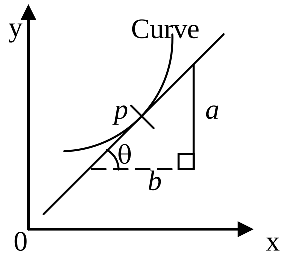
a. The rate of change of *y* with respect to x is the gradient m of a straight line
$y = mx + c$.

b. The rate of change of distance with respect to time is speed or velocity.

c. The rate of change of speed with respect to time is acceleration or deceleration (retardation).

The gradient of a graph can be estimated by drawing a tangent to the graph. A tangent touches the graph at the point where gradient is to be estimated.

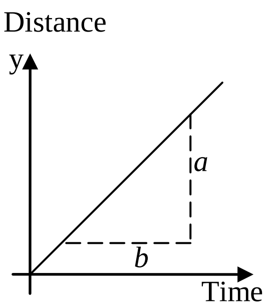


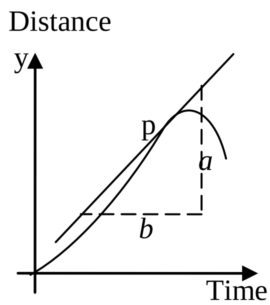


Gradient = tanθ = $\frac{a}{b}$ Gradient at P = tan θ = $\frac{a}{b}$

4.8 Kinematics

a. Distance – time graph



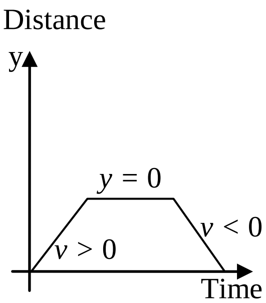


(i) The gradient of a distance – time graph gives the speed *v* of the moving object.

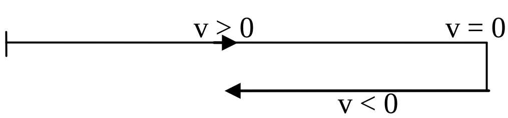
Gradient of the graph = v = $\frac{a}{b}$

(ii) Average speed = $\frac{\text{Total distance}}{\text{Total time taken}}$

(iii) A straight line indicates motion with uniform speed.

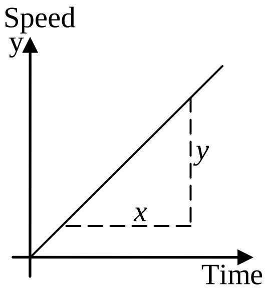


(iv) If $v = 0$, then the object is instantaneously at rest.
Graphically, this is indicated by a straight line parallel to the time axis.
(v) If $v < 0$, then the object is moving in the opposite direction, i.e. the distance from a fixed point is decreasing.
(vi) If *v* 0, then the object is moving in the direction in which the distance from a fixed point is increasing.

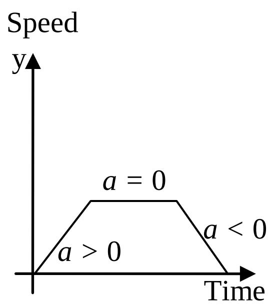


b. Velocity – time graph
(i) The gradient of a speed–time graph gives the acceleration, *a*, of the object at that instant.

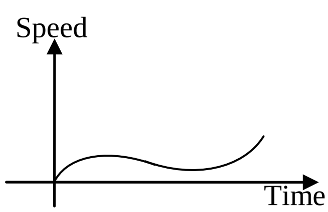
Acceleration = $\frac{y}{x}$



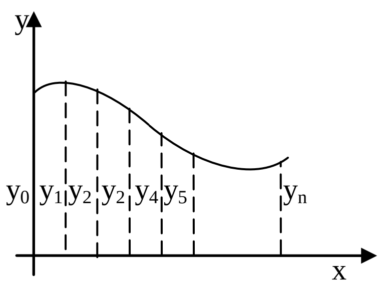
(ii) A straight line indicates motion with uniform acceleration or retardation.



(iii) If $a = 0$, then the speed v is constant. Graphically, it is indicated by a straight line parallel to the time axis.
(iv) If $a < 0$, then the speed v is decreasing, i.e. a retardation. Graphically, it is indicated by a line with a negative gradient.
(v) If $a > 0$, then the speed v is increasing. i.e. an acceleration. Graphically, it is indicated by a line with a positive gradient.
(vi) A curve indicates motion with varying acceleration or deceleration.



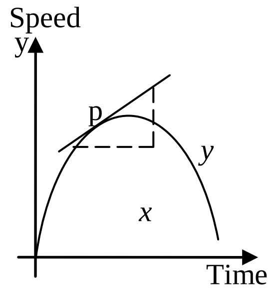
(vii) The area under the graph gives the total distance covered in the given time



The area A under the curve is divided into n trapeziums each of width h units.

Area $= \frac{1}{2} h\,[y_o + y_n) + 2(y_1 + y_2 + \ldots + y_{n-1})]$

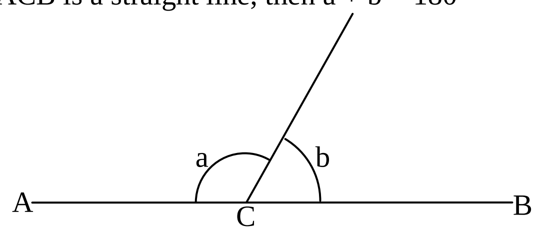
$= \frac{1}{2}$ (common width) × [(sum of end ordinates) + 2(sum of remaining ordinates)]



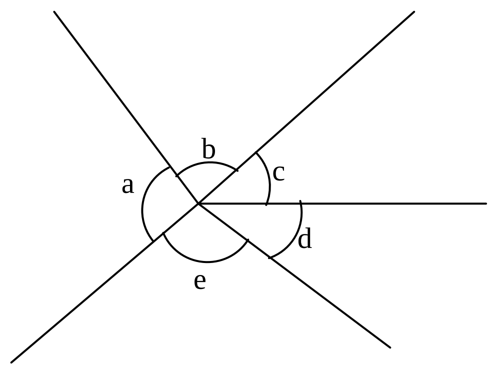
UNIT 5
GEOMETRY

5.1 Properties of angles

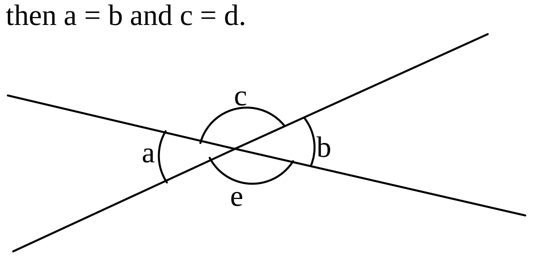
a. Adjacent angles on a straight line (adj. ∠ s on st, line)
If ACB is a straight line, then $a + b = 180^o$



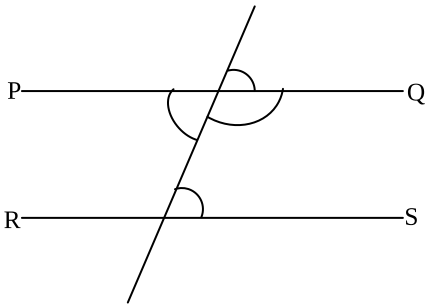
b. Angles at a point
The sum of angles at a point is equal to 360^o, $a + b + c + d + e = 360^o$.



c. Vertically opposite angles
(vert. opp ∠ s)
If two straight lines intersect, then a = b and c = d.



d. If PQ and RS are parallel, then
(i) a = b (alt. ∠ s)
(ii) c = b (corresp, ∠ s)
(iii) $b + d = 180^o$ (int. ∠ s)



5.2 Angle properties of polygons:

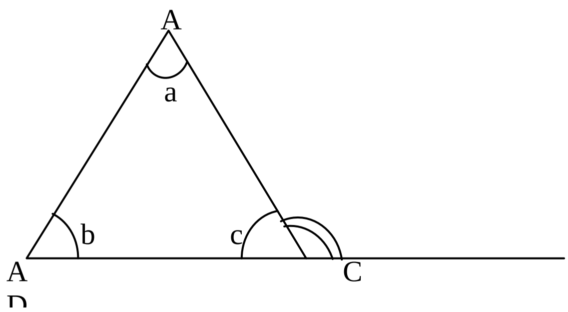
a. Angle sum of triangle (∠ sum of Δ)

The sum of the interior angles of a triangle is 180^o.

b. Exterior angle of triangle (ext. ∠ of Δ)

If the side of BC of ΔABC is produced to D, then

$A\hat{C}D = a + b$.



c. Interior angles in polygons (sum of ∠ s of a polygon)

(i) The sum of interior angles of an *n*-sided polygon

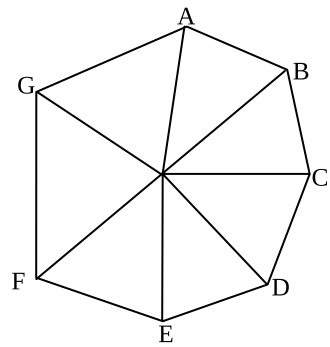
$= (2n - 4) \times 90^o$

$= (n - 2) \times 180^o$

(ii) Each interior angle of a rectangle *n*–sided polygon

$$= \frac{(2n-4)\times 90^o}{n}$$

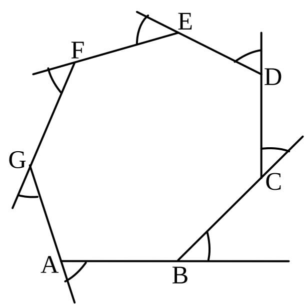
$$= \frac{(n-2)\times 180^o}{n}$$



d. Exterior angles in polygons (Sum of ext. ∠ s of a polygon)

(i) The sum of the exterior angles of an *n*-sided polygon is always 360^o.

(ii) Each exterior angle of a regular *n*-sided polygon $= \frac{360^o}{n}$



5.3 Congruent triangles:

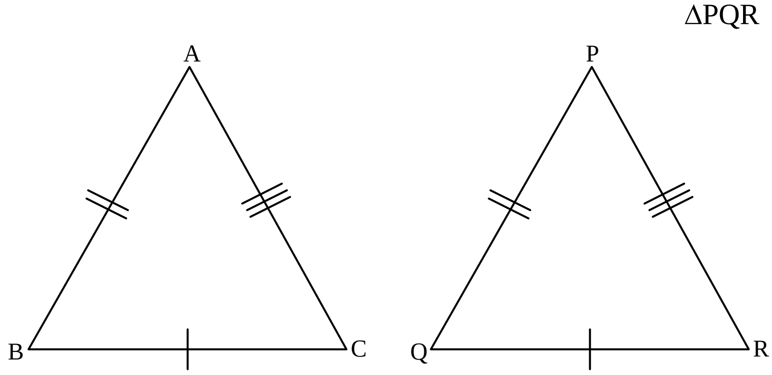
Two triangles are congruent if they are identical. If ΔABC is congruent to ΔPQR, then $AB = PQ$, $AC = PR$, $BC = QR$, $\angle A = \angle P$, $\angle B = \angle Q$ and $\angle C = \angle R$.

To prove that any two triangles are congruent, it is sufficient to show any one of the following tests.

a. S.S.S.

All the three corresponding sides of the two triangles are equal.

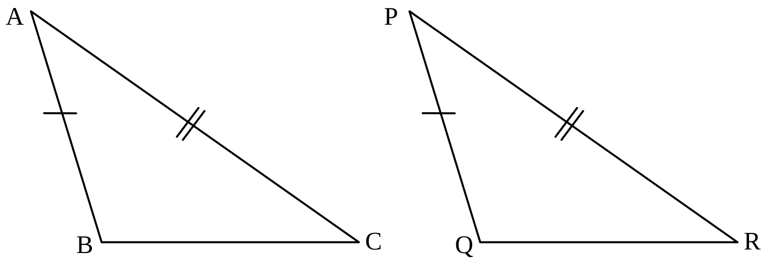
If AB = PQ, BC = QR, CA = RP, then ΔABC ≡ ΔPQR



b. S.A.S.

Two sides and the included angle of one triangle are equal to the corresponding sides and angle of the other triangle, if AB = PQ, AC = PR

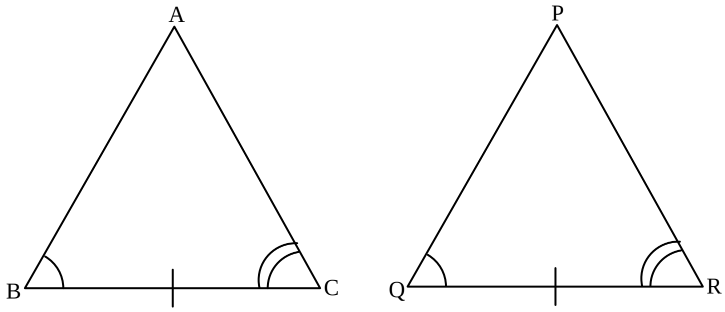
$B\hat{A}c = Q\hat{P}R$, then ΔABC ≡ ΔPQR



c. A.S.A or A.A.S.

Two angles and one side of one triangle are equal to the corresponding angles and side of the other triangle.

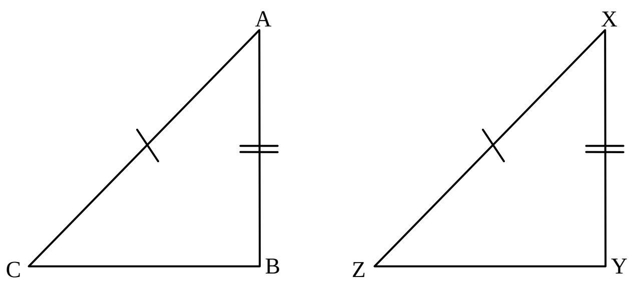
If $A\hat{B}C = P\hat{Q}R$ and $A\hat{C}B = P\hat{R}Q$ and if BC = QR, then $\Delta ABC \equiv \Delta PQR$



d. R.H.S

Both triangles are right angled with equal hypotenuse and another equal corresponding side.

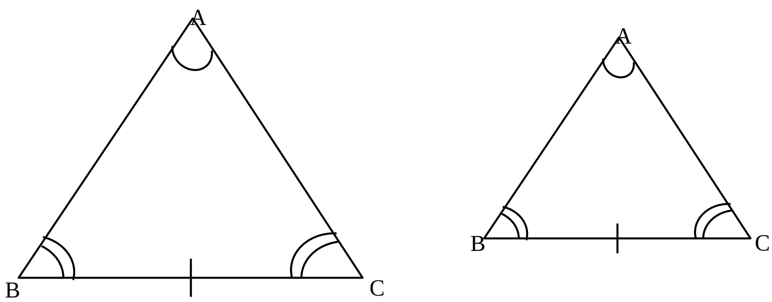
If AC = XZ, AB = XY or BC = YZ and $A\hat{B}C = X\hat{Y}Z = 90^o$, then $\Delta ABC = \Delta XYZ$



5.4 Similar triangles

a. Test of similarly in triangles

Two triangles are similar if all their corresponding angles are the same. If ΔABC is similar to ΔXYZ, $\angle A = \angle X$, $\angle B = \angle Y$ and $\angle C = \angle Z$.



Also both the triangles have corresponding sides with the same ratio.

$$\frac{AB}{XY} = \frac{BC}{YZ} = \frac{CA}{ZX}$$

To prove that any two triangles are similar, it is sufficient to show any of the following:

(i) Both triangles have two equal corresponding angles and an unequal corresponding side.

(ii) Both triangles have corresponding sides with the same ratios

(iii) Both triangles have two corresponding sides with the same ratio and the included angles are equal.

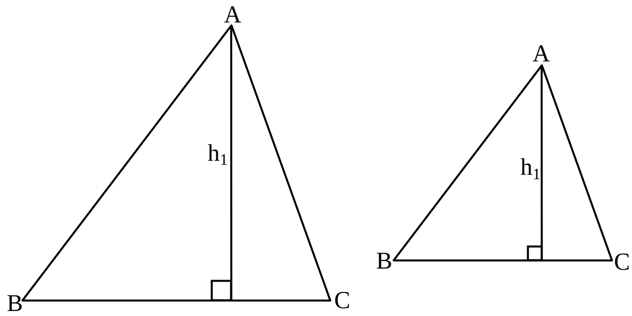
b. Similarity in plane figures

If ΔABC and ΔXYZ are similar triangles,

then $\frac{\text{Area of }\Delta ABC}{\text{Area of }\Delta XYZ} = \frac{BC^2}{YZ^2}$

$= \frac{BC^2}{YZ^2}$

$= \frac{h_1^2}{h_2^2}$



c. Similarity in solids

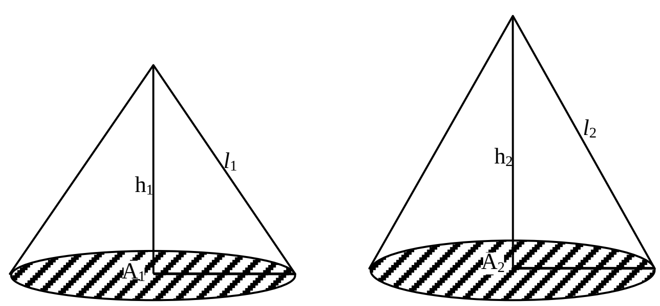
If *X* and *Y* are two similar solids, then

(i) $\frac{l_1}{l_2} = \frac{h_1}{h_2}$

(ii) $\frac{A_1}{A_2} = \left(\frac{l_1}{l_2}\right)^2 = \left(\frac{h_1}{h_2}\right)^2$

(iii) $\frac{V_1}{V_2} = \frac{m_1}{m_2} = \left(\frac{l_1}{l_2}\right)^3 = \left(\frac{h_1}{h_2}\right)^3$

(iv) $\frac{V_1}{V_2} = \left(\frac{A_1}{A_2}\right)^{\frac{3}{2}}$



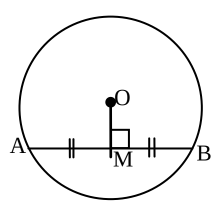
5.5 Symmetry properties of circles

a. Chords

A chord is a straight line joining two parts on the circumference of a circle.

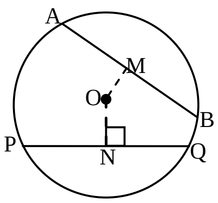
(i) The perpendicular bisector of a chord always passes through the centre of the circle. Conversely, the perpendicular from the centre of the circle to the chord bisects the chord.

(ii) If *M* is the mid-point of the chord *AB*, the *OM* is perpendicular to *AB*. Conversely, if *OM* is perpendicular to *AB*, then *M* is the mid-point of *AB*.



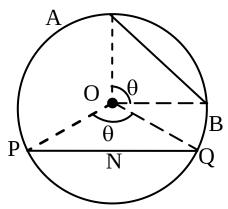
(iii) Equal chords of a circle are equidistant from the centre. Conversely, chords which are from the centre are equal in length i.e.

$AB = PQ \Leftrightarrow OM = ON$.



(iv) Equal chords of a circle subtend equal angles at the centre. Conversely, chords which subtend equal angles at the centre are equal in length.

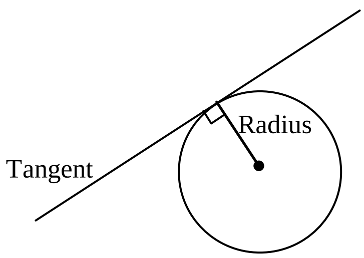
i.e. AB = PQ $\Leftrightarrow$ $A\hat{O}B = P\hat{O}Q$.

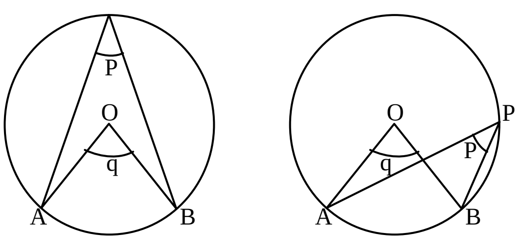


b. Tangents:

A tangent to a circle is a straight line that touches the circle at only
one point.
The point where the tangent touches the circle is called the point
of contact.

(i)A tangent is perpendicular to the radius at the point of contact.

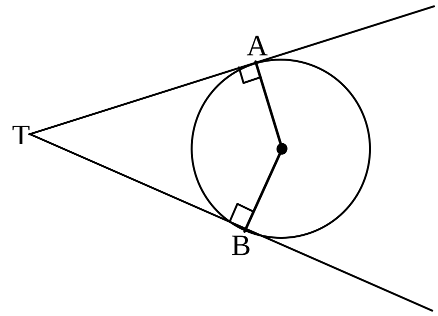




a. Angle at the centre and angle at the circumference (∠at centre = 2∠at circumference)
An angle at the centre of a circle is twice any angle at the circumference subtended by the same arc, i.e. $q = 2p$.

b. Angles in the same segment (∠s in the same segment)
Angles in the same segment of a circle are equal, i.e. $p = q$.

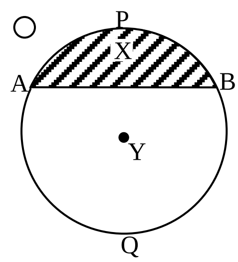
(ii) If two tangents are drawn from a point T outside a circle making contact at two points A and B on the circle, then $TA = TB$.



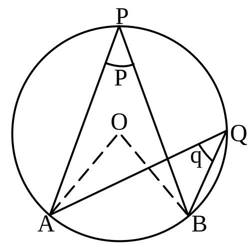
c. Arc and segment:

(i) A chord AB divides the circumference of a circle into two arcs. The shorter arc APB is called the minor arc. The longer arc AQB is called the major arc.

(ii) A chord divides the circle into two segment Y is called the major segment. X and Y are opposite segments.

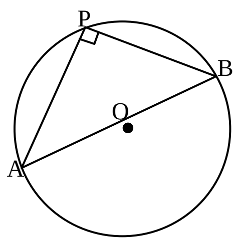


5.6 Angle properties of circles

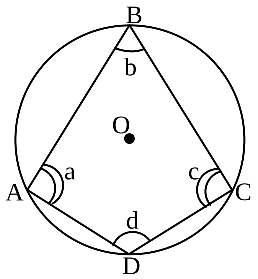


c. Angles in a semicircle (∠ in semicircle)

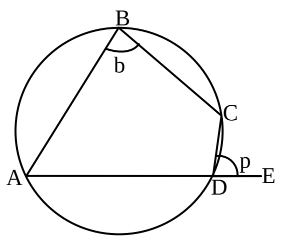
If AB is a diameter of the circle APB, then $A\hat{P}B = 90^o$.



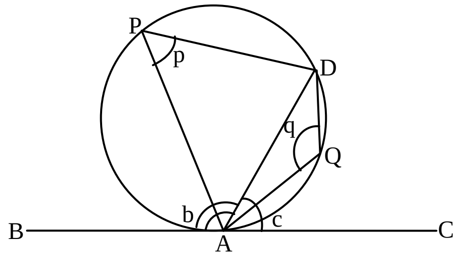
d. Cyclic quadrilateral (opp. ∠s of cyclic quad)
If ABCD is a cyclic quadrilateral, then $b + d = 180^o$ and $a + c = 180^o$.



e. Exterior angle of cyclic quadrilateral (ext. ∠ of cyclic quad)
If *ABCD* is a cyclic quadrilateral and *AD* is produced to *E*, then $b = p$.



f. Angles in alternate segments (∠ in alt segment)
If BAC is the segment is the tangent at A to a circle and AD is any chord, then c = p and b = q.

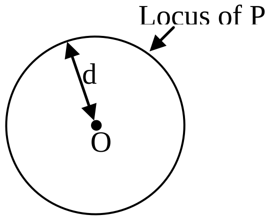


5.7 Symmetry in plane figures:
a. A line drawn through a figure dividing it into exactly halves which are mirror images is called an <u>axis of symmetry or a line of symmetry</u>.
b. The number of times a figure undergoing rotation through 360^o about a point coincides the original figure is called the order of rotational symmetry. All figures will at least have 1 order of rotational symmetry.
c. A figure which coincides the original figure after a rotation of 180^o has a <u>point symmetry</u>.
d. A plane dividing a solid into exactly equal halves which are mirror images is called a plane of symmetry.
e. If a solid has rotational symmetry of order 2 or more about an axis, then the axis is called <u>an axis of rotational symmetry.</u>
f. Symmetries of some common figures

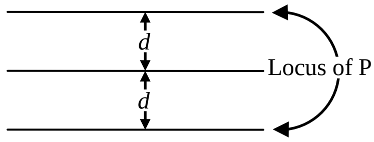
	No. of lines of symmetry	Order of rotational symmetry
Scalene triangle	0	1
Isosceles triangle	1	1
Equilateral triangle	3	3
Quadrilateral	0	1
Isosceles trapezium	1	1
Kite	1	1
Parallelogram	0	2
Rhombus	2	2
Rectangle	2	2
Square	4	4
Regular pentagon	5	5
Regular hexagon	6	6
n–sided polygon	*n*	*n*
Semicircle	1	1
Circle	infinite	infinite

5.8 Loci

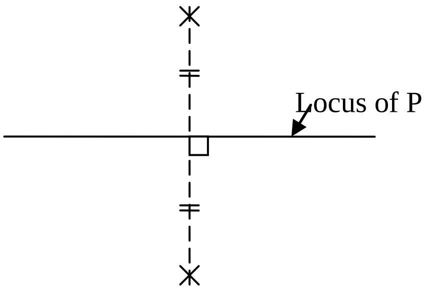
a. The locus of a point is the path traced out by a moving point satisfying a given set of condition(s).
b. Common loci in two dimensions
(i) If point P is at a distance d away from a fixed point O, then the locus of P is a circle of radius D, centre O.



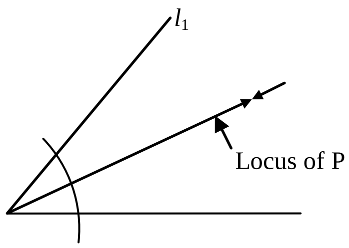
(i)If point P is at a distance d away from a given straight line l, then the locus of P is a pair of parallel lines at a distance d away from l.



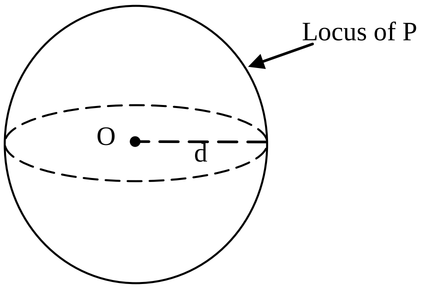
(ii)If point P is equidistant from two given points A and B, then the locus of P is the perpendicular bisector of line AB.

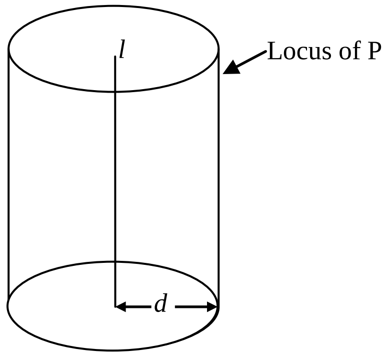


(iv) If point P is equidistant from two given intersecting lines l_1 and l_2, then the locus of P is the line(s) which bisect the angle(s) between l_1 and l_2.

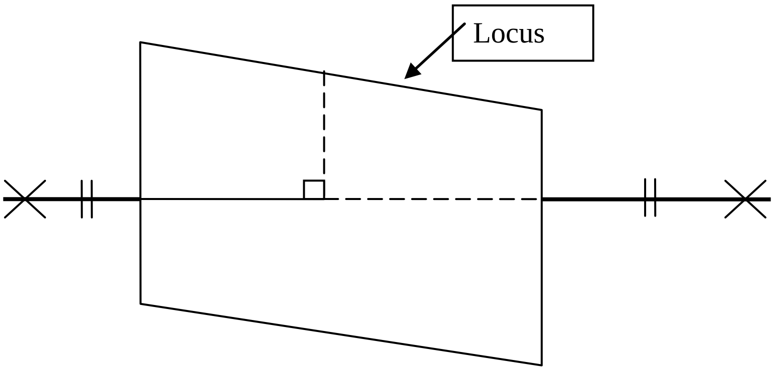


b. Common loci in three dimensions
(i) If point P is at a distance D away from a fixed point O, then the locus of P is the spherical surface of radius d centre O.



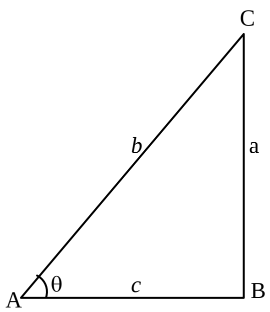


(ii) If point P is equidistant from two given points A and B, then the locus of P is the perpendicular to the line AB and passing through the mid-point of AB.



UNIT 6
TRIGONOMETRY

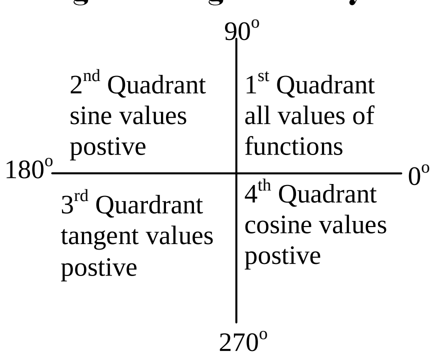
6.1 Simple trigonometry ratio of an acute angle



$$\sin\theta = \frac{\text{opposite}}{\text{hypotenuse}} = \frac{a}{b}$$

$$\cos\theta = \frac{\text{adjacent}}{\text{hypotenuse}} = \frac{c}{b}$$

6.2 Signs of trigonometry ratio

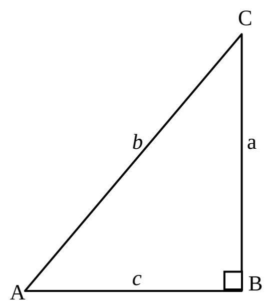


$\sin\theta = \sin(180^o - \theta)$
$= -\sin(180^o + \theta)$
$= -\sin(360^o - \theta)$

$\cos\theta = \cos(180^o - \theta)$
$= -\cos(180^o + \theta)$
$= -\cos(360^o - \theta)$

$\tan\theta = \tan(180^o - \theta)$
$= -\tan(180^o + \theta)$
$= -\tan(360^o - \theta)$

6.3 Pythagoras' Theorem

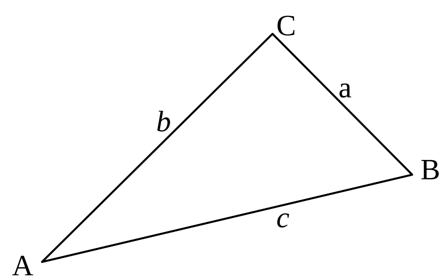


In a right–angled triangle ABC,

$b^2 = a^2 + c^2$ or

$AC^2 = AB^2 + BC^2$

6.4 Sine Rule



$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

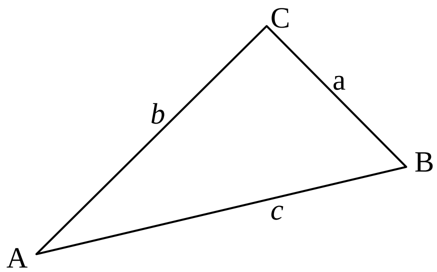
Or $$\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$$

This rule is used to find an unknown angle or length if we know.

(i) Two angles and one length

(ii) One angle and two lengths

6.5 Cosine Rule



$a^2 = b^2 + c^2 - 2bc \cos A$

$b^2 = a^2 + c^2 - 2ac \cos B$

$c^2 = a^2 + b^2 - 2ab \cos C$

Alternatively

$$\cos A = \frac{b^2 + c^2 - b^2}{2bc}$$

$$\cos B = \frac{a^2 + c^2 - b^2}{2ac}$$

$$\cos C = \frac{a^2 + c^2 - b^2}{2ab}$$

This rule is used to find an unknown angle or length if we know

(i) three lengths

(ii) two lengths and one angle.

6.6 Area of a triangle

For right-angled triangle ABC.

$$\text{Area} = \frac{1}{2} \times \text{base area} \times \text{height}$$

For any other types of triangles ABC.

$$\text{Area} = \frac{1}{2} bc \sin A$$

$$= \frac{1}{2} ac \sin B$$

$$= \frac{1}{2} bc \sin C$$

$$= \sqrt{s(s-a)(s-b)(s-c)}$$

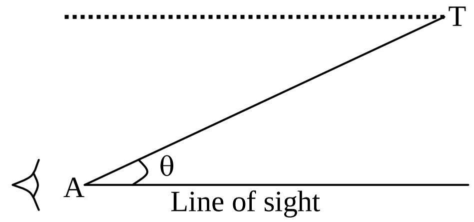
$$\text{where } s = \frac{1}{2}(a + b + c)$$

6.7 Bearings

True bearings are always measured from the North and in a clockwise direction. Bearing is between 0^o and 360^o. The degree part of a true bearing is written as a three–digit number in degrees e.g. 028^o, 279^o, 315^o .

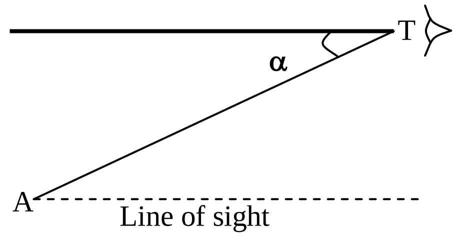
6.8 Angles of elevation

When *T* is observed from A, the angle between the line of sight (which is always horizontal the to a level ground) and the line *AT* is called the angle of elevation, θ.



6.9 Angle of depression

When *A* is observed from *T*, the angle between the line of sight and the line *AT* is called the angle of depression, *a*.

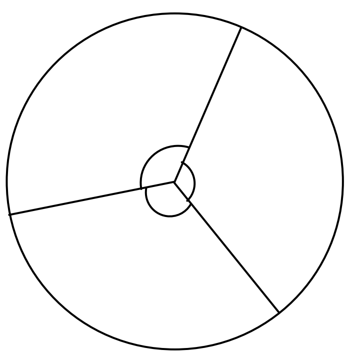


UNIT 7
STATISTICS

7.1 Pictograms

A pictogram uses pictures to represent quantities of an item. The quantities are proportional to the number of pictures or to the size of the pictures.

7.2 Pie charts



A pie chart uses sectors of a circle to represent different quantities.

a. The total angle of the sectors must be 360^o.

b. The angle of each sector is proportional to the given quantities.

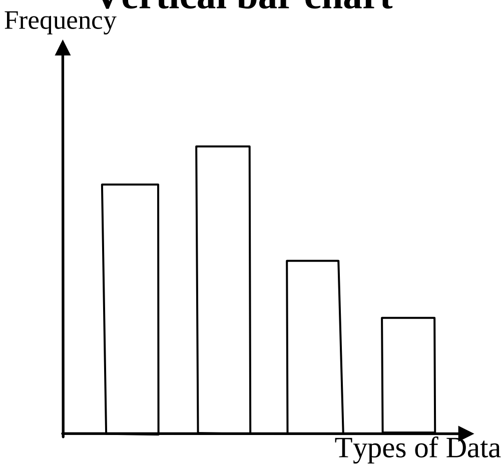
c. The angle of each sector is found using

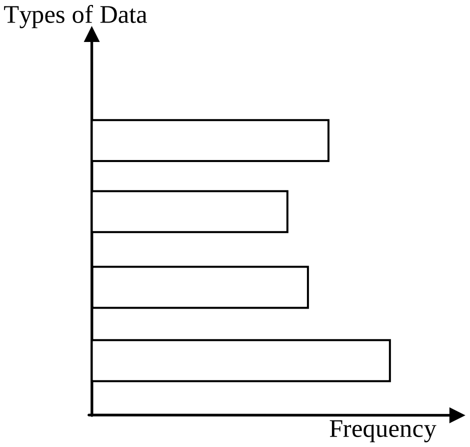
$$\frac{\text{amount of quantity}}{\text{total quantity}} \times 360^o.$$

7.3 Bar graph

There are two forms of bar graphs, namely the horizontal and the vertical bar charts. Each bar is drawn having the same width equally spaced out and the length of each bar is proportional to the given quantities to allow for easy comparison.

Vertical bar chart





Horizontal bar chart

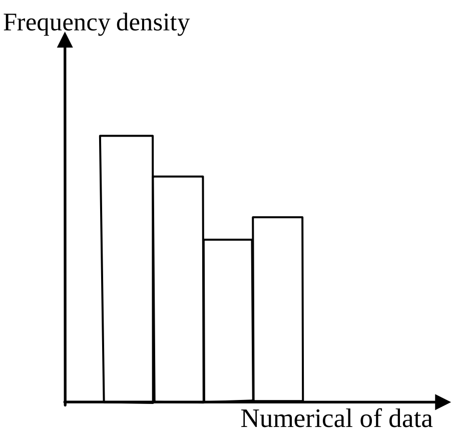
[Note: The width has no significance]

7.4 Line graphs

A line graph shows trends and changes between quantities. It is drawn by joining the mid-points of the top bases of a column graph by straight lines.

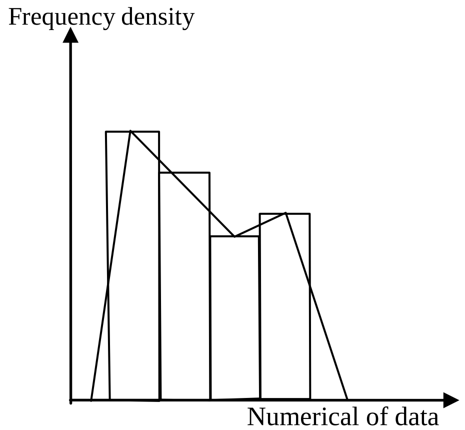
7.5 Histograms

A histogram is actually a vertical bar graph with no space between the bars. It is used to represent continuous or grouped data. The area of each column represents the frequency that corresponds to a class.



7.6 Frequency polygons

A frequency polygon may be obtained by joining the mid-points of the upper base of each vertical bar in the histogram.



7.7 Mean

a. The mean of a set of n numbers

$x_1, x_2, x_3, \ldots\ldots, x_n$ is denoted by $\bar{x}$

$$\bar{x} = \frac{x_1 + x_2 + x_3 + \ldots + x_n}{n}$$

$$= \frac{\sum x}{n}$$

b. The mean of a set of grouped data.

$$\bar{x} = \frac{\sum fd}{\sum f}$$

c. The mean of a set of grouped data taking an assumed mean

$$\bar{x} = \mathbf{a} + \frac{\sum fd}{\sum f}$$

where **a** = assumed mean, f = frequency and d = deviation from a, i.e,

$d = x - a.$

7.8 Median:

The median is the value of the middle term of a set of numbers arranged in ascending order

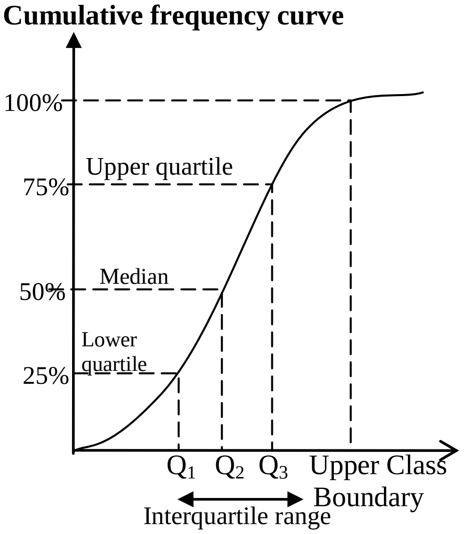
a. If there are odd numbers of terms, the middle term is the $\left(\frac{n+1}{2}\right)^{th}$ term.

b. If there are even n number of terms, the median is found by taking the average of the $\left(\frac{n}{2}\right)^{th}$ and $\left(\frac{n}{2}+1\right)^{th}$ terms.

7.9 Mode:
The mode is the measurement or event with the highest frequency. The modal class is the class with the highest frequency.
A set of numbers is said to be bimodal if it contains two modes.

7.10 Cumulative frequency curve (Ogive):
The cumulative frequency curve is obtained by graphing cumulative frequency against the upper class boundaries of data given.

Cumulative frequency curve



Q_1 is the 25th percentile or lower quartile, Q_2 is the 50th percentile or median, Q_3 is the 75th percentile or upper quartile.
The interval $Q_3 - Q_1$ is the interquartile range.
For a set of N observations arranged in increasing or decreasing order.

a. Lower quartile $= \frac{N+1}{4}$ th measurement

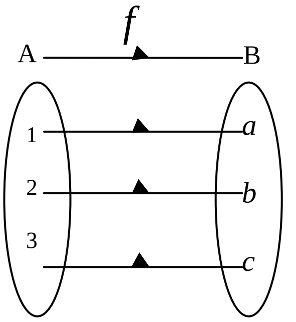
b. Middle quartile (Median) $= \frac{N+1}{2}$ th measurement

c. Upper quartile $= \frac{3(N+1)}{4}$ th measurement

d. Interquartile range = Upper quartile – Lower quartile

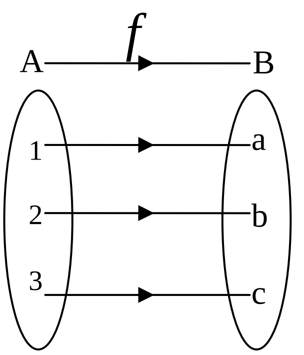
UNIT 8
FUNCTIONS
8.1 Functions

A function of a variable is an expression involving the variable and whose value depends on the variable. A function of variable x is denoted by $f(x)$, and its value depends on the value of x.



Set A is called the domain and the corresponding Set B is called the range. The member a in the range is the image of the member 1 in Set A. Different members in the domain can be mapped onto the same image. In other words, a relation is only a function when every member in the domain has a unique image in the range.

8.2 Inverse Functions
If a function f maps x onto y, the function that maps y back to x is called the inverse of f written as f^1. In other words, if $f: x \rightarrow y$, then $f^{-1}: y \rightarrow x$ or if f(x) = y, then $f^{-1}(y) = x$.
The following mapping illustrates the inverse function of f.
f (1) = a, f (2) = b, f (3) = c f^1(a = 1, f^1 (b) = 2, f^1(c) = 3



UNIT 9
SETS AND VENN DIAGRAMS
9.1 Sets
A set is a collect of distinct elements or members. Objects, names, numbers, lines, shapes and pictures can form the elements of any set.

9.2 Finite set
A finite set is a set which contains countable members or elements of the set.
e.g A = {a, b, c}

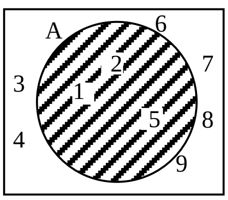
9.3 Infinite set
An infinite set is a set which contains uncountable number of elements.
e.g B = {x : x is a natural number}

9.4 Universal set
A universal set is the total set of all the elements under consideration. The symbol denoting universal set is ε.

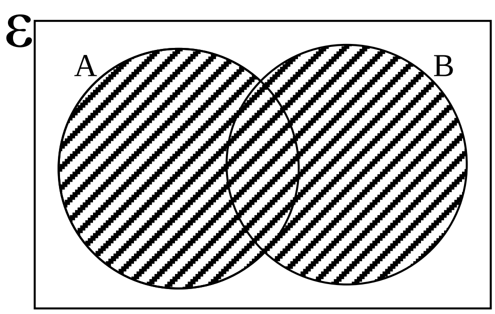
9.5 Empty set
An empty set ϕ or a null set {   } is a set which contains no elements.

9.6 Equal sets
An empty set B is equal if they contain the same elements. Therefore, we write 'A = B'

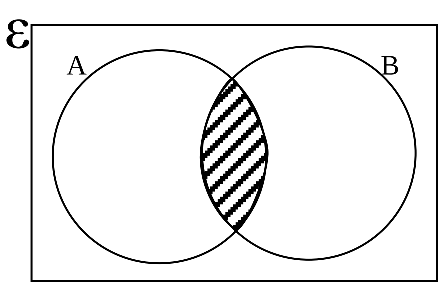
9.7 Venn diagrams
A Venn diagram is a diagram showing sets and their relationships. The universal set is represented by a rectangle. The other sets are usually represented by circles or ovals. Required sets are then indicated by shading the appropriate regions.



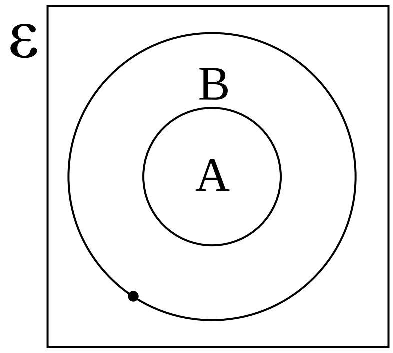
9.8 Union
The union of Set *A* and Set *B* denoted by A ∪ B is the set of elements which belongs to Set A or Set B or both.



9.9 Intersection
The intersection of set A and set B denoted by A ∩ B is a set of elements which belongs to both set A and B only.

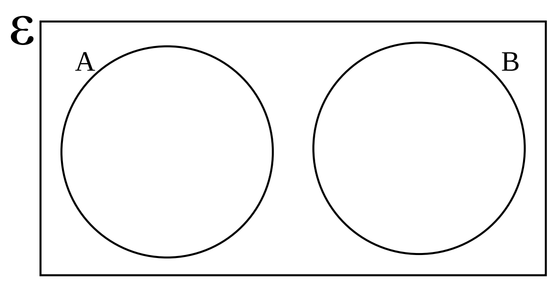


9.10 Subset
If every elements of set A is also a member of set B, then set A is a subset of set B which can be written as A ⊆ B. ϕ ⊆ A means empty set is a subset of any set A.

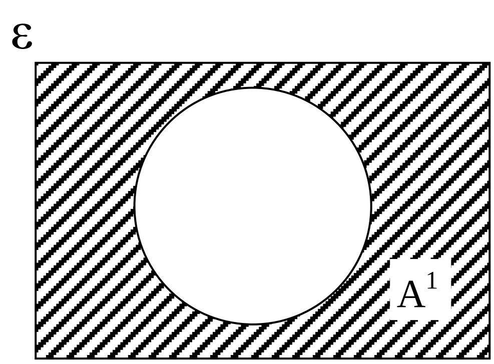


If set A is a subset of set B and A ≠ B, then set A is called a proper subset of set B which can be written as A ⊂ B.
A ⊄ B means set a is not a proper subset of set b

9.11 Disjoint sets
Disjoint sets
Disjoint sets do not have elements in common. If set A and set B are disjoint sets, A ∩ B = ϕ.
This result can be illustrated using a Venn diagram.



9.12. Complement
A is the complement of set *A* relative to a universal set e. It is the set of all elements in ε except those in *A*. The shaded region in he Venn diagram is *A*′.



9.13. Number of elements
The number of elements in set A denoted by n(A).
There are three points to note:
(i) n(ϕ) = 0
(ii) n(A′) = n(ε) – n(A)
(iii) n(A ∪ B) = n(A) + n(B) – n(A ∩ B)

UNIT 10
SIMPLE PROBABILITY

10.1. Probability of an event

If out of *m* equally likely outcomes in an experiment, *n* of these outcomes favor the occurrence of an event *A*, then the probability of event *A* happening, written P(A), is given by number of outcomes favorable to event A divided by total number of outcomes.

i.e. $P(A) = \frac{n}{m}$

In general, $P(E) = \frac{n(E)}{m(\varepsilon)}$

10.2 Properties of probability

(i) If *A* is an impossible event, then *P(A)* = 0

(ii) If *A* is a sure event, then *P(A)* = 1

(iii) For any event *A*, then $0 \le P(A) \le 1$

(iv) The probability of an event not happening is $P(A') = 1 - P(A)$ where P(A) is the probability that event A happening.

(v) Two events A and B are mutually exclusive if they cannot happen at the same. In this case,

$P(A \cup B) = P(A) + P(B)$

$P(A \cap B) = 0$

If the events are not mutually exclusive,

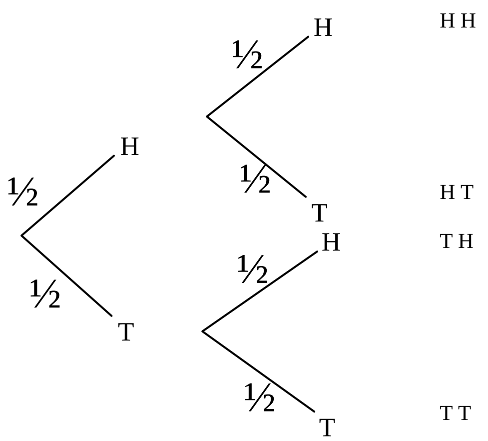
Then $P(A \cup B) = P(A) + P(B) - P(A \cap B)$.

(vi) If an event A has no effect on another event B, then A and B are said to be independent.

In this case

P (A and B) = P (A) × (B).

1st coin 2nd coin outcome



H = Head T = Tail

10.3 Conditional probability

When an event is carried out under certain restrictions, this probability is called conditional probability.

The probability of A and B is written as P(A/B).

$$P(A / B) = \frac{P(A \cap B)}{P(B)}$$

10.4. Possibility diagrams

A possibility diagram is a table or grip showing all the possible outcomes of a combination of two independent events. E.g. possibilities of two tosses of a fair dice

sum	1	2	3	4	5	6
1	2	3	4	5	6	7
2	3	4	5	6	7	8
3	4	5	6	7	8	9
4	5	6	7	8	9	10
5	6	7	8	9	10	11
6	7	8	9	10	11	12

10.5 Tree diagrams

Any tree diagram shows the possible outcomes of a combination of two or more events. Outcomes are written at the ends of the branches and their probability by the sides of the corresponding branches. To find the probability of a final outcome, multiply the probabilities from all branches leading to the outcome.

UNIT 11
MATRICES

11. 1 Matrices

A matrix is a rectangular array of numbers of the form:

$$\begin{pmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \vdots & \vdots & \vdots & \vdots \\ a_{m1} & a_{m2} & \cdots & a_{mn} \end{pmatrix}$$

The matrix above is an $m \times n$ matrix; it has m rows and n columns. The numbers a_{11}. a_{12}, … a_{mn} are called the elements of the matrix.

11.2 Zero matrix or null matrix

A zero matrix is a matrix whose elements are all equal to zero.

e.g. $\begin{pmatrix} 0 & 0 \\ 0 & 0 \end{pmatrix}$

11.3. Identity matrix unit matrix

An identity matrix is a square matrix in which the elements on the principal diagonal are all equal to 1 and the other elements are all equal to 0.

e.g $\begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$

11.4. Equal matrix

Matrices that have the same array of elements are called equal matrices.

e.g $A = \begin{pmatrix} 1 & 3 \\ 2 & 4 \end{pmatrix}$ and $B = \begin{pmatrix} 1 & 3 \\ 2 & 4 \end{pmatrix}$

11.5. Scalar matrix

A scalar matrix is a diagonal matrix in which all the elements in the principal diagonal are equal.

e.g $\begin{pmatrix} 2 & 0 \\ 0 & 2 \end{pmatrix}$ whose scalar k is 2.

11.6. Addition and subtraction of matrices

Addition and subtraction can be performed on matrices of the same order by adding all the corresponding elements or subtracting the elements from the corresponding ones.

e.g $\begin{pmatrix} a \\ b \end{pmatrix} + \begin{pmatrix} c \\ d \end{pmatrix} = \begin{pmatrix} a+c \\ b+d \end{pmatrix}$

$\begin{pmatrix} a \\ b \end{pmatrix} - \begin{pmatrix} c \\ d \end{pmatrix} = \begin{pmatrix} a-c \\ b-d \end{pmatrix}$

11.7. Multiplication of matrices

Two matrices are compatible for multiplication when the first matrix has as many columns as the second matrix has rows.

e.g $\begin{pmatrix} a \\ b \end{pmatrix}(c \quad d) = \begin{pmatrix} ac & ad \\ bc & bd \end{pmatrix}$

11.8. Determinant

The determinant of $A = \begin{pmatrix} a & c \\ b & d \end{pmatrix}$ is denoted by

$|A| = ad - bc$. If $|A| \neq 0$, then A is a non-singular matrix.

11.9. Inverse of matrices

The inverse of matrix $A = \begin{pmatrix} a & c \\ b & d \end{pmatrix}$ is given by A^{-1}

$= \frac{1}{|A|}\begin{pmatrix} d & -c \\ -b & a \end{pmatrix}$ where $|A| \neq 0$. The elements on the leading diagonal are swapped and the signs of the elements on the receding diagonal are changed.

UNIT 12
VECTORS IN TWO DIMENSIONS

12.1 Vector

A vector is a quantity having both magnitude and direction. A vector may be represented by $\overrightarrow{AB}$, **a**, or **AB**

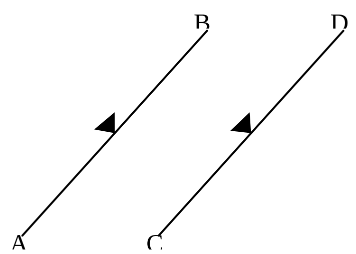
12.2 Equal Vectors

Two vectors are equal if they have the same magnitude and direction

i.e. $\overrightarrow{AB} = \overrightarrow{CD}$ if

(i) AB is parallel to CD

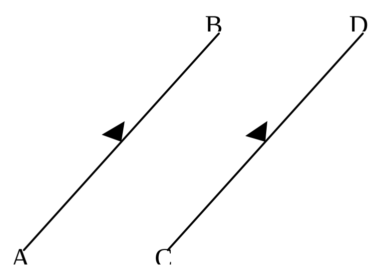
(ii) $|\overrightarrow{AB}| = |\overrightarrow{CD}|$



12.3 Negative Vector

$\overrightarrow{BA}$ is a vector having the same magnitude as $\overrightarrow{AB}$ but having direction opposite to $\overrightarrow{AB}$.

Therefore, $\overrightarrow{AB} = -\overrightarrow{BA}$ or $\overrightarrow{BA} = -\overrightarrow{AB}$



12.4 Zero vector

A zero vector is a vector whose magnitude is zero and is denoted by **0**

$\overrightarrow{AB} + \overrightarrow{BA} = \mathbf{0}$

12.5 Position vector

A position vector is a vector whose initial point is the origin, O. The position vector of *A* is written as $\vec{OA}$. If the point *A* has coordinates (*a*, *b*), then $\vec{OA} = \begin{pmatrix} a \\ b \end{pmatrix}$, where $\begin{pmatrix} a \\ b \end{pmatrix}$ is a column matrix.

12.6 Magnitude and Direction of a Vector

The magnitude or modulus of $\vec{AB}$ is denoted by $|\vec{AB}|$; it is the direct distance from A to B.

Given that *A (a, b)* and *B(c, d)*, then

$$\vec{AB} = \vec{OB} - \vec{OA}$$
$$= \begin{pmatrix} c \\ d \end{pmatrix} - \begin{pmatrix} a \\ b \end{pmatrix}$$
$$= \begin{pmatrix} c-a \\ d-b \end{pmatrix}$$
$$|\vec{AB}| = \sqrt{(c-a)^2 + (d-b)^2}$$

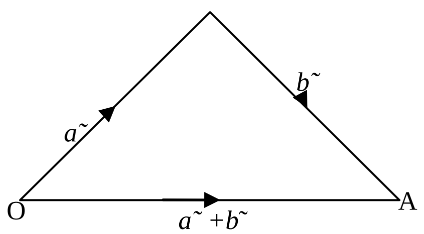
Hence, the unit vector of $\vec{AB}$ whose magnitude is unity is given by the vector divided by its magnitude.

The direction of $\vec{AB}$ is given by

$\tan\alpha = \dfrac{d-b}{c-a}$

12.7 Sum of Vectors

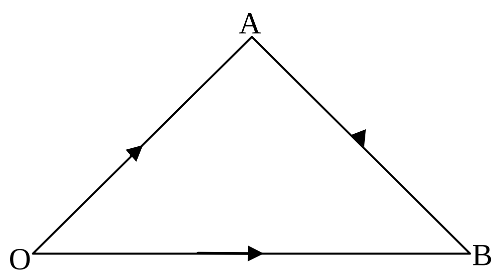
We add **a** and **b** by joining the initial point of **a** to the terminal point of **b**.The resultant vector is **a** + **b**.



12.8 Difference of two Vectors

Any vector can be expressed in terms of two position vectors.

i.e $\vec{AB} = \vec{OB} - \vec{OA}$



The difference of two vectors is equivalent to the addition of two vectors, only that the direction of one of the vectors is reversed.

a – b = a + (-b)

12.9 Scalar multiplication Vectors

If *a* is multiplied by ***a*** scalar ***k***, the result ***ka*** is a vector *k* times

(i) for ***k*** > **0**, *ka* is in the same direction as ***a;***

(ii) for ***k*** < **0**, *ka* is in the opposite direction as ***a***.

12.10 Parallel Vectors

(i) If ***a*** = ***kb***, then $|a| = k|b|$ and ***a*** is parallel to ***b***.

(ii) If ***ha*** = ***kb*** (where ***h*** and ***k*** are scalars) and ***a*** is not parallel to ***b***, then ***h*** = ***k*** = 0

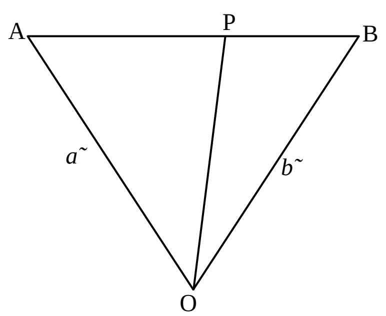
(iii) If ***pa*** + ***ab*** = ***ha*** + ***kb*** and ***a*** is not parallel to ***b***, then ***p*** = ***h*** and ***q*** = ***k***.

(iv) If $\vec{AB} = \boldsymbol{k}\,\vec{BC}$, then $\vec{AB}$ is parallel to $\vec{BC}$ and *A*, *B* and *C* are collinear.

12.11 The Ratio Theorem

The ratio states that the position vector of a point *P* which divides the line *AB* in the ratio *m : n*, where *m* ≠ *n*, is given by

$$\vec{OP} = \frac{na}{m+n} + \frac{mb}{m+n}$$
$$= \frac{1}{m+n}(na + mb)$$



If *m* = *n*,*P* is the mid-point of *AB*, then OP = $\frac{1}{2}$(***a*** + ***b***)

UNIT 13 TRANSFORMATIONS

13.1 Translation (T)

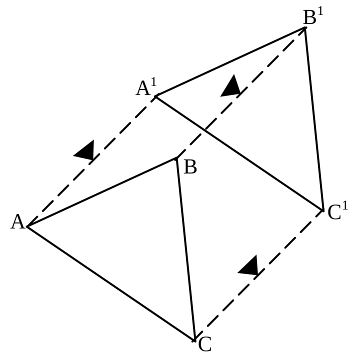
A plane figure that has undergone a translation exhibits the following characteristics;

a. The figure and its image are congruent

b. All points on the figure move the same distance in the same direction.

c. Any corresponding side of the figure is equal and is parallel to that of its image.

d. There are no invariant points



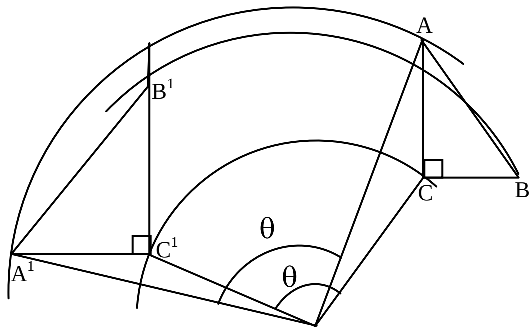
13.2. Rotation (R)

A plane figure that has undergone a rotation about a fixed point exhibits the following characteristics;

a. The figure and its image are congruent.

b. All points rotate about a fixed point through a given angle.

c. The centre of rotation is the only invariant point when the given angle is not a multiple of 360°.



13.3 Reflection (M)

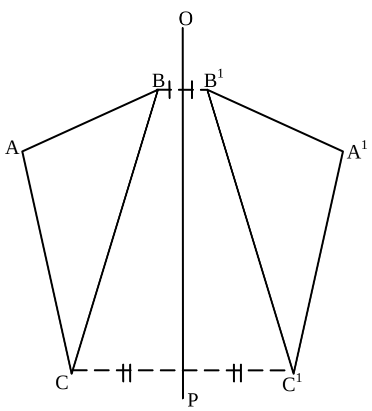
A plane figure that has undergone a reflection in a line exhibits the following characteristics.

a. The figure and its image are congruent

b. The axis of reflection, called the mirror line, is also the axis of symmetry.

c. The axis of reflection is the invariant line.

d. The axis of reflection is the perpendicular bisector of the lines joining the points on the object and the corresponding points on its image.



13.4 Enlargement (E)

A plane figure that has undergone an enlargement with a scale factor k centred at a fixed point exhibits the following characteristics;

a. The figure and its image are similar.

b. The scale factor k.

$$= \frac{\text{the length of the side of the image}}{\text{the length of the side of the object}}$$

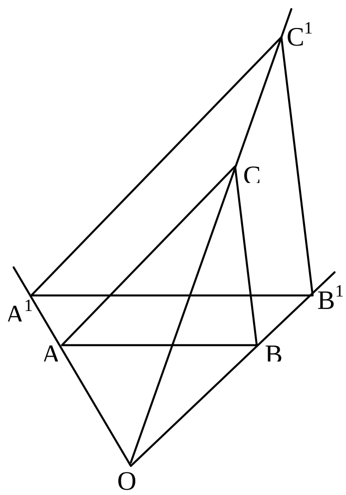
c. If $k > 0$, the object and its image are on the same side of the centre of enlargement.

d. If $k < 0$, the object and its image are on opposite sides of the centre of enlargement and the image inverted.

e. The change in area

$$= \frac{\text{the area of the image}}{\text{the area of the object}}$$

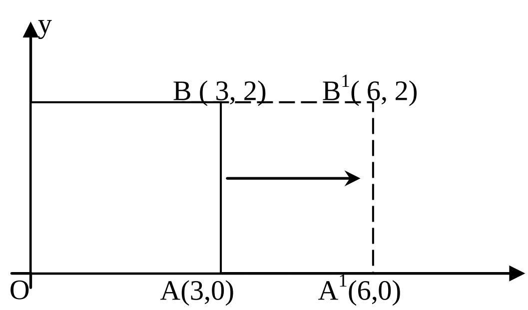
$$= k^2$$



13.5 Stretching (S)

A plane figure that has undergone stretching exhibits the following characteristics.

(i). Stretch parallel to the x – axis



In the diagram, the rectangle $OABC$ is mapped onto the rectangle $OA'B'C'$ under a stretch parallel to the x – axis, where

$$h = \frac{OA'}{OA} = \frac{OB'}{OB} = 2$$

a. It moves a point (a, b) parallel to the x-axis through a distance ha where h is the stretch factor.

b. The invariant line is the y-axis.

c. Stretch factor h

$$= \frac{\text{distance of new point from invariant line}}{\text{distance of original point from invariant line}}$$

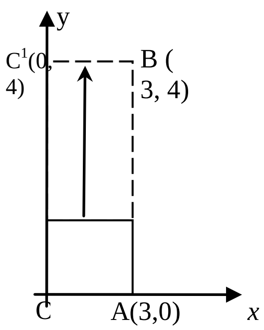
d. The change in area= $\dfrac{\text{area of image}}{\text{area of object}}$

$= h$

(ii) Stretch parallel to the *y*-axis

In the diagram, the rectangle *OABC* is mapped onto the rectangle OA′B′C′ under a stretch parallel to the y-axis

Where $k = \dfrac{OC'}{OC} = \dfrac{AB'}{AB} = 4.$



a. It moves a point *(a, b)* parallel to the *y*-axis is through a distance *kb* where *k* is the scale factor

b. The invariant line is the *x*-axis.

c. Stretch factor k

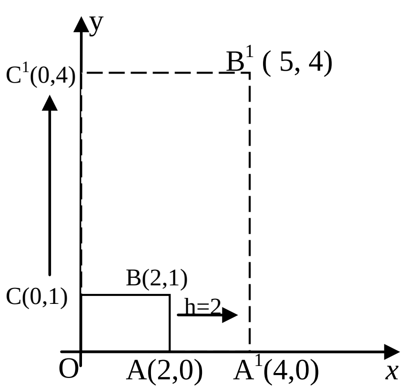
$= \dfrac{\text{distance of new point from invariant line}}{\text{distance of original point from invariant line}}$

d. The change in area = $\dfrac{\text{area of image}}{\text{area of object}}$

$= k$

(iii) Two – way stretch

A figure is stretched parallel to the *x*-axis as well as the *y*-axis. If the figure is stretched by the same scale factor *k* parallel to the both axes, it is an enlargement of the figure by a scale factor of *k*.



13.6 Shear (H)

A plane figure that has undergone shearing exhibits the following characteristics.

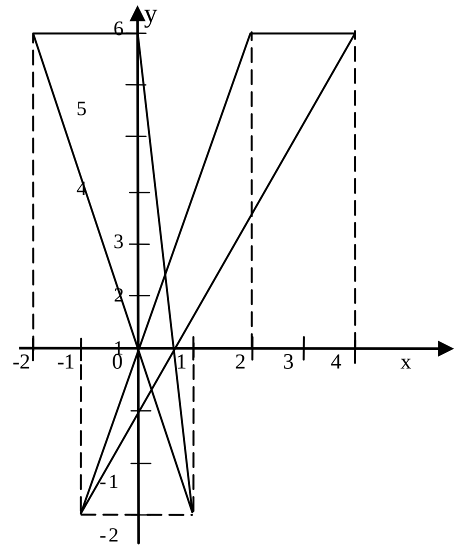
a. The areas of the figures do not change.

b. Points on opposite sides of the axis of shear move in opposite directions.

c. The points on the axis of shear are invariant.

d. All other points move parallel to the invariant line.

e. A shear parallel to the *x*-axis

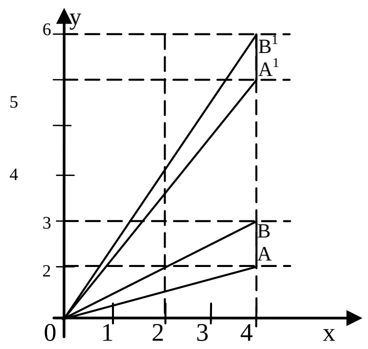


The triangle *ABC* is mapped onto the triangle *A′B′C′* by a shear with the *x*-axis as the invariant line *l*. The shear factor, λ, is given by

$\dfrac{\text{distance moved by A}}{\text{perpendicular distance of A to I}} = \dfrac{4}{6}$

$= \dfrac{2}{3}$

f. A shear parallel to the y-axis



The triangle OAB mapped onto the triangle OA′B′C′ under a shear with the y-axis as the invariant line I, the shear factor, λ, is given by $\dfrac{\text{distance moved by A}}{\text{perpendicular distance of A to I}}$

$$= \frac{4}{4}$$

$$= 1$$

13.7 Summary of transformation matrices

	Transformation Matrix	Matrix Equation	Remarks
TRANSLATION	Translation (T): $\begin{pmatrix} h \\ k \end{pmatrix}$	$T\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} x \\ y \end{pmatrix} + \begin{pmatrix} h \\ k \end{pmatrix} = \begin{pmatrix} x^1 \\ y \end{pmatrix}$	
ROTATION	Rotation of 90° about the origin, anticlockwise direction (R): $\begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$	$R\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} x' \\ y' \end{pmatrix}$	(x′, y′) is the image of (x, y) under the transformation
	Rotation of 90° about the origin (R): $\begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}$	$R\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} x' \\ y' \end{pmatrix}$	
	Rotation of 180° about the origin (R): $\begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix}$	$R\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} x' \\ y' \end{pmatrix}$	Under these transformations, the figures retained their shapes.
REFLECTION	Reflection in the x-axis (M): $\begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$	$M\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} x' \\ y' \end{pmatrix}$	

	Reflection in the y-axis (M): $\begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}$	$M\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} x' \\ y' \end{pmatrix}$	
	Reflection in the y = x (M): $\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$	$M\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} x' \\ y' \end{pmatrix}$	
	Reflection in the y = -x (M): $\begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix}$	$M\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} x' \\ y' \end{pmatrix}$	
ENLARGEMENT	Enlargement with centre at origin and scale factor k (E):	$E\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} k & 0 \\ 0 & k \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} x' \\ y' \end{pmatrix}$	Figures enlarged k times, i.e. the area of the image = k^2 x the are of the object
STRETCHING	Stretching from the x-axis with factor h(S):	$S\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 1 & 0 \\ 0 & h \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} x' \\ y' \end{pmatrix}$	x-axis invariant
	Stretching from the y-axis with factor h(S): $\begin{pmatrix} k & 0 \\ 0 & 1 \end{pmatrix}$	$S\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} k & 0 \\ 0 & 1 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} x' \\ y' \end{pmatrix}$	y-axis invariant
	Stretching from y-axis and x-axis with factors h and k respectively (S): $\begin{pmatrix} h & 0 \\ 0 & k \end{pmatrix}$	$H\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} h & 0 \\ 0 & k \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} x' \\ y' \end{pmatrix}$	The origin is invariant, when $h = k$,this transformation is equivalent to an enlargement
SHEARING	Shearing parallel to the x-axis with shearing factor k(H): $\begin{pmatrix} 1 & k \\ 0 & 1 \end{pmatrix}$	$H\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 1 & k \\ 0 & 1 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} x' \\ y' \end{pmatrix}$	Area of figures unchanged
	Shearing parallel to the y-axis with shearing factor k(H): $\begin{pmatrix} 1 & 0 \\ k & 1 \end{pmatrix}$	$H\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 1 & 0 \\ k & 1 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix}$	

		$= \begin{pmatrix} x' \\ y' \end{pmatrix}$	

UNIT 14
PROBLEM SOLVING AND NUMBER PATTERNS

14.1 Number sequences

A sequence is a set of terms which are written in a definite order obeying a certain rule. The following are some common sequences.

a. {1, 3, 5, ……}
This is an odd number sequence and the n^{th} term is $2n - 1$

b. {2, 4, 6, …}
This is an even number sequence and the n^{th} term is $2n$

c. {1, 4, 9, ….}
This is sequence of squares of natural numbers. The n^{th} term is n^2

d. {1, 8, 27, …..}
This is a sequence of cubes of natural numbers. The n^{th} term is n^2.

e. $\{1^3 - 1, 2^3 - 2, 3^3 - 3, ….\}$
This is a sequence of natural numbers subtracted from their cubes. The n^{th} term is $n^2 - n$.

f. {-1, 1, -1, 1, …..}
This sequence shows terms alternating in signs. The n^{th} term is $(-1)^n$.

g.{1, 2, 4, ….}
The n^{th} term of this sequence is 2^{n-1}

14.2 Number series

A series is the sum of the terms of a sequence. The following are some common series.

a. 1 + 2 + 3 + …………..
The sum of the terms in a natural number sequence is $\frac{n(n+1)}{2}$

b. 1 + 3 + 5 + ……
The sum of the terms in an odd number sequence is n^2.

c. 2 + 4 + 6 + ………….
The sum of the terms in an even number sequence is $n(n + 1)$

d. 1 + 2 + 4 + ………..
The sum of the terms is $2^n - 1$.

e.1 + 3 + 9 + ………..
The sum of the terms is $\frac{3^n - 1}{2}$

14.3 Arithmetic progression

An arithmetic progression is a sequence of terms in which any consecutive terms gives a common difference of a constant.

a. If a is first term of an arithmetic progression and d is the common difference, then the n^{th} term is

$$T_n = a + (n - 1)d$$

e.g {5, 7, 9, …..}

$$a = 5, d = 2$$
$$T_n = 5 + (n - 1) \times 2$$
$$= 2n + 3$$

b. The sum of the first n term is

$$S_n = \frac{n}{2}[2a + (n - 1)d] \text{ or}$$

$$S_n = \frac{n}{2}[a + l] \text{ if the last term } l$$

is given

e.g 3 + 7 + 11 + ……..

$$a = 3, d = 4$$

$$S_n = \frac{n}{2}[2 \times 3 + (n - 1) \times 4]$$

$$= \frac{n}{2}[6 + 4n - 4]$$

$$= n(2n + 1)$$

14.4 Geometric progression

A geometric progression is a sequence in which the common ratio obtained from a successive term over the term gives a constant.

a. If a is the first term of a geometric progression and r is the common ratio, then the nth term is $T_n = ar^{n-1}$

b. The sum of the first n terms is

$$S_n = \frac{a(r^n - 1)}{r - 1}, \text{ or } r > 1 \text{ or}$$

$$S_n = \frac{a(1 - r^n)}{1 - r}, \text{ if } r < 1$$

e.g. 5 + 15 + 45 + ……..

$$a = 5, \quad r = 3$$

$$S_n = \frac{5 \times (3^n - 1)}{3 - 1}$$

$$= \frac{5}{2}(3^n - 1)$$

The rules are given so that larger terms or sum of many terms can be easily found for any arithmetic and geometric progressions.

UCE MATHEMATICS
MODEL PAPERS
01

SECTION A:

1. Simplify

$$\frac{\left(3^2\right)^{\frac{3}{2}} \times \left(3^{-\frac{1}{2}}\right)}{3^{\frac{1}{2}}}$$

2. It is given that $y = \frac{k}{x} + 5$, and that y = 21, when x = 3.
(i) Calculate the value of k.
(ii) Hence calculate the value of x when y = 11

3. Factorise $x^2 + 3xy - 4y^2$ completely .

4. Find the equation of the straight line which passes through each of the following pairs of points (1, -1) , (4, 8).

5. Given that $L = \begin{pmatrix} 3 & 4 \\ 7 & 9 \end{pmatrix}$, $O = \begin{pmatrix} 4 & 3 \\ -8 & -5 \end{pmatrix}$

Calculate;
(i) L^{-1}
(ii) $(LO)^{-1}$

6. If $f(x) = 2x^2 + ax - 4$ and $f(1) = -3$,
Find
(i) the value of a,
(ii) $f(-2)$

7. A train traveling at 100km/h takes 4hours for a journey. How long would it take a train traveling at 60km/h ?

8. Given that $\overrightarrow{OA} = \begin{pmatrix} p \\ 4 \end{pmatrix}$ and $OB = \begin{pmatrix} 5 \\ 0 \end{pmatrix}$, find

i) the value of $|\overrightarrow{OA}|$

ii) a positive value for 5 if $\overrightarrow{OA}$ and $\overrightarrow{OB}$ are two sides of a rhombus.

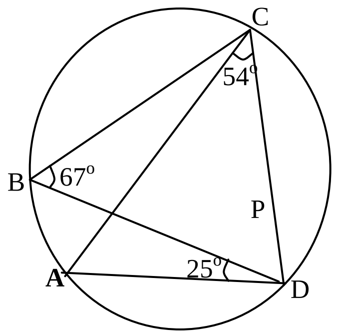
9. Without using tables or calculator, evaluate

$$3\log_{10}2 + \log_{10}20 - \log_{10}1.6$$

10. The diagonals AC and BD of the cyclic quadrilateral ABCD intersect at the point P.
Calculate
(i)the retardation during the last 20s.
(ii)the speed after 25s.
(iii)the total distance traveled

13. A transformation is represented by the matrix $\begin{pmatrix} 4 & 0 \\ -2 & 3 \end{pmatrix}$.

Given that $\angle$ **ABD** = 25^0, $\angle$ **ACD** = 54^0 and $\angle$ **DBC** = 67^0, calculate

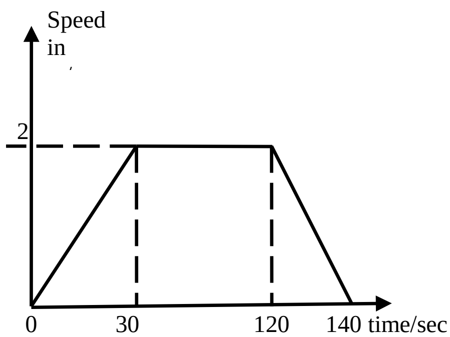


(i) $\angle$BAD
(ii) $\angle$CPD

SECTION B

11. Each of a group of students studies at least one of the three subjects Chemistry, Physics and Biology.
All those who study Physics also study Chemistry.
3 students study all three subjects,
4 students study only Chemistry
8 students study Physics.
14 Students study Chemistry
(i) Draw a Venn diagram to illustrate this information
(ii) How many students study only Biology?
(iii) How many students study chemistry and Biology but not Physics?

12. The diagram is the speed time graph for a particular journey.



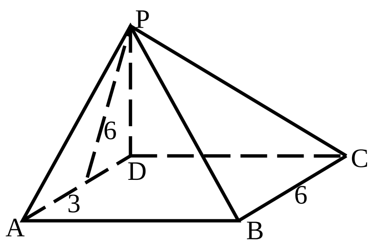
(i) Under this transformation, the point (1,-3) is mapped onto the point P. Find the co-ordinates of P.
(ii)Under the same transformation, the point Q is mapped onto the point (4,16). Find the co-ordinates of Q.

14. The marks scored by 800 candidates in an examination are shown in the cumulative frequency curve below.

(a) Using the curve, find, for this distribution;
(i) the number of candidates who scored 34 or less,
(ii) the median mark,
(iii) the inter-quartile range

(b) Given that 480 candidates passed the examination, find the pass mark.

15.



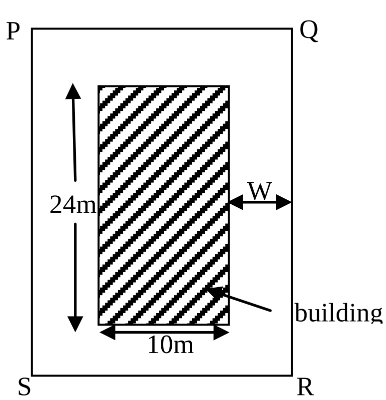
PABCD is a pyramid standing on a horizontal base ABCD. ABCD is a square with sides of length 6cm. E is the mid-point of AD. PE is vertical and PE = 6cm.
Calculate:
(a) the volume of PABCD,
(b) PA^2
(c) PB

16. The works obtained by a class of 30 boys in a mathematics test are given below.

21	13	10	15	11	20
23	14	16	13	18	12
19	19	21	17	12	15
12	11	14	15	18	11
10	14	16	11	18	21

(i)Construct a frequency table
(ii)State the modal mark
(iii)Calculate their mean mark

17.



Using the above figure to answer the question that follows.
A building 24m long and 10m wide, has a path of uniform width round it.
If the width of the path is w metres, write down $\overline{PQ}$ and $\overline{QR}$ in terms of w.
The area of the path is equal to the area of the rectangle PQRS,
Find an equation for w.
Calculate the width of the path.

UCE MATHEMATICS MODEL PAPERS 02

SECTION A:

1. (a) Factorise completely
$n^2 + n - 12$

(b) Solve the equation $\frac{3z}{4} - \frac{z}{3} = 2\frac{1}{2}$

2. (a) Simplify $\ell og_3 24 + \ell og_3 15 - \ell og_3 10$
(b) Evaluate $\ell og_{27} 3$

3. $f(x) = 3x - \frac{7}{2}$

(a) Find
(i) f (5)
(ii) f (-1)
(b) Find the inverse function $f^{-1}(x)$

4. $AB = \begin{pmatrix} -8 \\ 6 \end{pmatrix}$

(i) Calculate $|AB|$
(ii) Given that A is the point (7, 3), find the co-ordinates of the point B.

5. A universal set has 24 elements and **A** and **B** are subsets of the universal set such that
n(**A**) = 14, n(**B**) = 9 and n(**A**∩**B**) = 6

If P(**A**) is the probability of selecting an element belonging to set **A**,
calculate (a) P(**A**)
(a) P(**A** ∩ **B**)
(b) P(**A**)

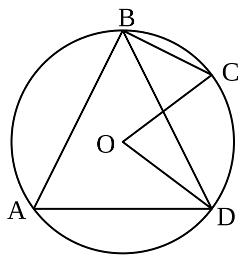
6. Given that $x = R\sqrt{A}$, where R is a constant, and that x =10 when A = 64,
Find (i) the value of R

(ii) The value of A when x = 15

7. Find the determinant of the matrix $\begin{pmatrix} -5 & 2 \\ 1 & -3 \end{pmatrix}$
hence obtain the inverse of the matrix .

8. Solve for t
$\frac{6}{t} - \frac{5}{t} + 2 = 1$

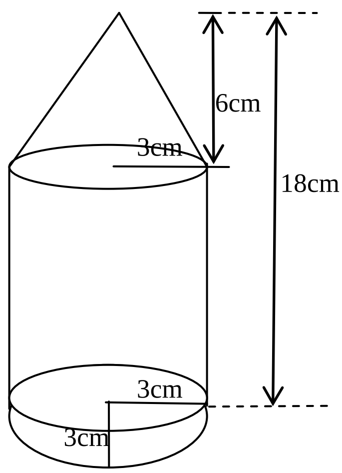
9.



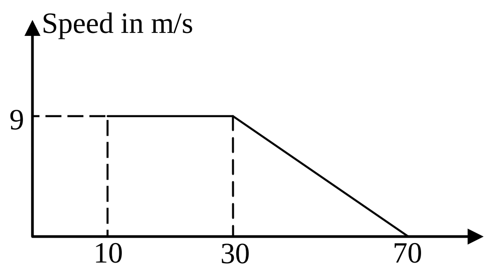
The point A, BC and D lie on a circle centre O.
ABD = 50^o and DBC = 60^o
Calculate (i) COD
(ii) ADC

SECTION B

11. Find the volume and total surface area of the figure below



12.



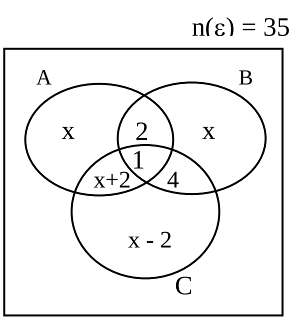
The diagram is the speed-time graph for a particular journey, calculate
(i) The acceleration during the first 10s.
(ii)The total distance traveled on the journey
(iii) The speed when t = 40.

13. Calculate
(i) mean distribution
(ii) median
(iii) mode of the following

Age in years	No. of students
12	2
13	3
14	5
15	6
16	4
17	3
18	2

14. People staying at a holiday hotel are able to take part in sailing , swimming and golf.
4 people take part in all the three activities.
17 People take part in sailing and swimming but not golf.
21 People take part in swimming and Golf but not sailing.
12 People take part in Golf and sailing but not swimming.
42 People take part in sailing only
x People take part in swimming only.
(x - 2) People take part in Golf only.
16 People do not take part in any of these activities.
(i)Draw a Venn diagram to show the above information.
(ii) Given that 250 people are staying at the hotel, calculate
(a) x
(b) The number of people who do not take part in swimming.

15.



Using the above Venn diagram,
(a) Calculate
(i) The value of x.
(ii) The number of elements in set C
(b) Find the probability that if an element is selected at random belongs to at most two sets.

16. Using a ruler and a compass only, construct
(i) Triangle ABC with B = 6cm, AB = 3.5cm and angle ABC = 120◦
(ii) Draw a circle with BC as diameter.

(ii) Find a point P on the circumference which is equidistant from AB and BC. Measure the angle BCP.

17. Two lamp posts of equal heights are standing opposite to each other on either side of a road, which is 80m wide. From a point between them on the road, the angles of elevation of the tops are 30◦

and 60°. Find the position of the point and also the height of the posts.

UCE MATHEMATICS
MODEL PAPERS
03

SECTION A:

1. Factorise completely
$6w^2 - w - 12$

2. Evaluate
$$\ell og_a\left(\frac{5}{7}\right) + 2\ell og_a\left(\frac{7}{6}\right) - \ell og_a\left(\frac{5}{6}\right)$$

3. If $f(x) = 2x^2 + ax - 4$ and f (1) = -3,
Find (i) the value of a

(ii) $f^{-1}(-2)$

4. It is given that OA $= \begin{pmatrix}3\\4\end{pmatrix}$, AB $= \begin{pmatrix}9\\n\end{pmatrix}$ and OB $= \begin{pmatrix}2m\\m\end{pmatrix}$
Find the value of
(i) | OA|
(ii) m
(iii) n

5. P = {x : x is an integer and 3 = x = 16} , Q = {All even numbers less than 11}
Find (i) n (P ∩ Q)
(ii) $n(Q)^1$

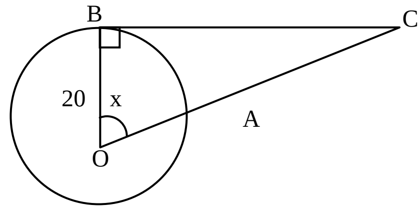
6. Given that p is proportional to q^3 and that p = 500 when q = 5.

(a) Express p in terms of q.
(b) Find the value of p when q = -3

7. Given that
$$\begin{pmatrix}3 & 1\\-1 & q\end{pmatrix}\begin{pmatrix}1 & 2\\0 & 1\end{pmatrix} = \begin{pmatrix}p & 7\\-1 & 4\end{pmatrix}$$, find the value of p and the value of q.

8. Solve the equation $\left(\frac{3}{r-2}\right) + \left(\frac{1}{r}\right) = 0$

9. In the diagram, O is the centre of the circle of radius 20cm which passes through the point A and B.

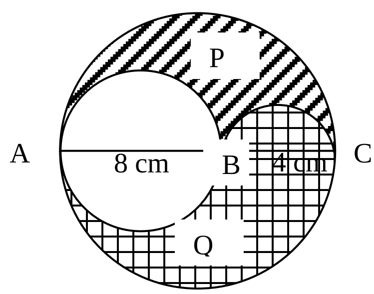


The tanget at B meets OA produced at C. Given that AOB = x° and using as much of the information given as is necessary, calculate
(i) OC
(ii) The area of triangle AOB

10. Solve the equation $6 + \frac{2x+1}{3} = x$.

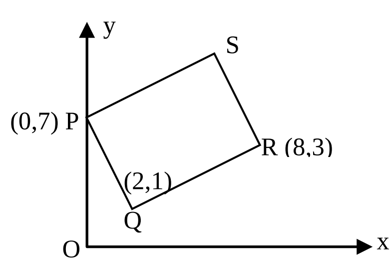
SECTION B

11. In the figure below, regions p and q are each bounded by 3 semi circles.



If AB = 8cm, BC = 4cm, Find
(a) area of region p.
(b) area of region q
(c) the ratio of the area p to that of area q. (Leave π in the answer)

12. In the diagram, PQRS is a square. P is the point (0, 7), Q is the point (2,1) and R is the point (8,3).



(a) Find
(i) the coordinates of S.
(ii) the equation of PQ.

(b) Calculate the area of the square.

13. IQ of 50 students was recorded as follows:

IQ score	No. of students

80 - 90	6
90 -100	9
100 -110	16
110 -120	13
120 -130	4
130 -140	2

Draw a histogram for the above data and estimate the mode.

14. The sides of a right angled triangle containing the right angle are 5x cm and $(3x-1)$cm. If the area of the triangle is 60 cm², calculate the lengths of sides of the triangle.

15. ABCD is a square with coordinates A (2,-1), B(4,-1), C(4,-3),and D(2,-3), is given a positive quarter turn to obtain A'B'C'D' about the origin and the image of A'B'C'D'is then given a reflection along the y axis.

a) Write down the coordinates of the points A'B'C'and'D and A"B"C" and D"

b) Find a single matrix that maps the square ABCD onto A"B"C" D"

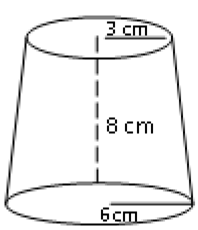
16.

Distance (km)	100	200	300	400	500
Reciprocal of time(h)	2	1	2/3	1/2	2/5

(a) Plot a graph of distance against time.

(b) From your graph determine the time taken to cover
(i) 350km
(ii) 600km

17.



The above diagram shows a drum which was cut off from a right circular cone of height 12cm.
Calculate:
(i) the volume of the cut off cone.
(ii) the volume of the drum.

UCE MATHEMATICS MODEL PAPERS 04

SECTION A:

1. Factorise completely
$2a^2-3a+2ah-3h$

2. Without using tables, evaluate
$$\frac{12^{3/2}\times 16^{1/8}}{27^{1/6}\times 18^{1/2}}$$

3. Given that $f(x)=x^2+1,\ \ g(x)=x-1$
Find x for which $fg(x)=gf(x)$

4. P is the point (3, 4) and Q is the point (11,10),
(i) Calculate the co-ordinates of the mid - point of PQ.
(ii)Express $\overline{PQ}$ as a column vector

5. It is given that n(ε) = 50 and that P and Q are two sets for which n(P∩Q) = 6, n(P) = 18, n(Q) = 14.
(a) Draw a Venn diagram to illustrate this information.
(b) Find $n(P\cap Q^1)$

6. The table below represents the relationship between the speed and the time taken for a train to travel between two stations.

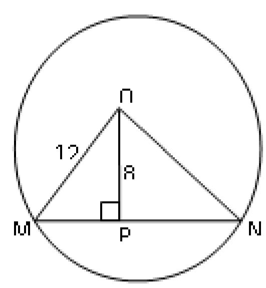
Speed (Km/h)	**60**		
Time(h)	**2**	**3**	**4**

Copy and complete the table and show your working.

7. Given that $\begin{pmatrix} 7 & 2k+1 \\ 2 & 3 \end{pmatrix}$ is a singular matrix, find the value of $4k+2$.

8. Given that $\frac{2p+q}{2p-q}$ express p in terms of q.

9.



In the diagram, O is the centre of the circle and OP is perpendicular to the chord MN. Given that OP = 8cm and OM = 12cm. Calculate the length MN.

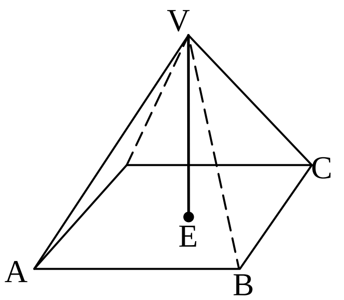
10. If electrical resistances, R_1 and R_2 ohms, are placed in parallel, the overall resistance R ohms, of the circuit is given by the formula $R = \dfrac{R_1R_2}{R_1 + R_2}$

(i) Find the overall resistance R, when $R_1 = 3$ and $R_2 = 5$.
(ii) Calculate the value of R_1 when R = 6 and $R_2 = 10$

SECTION B

11. In a certain trading centre there are 42 shops selling clothes (C), soda (S) and bee(B) of these 25 sell cloths, 20 sell sodas and 22 sell beer. 11 shops sell both cloths and soda, 10 sell both soda and beer, 9 sell both beer and cloths.
Given that the shops sell at least one of the items.
Find the
(i) number of shops which sell all the three items.
(ii) number of shops which sell at least two of the items.
(iii) probability that when a shop is selected at random sells only one item.

12.

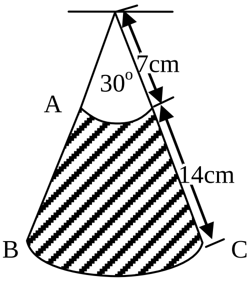


A B C D V is a pyramid. ABCD, 8cm square, is its base; V is 6cm vertically above the centre E of the base.
(a) Calculate the length BV.
(b) Find the angle between the planes AVC and BVD.
(c) Calculate the angle between the planes BCV and ABCD.

13. Find the mode of the following distribution by drawing a histogram.

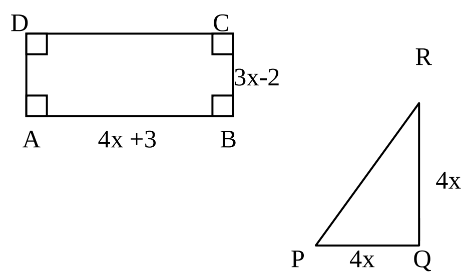
Class	Frequency
0 -10	6
10 - 20	10
20 - 30	18
30 - 40	22
40 - 50	15
50 - 60	8

14.



The given diagram represents the area swept by the wiper of a car.
With the dimensions given in the diagram, calculate the shaded area swept by the wiper.

15.



ABCD is a rectangle in which $AB = (4x + 3)$ cm and $BC \approx (3x - 2)$cm . PQR is a triangle in which $PQ = QR = 4x$ and angle PQR=90°. The area of the rectangle ABCD is equal to the area of the triangle PQR.

(i) Form an equation in x and show that it reduces to $4x^2 + x - 6 = 0$.
(ii) Solve this equation, giving your answers correct to 2 decimal places.
(iii) Hence find the length of PQ.

16. A triangle ABC with vertices A (1, 1), B (2, 1), and C (2, 2) is given a rotation about a point to obtain.
A′ (1, 3), B′ (1, 4) and C′ (0, 4). A′B′C′ the Image of ABC is then given a reflection along the y-axis to obtain A″ B″ C″.
(a)On the same axes draw triangle ABC and its images A′B′C′ and A″B″C″.
(b)Find the centre and the angle of rotation.

17. a) Solve the equations below simultaneously
$2x + 4y = 12$

$x^2 + y^2 = 25$

b) The function of $f(x)$ is given by

$f(x) = x^2 + 2x - 24 = 0$

Write the function in the form $(x+p)^2 + q$ where p and q are integers,

Hence find the solution set for the function.

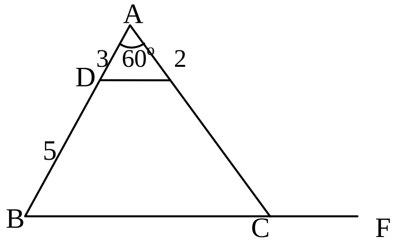
UCE MATHEMATICS MODEL PAPERS 05

SECTION A:

1. A man deposited Sh 6000 with the post office savings Bank on 1st January 1974. Four years later his saving had accumulated to Shs 6840 as a result of sinple interest paid by the bank.
Determine the bank interest rate.

2. A ball moves in such a way that its speed V and its displacement *x* from a given point, are related by $V = W\sqrt{(A^2 - X^2)}$ where W and A are constants given that A = 8m and W = $\sqrt{3}$
Find the points at which the ball is moving with a speed of $12ms^{-1}$

3.



In the figure above DE is parallel to BC, $\overline{BD} = 5$ cm, $\overline{DA} = 3$cm and $\overline{AE} = 2$cm. Calculate the length of BC

4. Given that $125_n = 53_{ten}$ Find the value of n.

5. 10 men take 2 hours off loading a track.
How many hours will 15 men take to do the same work if they all work at the same rate?

6. Solve the equation $x - 9 = \frac{-20}{x}$

7. Given that $\tan\theta = \frac{-3}{4}$, without using tables or calculator. Find the values of $3\cos\theta - \sin\theta$.

8. Simplify $\dfrac{2\frac{1}{4} + 4\frac{1}{3}}{1\frac{1}{4} - \frac{1}{12}}$

9. The binary operation A is defined by $a \Lambda b = a\sqrt{b}$ where a and b are real numbers. Given that $a = 6.25 \times 10^{-4}$, $b = 5 \times 10^5$ and $c = 2.5 \times 10^{-1}$.
Find the value of $a \wedge (b \wedge c)$.

10. Futuwak, a rub used by one of the super league division football teams is prepared from three drugs. Raka, Siko and Tik. Raka contains 3 dozes of P, 2 dozes of Q and 1 doze of R. Siko contains 1 doze of P, none of Q and 2 dozes of R. Tik contains 5 dozes of P, 3 dozes of Q and 2 dozes of R.
(i) Write down this information in a matrix form.
(ii) If each unit of P costs Sh 10, each unit of Q cost Sh 15 and each unit of R cost Sh 5. Find the total cost of preparing "Futuwak.

SECTION B

11. A plane flies from airstrip A to airstrip B due east for 300km. From B it flew due south for 400km to airstrip C. It then altered its course and flew to airstrip D on a bearing of $053^{0.}$
a) Using a scale of 1 cm to 100km, draw an accurate diagram showing the route of the plane.
b) From your diagram, determine the distance and the bearing of the final position of the plane from airstrip A.

12. The table below shows the allowances given to employees in a certain farm.

Medical Sh 50,000 per month.
Housing Sh 40,000 per month.
Water and electricity Sh 20,000 per month.
Insurance Sh 300,000 per annum.
Family allowance is allowed for only two children
between 0-9 years, Sh 10,000 and above 9 years, Sh 5000.

The tax structure of the farm is as shown below:

Income per month (shs)	Tax Rate (%)
0-80,000	10.0
80,001-160,000	15.0
160,001-240,000	25.0
240,001-320,000	32.0
Above 320,000	36.0

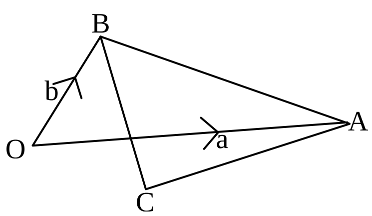
Given that James has 3 children all below 9 year and he pays income tax of
Shs. 87,200
Calculate i) his total allowance
ii) his monthly gross income
iii) the percentage of his gross income that goes to tax.

13. Copy and complete the table below for the curve $y = -x^2 - 2x$ and the line $y = 2x$.

x	-4	-3	-2	-1
-x	-16			
-2x	8			
y				
2x				
y				
0	1	2	3	4
0				
0				
0				
0				
0				

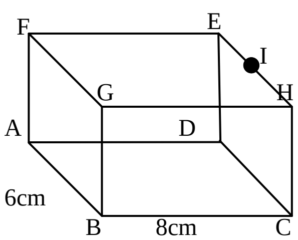
b) (i) Plot a graph of the curve $y = -x^2 - 2x$ and the line $y = 2x + 3$ on the same axes.
(ii) Use your graph to solve the equation $-x^2 - 2x = 2x + 3$.

14. Given the diagram below, the vectors OA = *a* and OB = b, $2\overline{BC} = 3\overline{CA}$.



Find in terms of a and b, the vectors
i) BA
ii) CA
iii) OC

15.



The above diagram ABCDEFGH is a cuboid of sides 6cm by 8cm by 12cm,
I is the mid-point of EH.
Calculate ;

(i) the length BE.
(ii) angle between the line BE and the plane ABCD.
(iii) angle between planes ABI and the base.

16. A reservoir, when full contains 1.8×10^8 litres of water.
a) During a period of dry weather, the volume of water was reduced by 1.2×10^6 litres each day until it was empty. Calculate the number of days supply the reservoir held when full.
(b) Find the volume of the water in the reservoir when it was half full.

17. (a) A cyclist is traveling from A to C. He travels for 50 km at a constant speed of *x*km/h, until he reaches the point B, where his bicycle chain breaks. He then walks the remaining 6 km from B to C at a constant speed of (x - 16) km/h.
Given that the total time for the whole journey is 4 hours.
Show that $x^2 - 30x + 200 = 0$

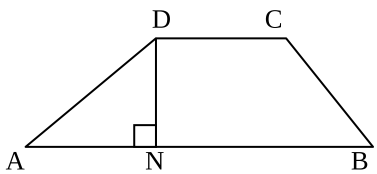
(b) Find the time in hours and minutes the cyclist would have taken if he had completed the whole journey by bicycle at the original, constant speed.

UCE MATHEMATICS MODEL PAPERS 06

SECTION A:

1. Given that $10022_{three} = 155_n$. Find the value of n.
2. There are 35 boys in Bongo's class 22 of them are chosen at random to play a game . What is the probability that Bongo will be missed out .
3.Given that $\cos A = \frac{15}{13}$ and $270^0 \langle A \langle 360^0$ find the values of sin A and tan A without using tables or calculators hence find sin A+ tan A
4. A man bought boat price at $3000 but was allowed discount of $7\frac{1}{2}\%$ calculate the price paid in shillings if 1$ = 2000 Ug shillings
5. A map is drawn to scale of 1 : 50,000 an airport runway is represented by a line of length 4.6 cm on the map calculate the actual length of the runway giving your answers in km

6.



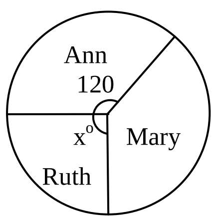
ABCD is a trapezium in which AB is parallel to CD. N is the point on AB such that angle DNA = 90, AD = BC = 15 cm DN = 12 cm and DC = 10 cm

Calculate

(i) AN

(ii) The area of ABCD

7. Ann, Mary and Ruth have 3000 stamps between them Ruth has 800 stamps the pie chart represents the number of stamps each girl has



(i) how many stamps does Ann have

(ii) calculate the value of x

8. The point A (4, 1) is mapped onto the point A^1 (4, 14) by a transformation matrix M find the matrix M

9. Given that y is directly proportional to the cube root of x and that y = 18 when x = 27 find the value of y when x = 125

10. Express as a single fraction

$$\frac{4}{2x-1} - \frac{3}{5x+6}$$

SECTION B

11. On the same coordinates axes, draw the curve

$y = \frac{1}{2}(7x - x^2)$ for $-2 \le x \le 8$ and the line

$y = x + 1$

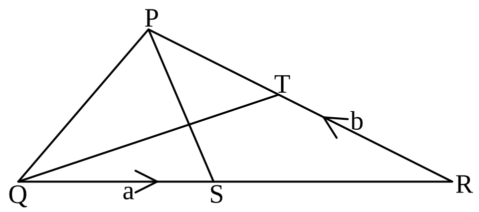
b) Use your graph to solve the equation

$7x - x^2 = 5$

c) By shading the unwanted region show the region represented by

$y \rangle \frac{1}{2}(7x - x^2)$

12.



In the diagram QR = 4 QS and SP = 5 SX. T is the midpoint of PR QS = a and RT = b

(i) Express as simply as possible in terms of a and b

a) SR

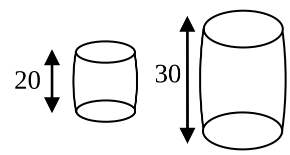
b) SP

c) SX

(ii) Show that $QX = \frac{2}{5}(4a + b)$

(iii) Express QT in terms of a and b and find the ratio of QX to QT

13.

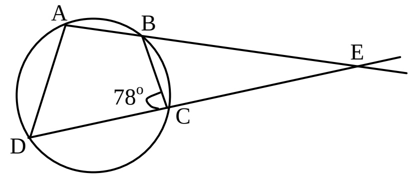


The two containers shows in the diagram are geographically similar their heights are 20cm and 30cm

a) The diameter of the base of the larger one is 12 cm calculate the diameter of the smaller container

b) The containers are completely filled with sand given that the smaller container holds 2.4 kg of sand estimate the mass of the sand the larger container holds

14.



A, B, C, D lie on a circle and angle BCD = 78. AB produced and DC produced meet at E

i) Calculate the angle BAD

ii) Show triangle ADE and CDE are similar

iii) Given that AD = 6cm, BC = 4cm, and the area of triangle BCE=12cm

Calculate the area of quadrilateral ABCD

15. a) A ship leaves a point P and sails for 5 cm on a bearing of 120^0 to a point Q

i) Find the bearing of P from Q

ii) Find how far Q is east of p

b) Ann stands at A, which is at the top of a vertical cliff AC she sees a boat on the lake at B which is 80m from C the angle of depression of B from A is 35^0

i) Calculate the height of the cliff

ii) If a yacht is on the lake at D and the angle of elevation of A from D is 55^0

Find the distance between B and D

16. The monthly income tax system of a certain country is given as below

Basic pay (shs)	Tax %
1st 0 - 200,000	Free
201000 - 300,000	10.0
301,000 - 400,000	12.0
401,000 - 500,000	15.0
501,000 - 600,000	30.0

The allowances in excess of sh 100,000 is subjected to a tax of 20% of the monthly allowance

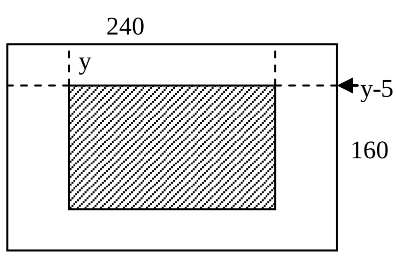
John and James earn as follows

John earns sh 500,000 and an allowance of 250,000 sh while James only a basic monthly pay of 600,000 sh

Find their monthly income tax

ii) Express John's income tax as a percentage of his monthly earnings

17. The diagram below shows a rectangular space which is 240 cm by 160 cm this is to have on row of rectangular tiles stuck inside each edge so that they cover the un shaded area only



The tiles measure y cm by $(y-5)$cm

Each tile is placed so that its longer side is vertical

(i) Write don an expression in terms of y for the number of tiles that will fit across the top row

(ii)Given that 44 tiles are required to fill the whole un shaded area form an equation and show that

$3y^2 - 65y + 100 = 0$

(iii)Find the length of each tile

UCE MATHEMATICS
MODEL PAPERS
07

SECTION A:

1. Find the cube root of $3\frac{1}{3}(55^2 - 25^2)$

2. Find the discount on a car priced at Shs 5million but sold at a discount of

$5\frac{1}{2}\%$ and how much was paid for the car.

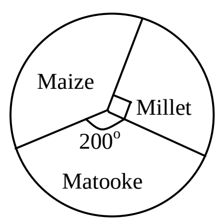
3. y is directly proportional to x^3 and when $x = 10$, $y = 500$.
Find the value of x when $y = 40$

4. Express the bearing of "West North West" (WNW) in degrees.

5. The scale of a map is 1cm: 40 km. Two towns are 10cm a part. A man driving a car covers this distance in 100 minutes. Find his speed in km/h

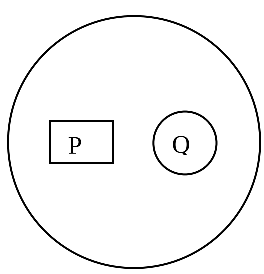
6. The numbers selected at random are (3,4,7,9,10,13,24,15)
Find the probability that a number chosen is divisible by three and it's a prime number.

7.



The pie chart above shows the distribution of food in a certain farm. If maize covers an area of 1400m². Calculate the area covered by matoke.

8.

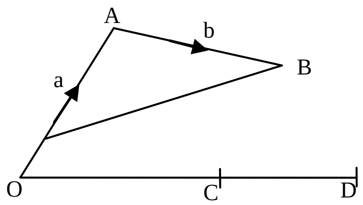


The diagram represents a cross-section of two holes P and Q bored in a cylinder solid of length 0.75m and diameter 16cm.
The cross-section of P is a square of length 2cm and that of Q is a circle of diameter 4cm.
Find the volume of the remaining solid (leave π in your answer)

9. Given the following domain
(-2, -1, 0, 1, 2, 3) write down the range of the mapping. $f : x \rightarrow |x - x^2|$

10. By writing 0.000025 as $a \times 10^n$, find the square root of 0.000025

SECTION B



11. Given that vector OA = a, AB = b, OF : OA = 1:5, $2\overline{CD}$ = OC and OC = $\frac{1}{2}$AB.

(a) Find in terms of a and b vectors
(i)FB
(ii) AC
(iii) BC
(iv) BD
(b) Show that OD is parallel to AB

12. (a) A man deposited Sh 400,000 in the bank at a simple interest rate of 4% per month. Find his interest after one year.

b) The table below shows an advertisement of a shop along Kampala road.

GET A LAPTOP CHEAPLY WHILE STOCK LASTS:

CASH TERMS: 2.5 MILLION

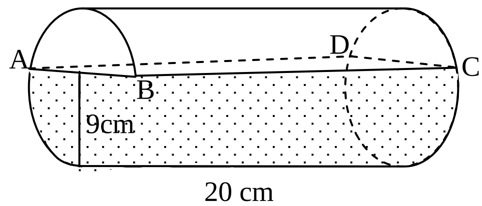
OR HIRE PURCHASE

DEPOSIT SH. 500,000 AND PAY SH 250,000 WEEKLY FOR 12 WEEKS.

Calculate the savings a customer makes by buying the laptop in cash terms rather than weekly hire purchase.

13. a) On the same axes, draw a graph of the curve $4 - 5x - 2x^2$ and the line $y = -x - 2$ for $-5 \leq x \leq 2$
b) Use your graphs to solve the equation.
i) $4 - 5x - 2x^2 = 0$
ii) $3 - 2x - x^2 = 0$

14.



A cylindrical vessel resting on a horizontal surface was cut off at the point A, B, C and D. The vessel, which has a radius of 6cm and length 20cm, contains liquid to a depth of 9cm.
Calculate i) the volume of the liquid
ii) the capacity of the cut off piece.

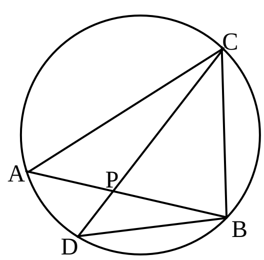
15. A straight road runs from west towards East to a person who was 60m away from a point B, observes a tree at A on a bearing of 216.8^0 from where he was.
Given that A is due south of B and is 80m away.
Using a scale of 1 cm to represent 10m.
a) Draw an accurate diagram to show the positions of the tree and the man.
b) Find the distance and bearing of the man from the tree

16. The table below shows the lengths of seedlings in centimeters.

Length	**No. of seedlings**
1.0 - 1.4	2
1.5 - 1.9	3
2.0 - 2.4	5
2.5 - 2.9	4
3.0 - 3.4	2
3.5 - 3.9	1
4.0 - 4.5	3

(a) State the (i) class width
(ii) modal class
(b) Determine the mean and the mode

17.



AB and CD are chords of a circle as shown above.
If AP = 6cm, PB = 4cm and CD = 14cm.
a) Find the length PD and CP
b) What can you say about PD and CP
c) Find the ratio of CP to PD.

UCE MATHEMATICS MODEL PAPERS
08

SECTION A:

1. A shirt costing Sh 100,000 was sold to Peter at a discount of 2%. Peter then sold the shirt to John at a profit of 10% . How much profit did Peter make?

2. Solve the equation $2x^2 - x - 3 = 0$

3. Given that y is inversely proportional to the square root of *x* and that when
x = 25, y = 40. Find the value of x when
y = 50.

4. If $(p+q)^3$ is miscopied and written as $p^3 + q$, find the percentage error made in evaluating $(p+q)^3$ when p = 5 and q = 3.

5. On a map of scale 1:40,000,000, Uganda is 1.4cm long and 1.2cm wide.
Calculate the approximate size of the country in km²

6. Use matrix method to solve for x and y in
$2x + 3y = 7$
$y - x = 2$

7. If $y = 2^x$ write the equation
$4^x - 2^{x+2} + 4 + 0$ as a quadratic equation in y.
Hence find the value of x.

8. A boy was sent to buy soap. He was given Sh 2,300 which was exactly sufficient for four bars of washing soap and five tablets of bathing soap. However when he reached town, he mixed up the figures. He asked for five bars and four tablets. Then he realized that he was short of money by Sh 125.
What was the cost for each bar and each tablet of soap?

9. A fisherman rowing on a lake towards a vertical tower on the top of a hill notices that the angle of elevation of the top of the tower is 45^0. After rowing a further distance of *y* metres in the same direction, the angle changes to 60^0 Given that the top of the tower is $500\sqrt{3}m$ above the level of the lake, find *y*.

10. The mean ages of 20 girls in a class is 14 and that of 30 boys is 16.
Find the average age of the class.

11. Draw on the same axes the graphs of the curve $y = x^2 + 2x + 1$ and the line $y = x - 3$. For $-4 \le x \le 4$.
Use your graph to solve the equations
i) $x^2 + 2x + 1 = 0$
ii) $x^2 + x + 4 = 0$

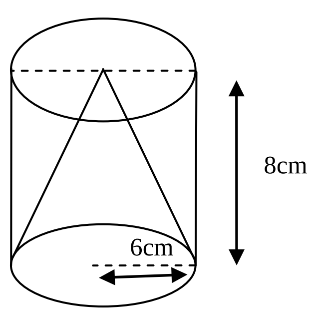
12. In a triangle ABC, the vectors AB = a, AC = b, E is the mid-point of AC, D divides the line BC in the ratio of 2:5 and F is a point on BE such that 2BF = 3FE.
a) Find in terms of *a* and *b* the vectors.
(i) BC
(ii)AD
(iii)BE
(iv)ED

13. The table below shows the tax structure on taxable income of a certain class of people in Kampala.

Income per month (sh)	Tax rate%
0-60,000	5.0
60,001-100,000	20.0
100,001-200,000	30.0
200,001-300,000	35.0
Above 300,000	40.0

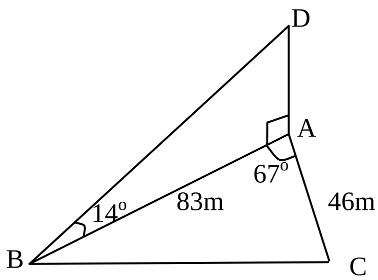
A man's gross monthly income is Sh 600,000. The allowances are as follows;
i) Marriage sh 20,000 per month
ii) Medical sh 30,000 per month
iii) Transport sh 500 per day
iv) Lunch sh 1500 per day
Given that the man is married
Determine (i) his taxable income
(ii) the income tax he pays monthly
(iii) the percentage of his gross income that goes to tax

14.



From a solid cylinder whose height is 8cm and radius 6cm, a conical cavity of height 8cm and of base radius 6cm is hollowed out.
(a) Find the volume of the remaining solid.
(b) Calculate the total surface area of the remaining solid.

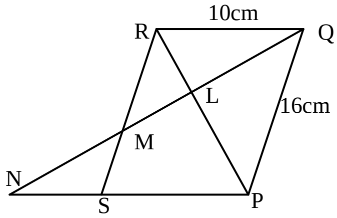
15.



In the diagram above, ABC represents a horizontal triangular field and AD represents a vertical tree in the corner of the field. A path runs a long the edge BC of the field.
The lengths AB and AC are 83m and 46m respectively and angle BAC = 67^0. The angle of elevation of the top of the Tree from B is 14^0
Calculate (i) the length of the tree
(ii) the length BC and area of the field ABC
iii) the greatest angle of elevation of the top of the tree when viewed from any point on the path

16. (a) Solve the simultaneous equations using graphical method.
$-x+3y-7=0$
$9-4y+x=0$
(b) A line passes through a point P (a, b) and it's perpendicular to the line
$3x=5y+8$
(i) Find the equation of the line.

17.



In the figure, PQRS is a parallelogram; PQ = 16cm, QR=10cm, L is a point on PR such that RL: LP = 2:3 QL produced meets RS at M and PS produced at N.
i) Prove that the triangle RLQ is similar to triangle PLN and hence find PN.
ii) Name a triangle similar to triangle RLM. Evaluate RM.

UCE MATHEMATICS MODEL PAPERS 09

SECTION A:

1. Solve for x in the equation
$\sqrt{(x+6)}=x-6$

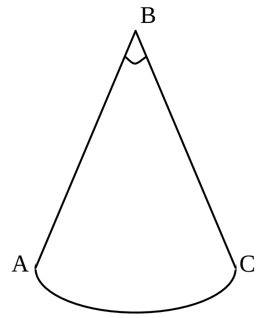
2. Given that $6x^2-3y^2:x^2+y^2=6:25$, find the value of x :y

3. A triangle whose area is $15cm^2$ is transformed under enlargement about a point in space. If the area of the image is $13.5cm^2$ find the scale factor of enlargement.

4. PQR is a triangle such that PQ = 9cm QR = 10 cm and angle QPR = 90
Find the angle PQR and QRP.

5.Find the perimeter of a triangle whose vertices are
(-1, 3), (1, 1) and (5, 1)

(6).



If the above figure was folded to form a circular cone of height 6cm. Given that the length of the arc AC is $\frac{432}{7}$ cm
Find the curved area of the cone

7. Find the L.C.M and H.C.F of 45 and 30

8. A car was bought at 2 million shillings and it depreciated at a rate of 20% in the first year and 10% in the second year. Find the cost of the car after 2 years.

9 A helicopter flies due north at $126\,km/hr$ for 1 hr and then due east at the same speed for 20 minutes.Calculate t he course it should take in order to return directly to its starting point.

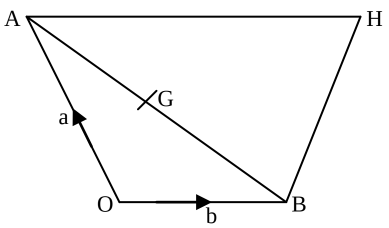
10. (i) A swimming bath has a cross - section in their shape of a trapezium. The water is 0.7m deep at one end and 2.5m deep at the other. The water

surface is 30m by 8m Calculate
(a) the angle of the slope of the bottom of the bath
(b) The volume of water.

SECTION B

11. A fair die is tossed once.
Find the probability that a triangular number shows up.
b) A boy picks two balls in succession from a basket containing 4 white and
8 yellow balls. If the first ball picked is not replaced
Find the probability that
(i)the second ball is white given that the first one was yellow.
(ii)both of them are of the same color.

12.



OB is a triangle, G is the point on AB such that $4AG = 2AB$.
It s a point produced from A such that AH = 3OB
Given that OA = a and OB = b
(i) express AG and OG in terms of a and b
(ii) if BH = xa + yb,
Find the values of x and y
(iii) Show that the points O, G and H are collinear

13.The table below shows the tax structure on taxable income of a certain
working class of people .An employee earns sh 750,000 per month his allowances include marriage allowance one fifth of his gross income. Water and electricity sh 25,000
per month sh 15,000 per months insurance sh 40,000 per months housing, medical sh 25,000 per months, transport shs 36,000 per months, family allowances for 4 children only. children in the age bracket of 0 to 10 years
12,000 per child, between 10 and 18 years shs 8000 and over 18 years sh 5000 per child

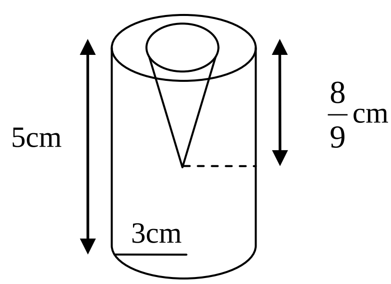
a) calculate the monthly taxable income and income tax he pays given that
he has 3 children, two of whom are aged between 0 - 10 and one is 20
years
b) What percentage of his gross income goes to tax?

Income sh per months	Tax rate%
0 – 30,000	10.0
30,001 -90,000	16.5
90,001 -190,000	23.5
190,001 -340,000	32.0
340,001 -500,000	40.0
Above 500,000	49.5

14. (a) Draw the graph of the curve $y = x^2 + x - 3$ and the line $y = x - 1$ for
$-3 \le x \le 3$
(b) Use your graph to solve the following equations
(i) $x^2 + x - 3 = 0$
(ii) $x^2 + x = 5$
(c) What are the points of intersection between the curve and the line write
only the x coordinates

15. the vertices of triangle ABC are A(4,2),B(4,5) and C(6,5) . The vertices of
triangle DEF are D (0, 6), E (-3, 6) and F (-3, 8)
a) Draw the two triangles on the same axes.
b) Describe fully the single transformation which maps ABC onto DEF.
c) A reflection in the y- axis maps triangle DEF onto triangle DKL
Find the coordinates of D, K, and L.

16.



A metallic cylinder has radius 3cm and height 5cm. It is made of a metal A. To reduce its weight a conical hole is drilled in the cylinder and it is completely filled with a lighter metal B. The conical hole has a radius
of $\frac{3}{2}$cm and its depth is $\frac{8}{9}$cm.
Calculate the ratio of the volume of the metal A to the volume of the metal
B in the solid.

17. If $x^4 = 6.36$, use tables to find the value of x
b) Given that $\log_{10} 2 = 0.301$ and $\log_{10} 3 = 0.477$
Find without using tables or calculator the value of $\log_{10} 288$

ii) x if $\log_{10} x = 2.956$

UCE MATHEMATICS
MODEL PAPERS
10

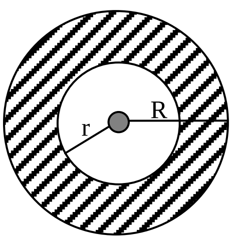
SECTION A:

1. In Δ DEF triangle, the angle DEF$=90^0$, DE = 5cm and tan F = 0.4.
Calculate the length EF.

2. A boy cycle from P to Q at an average speed of $16\,\text{km/h}$. He cycles back at $12\,\text{km/h}$. Find his average speed in km/h for the whole trip.

3. The RF of a map is $\frac{1}{50{,}000}$
Find the scale of the map in the form 1cm to km.

4.



In the figure above, the end of metal tube with a thick wall is as shown above.
Given that R = 10cm and r = 4cm.
Find the volume of the metal in a 10m length.

5. Two buildings of equal height are 50m apart. At a point P between the buildings, the angles of elevation of the tops of the buildings are 45^0 and 52^0
Find the height of the buildings.

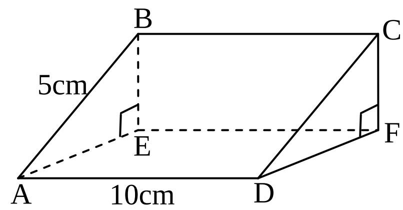
6. By selling an article for Sh 240,000 a shopkeeper makes a profit of 25% on the cost price. Find the cost price.

7. Simplify $\dfrac{1\frac{3}{5} \div 2\frac{2}{3} \times 1\frac{1}{5}}{\frac{16}{35} + \frac{1}{7}}$

8. Translation $\begin{pmatrix} 2 \\ 3 \end{pmatrix}$ followed by the translation $\begin{pmatrix} x \\ y \end{pmatrix}$ gives the translation $\begin{pmatrix} 5 \\ 2 \end{pmatrix}$
Find the values of *x* and y.

9. Find the area of an equilateral triangle ABC with sides 10cm each. Hence,
find the length of the perpendicular from B to AC

10.



Find the volume of triangular prism shown above

SECTION B

11. In Kenya income tax structure is such that a person's gross monthly income has certain allowances subjected to taxation.

Allowances

Marriage	-100,000 per month
Water and electricity	- 13,000 per month
Insurance	-120,000 per month
Housing	-70,000 per month
Transport	-1,100 per day
Medical	-300,000 per annum

Child above 10 years but below 18 years – 9,000
A child above 18 years – 11,000
A child below 10 years - 7000
Family allowance is for 3 children only. Juma has a family of 6 children, 3 children below 10 years, 1 child 14 years old, 1 child 16 years old and 1 child 20 years old.

Taxable income	Tax rate %
1- 20,000	7
20,001-100,000	15
100,001-200,000	20
200,001-300,000	25
300,001-500,000	28
Above 500,000	30

Given that he is married and earns 800,000 per month.
Calculate the
(i) total monthly allowances
(ii) income tax he pays
(iii) percentage of his gross monthly income paid in tax

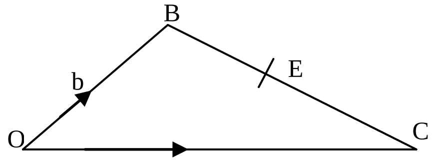
12. (a)Copy and complete the table for y = (x+1)(3-x)

x	-3	-2	-1	0
		5	0	

1.5	2	2.5	3.0	3.5
				-2.25

b) Draw a graph of $y=(x+1)(3-x)$ for values of *x* from -3 to 3.5
c) What is the greatest value of y?
d) Use the graph to solve $(x+1)(3-x)=-1$

13.



In the figure above OB = b, OC = c and E is a point on BC such that
If D is a point on OE produced, such that
$3\overline{OD}=5\overline{OE}$,
Express in terms of *b* and *c*, the vectors
i) BE
ii) OE
iii) OD
iv) BD
v) CD

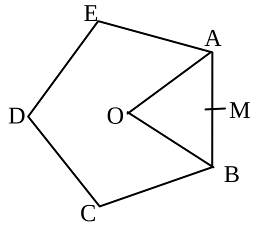
14. (a) The vertical height of a right circular cone is three times its diameter and its volume is
$y=(x+1)(3-x)$
Find its height.

b) A spherical ball of lead 4cm in diameter is melted and recast into 3 spherical balls. The diameter of two of these balls are 1 cm and 0.5 cm respectively.
Find the diameter of the third spherical ball.

15. a) Express as a single fraction in its simplest form. $\frac{1}{p-2}-\frac{2}{4p+3}$

b) Alice runs at a rate of 170m in one minute and walks at a rate of 90m in one minute. From the instant she leaves home, Alice takes 6 minutes, by running and walking to reach a bus stop. Find in terms of t minutes expression for;
i) The number of the minutes she walks
ii) The distance she runs
iii) The distance to the bus stop

16. ABCDE is a regular pentagon whose centre is O. The point M is the mid point of AB.



(a) Show that angle AOB = 72^0
(b) Given that OA = OB = 6cm
Calculate
(i)OM
(ii)AB
(iii)area of the pentagon

17. A sentence in a book has 20 words in it. The number of letters in each word is counted and the table below shows the frequency distribution.

No. of letters	2	3	4	5	6	7
Frequency	1	4	5	3	5	2

(i)A word is chosen at random from the whole sentence.
What is the probability that it has 4 letters?
(ii)A word is chosen at random from those with an odd number of letters. What is the probability that it has 7 letters?
(iii)One person chooses a word at random from the whole sentence. Another person then chooses a word at random from the sentence
What is the probability that one person chooses a two letter word and the other chooses a six letter word?

UCE MATHEMATICS MODEL PAPERS 11

SECTION A:

1. The value of a machinery plant depreciates by 10% annually. If its value is Sh 75,000 find its value after 3 years.
2. Find the equation whose solution set is $\left(\frac{-2}{7},\frac{2}{3}\right)$
3. The bearing of a ship from a port is 300^0 what is the bearing of the port

from the ship.

4. The mean of a set of eight numbers is 17.5
Given that six of the numbers are 12, 14, 15, 19, 24, and 25
Find the mean of the other two numbers.

5. A solid metal cube of side 3cm has a mass of 5 kg. Calculate the mass of another solid cube made of the same metal whose side is 6 cm.

6. The variables *x* and *y* are connected by the equation $y = \frac{k}{\sqrt{x}}$ where *k* is a constant.

x	36	4	q
y	4	P	8

Find (a) p
(b) q

7. Solve the equation $\frac{v}{8} = \frac{18}{v}$

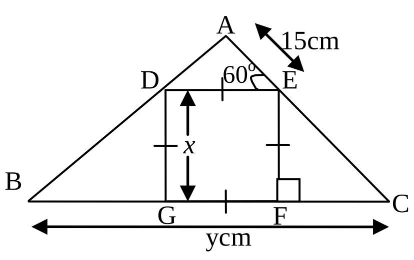
8. Given that $s^2t + 2s + 3t - 10 = 0$
Find the value of s when t = 3.

9. ABCD is a parallelogram in which and at A is obtuse and $AB \rangle AD$. Given that AB = 9cm and the area of the figure is $30.6cm^2$. Calculate the length of the perpendicular from A to DC

10. Evaluate $\sqrt{\frac{2.47}{0.4328 \times 73.54}}$ using tables

SECTION B

11. (a)



In the above figure $\angle AED = 60^0$ find x and y
b) Find the area of the square.

12. Three trading centers A,B and C are on the same horizontal level. To a man who was in trading centre A the angle of evaluation of a plane which was flying over B was 60^0. The pilot who was in the plane, when it was directly over B sees C at an angle of depression 40^0. The distance between A and B is 10km
Find the
i) Height of the plane when it was above B
ii) Distance between B and C
iii) Distance between A and C if the angle BAC $= 30^0$

13. The table below shows the tax rate on certain class of people in Uganda

Taxable income (sh)	Tax rate %
0-180,000	Free
130,001-150,000	10.20
150,001-200,000	15.20
200,001-280,000	20.0
280,001-420,000	32.0
Above 420,000	35.0

The allowances are as below
Transport – 1600 per day
Medical – 50,000 per months
Electricity – 300,000 per annum
Given that John earns sh 800,000 per months
Calculate the
i) taxable income
ii) income tax
iii) net pay

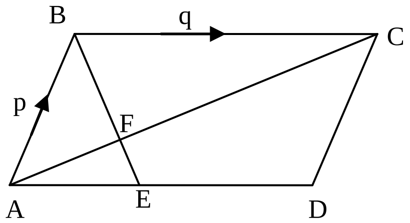
14. A bus travels at a constant rate (speed) of $30\,m/s$ for 40 seconds. It then slows down at a constant rate until it comes to rest after a further 20 seconds.
a) Draw on the same axes the speed time graph for the journey.
b) Calculate the rate at which the bus was slowing down during the last 20 seconds.
c) Calculate the distance traveled by the bus during the first 50 seconds.

15. (a) Draw a graph of the curve $y = x^2 + x - 12$ and the lines $y = 2x$ and $4x + y = 12$
b) Solve the equation $x^2 + x - 12 = 12 - 4x$
c) Show the region satisfying the inequalities $y \le 2x$, $4x + y \ge 12$ and $y \ge x^2 + x - 12$.

16. An unbiased blue die is numbered 1, 9, 10, 11, 12, and 15. An unbiased Red die is numbered 2, 3, 4, 14, 15, and 16.
The letter R indicates that the number (14) thrown on the Red die is greater than the number (9) on the blue die.

a) Make a sample space by putting letter R in each square where the number thrown on the Red die is greater than that on Blue die.
b) Find the probability that the number thrown the number thrown is greater than that on Blue.
c) The two dice are each thrown twice. Find the probability that the number thrown on the Red die is greater than that on the Blue die both times.

17.
Given that $\overline{AB}$ = P and $\overline{BC}$ = q. E is a point on AD such that AE = $\frac{1}{4}$AD and



ABCD is a parallelogram.
a) Express in terms of P and Q
i) $\overline{AC}$ ii) AE iii) BE
b) AC and BE interest at F given $BF = KBE$ express BF in terms of P, Q,K.
Hence show that AF = $\frac{1}{4}(1-k)P + \frac{1}{4}KQ$
(c) Find the ratio of AF: FC

UCE MATHEMATICS MODEL PAPERS
12

SECTION A:

1. Given that the operation $\uparrow$ is defined as a $\uparrow b = 2a - 3b$ solve for y
$y \uparrow 3y = 3y \uparrow (-2y)$

2. The combined ages of a man and his son are 78 years. Eleven years ago the father was three times as old as the son the was Find their present ages.

3. Given that $\cos\theta = 0.8$, without using tables or calculator. Find the value of
$2\tan\theta + \sin\theta$

4. Find the equation of the line passing through (1, 2) and perpendicular to the line. $2y + 4 = x$

5. Simplify $\frac{1}{2} + \frac{1\frac{1}{2} \text{ of } 2\frac{1}{2}}{2\frac{1}{7}}$

6. There is enough food to feed 200 layers for 15 days. For how long will the food last if 50 more layers were added to the group?

7. Express 2.822…as a fraction

8. A fair coin with one side showing tail (T) and the other showing head (H) is tossed twice. Find the probability that at least a head is tossed twice.

9. A roof measuring 25 m by 20 m is to be covered by square tiles measuring 25cm each. Find the number of tiles that will be needed to cover the roof.

10. Solve the equation
$$\frac{x^2-1}{2x+1} = \frac{x-1}{2}$$

SECTION B

11 .a) A coin and die are tossed together once and the outcomes obtained
(i) write down the possibility space.
(ii) what is the probability that the throw results in a head and a prime number.
(iii) what is the probability that an odd number is obtained on the die.
(b) A bay contains 8 balls of which 3 are white, 4 are green and 1 black.
Two balls are drown at random in succession without replaced.
calculate the probability that;
(i)all the balls are of the same color.
(ii)the first ball is green and the second not green.

12. (a) Draw a graph of $y = (x+1)(x-3)$ for $-3 \le x \le 5$
b) State the minimum value of the curve.
c) Use your graph to solve
i) $x^2 - 2x - 3 = 0$
ii) $x - 5x - 5 = 0$

13. A unit square is reflected in the line y = x to get the image O′I′J′K′ the image OIJK is given an enlargement with scale factor 12 and centre of

enlargement the origin to get O′J′J′K′.The image O'J'J'K' is given an enlargement with scale factor +2 and centre of enlargement the origin to get OJ"J"K".

i) write the matrix of transformation for the reflection R

ii) Use the matrix R to get the coordinates of O"I"J"K"

iii) Describe the matrix E for the enlargement and use it to get O"I"J"K"

iv) O"I"J"K" is then given a positive quarter turn about the origin to get O"I"J"K"

Find the vertices of OIJK

v) Find the matrix that would map OIJK onto O"'I"'J"'K"' directly

14. A company exports 2.6 tones of fish at 4.5 and 1.1 per kg. Export tax at 30% is added.

Find the total amount of the export tax. Given your answer in Ug. Shillings US\$1 = Ush 1615.

(b) Mary, who is not married, earns shs 96,160 per month. She has a personal allowance of sh 5800 with an allowance of 15% for earned income.

Income tax is charged at 20% on the first sh 26,500 and 30% on extra money.

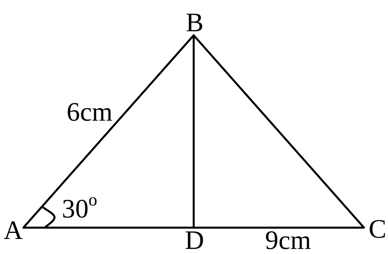
i.calculate the income tax payable by Mary

ii.If Mary pays 12% of her net pay as house rent.

Find how much money she is left with after settling everything.

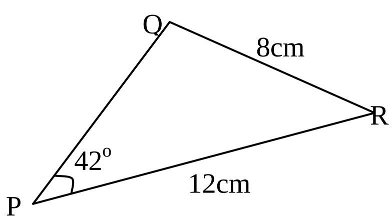
15. a) Use tables to evaluate $\dfrac{34.36 \times 0.48}{79.5}$

(b) In the figure below angle BAD = 30, AB = 6cm and DC = 9 cm.



Find AD and angle BCD

(c) In the figure PQR, PR =12 cm QR = 8cm and angle QPR = 41 find angle Q



16. Some holiday makers take out a boat from the end R of a pier. They sail 5 km south and then 4km south east

Calculate

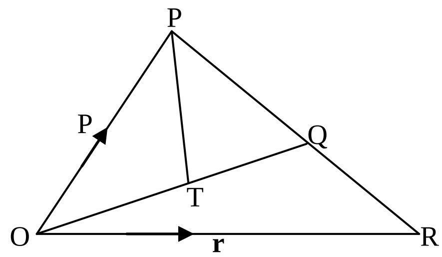
(a)the distance the boat now is south of R.

(b)its distance East of R

(c)its distance in a straight line from R

(d)its bearing from R

17. In the figure below OP = P, OR = r, PQ = 3QR, and OT = TQ



(a) Express the following vectors in terms of p and r.

(i) RP

(ii) RQ

(iii) OQ

(iv) OT

Show that PT $= \frac{1}{8}(3r - 7p)$

Given that PT is produced so that PT = 7TM express OM in terms of p and r.

UCE MATHEMATICS MODEL PAPERS

13

SECTION A:

1. (a) Simplify

x(3x+2) – (2x+4)

(b) Factorise completely

$3ap + 6p^2$

2. Evaluate $\dfrac{9^{1/2} \times 3^{5/2}}{3^{2/3} \times 3^{-1/6}}$

3. Given the function $f(x) = px + q$. $f(3) = 4$ and $f^{-1}(7) = -1$,

Find the value of p and of q.

Hence find $f^{-1}(x)$

4. $\overrightarrow{AB} = \begin{pmatrix} 8 \\ -6 \end{pmatrix}$ and $\overrightarrow{AB}$ and

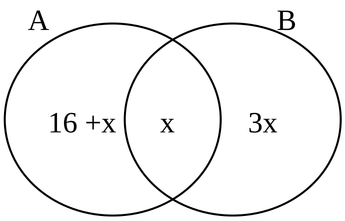
CD = $\frac{3}{2}\overrightarrow{AB}$

$\rightarrow$

(i) Calculate $|AB|$

(ii)Express CD as a column vector.

5. A and B are two sets and the numbers of elements are as shown in the venn diagram below.



Given that n(A) = n(B).
Calculate
(i) value of x
(ii) $n(A \cup B)$

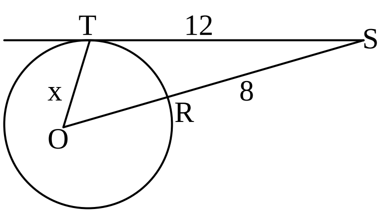
6. A farmer increases the yield on his farm by 15 %. If his previous yield was 6500 tones, what is his previous yield?

7. Find the matrix M which is such that

$$2M - \begin{pmatrix} 0 & 4 \\ -6 & 8 \end{pmatrix} = 3\begin{pmatrix} 2 & 0 \\ 0 & -4 \end{pmatrix}$$

8. Given that $P = a + \frac{bv^2}{k}$, express v in terms of P, a, b and k.

9.



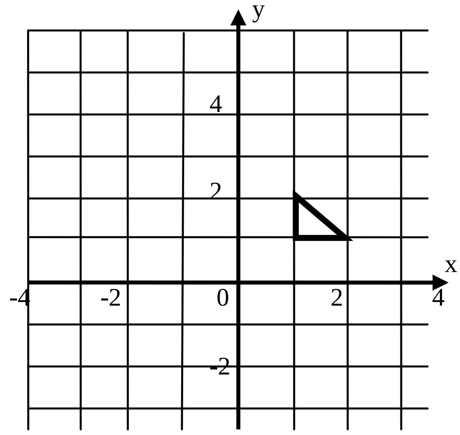
In the diagram, the point R and T lie on a circle with centre O. the tangent at T meets OR circle produced at S TS =12cm and RS = 8cm.

(i) Express the length OS in terms of x.
(ii) Write down an equation and solve it to find the value of x.

10. Solve the simultaneous equations
5x – 2y = 13
2x – 3y = 3

SECTION B

11.



(a) The diagram shows a triangle A with vertices at $(1,1)$, $(2,1)$ and $(1,2)$.
The transformation S is a one-way switch parallel to the x-axis, leavin the y-axis in variant and with scale factor 2. Qn the diagram draw the triangle S(A).
b) The transformation T is represented by the matrix $\begin{pmatrix} -3 & p \\ q & r \end{pmatrix}$

under T, the point $(1,8)$ is mapped onto the point $(13,1)$ and the point $(-3,4)$ is mapped onto the point $(k,4)$.
Calculate the value of p, q, r and k.

12. In a certain school there are 42 students in S.5. 28 take mathematics (M), 20 take Physics (P) and 21 take Chemistry (C). Given that 6 students take all the three subjects and $M^1 \cap P \cap C = M \cap C \cap P^1 = M \cap P \cap C^1$. Every student takes at least one of the three subjects.
Find
(i) the number of students who take at least two subjects.
ii) the number of students who take at most two subjects.
iii) the probability that a student selected at random takes Physics but not math.

13. Marks scored by 400 students of Seeta High school in Physics are as follows:

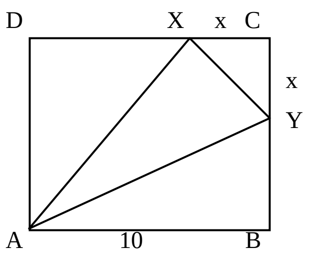
Marks	No. of students
0 - 10	10
10 - 20	20
20 - 30	22
30 - 40	40
40 - 50	55
50 - 60	75
60 - 70	80
70 - 80	58

80 - 90	28
90 - 100	12

Draw the ogive and from it determine;
(i)the median mark and
(ii)the pass marks if 80% of the students pass the examination.

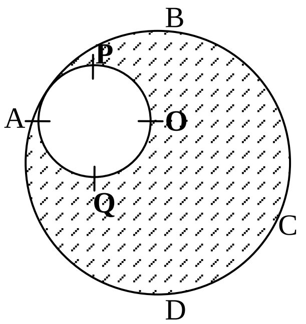
14. Three numbers are in the ratio
If the sum of their squares is 644, find the numbers.

15.



In the figure above, the square ABCD has sides of length 10cm, and CX = CY = xcm.
Obtain an expression, in terms of x, for the area of
(i) DCXY
(ii) DADX
(iii) DABY
Hence show that $T = 10x - \frac{x^2}{2}$, where Tcm^2 is the area of the triangle AXY

16.



A,B,C and D lie on a circle, centre O, of radius 14cm. AO is a diameter of the circle through A, P, O and Q.
(a) Write down the radius of the circle APOQ
(b) Calculate i) the area of the shaded region.
ii) the total length of the boundary of the shaded area

17. A cinema has seats for 50 people. The charges are Shs. 5 for front seats and Shs. 8 for the remainder.
The expenses for each performance are Shs. 1600.

(a) Assuming that a profit is made and x seats at Sh 5 and y seats at Sh 8 are sold, write down the inequalities.

(b) The number of seats at Sh 5 is never less than 100 or more than 200. the number sold at sh 8 is never more than twin the number sold at sh 5 write down more two inequalities. Represent your inequalities graphically. What is the least value of x + y for which there is a profit. If the cinema is full, how many of each price should there be for maximum profit?

UCE MATHEMATICS
MODEL PAPERS
14

SECTION A:

1.Factorise completely
$3xy - 5x + 6ay - 10a$

2. Find the value of x
$2^{(x-2)} = 32$

3. Given that

Find (i) $f g(x)$

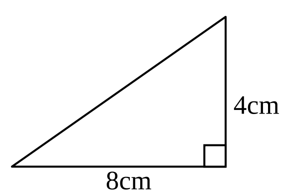
(ii)values of x for which $gf(x) - fg(x) = 1$

4. $PQ = \begin{pmatrix} 2 \\ -4 \end{pmatrix}$, $QR = \begin{pmatrix} -8 \\ 6 \end{pmatrix}$
Find (i) PR

(ii) $\overrightarrow{RX}$, given that $2\overrightarrow{RX} = \overrightarrow{QP}$

5. P and Q are two sets and $P \cup Q = \varepsilon$
Given that $n(P \cap Q) = 9$, $n(P) = 16$ and $n(P') = 12$, find
(i) $(P \cup Q)$
(ii) $n(Q')$

6.



The triangle is to be reduced by a ratio of 1:2
(a)Calculate the area of the original triangle.
(b)Calculate the area of the reduced triangle

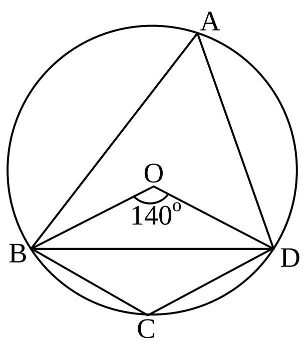
7. $A = \begin{pmatrix} 3 & 2 \\ -1 & 0 \end{pmatrix}$ and $B = \begin{pmatrix} 4 & -3 \\ 2 & 1 \end{pmatrix}$
Find the
(i) $3\mathbf{A} - \mathbf{B}$
(ii) The inverse of A

8.It is given that $y = \frac{8-5x}{x}$

(i)Find the value of y when x = ½

(ii)Express x in terms of y

9.In the diagram, the point A, B, C and D is on a circle centre O. BOD = 140^0 and ADO = 42



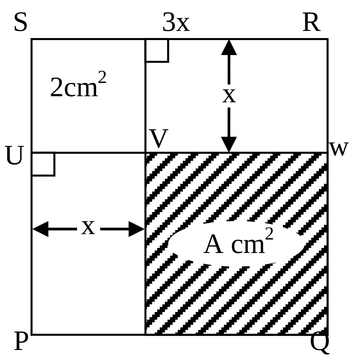
Calculate (i) BAD

(ii) BCD

10.If $y = 2^x$ write the equation $4^x - 2^{x+2} + 4 = 0$ as quadratic equation in y. Hence find the values of x satisfying the equation.

SECTION B

11.



In the figure above, PQRS is a square. Lengths are given in cm

(a) Find an expression in terms of x, for

(i) UV (ii) VW

(b) Find the area of A in terms of x.

(c) Calculate the values of x when A = 20

12.Using the data given below construct the cumulative frequency table and draw the ogive. From the ogire determine

(i)the median

(ii)the inter quartile range

Marks	Frequency
0-10	3
10-20	8
20-30	12
30-40	14
40-50	10
50-60	6
60-70	5
70-80	2

12.A person standing on the bank of a river observes tat the angle of elevation of the top of a tree standing on the opposite bank is 60^0, when he moves 40m away from the bank, he finds the angle of elevation to be 30^0.

Find

(i)the height of the tree correct to 2 decimal places.

(ii)The width of the river.

12. Given that the point A, B and C are the vertices of a triangle where A, (0,0), B(1,0) and C (1,2). The image of ABC under a transformation has coordinates A^I(0,0), B^I (0,-1) and C^I (-2, -1). The image $A^IB^IC^I$ is then given a transformation represented by the matrix to obtain $A^{II}B^{II}C^{II.}$

(i) find the matrix of the transformation

(ii) Obtain the coordinates of $A^{II}B^{II}$ and $C^{II.}$

(iii) Determine a single matrix that can map $A^{II}B^{II}C^{II}$ back onto ABC

13.

The Uganda sports association had arranged a race between two athletes from the junction and senior categories. When the junior one had covered 10km and running steadily at 20kmh^{-I} towards the finishing point of the 70km race, the senior one is allowed to start from the same point running at 30kmh^{-1}

(i) When and where did the over take occur?

(ii) If the two continued running at the same speed, find the difference in the times of arrival.

14. The 48 tourists who visited Uganda had to travel either to Jinja, Mukono and Wakiso districts.

29 visited Jinja

19 Visited Mukono

15 visited Wakiso

13 visited both Jinja and Mukono,

6 visited both Mukono and Wakiso.

7 Visited Jinja and Wakiso and 7 visited neither of the towns.

(a) Represents the above information on a venn diagram.

(b) Find the number of tourists who visited all the three districts.

(c) Find the probability that when a tourist is selected at random has visited exactly two districts.

15.(a) Construct a triangle ABC such that AB = 10.0cm, BC = 8.4cm and AC = 9.6cm. measures and records the angles ABC and ACB.

(b) Draw a circle inscribed in the triangle ABC and measure its radius.

UCE MATHEMATICS MODEL PAPERS

15

SECTION A:

1. Given that $P = a + \frac{bv^2}{k}$, express v in terms of P, a, b and k .

2. Solve the equation $\log_4 x - \log_4 7 = \frac{3}{2}$

3. Given that $f(x) = \frac{5+x}{x}$ $(x \neq 0)$

(a)Calculate f(⅓).
(b)Solve f(x) = 1 ½

4. **PQ** $= \begin{pmatrix} -4 \\ 7 \end{pmatrix}$, **QR** $= \begin{pmatrix} 1 \\ 2 \end{pmatrix}$, **RS** $= \begin{pmatrix} h \\ 10.5 \end{pmatrix}$
(a) Express as a column vector
PQ + 3**QR**

(b) Given that RS is parallel to PQ, find the value of h.

5. P , Q and R are sets such that $\varepsilon = P \cup Q \cup R$
The number of elements in each subject is shown in the venn diagram.

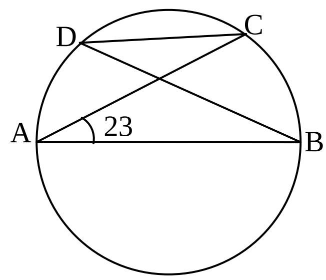
(i) Find x, given that n(P) = n(Q)
(ii) Find y, given that $n(P \cup Q)^1 = n(P \cap Q)$
(iii)Find n(ε)

6. The ration of the angles of a quadrilateral is 2:3:3:4
Calculate the size of each of the angles.

7. The determinant of the matrix is equal to 30. Find the value of x

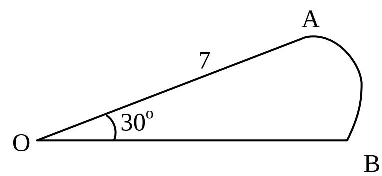
8. Factorise
$15x^2 - 7x - 2$

9.



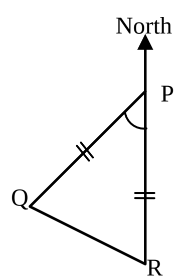
AB is a diameter of the circle which passes through A, B, C and D DC is parallel to AB and CAB = 23^0.
Calculate
(i) BCD
(ii)CBD

10. The diagram shows sector OAB of a circle, centre O, radius 7cm, in which AOB $=30^0$.



Taking π to be $^{22}/_7$,
Calculate
(i)the perimeter of the sector.
(ii)the area of the sector.

11. P, Q and Q are three points an level ground with P due north of R



Angle QPR = 40^o and PQ = PR
Calculate the bearing of
(a) Q from P
(b) P from Q
(c) Q from R

12.In a certain trading centre there are 42 shops selling clothes (C), Soda (S) and beers (B) of these 25 sell clothes, 20 sell Soda and 22 sell beer.
11 shops sell both clothes and Soda, 10 sell booth Soda and beer, and 9 sell both beer and clothes.
Given that the shops sell at least one of the commodities.
Find the

number of shops which sell all the three commodities.

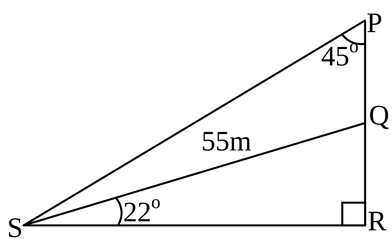
(i) Probability that when a shop is selected at random sells only one commodity.

13. Draw ogive for the following distribution.

Monthly Income in 1000's (US shs)	No. of employment
600-700	40
700-800	68
800-900	86
900-1000	120
1000-1100	90
1100-1200	40
1200-1300	26

Hence determine
(i)the median income
(ii)the number of employees whose income exceeds Shs.1,180,000
(iii)the lower and upper quantiles
(iv)the inter quantile range

14.



From the diagram above
Find
(i) SR
(ii) QR
(iii) PQ
(iv) SP

15. A Taxi leaves Kampala at 6:30am towards Mbarara at a steady speed of 60kmh^{-1}. after 1 ½ hours later a Pajero leaves Kampala traveling at a stedy speed of 80kmh^{-1}. g iven that Mbarara is 380km from Kampala. Using aa scale drawing (use a scale of 1cm to 20mk)
(a) find when and where the Pajaro over took the Taxi.
(b) If after overtake both the Pajero and theTaxi maintained their speeds. Find how long the Pajero took waiting for the Taxi.

16. Coca-Cola factory produces Soda in three different sizes and types in thousands of bottles in a day as indicated in the table below.

	Small	Medium	Large
Coke	40	20	10
Spirite	30	10	5
Crest	10	5	0

The costs per bottle are indicated in the table below.

	Small	Medium	Large
Cost	600	800	1,200

(a) Write down
(i) 3 x 3 matrix for the production of Soda
(ii) 3 x 1 cost matrix
(b) If all these Sodas are sold within a month determine how much money the factory will get for each type.

17. (a) Using a pair of compass, ruler and pencil construct a triangle PQR such that PQ = 8.2cm,QR = 6.4cm. Measure and record the distance PR.

(b) Bisect the sides PQ and PR and let the two bisectors meet at a point O.
(c) Using the centre as O, construct a circle circumscribing triangle PQR and measure its radius.

UCE MATHEMATICS MODEL PAPERS 16

SECTION A:

1.Given that $63^2 - 57^2 = 6p$, find the value of p.

2.Simplify $\dfrac{3^{n+1} \times 9^n}{27^{(2/3)n}}$

3. If $f(x) = \dfrac{2}{3-x}$ and

$g(x) = x + 1$

Find (i) $g^{-1}(x)$
(ii) $fg(x)$

4. The vectors $\overrightarrow{AB}$ and $\overrightarrow{CD}$ are such that

$\overrightarrow{AB} = \begin{pmatrix} -6 \\ 8 \end{pmatrix}$ and CD $= \begin{pmatrix} u \\ 2 \end{pmatrix}$

(i) Find $|\overrightarrow{AB}|$

(ii) Given that $\overrightarrow{CD}$ is parallel to $\overrightarrow{AB}$, find the valve of u.

5. It is given that.
A = 2, 3, 4, 6, 8, 9, 10, 12

B = 3, 5, 7, 9, 11
ε = AUB.

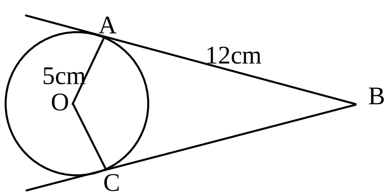
(i) List the elements of the set (A∩B).
(ii) Find n (ε)
(iii) If one element of ε is chosen at random. What is the probability that it is a member of both A and B ?

(6)The gravitational force (F) between two masses is inversely proportional to the square of the distance (d) between them.
If F = 4 when d = 5, calculate:
(a)F when d = 8
(b)d when F = 25.

7. The determinant of the matrix $\begin{pmatrix} w & 2w+5 \\ -1 & w+1 \end{pmatrix}$ is 5.Find the value of w

8. Make x the subject of the formula $y = \frac{A}{y-2}$

9. AB and BC are both tangents to the circle centre O. If OA = 5cm and AB = 12cm.

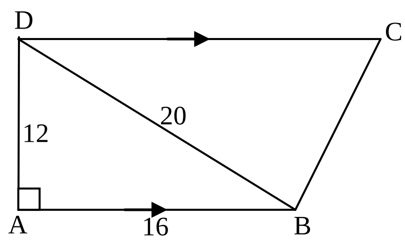


Calculate
(i) the size of angle OAB
(ii) the length OB

10. If the gradient of the line joining the points P(6, k) and Q (1 - 3k, 3) is ½ . Find the value of k . Hence, find the mid-point of P and Q.

SECTION B

11.



In the diagram, angle DAB = angle DBC = 90^0, AB = 16cm, BD = 20cm, AD = 12cm and AB is parallel to DC.
(i)Express ABD as a fraction in its lowest terms.
(ii)Calculate BC
(iii)Calculate the area of trapezium ABCD.

12. Each of the 56 pupils in the fourth year of a small school studies at least one of the subjects History, English and Agriculture of the 14 pupils who study Agriculture, 4 also study History and English 3 study neither History nor English 5 study English but not History of the 42 pupils who do not study Agriculture 6 study both History and English x study only History and 2x study only English.

Find
(i) Value of x
(ii) Total number of pupils studying English.

13. In Ntinda View High School the marks of 60 students in a test were recoded as follows:

Marks	No of students
0-10	5
10-20	8
20-30	21
30-40	20
40-50	6

Find
(i)medium
(ii)Lower quartile
(iii)Upper quartile
(iv)Inter quartile range

14.a) A classroom has 40 chairs.
Drawing one lesson no-one sits on 55% of these chairs. The pupils sit on the remaining chairs. Given that boys sit on two fifths of these, calculate
(i) the number of chairs which are occupied.
(ii) the number of girls in the class

(b) On a certain day, a girl took three tests. The first in mathematics, the second in English and the third in science.
Her marks in the three tests were in the ratio 5 : 6 : 6
Her total mark for the three tests was 105.

(i) Calculate her mark in Mathematics
(ii) On the next day one took a French test and scored 19 marks. Calculate her mean mark for the four tests.
(iii) Some times later she took another French test and improved her mark from 19 to 26.

Calculate the percentage increase in her French mark.

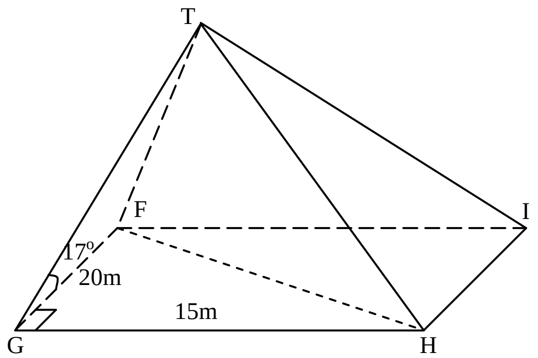
15.Amini-bus left Kampala traveling steadily at 56km h^{-1} at 8:00am. And at the same time a taxi leaves Malaba for Kampala traveling steadily at 70km h^{-1}. Given that Kampala is 378km away from Malaba.

Determine the
(i) time taken before they meet. and hence state the time.

(ii) the distance covered by each vehicle at the point they meet.

16. The triangle ABC is given a transformation represented by the matrix. this is then followed by another transformation to obtain A″ B″ C″.
Find (i) the coordinate of A″, B″ and C″.
(ii) a single matrix that maps ABC onto A″ B″ C″.
Given that the coordinates of A,B and C are A(-1,-2), B(-3,0) and C(-4,1)

17.



Four points GFHI form a rectangle on the same horizontal level. The length of the rectangle is 20cm and the width is 15cm.
A vertical pole TF stands at one corner and the angle of elevation of T from G is 17^0.
a) Find the height of the pole.
b) Calculate the (i) Length FH
(ii) angle FHT

UCE MATHEMATICS MODEL PAPERS 17

SECTION A:

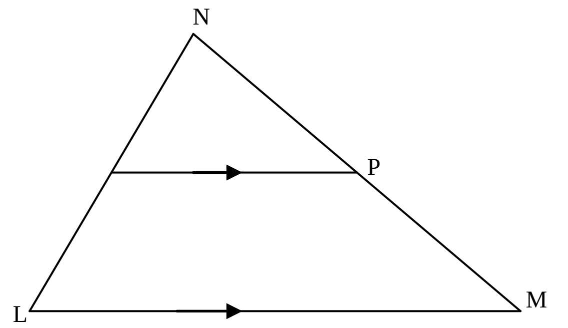
(1)Amap is drawn to a scale of 1cm to 5km. How far a part are two towns if the distance between them on the map is 30.5cm.

2. There are 756 children in a school. This number is 5% more than it was last year. Calculate the number of children that were in the school last year

3. Sixteen workers can build a week in 25 days. How many more workers are needed to build the wall in 10 days.

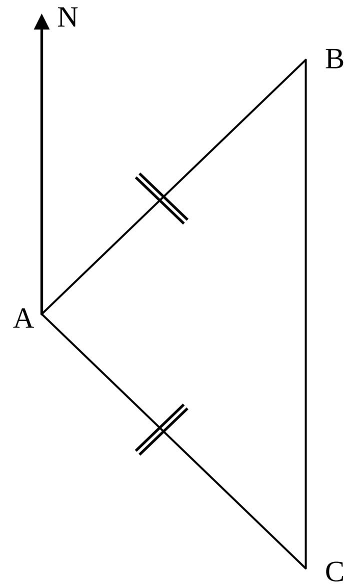
4. John is x years old and Mary is (5x-12) years old. Given that Mary is twice as old as John. Find Mary's age.

5. Solve the inequality 2x-1› x/3
6.



In the diagram Q R is parallel to ST and the ratio of areas of triangle PQR to PST is 9:64

7.



Find the area of the trapezium QRTS
The bearing of B from A is 031. The bearing of C from A is 129. Calculate the bearing of C from B.

8. A cylinder has a diameter of 20cm. The area of the curved surface is 1000cm2. Find the height of the cylinder.
An agent receives a commission of 10% on the first 200,000 shillings for selling Books and another 20% on the remainder. Given that he was given that he was given books worth 1000,000 shillings. Find his total commission.

Without using tables or calculator. Find the Square root of 0.000025

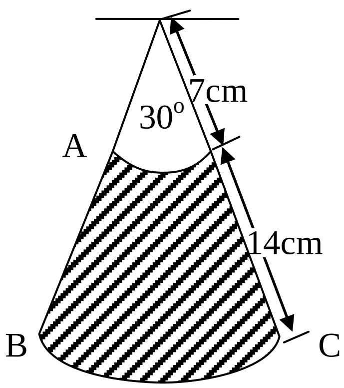
SECTION B

11.Using a ruler and compass only, construct a parallelgram ABCD such that BC = 4cm, the diagonal AC = 8.6 cm and diagonal BD = 4.4cm. measure the side AB. Mark the point of symmetry of the parallelogram as 0.

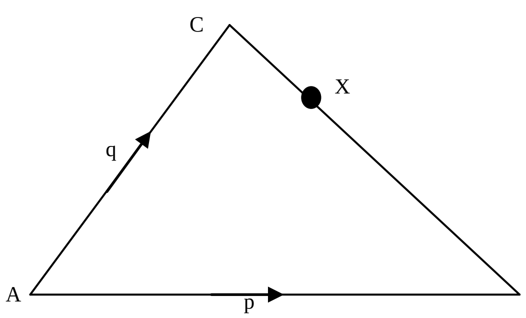
12. (a) The triangle ABC is right angled at C. from P, a point on the hypotenuse, PQ at Q. if AC = 2.5cm, BC = 6cm and PQ = 1cm

Find (i) BQ (ii) BP.

(b)



13.



Given that OBC is a car wiper. Calculate the area of the shaded part

In the diagram AB = P, AC = Q and X is the point on CB such that CX = $^1/_3$ CB

(a)Express as simply as possible in terms of P and Q

(i)CB

(ii)AX

(b)Given further that AX = HP × KQ and that T is the point such that AT = HP

Find the valves of H and K

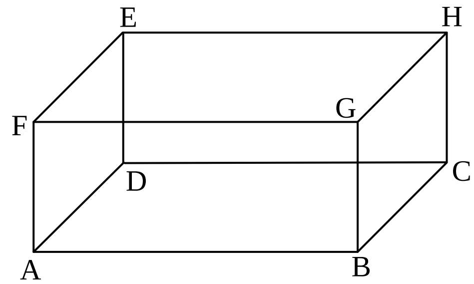
14.(a) Draw a graph of the curve y = x(6 - x) for -7 < x > 7

(b)The line y = mx cuts the curve at the origin and at point c.

Given that the x coordinate the valve of m.

(c) Solve the equation y + x^2 - 6x = 0

15.



ABCDEFGH is a cuboid with ABCD and FGHE are squares of side 10cm and the length DE = 6cm Find the

(i) length BE

(ii)angle between the line BE and the base

(iii)angle between the planes ADH and AFED.

16.Two six sided dice, one coloured red and the other blue are thrown together. Giving each answer as a fraction. Find the total number of the possibility space.

(b) Find the probability that

(i)the total score is 12

(ii)the total score is 12

(iii)the score on the red die is twice the score on the blue die.

(17). (a) sh 2million was invested at a compound interest rate of 10% per annum. Find how many years it will take to accumulate to 4 million

(b) Tax is levied on importers of cars as follows.

(i) Import tax = 10% of the value of the car

(ii) Boarder tax is 4% of the value after the removal of import tax. If he imported 20cars each costing 15 million and 10 cars each costing 25 million. Find how much he pays for the cars in tax

UCE MATHEMATICS MODEL PAPERS 18

SECTION A:

1. Given that

$a^2 - b^2$ = 96 and a + b = 16. Find the value of a - b

2. Find the value of x in the equation

$$\frac{3^x \times 3^5}{3^7} = 27$$

If f (x) = 8x+2 and g (x) = 4x-1 find

(i)f(-2)

(ii)f g (x)

(4) Given A(2,-1), C(6,7) and B is on line AC such that AB = ¾ AC, find

(a) Column vector AB
(b) Co-ordinates of B

(5)
A = (x: x is a multiple of 4)
B = (x: x is a multiple of 3)
C = (x: x is a multiple of 12)
(a) List the elements of the set A
(b) Find N (ANB)
(6) A hemisphere has a radius of 8cm. calculate
(a)its total own face area
(b)its Volume

(7) Given that

$$(2 \quad 1)\begin{pmatrix} x \\ 5 \end{pmatrix} = (x \quad 2)\begin{pmatrix} 1 \\ 4 \end{pmatrix}$$

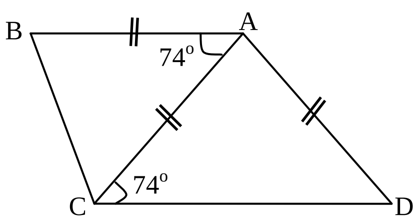
Find the value of x

(8) Given that 7 + 4p = c - kp, express p in terms of c and k

(9)The variables x and y are connected by the equation y = k, where k is a constant.
Pairs of corresponding valves r are given in the table below.

x	4	9	n
y	12	m	42

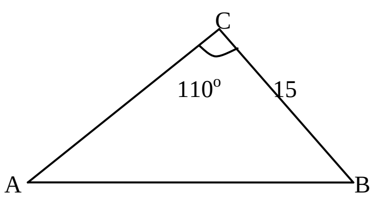
Find the value of k,m and n
10.



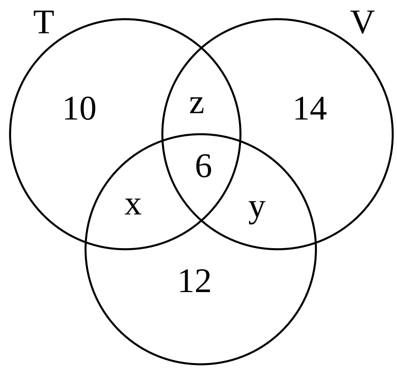
In the diagram, ABC and ACD are isosceles triangle in which AB = AC = AD and BAC = ACD = 74.
Calculate CAD, BCA .

SECTION B

11.



In the diagram, A,B and C represent three towns. They are joined by straight roads.
The distance AC = 20km, BC = 15km and angle ACB = 110,
Calculate
(i)the area of triangle ABC
(ii)the distance AB
(iii)the shortest distance from C to the road AB .12.



(a) .Given that the above Venn diagram shows the number of items sets T, V and V, find the values of X, Y and Z
(b)Find the probability that when an object is picked at random belongs to ANB or BNC.

13. The following table gives the marks scored by students in an examination

Marks	No. of students
0 - 5	3
5 -10	7
10 -15	15
15 - 20	24
20 - 25	16
25 - 30	8
30 - 35	5
35 - 40	2

Calculate the mean of the data.

14. The Coordinates of the points A and B are (2, 4) and (6, 2) respectively.
(i) Write down the coordinates of the point which is the reflection of B in the x-axis
(ii) The line AB is rotated through 90 clockwise about A. Find the Coordinates of the image of the point B.
(iii)The line x = 2 is the line of symmetry of the triangle ABC.
Find the Coordinates of the point C

(15)(a) On the same axes plot the graph of the lines 5y = 4x + 40, 3y = 2x + 8, y = 0 and x = 0
(b)Show the region satisfying the inequalities
5y < 4x + 40
3y < 2x + 8
X > 0
y > 0
By shading the unwanted region.
Find the greatest value of X and Y that can satisfy all the inequalities.

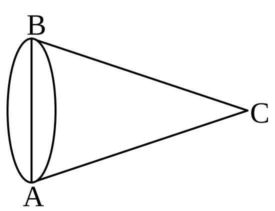
16 (a) From a point 100m, above a lake that angle of elevation of an object is 35 and the angle of depression of its image in f the object above Lake . the water of the lake is 55. Find the height o

17. A school had to transport students to an end of the term party. The total amount of money put a side for the transport is 800,000
Each trip made by the bus costs sh 20,000 and that of the mini bus costs sh. 30,000.
The capacity of the bus is 50 and that of the mini-bus is 40. The school must transport more than 200 students and the bus makes more trips than the mini-bus.
(i)On the same axes, draw a graph to show the region satisfying all the inequalities.
(ii) Find the maximum number of students who went for the party.
(b) Two poles of height 15m and 25m respectively stand on level ground. The angles of elevation of their tops from a point between the two poles on the line joining their feet are 45^o and 60^o respectively. Find the distance between the two poles.

UCE MATHEMATICS MODEL PAPERS 19

SECTION A:

1. Evaluate 3.142 $(5.5^2 - 4.5^2)$
2. Three variables x, y, z are connected by he relation xz = ky^2 where K is a constant. Given that x = 4, when y = 1.0×10^3 and z = 9. Find in standard form the value of k.
3. Given that $\frac{x}{x+2y} = \frac{5}{11}$, find $\frac{x}{y}$
4.



The diagram shows a right circular cone with slanting side BC = AC = 13cm and base AB = 10cm. Calculate its volume
5. A shopkeeper sells 20kg of sugar at sh 40,000. If the cost of sugar is then reduced by 20%. How many kilograms of sugar can be bought with the same amount of money after the decreases?
6.The area of a field on a map is $20cm^2$ if the scale of the map is 1: 4000. What is the actual area of the field.
7.In a certain school there are 400 students of these 140 like dancing 100 like singing and the rest like reading. Draw a pie chart to represent the above information.
8.A triangle ABC, is an issocles triangle; AB = AC = 4cm and angle BAC = 50^o. Find the length BC.
9. In St Leo primary school, a group of 18 pupils were asked whether they like football or volley ball. It was found that 10 like football and 12 like volley ball. Find the probability that a pupil selected at random likes both football and volley ball.
10. If n is the medium number of 109, 301, 103, 183, n and 101. What are the possible integral values of n

SECTION B

11. It is approximately 6500km from Nairobi to London by a certain route. The flying times varies at various speeds are shown on the table below

Speed(x) Km/h	300	400	500
Time (hours)	22	16	

Speed(x) Km/h	600	800	900	1000
Time (hours)				

(a)Copy and complete the table; Draw a graph of speed against time
(b)From your graph (i) the time for the aircraft flying at $750kmh^{-1}$
(ii) The increase in speed necessary to cut the time down from 15 to 10 hours
(iii)Without calculating any further continue your graph as far as x = 1200 and estimate the time for a speed of 1180km/h
12.In triangle OAB, the vector OA = $4a^2$, OA = 9b ; N is a point on AB such AN : AB = 1 : 5 and M is the mid. point of ON (a) Find in terms of a and b the vectors
(i) AB
(ii)NB
(iii)ON
(iv) MB
(a)show that the points B,N and A are collinear
(13)(a) Copy and compete the table below for y = $x^2 - 2x - 2$ for - 4

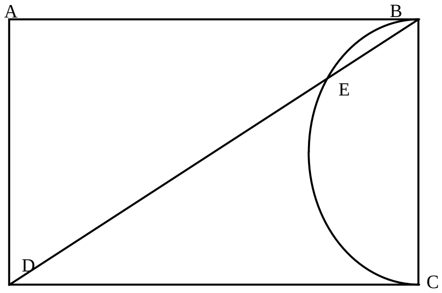
x	-4	-3	-2	-1	0
-2x					0
y	22				-2

x	1	2	3	4	
-2x					
y					

(b) Draw a graph of $y = x^2 - 2x - 2$ and use it to solve the equation
(i) $x^2 - 2x - 2 = 0$
(ii) $x^2 - 2x - 6 = 0$

14. On the same axes draw the following lines on a graph paper $3x + 4y = 360$, $x + 4y = 160$, $x = 100$ and $y = 100$
(b) By shading the unwanted region show the region satisfying the in equalities
$3x + 4y = 360$, $x + 4y = 160$, $x = 100$ and $y = 100$. List the greatest possible values of x and y.

(15).

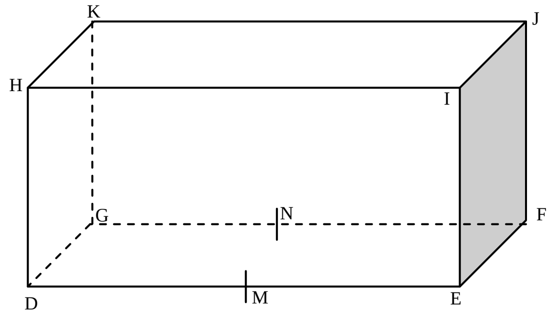


The rectangle ABCD is not drawn to scale AD = 4cm, AB = 2cm, CED is a semi-circle on Cg as diameter.
Calculate (i) BD
(ii)CE
(iii) BE
(iv) angle CBD.

(16) The following are allowances given to anemployee working in a certain farm
- Medical- sh 140,000 per annum
- Water – Sh 240,000 per annum
- Marriage $1^{th}/10$ of the gross income
- Transport – 1000 per day

Each child below 10 years – Sh 10,000 per month.
The workers are taxed as below 30% on the first Sh 800,000 and 25% on the remaining. Given per annum earns 2 million shillings per annum and has two children below the age of years.
Find
(i) taxable income
(ii) percentage of his income that goes to tax.

17.



The above diagram is a cuboid in which
DE = 6.2cm, EF = 4.4cm and EI = 3.2cm. M and N are the mid points of DE and GF respectively
Calculate
(i) EH
(ii) EK
(iii)Angle KEJ
(b) Calculate the angle between
(i) Places HMNK and IMNJ
(ii) KM and MJ
(iii) DG and IN

UCE MATHEMATICS MODEL PAPERS 20

SECTION A:

1) Solve the equation

$$6 + \frac{2x+1}{3} = x$$

(2) Find the values of x in the equation

$$8^{-3x} = \frac{1}{4}$$

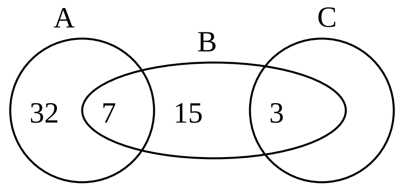
(3) Function f(x) is defined by $f(x) = \frac{2}{x} + 3$

Find (i) (2)
(ii) the value of x for which f(x) = 4

(4) $p = \begin{pmatrix} 6 \\ 8 \end{pmatrix}$, $r = \begin{pmatrix} 9 \\ k \end{pmatrix}$

(i)Find $|p|$
(ii)Given that r is parallel to p, find the value of k.

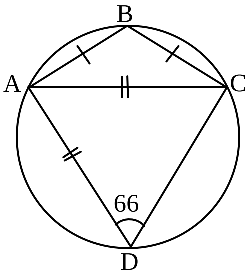
(5) A, B and C are three sets and $\varepsilon = A \cup B \cup C$.
The numbers of elements in some of the subsets are in the Venn diagram and
$n(\varepsilon) = 66$



Find

(i)n(AUB)
(ii)n(C)
(iii)n (AUB)

6. $m = \frac{k}{\sqrt{n}}$. when m = 1, n = 25
(a)Calculate the value of k
(b)Calculate m when n = 16
(7) Find the value of k for which the matrix
$\begin{pmatrix} 2 & 3 \\ 1 & k \end{pmatrix}$ has no inverse
(8) Express as a single fraction in its simplest form
$$\frac{1}{2y-1} + \frac{y}{2y+3}$$
(9)



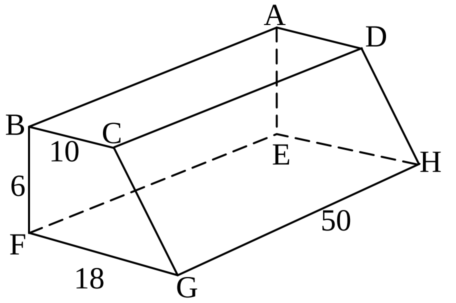
A, B, C and D are four points which lie on a circle. Given that AB = BC, AC = AD and ADC = 66^o
Calculate
(i) CAD
(ii)ABC
(10) Solve the simultaneous equitation
x + y = 5½
x - 2y = 2½

SECTION B

(11) (a) The transformation P is represented by the matrix $\begin{pmatrix} -3 & 2 \\ 4 & -1 \end{pmatrix}$ and it maps the point (2,3) on to the point A. Find the coordinates of A
(b) The transformation Q is represented by the matrix $\begin{pmatrix} k & 0 \\ 2 & -3 \end{pmatrix}$ and it maps the point (4,-1) onto the point (12, 11)
(i) Find the value of k
(ii) The transformation Q also maps the point B onto the point (-18,3). Find the coordinates of B.
(12) A group of 60 threatre artistes staged 3 plays Dhamufula (D), Wakaisuka (W) and Munwagulya (M). Each artiste participated in at least one play as shown below
38 participated in D
35 participated in M
31 participated in W
21 participated in both D and M
19 participated in both M and W
20 participated in both D and W
Find
(i)number of artists who participated in all the three plays.
(ii)Number of artistes who participated in W only
(iii)Probability that a member in picked at random from the group will have participated in only play.
(13)Draw an orgive for the following distribution

Maths	No of students
0-20	10
20-40	25
40-60	42
60-80	23
80-100	8

Find
(i)the median
(ii)the lower and upper qualities
(iii)the inter qualitite range
(14)



The diagram represents a solid block of wood length 50cm. The faces of ABCD and EFGH are horizoritai rectangles. The faces ABFE, BCGF and ADHE are vertical. BC = AD=10cm, BF = AE = 6cm and FG = EH = 18cm
Calculate
(i)CG
(ii)The volume of the blocks,
(iii)The total surface area of the block.
15. In a triangle ABC, AB = 6cm, AC = 9cm and D is a point on the side AC such that angle ABC = angle ACB
(i)write down another pair of equal angles
(ii)Use similar triangle to calculate the length AD
(iii)Given that the area of triangle ADB is 10cm^2. Calculate the area of triangle ABC
16. A bag contains 6 red sweets, 3 yellow sweets and 1green sweet. Two sweets are drawn at random from the bag one after the others, and are not placed.
Find the probability that
(i)the first sweet taken is red
(ii)both the sweets are red
(iii)Both of the sweets are of the same colour.
(iv)The two sweets are of different colours
(17) Using a compass and a pencil only construct a triangle XYZ in which Xy = 9.2cm, XZ = 6.7cm and ZY = 10.5cm.Measure the angle YXZ
(a) (i)On the diagram is drawn a Locus of points that are equichlist and XY and XZ
(ii) Construct a circle that touches the three sides of the triangle and measures its radius

1987 U.C.E
PAPER 1

1. Evaluate $1.2(4.75^2 - 2.25^2)$ ***(4 marks)***

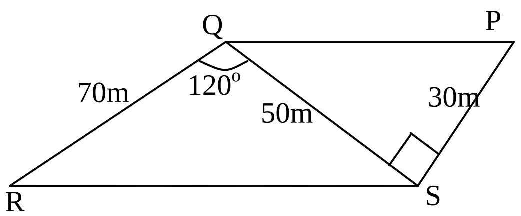
2. Without using tables, find

$(243)^{\frac{3}{5}} \times (81)^{\frac{-3}{2}}$ ***(4 marks)***

3. Given that $\begin{pmatrix} 5 & x \\ 3 & x \end{pmatrix} \begin{pmatrix} y \\ 2 \end{pmatrix} = \begin{pmatrix} 25 \\ 4 \end{pmatrix}$,

find x and y. ***(4 marks)***

4.



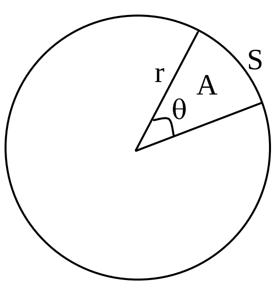
In the figure above PQRS, angles PSQ is 90° and angle SQR = 120. Calculate the area of the figure.

5. Given that f(x) = 3x + 4, find $f^{-1}(5)$ ***(4 marks)***

6. Factorize $2a^2 + 4ab + 3ac + 6bc$. ***(4 marks)***

7. The sets A and B are such that
A = (2a: 0 < a < 27)
B = ($b^{2:}$ 0 < b < 11)
where a and b are integers. Find $(A \cap B)$ ***(4 marks)***

8.

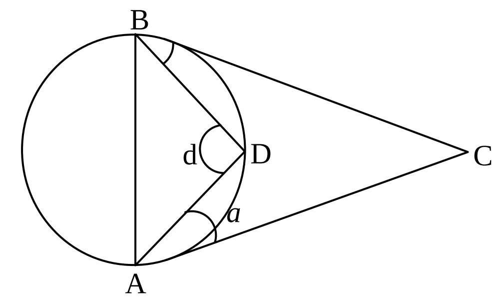


In the diagram above the sector of the circle has area A and angle θ°. Find S and A in terms of r and θ.

9. Vectors OA = $\begin{pmatrix} 3 \\ 5 \end{pmatrix}$ and OB = $\begin{pmatrix} 5 \\ -2 \end{pmatrix}$, find the magnitude of vector AB ***(4 marks)***

10. Given that $\sin A = \frac{5}{3} \cos B$ and B = 65° calculate the possible values of angle A between 0 and 360^0

11.

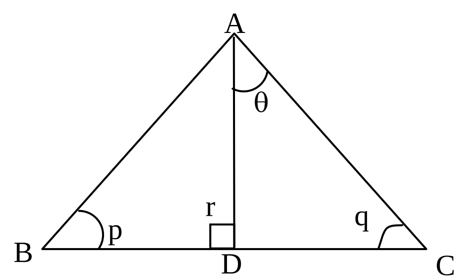


In the figure above the tangents at A and B meet at C. Show that a + b + d = 180^0

12. In the family of two children find the probability that both children are of the same sex.

13. On the map of scale 1:250,000 the distance between two towns A and B is 16 cm find the actual distance of AB in kilometers.

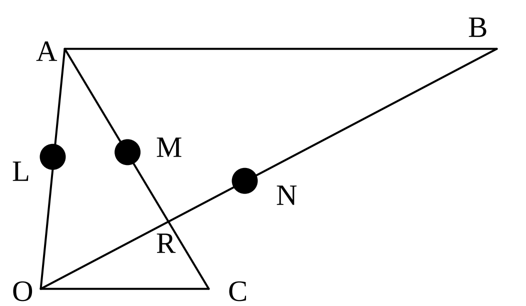
15.



In the figure above AD is the bisector of angle BCA . Find r in terms of p and q.

SECTION B

16. (a)A car traveling at a speed of 84 km /h takes 40 min to cover a certain distance if a second car takes 48 min to cover the same distance find the speed of the car.
(b) A lorry carrying 20 bags of sugar and 15 bags of salt is overloaded by 160 kg. Given that the weight of 20 bags of salt and 15 bags of sugar is equal to the maximum load of lorry of 2930 kg, find the weight of each bag of salt and sugar.
17.



]

In the figure above OB = 2b, OA = 2c, 3OR = 2NO and 3CR = 2CM. Given that L, M and N are the

midpoints of OA ,CA and OB respectively find in terms of c and b:
(i) OA
(ii) LM
(iii) LN
(b) Show that OCNL is a parallelogram.

19. Given that

$$A = \begin{pmatrix} 2 & -1 \\ 0 & -1 \end{pmatrix}$$

$$B = \begin{pmatrix} 6 & 8 \\ 10 & -12 \end{pmatrix}$$

Find (i) $(AB)^{-1}$
(ii) $B^{-1}A^{-1}$
Hence write down the relationship between $(ABC)^{-1}$ and A^{-1}, B^{-1} and C^{-1}. ***(4 marks)***

(b) A company making soft drinks has three factories P, Q and R each of which can produce three types of drink, orange, coca and lemonade. Each type is bottled in three sizes, large, mini and standard. The quantity of soda bottled each day at the three factories and the proportion of each type in the various bottle sizes is shown in the tables below:

Crates of soda (thousands)

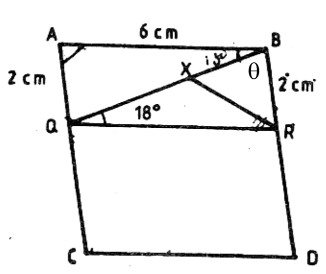
$$\begin{array}{c} \text{Factory} \\ P \\ Q \\ R \end{array} \begin{array}{c} \begin{array}{ccc} \text{Orange} & \text{Cola} & \text{Lemonade} \end{array} \\ \begin{pmatrix} 12 & 6 & 15 \\ 8 & 3 & 12 \\ 0 & 3 & 18 \end{pmatrix} \end{array}$$

Proportion per type of bottle

$$\begin{array}{c} \\ \text{Orange} \\ \text{Cola} \\ \text{Lemonade} \end{array} \begin{array}{c} \begin{array}{ccc} \text{Large} & \text{Mini} & \text{Standard} \end{array} \\ \begin{pmatrix} 0 & 3/4 & 1/4 \\ 0 & 2/3 & 1/3 \\ 1/3 & 1/3 & 1/3 \end{pmatrix} \end{array}$$

(b) Find the amount of soda (in thousands of crates bottled at each factory in each of the three bottle sizes

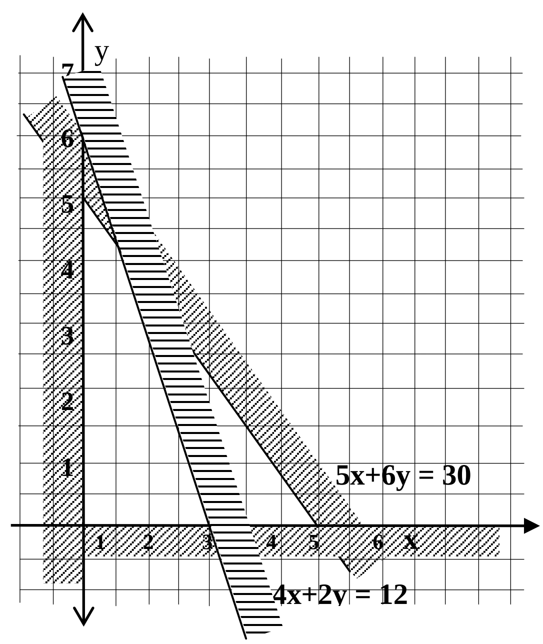
20.



The diagram above shows a rhombus ABCD of side 6 cm
Calculate angle BRQ, QC and BQ

21. The profit for two types of tables A and B by a certain company are
sh50,000 and 75,000 respectively.
Type A requires 4 hrs for assembling and 2.5 hrs for finishing. Type B requires 2 hours for assembling and 3 hours for finishing. Given that there are 12 hours for assembling ad 15 hours for finishing;
i) use inequalities to represent this information.
ii) use a graphical method to find the possible number to tables of each type that can be produced.
iii)calculate the maximum profit.

	Time needed assembling	In hours, Finishing	Profit shs
Type A	4	2.5	50,000
Type B	2	3	75,000
Total	12	15	



22. Two points A and B 32 m part are at the same horizontal level. A tower FT stands north of A with FA horizontal. The angles of elevation of T from A and B are 45° and 30° respectively. Given that B is due east of A find
i) The height of the tower FT,
ii) The bearing of B from the tower.

1987 U.C.E
PAPER 2

1. Write down the number $n^2 + 3n + 2$ in base n where n > 3. ***(4 marks)***

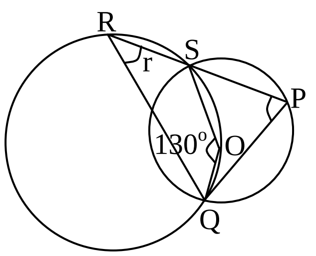
2. Find $\frac{y}{x}$ if $9^x = 27^y$ ***(4 marks)***

3. Given that $\mathbf{a} = \begin{pmatrix} 3 \\ 1 \end{pmatrix}$, $\mathbf{b} = \begin{pmatrix} -2 \\ 3 \end{pmatrix}$ and $\mathbf{c} = \begin{pmatrix} 1 \\ 4 \end{pmatrix}$. Find scalars p and q such that

$p\mathbf{a} + q\mathbf{b} = c$ ***(4 marks)***

4. Q is a positive quarter turn about (0, 0). R is reflection in line y = x.
Find QR (2, 1)

5.



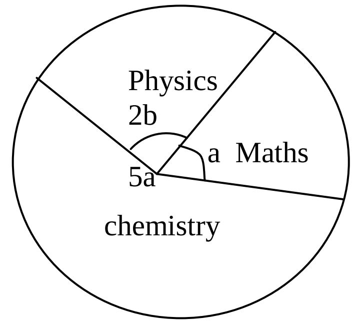
In the diagram above, O is the centre of the circle SPQ. Angle SOQ = 130°. Write down the values of r and p. ***(4 marks)***

6. The mean marks in a mathematics test in a class of 30 boys and 20 girls were 60 and 70 respectively. Find the mean mark for the whole class. ***(4 marks)***

7. An article costing sh. 280,000 was sold making a profit of 20% of the selling price. Find the selling price. ***(4 marks)***

8. Transformation T is an enlargement with centre (1, 5) and scale factor 2. Find T (3, 4) and T (2, 6) ***(4 marks)***

9.



The pie chart above represents the number of students taking one subject from Mathematics, Physics and Chemistry.
Given that a + 2b = 150° and that the total number of students is 60, find the number of students taking each subject.

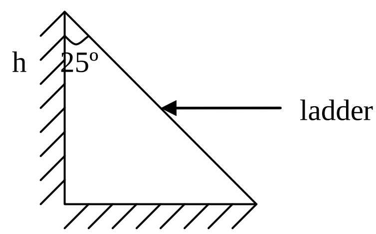
10. Represent the set

A = {m, n, r, s}
B = {n, s, p, q}
C = {m, n, p, t}

On a Venn diagram. Write down $A \cap B^1$.

11. Given that $g(x) = ax^2 + b$, $g(-2) = 3$ and $g(1) = -3$, find a and b.

12.

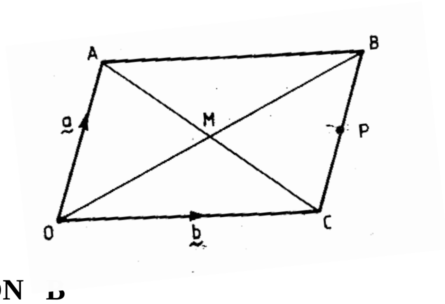


In the diagram above a ladder leans against a vertical wall. Find h.

13. In triangle ABC, $\overline{AB} = 42$m, $\overline{AC} = 114$m and angle B$\hat{A}$C is a right angle. Find $\overline{BC}$ by calculation.

14. Find the inverse of $\begin{pmatrix} 3 & 2 \\ 4 & 2 \end{pmatrix}$. ***(4 marks)***

15.
In the diagram below, OABC is a parallelogram. Express OM + MP in terms of a and b.



SECTION B

16. (a) In a class of 100 students, 41 take History, 29 take Geography, 28 take Literature, 15 take history and geography , 8 take geography and literature ,19 take History and Literature and 5 take all the subjects. Using a Venn diagram, find the number of students

(i) That are not taking any of the three subjects.
(ii) Taking just one subject.
(b) Find the probability that a student selected at random takes at least 2 subjects.

17.(a)The income tax rates of a certain country are as follows:

Income (Sh)	Rates
0 – 394000	Tax free
394001 – 694000	30%
694001 and more	36%

Find the income of a man who paid sh. 385200 of tax.
(b) A certain amount of money was invested at compound interest at a rate 10% for 5 years. Given that at the end of period, the owner received sh.500000, find the amount originally deposited.
(4 marks)

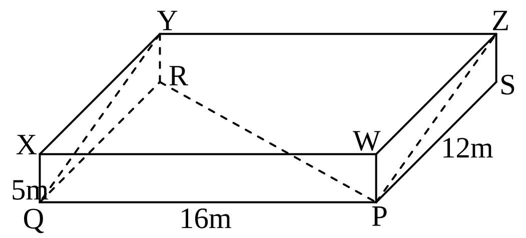
18. Find the equation of a line through (5, −7) which is parallel to the line 6x + 3y – 4 = 0. Find the equation of a line passing through (6, −2) and (3, 7). Hence determine the point of intersection of this line with 6x + 3y – 4 = 0. ***(4 marks)***

19. The frequency distribution below shows the marks obtained in a physics examination by 2000 candidates.

Mark	Frequency
11 – 20	30
21 – 30	60
31 – 40	220
41 – 50	540
51 – 60	490
61 – 70	310
71 – 80	180
81 – 90	110
91 – 100	60

Calculate:
(i) The mean mark using an assumed mean of 55.5
(ii) The standard deviation
(iii) Median

21.



In the cuboid above, calculate
(i) The angle between the base PQRS and the plane PQYZ,
(ii) $\overline{PR}$
(iii) The angle between the plane PYQ and the base PQRS.

22.
The data below sows the height in centimeters of pupils in a certain school.

132	125	117	124	108	112	100
130	122	118	114	103	119	106
125	128	106	111	116	132	129
136	92	115	118	121	137	123
119	115	101	129	87	108	104
127	103	110	126	118	82	104
146	126	119	119	105	132	126

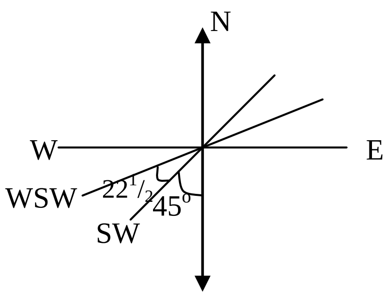
(i) Form a frequency distribution table for the data having equal interval size starting with 80 – 89.
(ii) Convert the distribution in (i) above to a cumulative distribution.
(iii) Draw an ogive the cumulative distribution and use it to find the median height. ***(4 marks)***

1988 U.C.E
PAPER 1

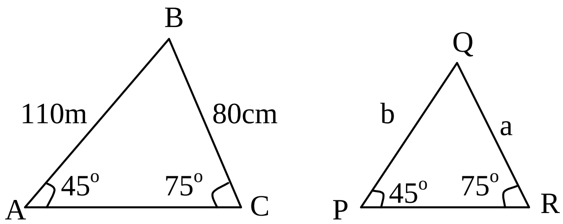
1. Evaluate $4\frac{1}{2} - 3\frac{5}{6}$

2. Divide sh. 60,000 between Damba, Dimbwe and Dumba in the ratio 2:7:3 respectively.

3. Express the bearing West South West (WSW) in degrees.



4.



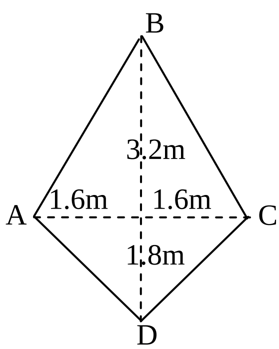
The two given triangles are similar. Find the value of b and a

5. Factorise 10a(m– n) – 3a(m - n) ***(4 marks)***

6. Given that M = $\begin{pmatrix} -1 & 2 \\ 2 & 4 \end{pmatrix}$.

Show that det $(M^{-1}) = \dfrac{1}{\det M}$ ***(4 marks)***

7.



Find the area of ABCD ***(4 marks)***

8. A car left Mutukula at 9.00am and arrived at Lukaya at 10:20am. The distance travelled was 120km. Find the average speed of the car. ***(4 marks)***

9. Given that $E = \sqrt{VL}$

Evaluate V when E = 60 and L = 40.

10. Given that A = $\begin{pmatrix} 2 & 3 \\ 1 & 2 \end{pmatrix}$

B = $\begin{pmatrix} 2 & -3 \\ -1 & 2 \end{pmatrix}$.

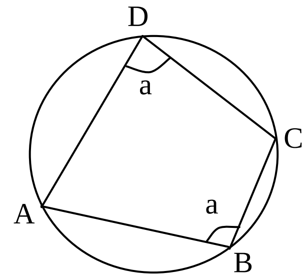
Evaluate AB and BA. ***(4 marks)***

11. Solve the simultaneous equations

$$2x - y = 4$$
$$3x + 2y = 13$$ ***(4 marks)***

12.

In the figure ABCD is a cyclic quadrilateral state the value of a.



(4 marks)

13. Give that

$$\begin{pmatrix} 2 & 3 \\ 1 & 2 \end{pmatrix}\begin{pmatrix} a \\ b \end{pmatrix} = \begin{pmatrix} 0 \\ -10 \end{pmatrix}$$

Find the values of a and b solutions ***(4 marks)***

14 The daily average temperature in degrees Celsius for 20 days of April 1987 at Kampala was recorded as

25	23	23	22	20
20	21	22	25	24
23	21	25	24	22
22	24	23	24	23

(i) State the modal temperature.

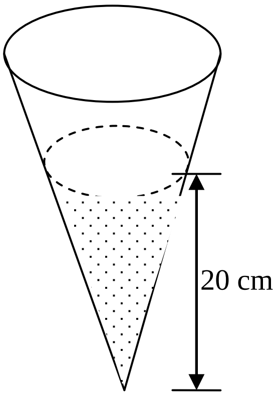
(ii) Find the mean temperature for the first 10 days. ***(4 marks)***

15. A plot of land 32m by 12m is to be divided into square gardens each of side 4m. Find the number of gardens. ***(4 marks)***

16. A right circular conical flask of bade radius 10cm and vertical height 30cm has a maximum internal capacity of 3 litres.

i) Find the difference between the total volume of the flask and its internal capacity.

ii) The flask is inverted such that its apex is at the bottom. It is then filled with water to a depth of 20cm.



Find the radius of the water surface.

ii) The water is then poured into a rectangular trough of base 25cm by 16cm.
Find the depth in the trough.
Volume of a right circular cone $= {}^{1}/_{3}$ base area × height.

17. a) In a year the ministry of Education made a survey of 500 schools. The results were as follows.
360 were day (**D**) schools,
290 were boarding (**B**) schools
225 were both day and boarding
Find the number of schools which were
(i) only day,
(ii) only boarding.
(b) In a class of 30 "A" students.

18 study Geography and 19 study principal Math. Each student has to study at least one of these subjects. How many students study both Math and geography?

18. The monthly salaries in shillings paid to 500 employees are as follows

Salary range	No. of employees
1601 to 1700	106
1701 to 1800	154
1801 to 1900	142
1901 to 200	98

Calculate the
i) mean salary,
ii) median salary.
(4 marks)

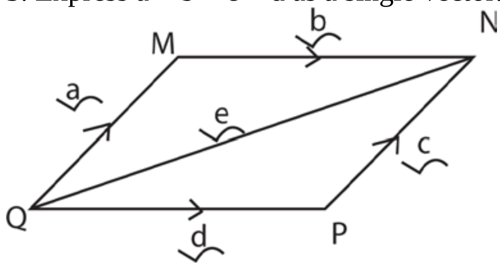
1988 U.C.E
PAPER 2

1. Use tables to find the angle whose tangent is 0.365.
2. In an examination marked out of 160, a candidate obtained 128. Find his percentage mark.
3. The following were electricity meter readings at Peter's house.

1st April	28932
1st July	29559
1st October	30075

Calculate the amount of money Peter paid in each quarter of the year if the cost of each unit was sh 1.25 ***(4 marks)***
4. Convert the time of 1850 hours on the 24-hour clock to the time using the 12-hour clock.

5. Express a + b + c + d as a single vector.



6. A merchant imported a pound 3500 car from Britain. He could only buy US dollars from Bank of Uganda. The exchange rate was $1 to s 60 and pound 1 to $ 1.86. Find how much Uganda currency he needed.

7. Solve the in equation $\frac{1m}{5} - 3 < 7$ ***(4 marks)***

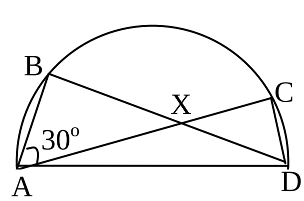
8. 135 children out of 150 at a nursery school are present. Express the number of children present as a decimal of the whole school.

9. At an RC1 meeting there were 100 people. At the meeting 50 people complained that they had not received paraffin. 40 people wanted the RC1 chairman to be voted out. Only 8 of those who wanted the chairman to be removed had missed paraffin.
Represent this information on a Venn diagram. How many people neither missed nor wanted the chairman removed?

10. Given that in triangle ABC, angle ABC is 90^o BC = 90cm and angle BAC = 30^o. Find AC.

11. Given that $(x - 1)(x + 1)(x^2 + 1) = (x^y - 1) - 1$, state the value of y.

12. Factorize $6x^2 + x - 12$. Hence write down the roots of $6x^2 + x - 12 = 0$
13.



In the diagram ABCD is a semicircle, state the size of

(i) Angle ACD,
(ii) Angle CDX.

14. The position vectors of A and B are

$\begin{pmatrix} 3 \\ 1 \end{pmatrix}$ and $\begin{pmatrix} 5 \\ 2 \end{pmatrix}$ respectively. Find AB.

15. Dumba's school bag contains 8 red books, 4 blue books and 1 white book. He pulls one book at random. Find the probability that he pulls out

(i) a red book,
(ii) a blue book,
(iii) a red or blue book.

SECTION B

16. (a) The cost of printing 4000 books was Sh. 1.2million. A bookshop bought all the books by paying all printing costs plus 30%. The books were then retailed at Sh 500 per copy. Find percentage profit made by the bookshop

(b) Kyasanku receives a total monthly income of Sh x as follows:

Part – time teaching 30%
Trade 50%
Salary as Government employee 20%

This month he expects changes in his income as follows:

Part – time teaching 5% increase
Trade 10% increase
Salary as Government employee 15% increase

Find the overall percentage change in Kyasanku's income this month

17. A helicopter flies from Kampala due north for 400km. It then flies on a bearing of 285 for 280 km. From there it flies on a bearing of 090 for 400km. Draw a sketch diagram to show the route of the helicopter. Hence draw an accurate diagram using a scale of 1cm to represent 50km.
From your diagram, find the distance and bearing of Kampala from the final destination of the helicopter.

18. (a) Find the matrix which maps the unit square into $\begin{pmatrix} 0 & 2 & 1 & -1 \\ 0 & 2 & 0 & -2 \end{pmatrix}$
Illustrate your answer by a sketch

(b) A shopkeeper filled his order from his U.S as follows:

	Size			
	Small	Medium	Large	Giant
Blue	0	40	20	0
Green	20	0	20	0
Yellow	0	20	0	20

The table below shows the cost for each size of shirt.

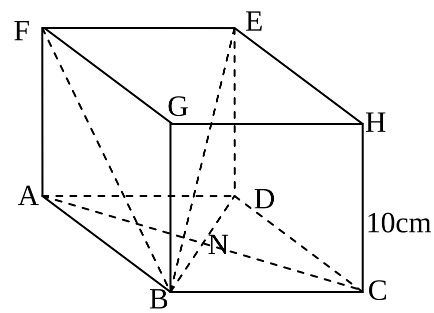
	Size			
	Small	Medium	Large	Giant
Costs (Sh)	900	960	1020	1080

(i) Write down a 3 x 4 matrix
(ii) Write down the cost matrix of 4 x 1
(iii) Given that the shopkeeper had to pay a tax of 20% of value of goods imported, find his expenditure on the order. ***(4 marks)***

18. (a) Matrix is given by $\begin{pmatrix} a & b \\ c & d \end{pmatrix}$

$$\begin{pmatrix} a & b \\ c & d \end{pmatrix} \begin{pmatrix} 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 \end{pmatrix} = \begin{pmatrix} 0 & 2 & 1 & -1 \\ 0 & 2 & 0 & -2 \end{pmatrix}$$

19.



From the diagram of a cube shown above calculate.
(i) BF
(ii) BE
(iii) the angle between BE the face ABGF
(iv) the angle between the planes BDF and ABCD
(4 marks)

21. (a) Use table to evaluate

$\dfrac{35.27 \times 9.56}{8.35}$ ***(4 marks)***

Correct to 2 significant figures.

22. The following are the highest marks scored in 45 different examinations

74	76	82	76	59	67	73	80	90
63	48	73	91	66	88	63	74	86
67	71	51	49	96	71	72	85	87
86	71	82	83	66	71	76	48	51
92	90	46	72	81	86	82	76	64

(i) Make a frequency table starting with the class of 40 - 49
(ii) Draw a histogram for the data
(iii) State the modal class.

1989
SOLUTION TO 1989
PAPER ONE

1. Factorize $8x^2 - 38x + 35$.

2. Find the highest common factor of 56, 72, 104.

	56	72	104
2	28	36	52
2	14	18	26
2	7	9	13

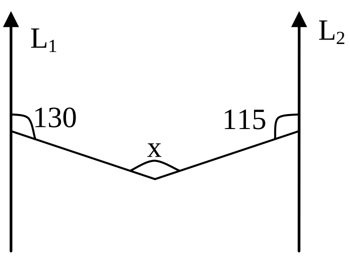
3. A maize wholesaler has $13\frac{1}{2}$ tones of maize flour.

How many orders of $\frac{3}{4}$ tones can he meet? ***(4 marks)***

4. Given that AB = $\begin{pmatrix} 3 \\ 3 \end{pmatrix}$, BC = $\begin{pmatrix} -4 \\ 3 \end{pmatrix}$, find:

(i) AC
(ii) The magnitude of AC ***(4 marks)***

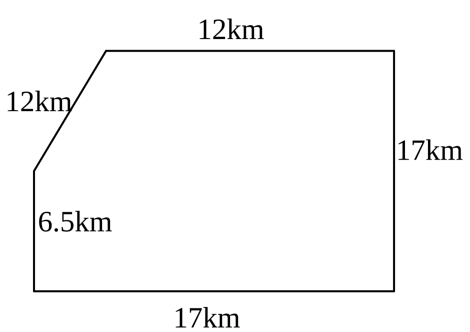
5. The highest in centimeter of eight nursery school girls were 70, 69,60,71,73,58,63,65 find the medium height
6. Given that M_x = {multiples of x} and F_y = {all factors of y}, find $n(M_5 \cap F_{10})$.
7.



Given that L_1 and L_2 are parallel lines find the values of x

8. Convert:
i) 7.58pm to the 24 hr time,
ii) 2400hours to the 12 hr time.
9. Kapere bought 0.5 km of wire from Uganda cables for sh 25,000 and sold it at sh 75 per meter .find his percentage profit

10.



Find the area of the field shown above.

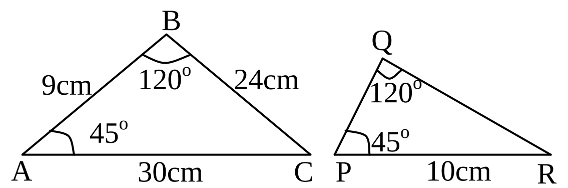
11. Given that 15 men need 100 min to offload a lorry, find how long it takes 20 men working at the same rate to do the same job.

12. The table below gives a description of two African Capitals

Country	City	latitude	Longitude
Zimbabwe	Harare	18S	31E
Egypt	Cairo	30N	31E

Taking π as $\frac{22}{7}$ and the earth radius as 6300 km find the shortest distance between the two capitals
(4 marks)

13.

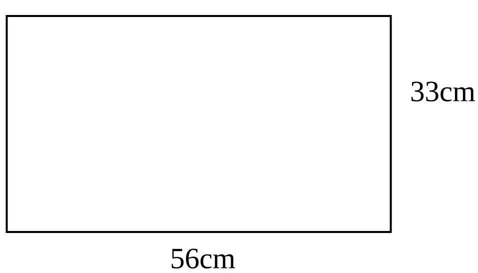


Given that the two triangles are similar, find $\overline{PQ}$. ***(4 marks)***

14. Given that $A\left(\frac{Pm}{q}\right)^2 = -2r$ make q the subject

(4 marks)

15. A man making biscuits uses a board shown below. He spreads the dough uniformly to cover the top face of the board.



Given that each biscuit has a radius of 7cm find
Verify that (A + B) + C = A + (B + C).

(b) Use matrix methods to solve the simultaneous equation

$$x - 3y = 7$$
$$4x + y = 5$$ ***(4 marks)***

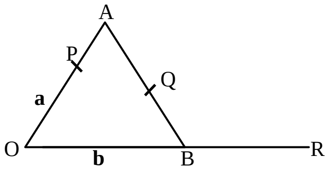
18. Three points P,Q,N are on level ground A vertical pole AF stands between P and Q such that P is 12 m from A the base of the pole . The angles of elevation of F from P and Q are 21 and 53^0 respectively given that angle QPN = 80^0 and NP = 12m
Calculate

(i) the length PQ and the height of the pole
(ii) the angle of elevation of F from N ***(4 marks)***

19. The directors of Mungu-Iko College of commerce made the following budget for the 1989 academic year. Total minimum cost for the college to run for the whole year was to be shs 11.5 m
The college could cater for a maximum of 220 boarders and the total number of students should not exceed 400
Each boarder would pay sh 50,000 and each day student would pay sh 23,000 per year
Given that x and y represents the number of day students and boarders respectively

i) Write down the five inequalities which must be satisfied represent them graphically using a scale of 1 cm to 50 units on each axis
ii) Shade the unwanted regions
iii) From your graph determine the minimum number of borders needed if the college is to be able to run the whole year

20.



In the figure above OA = a, OB = b,
2OA = 3OP, 5AB = 9AQ and
3BR = 2 OB

a) find in terms of a and b
   i) PA
   ii) AQ
   iii) QB
   iv) BR

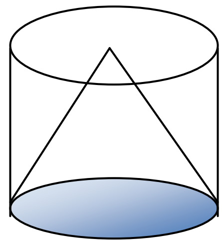
(b) Show that P,Q,R are in a straight line
(4 marks)

21. By use of a ruler and a pair of compasses only construct a quadrilateral ABCD in which AB =AC = 6 cm, AD = 5 cm, angle ABC = 45 ^{o} and angle DAB = 120^{0}
Construct a circle that passes through the points A, B, C of the quadrilateral measure the distance between the centers of the vertex D

The length AB is drawn i.e. AB = 6cm and angles of 120^{o} and 45^{o} are drawn at A and B respectively. The line AD = 5cm is then drawn. The length AC = 6cm is measured and the point D is joined to C.

The distance from the centre to vertex D = 5.5cm.

22.



The figure above shows a trough for watering poultry. It consists of a solid cone of height 14 cm, welded onto the base of a right circular cylinder of the same height.
Given that the radius is 25 cm at the base find;
i) The volume of the cylinder,
ii) The capacity of the trough where it is full.
(Take π = 3.14)

SECTION A

1. Express the ratio 450kg to 1 tonne in its simplest form. ***(4 marks)***

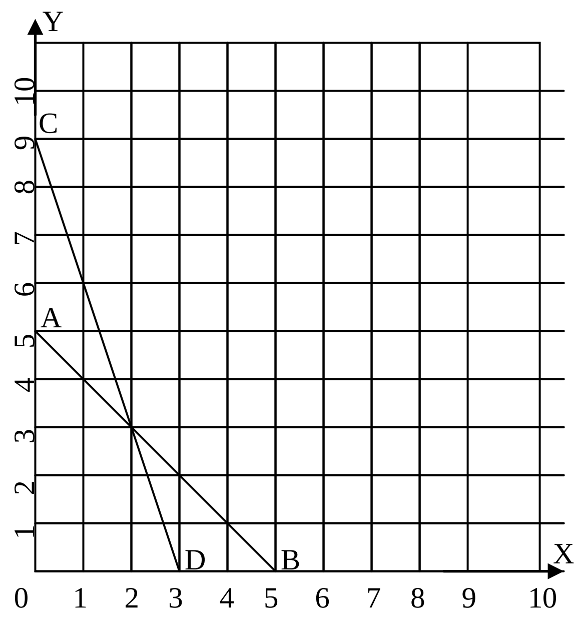
2. Express 3.1789km into m and cm. ***(4 marks)***

3. Evaluate $25(383^2 - 17^2)$. ***(4 marks)***

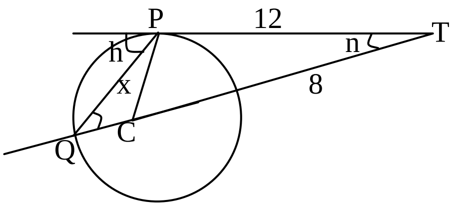
4. Solve the equations:

$$x + y = 8$$
$$4x - y = 17$$ ***(4 marks)***

5. Given that $x = \frac{\sqrt[3]{a}}{b}$, find b when x = 2 and a = 24.

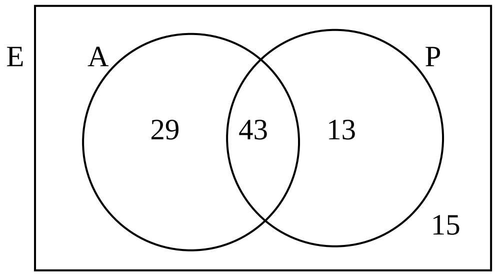


Find (i) the gradient of CD
(ii) The equations of the lines AB and CD
7.



In the diagram TP is tangent to the circle with centre C and angle PQC = 40^o. Find h and n. ***(4 marks)***

8.



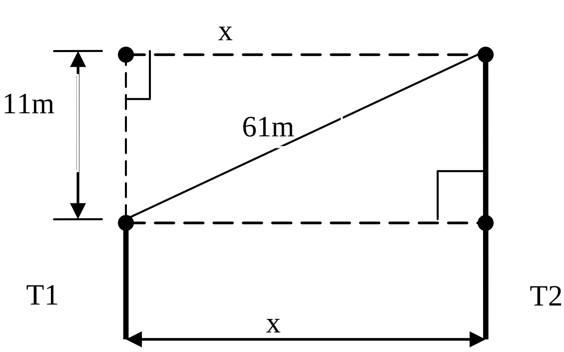
The Venn diagram shows:
E = {UNEB senior staff}
A = {those who checked 1988 UACE}
P = {those who checked 1988 PLE}
(a) Write down the number of staff who checked
(i) PLE,
(ii) Neither examination.
(b) Find the probability of a member of staff picked at random having checked two examinations.

9. As part of his pay a land is normally given commission which is a percentage of the sales price. The rates as follows:

Sales Price	**Commission**
First 1 million Sh	3%
Anything above 1 million Sh	$1\frac{3}{4}$%

Find his total commission on a farm which is sold for 3.5 million shillings. ***(4 marks)***

10.

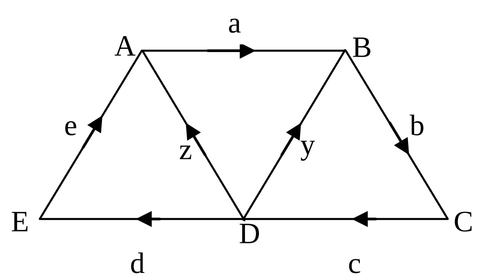


The bases of two vertical towers are separated by a distance of x meters, their height differ by 11m and the shortest distance between their tops is 61m.

11. The standard pay rate of Okumu is Sh 60 per hour for a basic week of 40 hours. His overtime rate is time half ($1\frac{1}{2}$ times the usual rate) find his income in week in which he works for 48 hours. ***(4 marks)***

12. Find the integral solution set for
$3x - 16 \leq 29$ where $x > 12$. ***(4 marks)***

13.



Express as single vector
(i) y + b,
(ii) b + c + z

13. (i) y + b = ⁻ c
(ii) b + c + z = ⁻ a ***(4 marks)***

14. Given that A = $\begin{pmatrix} 2 & 4 \\ -1 & 3 \end{pmatrix}$ find the inverse of A

15. Calculate the radius of circle that circumscribes an equilateral triangle of side 6cm.

SECTION B

16. (a) A shopkeeper had two similar television sets for sale marked sh.75,000 each. He sold them to two men. Mr. Kato was allowed a 15% reduction after hard bargaining. Mr. D. high-class bought at the marked price.
The shopkeeper made a profit of 25% on its price in the sale to Kato. Find

(i) How much the shopkeeper had paid for each television set?
(ii) The profit from the sale to Mr. High class as a percentage of the cost price to the shopkeeper.

(b) A man invests Sh 20,000 at the beginning of each year with Equator building society. The money accumulates at 4% annual compound interest. Find the total amount of money immediately after payment of his third investment.

1990 PAPER ONE
SECTION A

1. Evaluate $\frac{0.42 \times 360}{14000}$

2. Solve the inequality $2x + 4 \geq 5x - 5$.

3. Without using table, find $(32)^{2/5} \times (2)^{-4}$

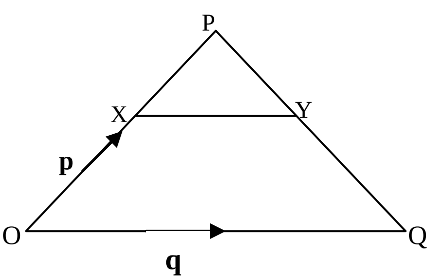
4. The points P(8, 11) and Q(12, 19) lie on a line which is parallel to another line passing through O(0, 0). Find the Equation of the line through O(0, 0).

5. A chord of a circle of radius r centimeters is 10cm long and subtends an angle of 130^o at the centre. Find r correct to two decimal places.

7. Given that a = $\begin{pmatrix} 3 \\ -2 \end{pmatrix}$, b = $\begin{pmatrix} -5 \\ 4 \end{pmatrix}$, and

c = $\begin{pmatrix} -1 \\ -5 \end{pmatrix}$. Find the length of a + b + c.

8. In the figure below, OP = p, OQ = q, PY = $\frac{1}{3}$PQ and X is mid-point of OP. Find XY.

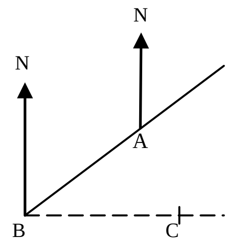


9. The transformation described by the matrix $\begin{pmatrix} 3 & x \\ y & 3 \end{pmatrix}$ maps the point A (3, 5) onto the point $A^1(6, 8)$, find the values of x and y. ***(4 marks)***

10. Mr. Mugabi put Shs 2,400 in his savings account at the Bank. The Bank's simple interest rate was 5% per annum. Find the number of years he should leave the money in the Bank in order to be able to receive a total sum of Shs 2,700.

11. Given that $a * b = ab^2 + b - a$, evaluate 0.01 x 150. Correct to 3 significant figures.

12.

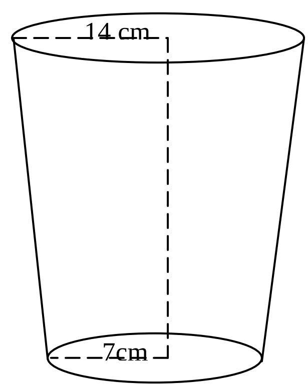


In the diagram shown, angle ABC is 50^o. Determine the bearing of B from A. ***(4 marks)***

13. Given that $\log_{10}a = 1.621$ and $\log_{10}b = 1.152$, evaluate $\log_{10}a + \log_{10}b^{1/2}$. ***(4 marks)***

14. Two men leaving a point B, walk in opposite directions along a straight road with the same speed. Given that the first man takes four minutes to walk 100 metres. Find the distance from B walked by the second man in 2.5 minutes?

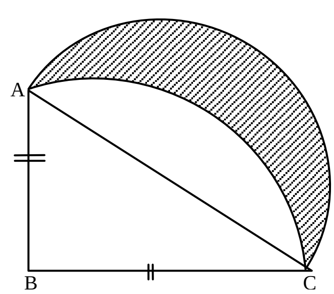
15.



The diagram above represents a light circular pail with a circular base of radius 7cm and a circular top of radius 14cm. The pail is 40cm high. Find the capacity of the pail. (Use $\square\square = \frac{22}{7}$, volume of a cone) = $\frac{1}{3}$ h x (base area)

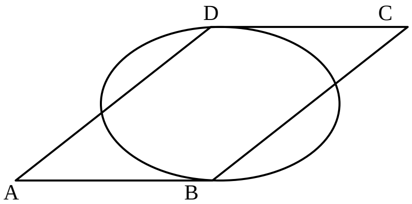
SECTION B

16.



In the diagram above ABC is an isosceles right-angled triangle arcs. The outer arc is a semi – circle with AC as diameter and the inner arc is a quarter of a circle with centre B. Find the area of the shaded region.

(b)



In the figure above AB and CD are targets to the circle at points B and D respectively.

ABCD is parallelogram with AB = 4.5cm and BC = 6.3cm. Find (i) the radius of the circle,

(ii) the length of the cord DE.

17. (a) Given the equation $ax^2 + bx + c = 0$, $(a \neq 0)$ derive the formula;

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

For finding the roots of the above equation, use the formula to solve the equation $3x^2 + 14x + 24 = 0$.

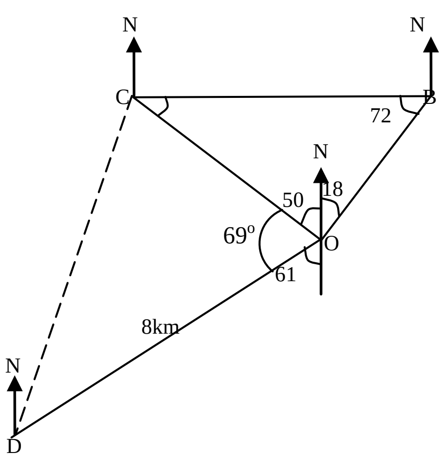
(b) To print wedding cards at the diamond printery, one as to pay a deposit of Shs 50 and an amount which is directly proportional to the number of cards to be printed. Te table below gives the total cost c, required to print d cards.

d	1	3	6	8
c	100	200	350	450

Find (i) c in terms of d,

(ii) The total cost of printing 248 cards.

18. A port B is 2.5km East of Port C. A navigator observes that the bearing of C from his ship is 310° and that of B is 018°. By an accurate scale drawing or otherwise; find the position and the bearing of the ship from B given that that the ship begins to sail at a speed of $10km^{-1}$ on the bearing of 241°. Find by drawing or otherwise the bearing and the position of the ship from C after 48 minutes.



19. In a class of 53 students 30 study chemistry, 20 study physics, and 15 study mathematics. 6 study both chemistry and physics, four study both mathematics and chemistry, 5 study both physics and mathematics. All students study at least one of the subjects.

(a) Find the number of students who study all the three subjects

(b) A student is selected at random from the class, find the probability that;

(i) He studies physics only

(ii) He studies physics but not mathematics.

20. (a) Using matrix methods find the values of x and y which satisfy the equations.

$2x - y = 1$

$3x + 2y = 12$

(b) Given that $M = \begin{pmatrix} 3 & -1 \\ 4 & 6 \end{pmatrix}$, find a matrix N such that $MN = \begin{pmatrix} 14 & 0 \\ 0 & 14 \end{pmatrix}$

Hence or otherwise find the inverse matrix for M.

21. (a) Given the vectors, $PQ = \begin{pmatrix} 6 \\ -8 \end{pmatrix}$, $QR = \begin{pmatrix} 1 \\ 5 \end{pmatrix}$ and the point Q (2, 3), find:

(i) PR

(ii) The coordinates of point p.

(b) The positions of the three points in a plane are L(-3, 4), M(8, -5) and N(x, 3). Given that OL is parallel to MN, where O is the origin, find the value of x.

22. Draw on the same coordinate axes the graphs of

$y = 2x^2 - 3x$ ---------------(1)

$y = 3(2x - 3)$ --------------- (2)

(a) Using your graph, find the points of intersection of (1) and (2).

(b) Find a quadratic Equation whose roots are the x-coordinates of the points you stated in (a)

1990 PAPER TWO
SECTION A

1. Given the sequence

$\frac{1}{4}, \frac{4}{9}, \frac{9}{16}, \frac{16}{25}$

Write down the seventh term.

2. Factorize $25 - (x^2 + 2xy + y^2)$.

3. Given that $\cos\theta = \frac{-5}{13}$ and that θ lies between 0° and 180°. Find without using table the values of

(i) sin θ,

(ii) tan θ.

4. Find, without using tables, the square root of

2500 x 1764. ***(4 marks)***

5. A map is drawn to a scale of 1:250,000. Find actual distance in km, of a piece of a road represented by 3.6cm on the map. ***(4 marks)***

6. The functions f and g are defined as follows;

$f(x) = \frac{1}{2x-6}$, $g(x) = x^2 - 1$. Find the value of x such that fg(x) is meaningless. ***(4 marks)***

7. Solve the simultaneous Equations

$$-x + 2y = 10$$
$$y - 4 = x$$
(4 marks)

8. The following are the percentage marks obtained by ten pupils in a mathematics test.
12, 3, 39, 61, 40, 10, 28, 40, 15, 52
Find the probability of a pupil selected at random from this group having obtained a mark below the mean mark. ***(4 marks)***

9. The position vectors of the vertices of a triangle ABC are $OA = \begin{pmatrix} 2 \\ 0 \end{pmatrix}$, $OB = \begin{pmatrix} 5 \\ 0 \end{pmatrix}$ and $OC = \begin{pmatrix} 2 \\ 4 \end{pmatrix}$. Find the area of the triangle.

10. Petrol costs \$ 0.85 per litre in U.S.A. Find the price of petrol in pound sterling (£) if \$1 = £0.48.
(4 marks)

13. Find the matrix A such that

$AP = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$, where $P = \begin{pmatrix} 3 & 1 \\ -1 & 3 \end{pmatrix}$ ***(4 marks)***

14. Given that x – y = 10 and a – b = 3, evaluate

$\frac{10}{y-x} - \frac{3}{b-a}$ ***(4 marks)***

15. Express 2.3 as a rational number

SECTION B:

16. (a) Evaluate $\dfrac{3\frac{1}{2} - 1\frac{5}{6} \times \frac{3}{11}}{1\frac{3}{4} + 7\frac{2}{3} \div 3\frac{5}{6}}$

(b) In the triangle XYZ, $\overline{YZ}$ = 5.5cm, $\overline{XZ}$ = 3.7cm and $\overline{XY}$ = 7.8. Find:
(i) sin XYZ
(ii) The radius of the circumcircle of the triangle XYZ.

17. (a) A shirt and a pair of trousers were each sold at sh 6000. The shirt was sold at a profit of 25% and the pair of trousers was sold at a loss of 20%. Find the percentage loss on both articles.
(b) A total of 1200 exercise books is to be shared by four classes, 4A, 4B, 4C and 4D. Senior 4A is given $\frac{1}{3}$ of books; of the remainder $\frac{2}{5}$ is to go to 4B. The other two classes share the remainder with 4C getting 60 more books than 4D.
Find the fraction of the total number of books obtained by 4D.

18. Use graph paper for this question.
Scale: 1cm to 1 unit on the x-axis,
1cm to 0.5 units on the y-axis.
(i) Plot the triangle PQR: P(1, 2), Q(0, 0), R(2, 0).
(ii) Write down the coordinates of PQR as a 2 by 3 matrix A.
(iii) Multiplying A on the left, by T_1 the transformation matrix $\begin{pmatrix} 1 & 2 \\ 0 & 1 \end{pmatrix}$ to give the image of triangle PQR under T_1.
(iv) Plot P′Q′R′
(v) Find the coordinates of P″Q″R″, the image of P′Q′R′ under T_1 whose matrix is $\begin{pmatrix} 2 & 0 \\ 0 & 2 \end{pmatrix}$
(vi) Plot P″Q″R″
(vii) Write down the matrix of a single transformation which would map PQR onto P″Q″R″.

19. Use graph paper. Draw x and y axes for;
x – axis from $^-3$ to $^+5$
y – axis from $^-4$ to $^+6$.
On both axes use 1cm: 1 unit
(a) Draw and label the graphs of the following lines:
(i) x + y = 3
(ii) y = x – 4
(iii) y + 3x = 0
(b) By shading the unwanted regions, show clearly the region R which satisfies the inequalities
$x + y \leq 3$
$y \geq x - 4$
$y \geq -3x$
Given that P(x, y) = 5x + 4y, find the two positive values of P(x, y) in R for which x = 1 and y is an integer.

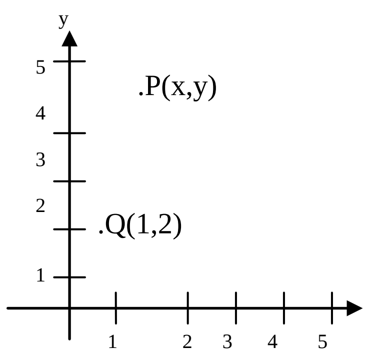
20. The table below shows the frequency distribution of weights in kg of luggage for 100 passengers boarding the Uganda air lines plane traveling from Dubai to Entebbe.

Weight	Frequency

(kg)	
50 – 54	1
55 – 59	2
60 – 64	5
65 – 69	11
70 – 74	21
75 – 79	20
80 – 84	17
85 – 89	10
90 – 94	6
95 – 99	4
100 – 104	2
105 – 109	1

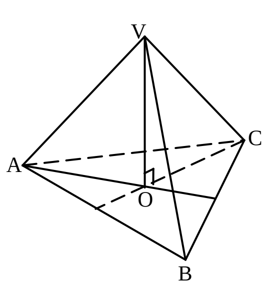
Find;
(i) The mean weight
(ii) The median weight
(iii) The model weight

21. (a) The daily cost per child in a Kampala family is partly constant and partly inversely proportional to the number of children in the family. Given that cost per child for a family of 10 is Shs 350 and for a family of 20 is Shs 300, find the cost per child for a family of
(i) 50 children
(ii) n children
(b)



In the figure above the point P moves in the plane in such a way tat its distance from (0, 0) is equal to its distance from Q. Find the locus of P in terms of x and y.

22.



The figure above shows a regular tetrahedron VABC with $\overline{VA}$ = 6cm.
Calculate
(i) The height of V above the base ABC
(ii) The angle between the edge VA and the base ABC
(iii) The volume of the tetrahedron ***(4 marks)***

1991 PAPER ONE
SECTION A

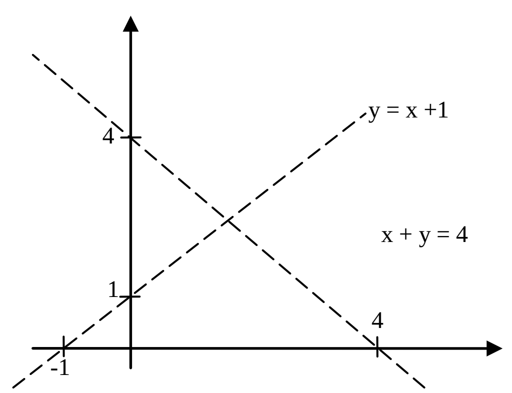
1. Without using tables or calculator, evaluate $3\ell og_{10}2 + \ell og_{10}20 - \ell og_{10}1.6$

2. Given $f(x) = (x - 3)^2$, find the values of x such that $f(x) = 16$.

3. Factorize $x^3 - xy^2$

4. Express the recurring decimal number 0.3636 … as a fraction

5.



Copy the above diagram and show the region satisfying the inequalities.
$y < x + 1$, $x + y < 4$ and $y > 0$.

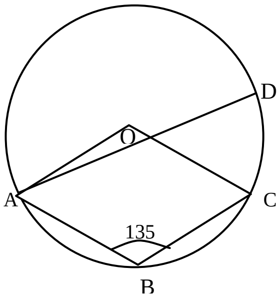
6. Given that operation $\uparrow$ is defined by $l \uparrow m$ = smaller of two numbers l and m, find $-3 \uparrow (4 \uparrow 3)$

7. A man bought a shirt at 20% discount. If he paid Shs 2,000, find the original price of the shirt.

8. Find all the integers x that satisfy the inequality $7x^2 < 63$.

9. Given tat $\tan\theta = {}^5\!/_2$, calculate without using tables or calculator, the value of $\cos\theta - \sin\theta$

10.



In the diagram above O is the centre of the circle. Given that angle ABC = 135^o, find the angle ADC and the reflex angle AOC.

11. The mean of three numbers is 3 and the sum of the smallest and the middle numbers is 5. Find the largest number.

12. The scale of a map is 1cm: 20km. Two towns on the map are 5cm apart. A man driving a car covers this distance in 80 minutes. Find is speed in kmh^{-1}.

13. Given that $E = 1.42 \times 10^3$, $D = 144 \times 10^6$ and

$$V = \frac{E^2}{D}.$$

Find V in the scientific form. ***(4 marks)***

14. The bearing of P from C is 060^o. What is the bearing of C from P? ***(4 marks)***

15. A spider made the following four moves

$OA = \begin{pmatrix} 2 \\ 3 \end{pmatrix}$, $AB = \begin{pmatrix} -3 \\ 1 \end{pmatrix}$, $BC = \begin{pmatrix} 4 \\ 0 \end{pmatrix}$ and

$CD = \begin{pmatrix} 2 \\ -8 \end{pmatrix}$. What single vector is equivalent to these four movements?

SECTION B:

16. (a) Given that matrices

$A = \begin{pmatrix} 1 & 2 \\ 4 & 6 \end{pmatrix}$, $B = \begin{pmatrix} 9 & 9 \\ 1 & 1 \end{pmatrix}$ and $C = \begin{pmatrix} 5 & 0 \\ 1 & 4 \end{pmatrix}$

Find $(ABC)^{-1}$.

(b) If $\begin{pmatrix} 4 & 1 \\ x & -1 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 4 \\ 8 \end{pmatrix}$

Determine the values of x and y

17. (a) By plotting suitable graphs on the same axes, find the solution of the equations.

$$-3x + 2y = -16$$
$$x + y = 7$$

(b) Plot the graph of $x^2 - 5x - 24$ for $-5 \le x \le 10$.

Use your graph to find the roots of the equation $x^2 - 5x - 24 = 0$.

18. Using a ruler, pencil and a pair of compasses only,

(i) Construct a triangle PQR with angles RPQ = 60^o, PQR = 45o and PQ = 8.4cm, measure the length of PR and QR.

(ii) Construct the line ST 12.6cm long bisecting and perpendicular to QR and meeting PQ at T. What is the size of angle STQ?

(iii) Join S to R and Q. Draw the circle circumscribing the triangle QRS. From your diagram determine the radius of the circle.

19. Copy and complete the table below sowing the number of senior four candidates of a certain school who passed a zonal mock examination in mathematics.

Marks	x	f	fx
35 – 39	37	60	2220
40 – 44	____	72	____
45 – 49	47	____	3760
50 – 54	52	____	2600
55 – 59	____	48	____
60 – 64	____	35	____
65 - 69	____	____	2010
70 – 74	____	25	____
75 – 79	____	____	924
80 – 84	____	5	____
85 – 89	____	2	____
90 - 94	____	1	____
		$\sum f = 420$	$\sum fx =$

(a) State:

(i) the class width.

(ii) the modal class.

(b) If a distinction was awarded for a score of 70 or more marks, determine the percentage number of candidates who passed with distinctions.

(c) Calculate the mean mark. ***(4 marks)***

20. Three points P, Q and R in a plane have position vectors $p = \begin{pmatrix} 4 \\ 6 \end{pmatrix}$, $q = \begin{pmatrix} 1 \\ 2 \end{pmatrix}$ and $r = \begin{pmatrix} 12 \\ 0 \end{pmatrix}$ respectively.

(a) Find:

(i) The length of PQ, QR and PR

(ii) The size of the angle QPR

(iii) The area of triangle PQR

b) Given that S is the midpoint of QR, find:

(i) The coordinates of S

(ii) The equation of the line through S having the same gradient as PQ***(4 marks)***

21. A plane flew west from Entebbe (E) at the speed of 200kmh^{-1} for $1\frac{1}{2}$ hours to reach Kasese (K). At Kasese it altered its course and flew North-East to Moroto (M) at 150km^{-1}. The total time when was in air was 5 hours.
(i) By using a scale drawing determine the distance and bearing of Entebbe from Moroto.
(*Use the scale 1cm to 50km*).
(ii) On its way to Moroto the plane passed over Soroti which is North of Entebbe. Estimate the distance between Soroti and Moroto.
(iii) If the plane flew back to Entebbe via Soroti at the speed of 200kmh^{-1}, determine the time it took to fly from Moroto to Entebbe.

22. Two transformations T_1 and T_2 are represented by matrices $\begin{pmatrix} 3 & 1 \\ 2 & 4 \end{pmatrix}$ and $\begin{pmatrix} 3 & 1 \\ 4 & 2 \end{pmatrix}$ respectively. A point P (a, b) in the plane under T_1 followed by T_2 is mapped into the point P (a + 2 , 12b + 48). Find the values of a and b and the coordinates of the image P^1.

1991 PAPER TWO
SECTION A

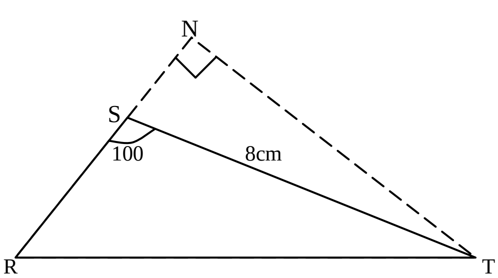
1. Simplify $\dfrac{3^x \times 9^{x+1}}{27^{x-1}}$

2. Without using tables or calculators, evaluate
$5.2 \times (3.75^2 - 1.25^2)$

3. Given that $f(x) = x^2 + 1$ and $g(x) = x – 1$, find the value of a for which fg(a) = gf(a)

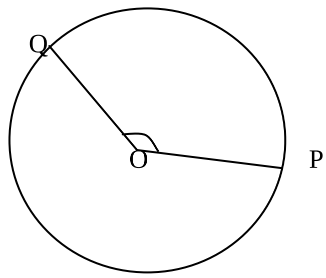
4. Given that the operation $*$ is defined by the relation $a * b = a + b + ab$ evaluate
$2 * (1 * 3)$

5.



In the diagram above determine the length of the perpendicular NT from T to RS. (Correct your answer to 2 s.f)

6.



In the diagram above, the length of the minor arc PQ is equal to diameter of the circle. Determine the obtuse angle POQ where O is the centre of the circle.

7. Given that x: y = 6:4 and that x + y = 30, determine the value of y.
(4 marks)

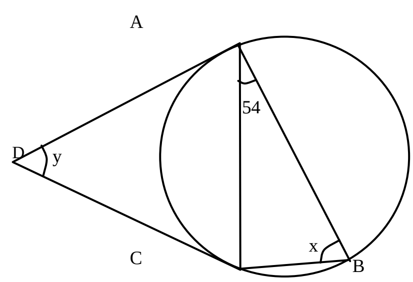
8. It is given that OP = $\begin{pmatrix} 5 \\ 3 \end{pmatrix}$ and OQ = $\begin{pmatrix} -2 \\ 5 \end{pmatrix}$. Find the magnitude of QP. ***(4 marks)***

9. Given that $\begin{pmatrix} 2 & 4 \\ 1 & 0 \end{pmatrix}\begin{pmatrix} a \\ b \end{pmatrix} = \begin{pmatrix} 24 \\ 6 \end{pmatrix}$, find the value of a and b. ***(4 marks)***

10. Given that $R = 4m\sqrt{\left(xn / k^3\right)}$ express x in terms of R, m, n and k. ***(4 marks)***

11. A number is selected at random from the set B = {3, 6, 9, 12, 18, 21}. Find the probability that the number is even. ***(4 marks)***

12.



In the diagram above AB is the diameter of the circle and DA and DC are tangents to the circle at A and C respectively. Given that angle CAB = 54^o, find the values of x and y. ***(4 marks)***

13. The size of an interior angle of a regular polygon is one and a half times the exterior angle. Find the number of sides of the polygon. ***(4 marks)***

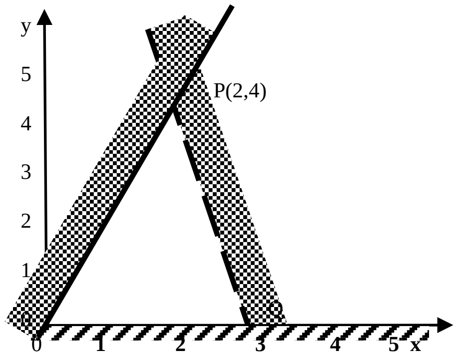
14. When the rays of the sun make an angle of 30^o. with a horizontal ground the length of the shadow of

a vertical pole on the ground is 10cm. Find the height of the pole.

15. Find the median of the following numbers: 27, 28, 04, 19, 11, 32, 10, 46, 03, and 14.

SECTION B

16.

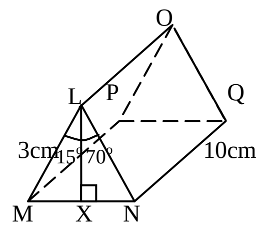


In the figure above find all the inequalities satisfying the unshaded region OPQ. Determine the maximum value of 2x + 3y over the region OPQ.

17. In a senior four class of 30 students, 18 play football (F), 15 play volleyball (V) and 13 play hockey (H). The number of students who play all the three games equals the number of those students who do not play any of these games.
Ten students play both F and H, and 3 play only H and V.
Determine
(i) The number of students who play all the three games
(ii) The number of those who play only one game.
(iii) The probability that a student selected at random from the class plays two or more of these games.

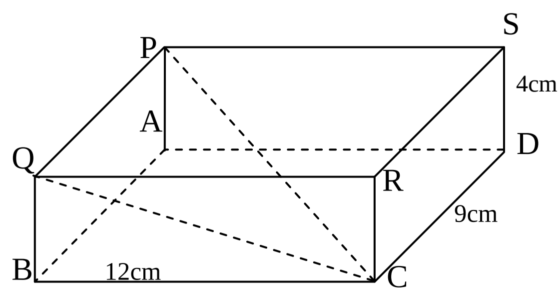
18. Plot the points A (-2, 1), B (-1, 2), C (2, 2) and D (0, -1) on a graph paper. The quadrilateral ABCD is enlarged to another one whose points are P (1, 3), Q (3, 5), R (9, 5) and S (5, -1) respectively.
(i) Determine the coordinates of the centre T and the scale factor of the enlargement.
(ii) Determine the area of the quadrilateral PQRS.

19. (a) The height of a right cone is 12cm and the angle at the vertex of the cone is 30^o. Find the surface area of the cone. (Take π = 3.14)
(b)



The diagram above shows a triangular prism LMNOPR of length 10cm and edge LM = 3cm. LX is perpendicular to MN such that $\angle$ MLX = 15^o and $\angle$ MLN = 85^o. Find the volume of the prism.

20.



The above diagram is a cuboid with the dimensions as shown.
Calculate
(i) The length QC
(ii) The length PC
(iii) $\angle$ PCQ and
(iv) The angle between the planes PQC and PQRS.

21. Asabat, Bitumoko and Cholimar form a trade partnership. Asabat contributes Shs 750,000, Bitumoko Shs 500,000 and Cholimar Shs 900,000, Twenty percent (20%) of the annual gross profits are to remain as development capital and a monthly taxation of Shs 10,000 is to be paid by each share holder. The net profit is shared in the ratio of the initial contribution of the shareholders.
If at the end of the first year the partnership recorded gross profits amounting to Shs 3,160,000, how much did each member get as his net profit?

22. At Jenga – mwili supermarket, Ali bought 5 trays of eggs and 7kg of Irish at Shs 11,800. Moses bought 6 trays of eggs and 8kg of Irish potatoes at Shs 14,000. If Shs t and Shs p are the prices of a tray of eggs and a kg of potatoes respectively,
(i) Write two equations to describe the purchase of the two men.
(ii) By combining the two equations to a matrix form determine the cost of purchasing each item.
(iii) How much would Dulu pay for 2 trays of eggs and 2 kilograms of Irish potatoes?

1992 PAPER ONE

SECTION A

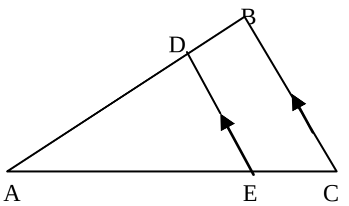
1. Express $\frac{1}{6} \div \frac{2}{9} - \frac{0.56}{0.64}$ in the form $\frac{a}{b}$, where a and b are integers. ***(3 marks)***

2. Factorize $ax^4 - a$ completely ***(3 marks)***

3. A man borrowed Shs 200,000 from the bank at a simple interest rate of 2.5% per annum. He paid back the money in 24 equal monthly installments over a period of two years. How much money did he pay every month? ***(4 marks)***

4. Given that $\ell og_{125} x + \ell og_{125} 5x = \frac{1}{3}$, find the values of x. ***(4 marks)***

5.



In the figure above AD : AB = 4 : 5 and DE is parallel to BC. Find the ratio of the areas of the triangle ADE and the quadrilateral BCED. ***(4 marks)***

6. Solve the inequality: $-x - 16 \geq 3x$ ***(2 marks)***

7. In a group of 10 people, 7 people speak English, 4 speak French and 2 speak neither of the two languages? ***(3 marks)***

8. $\frac{6}{3\sqrt{2} - 2\sqrt{3}} = a\sqrt{3} + b\sqrt{3}$, find the values of a and b ***(4 marks)***

9. Given the function $f(x) = \frac{3}{4x - 3}$, find the value of x for which f(x) = 3. ***(2 marks)***

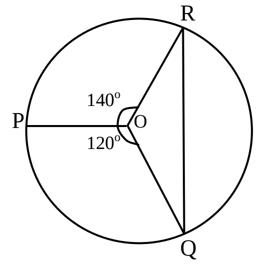
10. Given that $x \Lambda y = \frac{1}{3}x^2y$, evaluate

$3 \Lambda (2 \Lambda 3)$ ***(marks)***

11. Given that $(1 \quad 3)\begin{pmatrix} 4 & y \\ x & 2 \end{pmatrix} = (7 \quad 7)$. Find the value of x and y. ***(mks)***

12. The numbers 3, 4, 5 are arranged in a random order so as to form a three – digit number. No digit is repeated in a number form.
(i) Write down the possibility space for the numbers formed.
(ii) Determine the probability that the number formed is not odd.

13.



The diagram above shows a circle with centre O. Given that ∠ POR = 140° and ∠POQ = 120°. Determine the angles of triangle QOR. ***(mks)***

14. Find the image of the point (2, 1) under the reflection in the line y = x ***(mks)***

15. Given that
$\cos\theta = 0.599$ and $0^\circ < \theta < 90^\circ$, find in degrees, the value of ***(mks)***

SECTION B

16. Copy and complete the table for the relation y = (x + 2)
(i)

x	-7	-6	-5	-4	-3
y					

-2	-1	0	1	2	3
		4			25

17. The following is a frequency table for the weights, in kg, of adult patients who visited a certain doctor in a certain week.

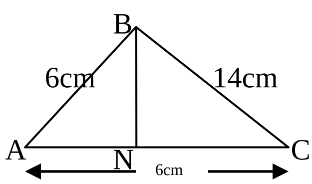
Weight (kg)	Frequency
50 -54	3
55 – 59	5
60 – 64	8
65 – 69	11
70 – 74	21
75 - 79	19
80 – 84	18
85 – 89	11
90 - 94	4

(i) Calculate the mean weight of the patients.
(ii) If the above data is representative of the type of patients that visit the doctor, find the probability that the weight of the first patient in the next week belonged to the model class. ***(mks)***

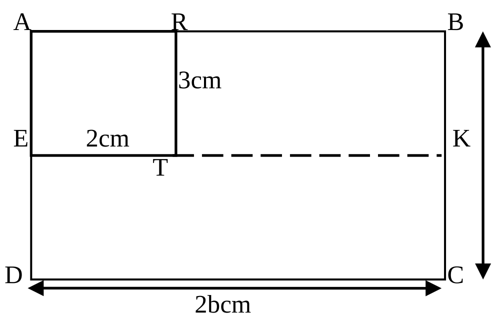
18. A transformation represented by the matrix $\begin{pmatrix}4 & 6\\ 1 & 2\end{pmatrix}$ maps the vertices A, B, C of a triangle onto the points $A^I(6, 2)$, B^I (16, 7) and C^I (22, 9) respectively.
Find
(i) The coordinates of A, B ad C ***(mks)***
(ii) The determinant of the matrix ***(mks)***
(iii) The areas of ABC and its image $A^IB^I C^I$.

19. Mukasa is to travel from station A to station B, 400km a part, on the bearing of 065°. On his start of the journey, he makes a mistake and sets off on a bearing of 056° and moves for 300km. Using scale drawing
(i) Determine how far he then is from station B.
(ii) If he is to move to station B from where he is, on what bearing should he set off?
(iii) If his speed is $80kmh^{-1}$, determine the time wasted due to the mistake made at the start of the journey? ***(mks)***

20. (a)



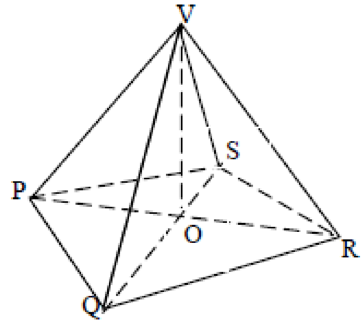
In the figure above BN is perpendicular to AC. Find the ratio of the area of triangle ABN to that of ABC.
(b)



Using the information given in the diagram above,
(i) find in terms of b the area of CDEK.
(ii) Show that area RBKT is equal to 6b – 6.

Given that the area of RBKT is three times the area of ARTE, find the value of b and hence the dimension of CDEK

21
The figure above shows aright pyramid standing on a horizontal rectangular base PQRS. Given that PQ = 6cm, QR = 8cm and V is 12cm vertically above the horizontal base PQRS.



Find:
(i) The length of VQ
(ii) The angle between VQ and the horizontal base
(iii) The angle between the planes VPQ and VSR.

22. A school lorry and a school bus are to be used to transport students to a certain function. The capacities of the lorry and the bus are 50 and 70 students respectively. The number of students to attend the function should not exceed 350. Each trip made by the lorry or the bus cost Shs 3,000. The money available for the transportation is Shs 18,000. The number of trips made by the lorry should not exceed that made by the bus. If x and y are the number of trips to be made by the lorry and the bus respectively,
(i) Write down five inequalities representing this information
(ii) Plot these inequalities on the same axes.
(iii) By shading the unwanted region show the region satisfying all inequalities.
(iv) If all the available money for transport is to be used, list all the possible number of trips that each vehicle will make. (Assume that for each trip a vehicle makes it must be full).
(v) Find the greatest number of students that can be transported.

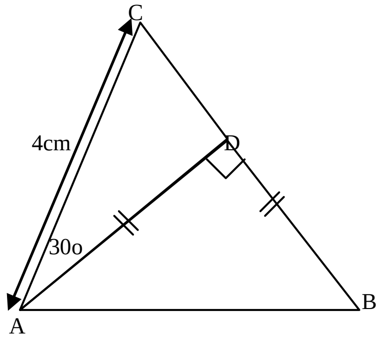
1992 PAPER TWO
SECTION A

1. Simplify 20.1 – 4.623 ÷ 0.23

2. If the position vector of point A is $\begin{pmatrix}-3\\ 2\end{pmatrix}$ and $BA = \begin{pmatrix}5\\ 2\end{pmatrix}$, find the position vector of B ***(mks)***

3. In a group of 22 tourists visiting Uganda it was found that 12 ad been to Karuma falls and 11 to Entebbe Zoo. Find the minimum possible number of tourists who had visited both the falls and the Zoo.

14. Given that $h(x) = \frac{1}{2x^2 + 9}$ and $k(x) = \frac{1}{x} - 9$, evaluate kh(-1) ***(mks)***



5.

In the figure above AD is perpendicular to BC. $\overline{AD} = \overline{DB}$, $\overline{AC}$ = 4cm and $\langle CAD = 30^o$. Find $\overline{AB}$. ***(mks)***

6. In a certain class there are 72 boys. If the ratio of the number of girls to the total number of pupils in the class is 3 : 7, find the number of girls in the class.

7. Given that $81^x = \left(1/3\right)^{x-5}$ find the value of x ***(mks)***

8. Given that $\tan x = \frac{-3}{4}$ and $0^o \le x \le 360^o$. Without using tables or calculator, find the possible values of cos x + sin x ***(mks)***

9. Express $4.\overline{454}$ as a national number. ***(mks)***

10. An insect moves along straight lines from point A(2, 0) to point B(0, 3) and finally to point C(5, 4). How far away is the insect from its starting point?

11. The scale of a map is 1 : 25,000. The distance between two schools on the map is 8cm. Find the actual distance, in km, between the two schools.

12. Form a quadratic equation whose solution set is (-2, 3). ***(mks)***

13. Factorize $20x^2y^2 + xy - 1$ ***(mks)***

14. If the determinant of the matrix $\begin{pmatrix} 3a & a-8 \\ -6 & a-2 \end{pmatrix}$ is zero. What are the values of a? ***(mks)***

15. The total weight of a train with n coaches is T. The weight of the engine alone is E and the average weight of the coaches is A. Write down an equation connecting T, E, n and A. ***(mks)***

SECTION B

16. (a) A farmer bought a machine at sh. 2,200,000/=. If the machine depreciates at the rate of 15% per annum, find the value of the machine after two years.

(b) In a certain country the income tax is levied as follows;

A person's monthly gross income has certain allowances deducted from it before it is subjected to taxation. (this includes family relief and insurance value).

The allowances are as follows:

Married man	sh. 1,800
Unmarried man	sh. 1,200
Each child below eleven years	sh. 500
Each child above eleven years but below eighteen years	sh. 700
Insurance premium	sh. 1,200

Peter earns sh. 64,000. He is married with 3 children of ages between eleven and eighteen years and 2 children below eleven years.

Given that he is insured and has claimed transport allowance of sh 1,700. Calculate the income tax he pays under the income tax rates below;

Taxable income	rate (%)
0 – 10,000	10
10,001 – 20,000	25
20,001 – 30,000	30
30,001 – 40,000	45
40,001 and above	50

17. (a) The solution of the simultaneous equations 2ax + by = -4 and bx + 3ay = 1 where a and b are constants is x = 1 and y = 2.

Find the value of a and b ***(mks)***

(b) Given that $A = \begin{pmatrix} 3 & 1 \\ 2 & 4 \end{pmatrix}$ and $B = \begin{pmatrix} \frac{5}{2} & 7 \\ 1 & 3 \end{pmatrix}$

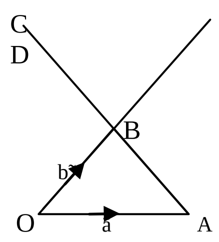
(i) Show that det(AB) = det(A) det(B) ***(mks)***

(ii) Hence write down det(A^2) ***(mks)***

(iii) A geometrical figure of area 18cm^2 is transformed by the combined matrix AB.

Find the area of the transformed figure. ***(mks)***

18.



In the diagram above OA = a and OB = b, 2OD = 5OB and AC = 3AB; E and F are midpoints of $\overline{OD}$ and $\overline{AC}$ respectively. Find it terms of a and b, the vectors ED, OF, and CD

19. A circle passes through the points A(-3.5, 1) B(0.5, 5) and C(4, 3).

(i) Using 2cm to represent one unit, plot the points A, B and C on a graph paper.
(ii) By construction find the centre and radius of the circle
(iii) Calculate the area of part of the sector (segments) cut off by the line segment AB. ***(mks)***

20. Of the 35 candidates in senior four, 13 registered for Biology (B), 20 registered for History (H) and 17 registered for Fine Art (A).
If 9 registered for both Biology and Fine Art and $n(B \cap H) = 3$, $n(B \cap H \cap A) = 2$ and $n(H \cap A \cap B^1) = 8$, represent these information on a Venn diagram.
From the diagram
(a) Find:
(i) the number of candidates who registered for History only.
(ii) The number of candidates who registered for at least two of the three subjects.
(b) Which of the subjects had to be taken with at least one other subjects?
(c) How many candidates did not take any of the three subjects?

21. When Mukasa was 5km from home and walking at $2\frac{1}{2}$ kmh^{-1} on his way to visit his aunt 15km from his home, his brother Musoke decided to run after him at 4kmh^{-1}.
(i) When and where did Musoke catch up with Mukasa?
(ii) If Musoke continued to run at the same speed, how long did he have to wait at his aunt's home before Mukasa joined him? ***(mks)***
(Express your answers in minutes)

22. From a point P on the top of a cliff 150m high, two ships A and B are observed on the bearing of 240^o and 150^o respectively.
If B is 720m from A on the bearing of 120^o, calculate the angles of depression of A and B from P.

1993 PAPER ONE
SECTION A

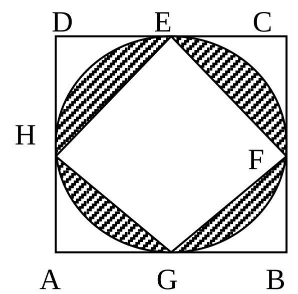
1. Given that f (x) = px + 3 and f (5) = 33, find the value of (i) p, (ii) f (-2).

2. A rectangular piece of land is 12m by 15m. Find the area of the land in cm^2 on a map whose scale is 1: 500.

3. Given that $\sqrt[4]{px^2 + a} = L$ express x in terms of a, L and p. Hence determine the values of x for which a = 4, p = 4/3 and L = 2.

4. In a class, 15 pupils play cricket, 11 play hockey, 6 play both games and every one plays at least one of the games.
Find
(i) The number of pupils in the class. ***(mks)***
(ii) The probability that a pupil picked at random plays only one game. ***(mks)***

5.



The diagram above shows a circle inscribed in a square ABCD of side 2x and a square EFGH inscribed in the circle. Find the expression for the area of the shaded region. ***(mks)***

6. A stick 10cm long on a 0.57m high plat form rests against a vertical wall making an angle of 40^o with a horizontal ground. Find the height of the top of the stick above the ground. ***(mks)***

7. The lengths of the sides of a right angled triangle are a, 2a – 1, and 2a + 1. Find the value of a and hence the sides of the triangle. (a > 0)

8. The image of (0, 2) under an enlargement scale factor 3 is (4, 6). Determine the centre of enlargement. ***(mks)***

9. Given that matrix A = $\begin{pmatrix} 3 & x \\ y & 4 \end{pmatrix}$, and det A = 3x + 12, determine the value of x and y. ***(mks)***

10. Determine the equation of the line passing through the points (2, 1) and (3, 3).

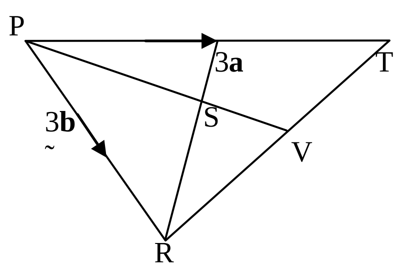
SECTION B
11. Triangle ABC has its vertices at A (2, 0), B (4, 0) and C (4, 3). The triangle is given a positive quarter turn about (0, 0) to produce $A^1B^1C^1$ the image of ABC; followed by a reflection in the line x + y = 0 to produce $A^{11}B^{11}C^{11}$, the image of $A^1B^1C^1$.
(i) Determine the co-ordinates of $A^1B^1C^1$ and $A^{11}B^{11}C^{11}$. ***(mks)***

(ii) Describe fully a single transformation which maps ABC onto $A^{11}B^{11}C^{11}$. ***(mks)***

12. (a) Find the inverse of $A = \begin{pmatrix} 4 & -1 \\ 2 & 3 \end{pmatrix}$

(b) Tom bought 2 eggs and 3 tomatoes at a total cost of shs. 370. The cost of 4 tomatoes is shs. 90 more than that of one egg.
(i) Write down this information as a pair of simultaneous equations.
(ii) Find the cost of one egg.
(iii) Calculation the cost of one tomato.
(iv) Determine the number of eggs and tomatoes shs. 1470 fetched if twice as many tomatoes as eggs were obtained.

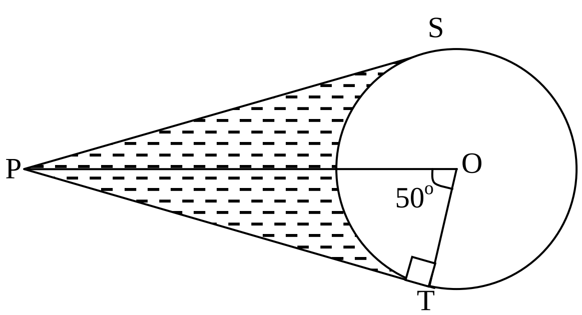
13.



In diagram above PQ = 4PT; 2PS = PV, 3RS = 2RT, PT = 3**a** and PR = 3**b**
(a) Express in terms of a and b.
(i) RS,
(ii) PV,
(iii) RQ,
(b) Find the ration of RV to RQ.

14. In a country with a population of 14,000,000 people, 55% are females, 45% of the males population is employed and 25% of the female are employed.
Find:
(i) The male population in the country.
(ii) The female population unemployed.
(iii) The ratio of the male population employed to the female population employed.
(iv) The total number of people employed in the country.

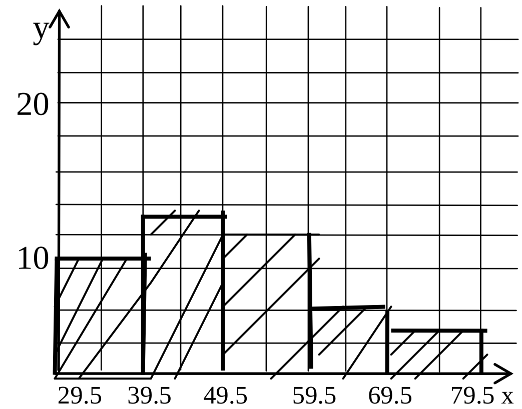
15.



(a) In the above diagram PT and PS are tangents to the circle with centre O, if OT = 6cm and angle POT = 50°. Calculate the area of the shaded region. (Take $\pi = 3.14$).

(b) Two Equal circles of radius 5cm intersect at right angles.
(i) Find the distance between the two centers of the circles.
(ii) Calculate the area of the common region of the circles.

16.



Study the bar graph given above showing the ranges of marks obtained by students in a certain math test.
(i) Determine the number of students who sat the test.
(ii) Write down class groups and their frequencies.
(iii) State the modal and median classes.
(iv) Use your results in (ii) above to calculate the mean mark obtained in the test.

17. Draw the graph of the curve y = cos 3x for $0^o \le x \le 150^o$. Using your graph determine the values of x($0^o \le x \le 150^o$ for which
$4\cos 3x + 3 = 0$

1993 PAPER TWO
SECTION A

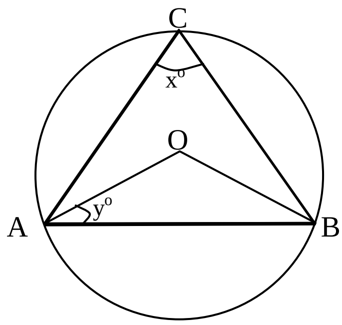
1. Determine the value of K for which the expression $\frac{k^2 - k - 6}{k + 2}$ is zero. ***(mks)***

2. A fair die is tossed once. Find the probability that
(i)The die shows a number greater than two.
(ii)An odd or even number less than four shows up.

3. Two right angled triangles ABC and PQR are similar.
Given that angle ABC = angle PQR = 90° $\overline{AB}$ = 10cm, $\overline{BC}$ = 6.5cm and $\overline{QR}$ = 52cm. Find $\overline{PQ}$ ***(mks)***

4. Factorise completely $x - x^2 + y + y^2$ ***(mks)***

5.



The figure above shows a circle centre O circumscribing a triangle ABC.
Determine (i) the reflex angle ADB.
(ii) An expression of y in terms of ×.

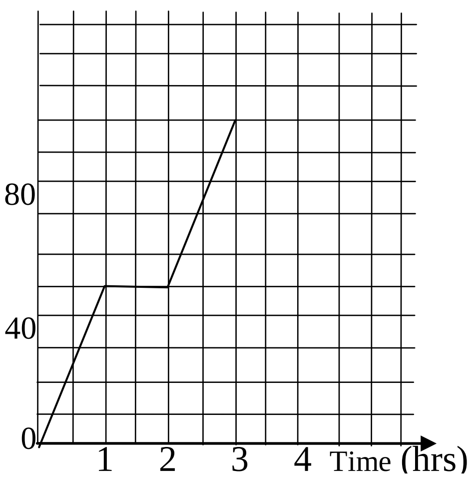
6. Solve the simultaneous equations

$3x + 4y = 20$
$x + 2y = 0$ ***(mks)***

7. The images of I (1, 0) and J (0, 1) under a transformation represented by a 2 x 2 matrix are I^1 (2, 0) and J^1 (0, 3) respectively. Determine the coordinates of K^1, the image of K (1, 1) under the same matrix transformation.

8. The coordinates of points P and Q are (2, 3) and (4, -1) respectively. Calculate the length of PQ.

9.



The graph above shows motion of a lorry from Tako's home to the city, O to C.
(i)How far did the lorry travel in the first two hours?
(ii)For how long did the lorry have a stop over?
(iii) Determine the average speed of the lorry for the journey from home to the city. ***(mks)***

10. Without using a calculator, evaluate $\sqrt[3]{0.002406}$ to 3 decimal places. ***(mks)***

SECTION B

11. Plot on the same axes the graphs of xy = 24, for $1 \leq x \leq 24$ and x + y = 12
Using your graph
(i) Find the coordinates of the points of intersection of the line and the curve.
(ii)Estimate the area enclosed between the line and the curve.

12. A plane flies 540km from station A to station B on bearing of 060°. From B it travels 465km to station C on bearing of 150, from C it heads for station D 360km away on bearing of 265°.
(i)Draw to scale a diagram showing the route of the plane (use the scale 1cm:5km)
(ii)From your diagram determine the distance and bearing of station A from station D.
(iii)Determine how long it would take a plane traveling at a speed of $400kmh^{-1}$ to travel direct from station A to station C.

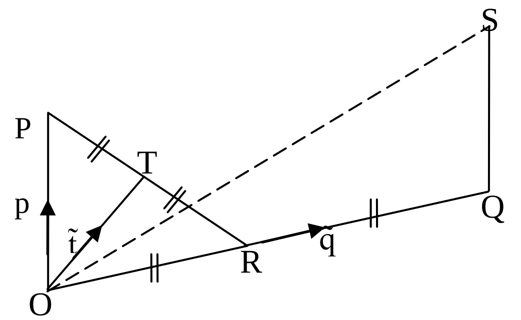
13. The following results were obtained in an experiment to measure the length of leaves from the stalk to the a pex (to the nearest tenth of a cm)

6.6	8.5	7.4	10.8	11.2	9.1	8.7	9.9
12.4	10.0	6.5	7.3	12.8	8.2	6.4	8.9
8.9	8.1	8.3	9.0	7.6	7.1	8.8	10.4
11.7	9.2	10.2	9.8	9.5	12.3	6.2	8.8
7.0	7.9	9.3	6.9	7.7	6.2	8.6	7.4

(i) Starting with 6.0 – 6.9 as the first class and using classes of Equal length draw up the frequency table for the data in (i) above.
(ii) Calculate the mean length of the leaves ***(mks)***

14. A line whose end points are P(1, 3) and Q(3, 4) undergoes a rotational transformation. The images of the endpoints of line PQ are P^1 and Q^1 respectively.
(i) Draw the line and its images in the same set of axes using a scale of 2cm to 1 unit.
(ii) Find the centre and angle of the rotation.
(iii) Determine the image of PQ when its image $P^1 Q^1$ further undergoes a rotation of 120°.
State the size of angle formed between PQ and the image of $P^1 Q^1$.
Solution:
(i) It is impossible since the image points are not given

15.



In the diagram above, OP = p, OQ = q and OT = t. R and T are mid-points of OQ and PR respectively.
(i) Express t in terms of p and q.
(ii) Given that $\overline{OP}$ is parallel to $\overline{QS}$ such that $\overline{OP} = 2\overline{QS}$, find OS in terms of p and q.
(iii) Taking O as the origin and P (0, 8) and Q (6, 4) determine the lengths of $\overline{OS}$ and $\overline{PS}$

16. Using compass and ruler only, construct a triangle ABC in which AC = 8cm, AB = 6cm and angle BAC = 30^o.
On the same side AC construct a triangle such that AS = SC and BS = 8cm.A point K is on the same side of BS as C. Its distance from BS is the same as distance of C from BS. Construct the locus of K. Given that angle BKS = 90^o, find by construction two possible positions K_1, and K_2 of K. Measure $\overline{K_1K_2}$.

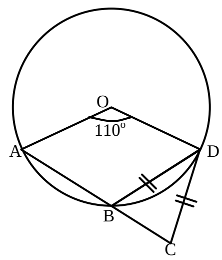
17. A manufacturer makes two types of hoes A and B. The following conditions apply to daily production.
(i) Each type of A costs sh 3000/= and each type of B costs sh. 5000/= and the manufacture has a maximum of sh. 450,000/= available.
(ii) Due to labor shortage the production of type A plus four times that B should not exceed 160.
(iii) A study of the market recommended that the number of type B produced should not exceed twice the number of type A produced.
(a) Given that x hoes of type A and y hoes of type B are made, write down three inequalities a part from x ≥ 0, y ≤ 0, satisfying the above conditions.
(b) Show graphically the region containing the points satisfying the above conditions.
(c) Taking x + 2y as a suitable expression for the manufacturer profit find the number of each type of hoe that should be made to obtain the greatest profit.

1994 PAPER ONE
SECTION A

1. (i) Express $\frac{108}{8}$ as a product of its prime factors ***(mks)***

(ii) Simplify $\frac{4^2 \times 2^3 \times 16^{1/2}}{8^3}$ ***(mks)***

2. x, y and z are connected by the relation x $\frac{ky^2}{z}$, where k is a constant. Given that x = 6 when y = 1000 and z = 9, find the value of z when x = 2 and y = 5. (Give your answer in standard form)



3. In the figure above, O is the centre of the circle and ABC is a straight line BD = CD and angle AOD = 110^o. Find the size of size of angle
(i) DBC, ***(mks)***
(ii) BDC. ***(mks)***

4. Betty and Alex are to share 144 oranges, with Betty getting twice as many oranges as Alex. Find how many oranges each will get. ***(mks)***

5. Two areas on a map represented by two rectangles OABC and OPQR are similar with length AB corresponding to PQ = 42cm, and OC to OR , and width BC = 5cm corresponding to QR = 20cm and AO corresponding to PO.
(i) Determine the length of AB *(mks)*
(ii) If the width QR = 20cm on the map measured on actual ground is 50km, state the scale of the map.

6. Given that f (x) = x – 2x^2 and g (x) = 3 – x determine an expression for gf (x). Hence evaluate gf (-2).

7. y is known to be inversely proportional to the square of x. When x = 2, y = 2, find the value of x when y = 32.

8. In a showroom, the price of a car is given as shs. 5,800,000. During sale, a discount of 15% is allowed.
(a) How much does a customer pay for a car?
(b) After the car has been bought, in the first year its value depreciates by 25% and by 20% during the second year. Find the price of the car after (i) one year (ii) two years.

9. Given that $\log_{10} 7 = 0.854$ and $\log_{10} 2 = 0.301$, use this information to find $\log_{10}\left(\frac{49}{64}\right)$ Hence determine the value of $\frac{49}{64}$ giving your answer to 3 significant figures

10. A and B are two matrices such that

$A = \begin{bmatrix} 1 & 3 \\ 4 & 11 \end{bmatrix}$, $B = \begin{bmatrix} -1 & 2 \\ 1 & 3 \end{bmatrix}$

Find

(i) Matrix P = (AB) ***(mks)***

(ii) P^{-1} ***(mks)***

SECTION B

11. (a) The table below shows a sample of ages (to the nearest tenth of a year) of patients randomly selected from a group of patients who sought medical treatment at a certain clinic during a certain week.

0.6	2.0	18.0	3.4	19.0
15.0	16.3	14.0	7.0	12.2
18.9	5.9	1.5	12.0	9.0
5.0	12.8	17.0	7.7	0.2
8.0	14.0	5.4	15.8	17.8
5.5	11.4	6.0	6.9	16.0
10.0	0.8	13.6	11.0	3.9
13.0	9.0	6.6	10.9	4.0

(i) Form a frequency distribution table for the ages having equal class intervals of 5 years and starting with 0.0 – 4.9 class. State the modal class of the distribution.

(ii) Draw a histogram (bar chart) to show the data.

(b) The mean of four numbers is 25, their median is 23. If the largest number exceeds the smallest by 30, and the largest number is one and a half times the second largest number, determine the four numbers.

12. (a) Show by shading the unwanted regions the region satisfying the inequalities $y \leq 2x + 1$ and $y \geq 3$.

(b) Find the equation of the line through the points A(2, 7) and B(5, 13). The points A and B are reflected in the line x = y.

(i) Determine the co-ordinates of A^1 and B^1 the images of A and B respectively.

(ii) Find the equation of the line through A^1 and B^1.

13. In a certain game a die and a coin are each thrown and tossed once respectively. One side of the coin is labeled T (tail) and the other H (head). The number which appears on the upper face of the die is the players' score. In addition, if a tail appears the player receives a score of 4, and a score 6 when a head appears. The score obtained by tossing a coin is then divided by the score obtained by throwing a die. If this quotient is a prime number a player takes the first prize. A player takes the second prize if his quotient is a recurring decimal and a third prize if the quotient is a triangular number.

Copy and complete the table below giving the possibility space of the game.

Score on die	1	1									6	6
Score on coin	4	6										
Quotient	4	6										

Find the probability that a player wins

(i) The first prize

(ii) The second prize

(iii) The third prize

(iv) None of the prizes given that there are only three prizes.

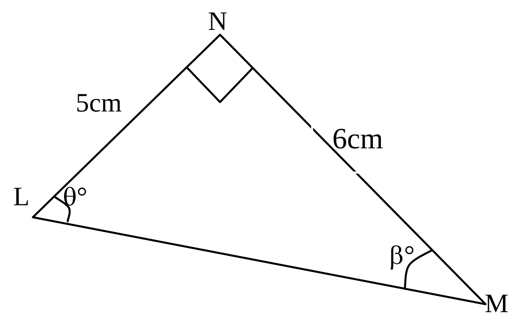
14. The points A (1, 5): B (4, 2): C (11, 5) and D (4, 8) are vertices of a quadrilateral ABCD.

(i) Find the lengths of the sides of the quadrilateral. Hence state the name of the quadrilateral.

(ii) Given that AC meets BD at a point 1, find the coordinates of 1 and show that the points A, 1 and C are collinear.

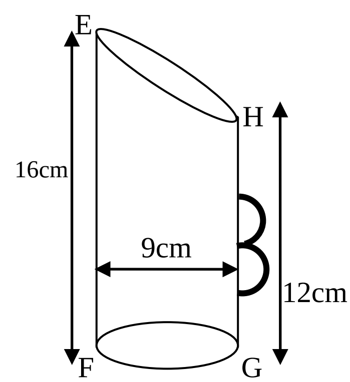
(iii) Find the area of the quadrilateral

15. (a)



In the above figure angle MNK = 90°, NM = 6cm and NL = 5cm. Calculate the value of $\sin\theta^o + \cos\beta^o$, correct to two significant figures.

(b)



The figure above shows a container EFGH (part of a cylindrical can) used by shopkeepers for scooping out sugar from a sack. Calculate the;

(i) Maximum volume of sugar the container can scoop (volume of a cylinder is $\pi r^2 h$, $\pi = \frac{22}{7}$)

(ii) Ratio of the volume of the cut-off piece of the cylindrical container to that of the container EFGH.

16. (a) Mr. Kapere deposited shs. 2.421 million on his savings account at the bank at a compound interest rate of 8.5% per annum.

Determine the number of years his money will take to accumulate to shs 2.85million.
(b) The following is an advertisement of a canon photocopier.

> ***GET YOURSELF A PHOTOCOPIER CHEAPLY WHILE STOCK LASTS: TERMS: CASH AT USH 960,000 OR HIRE PURCHASE: DEPOSIT 15% OF MARKED PRICE AND PAY EITHER USH. 75,000 WEEKLY FOR 12 WEEKS OR USH. 245,000 MONTHLY FOR 4 MONTHS***

Calculate:
(i) The saving a customer would make by buying the photocopier on cash terms rather than weekly hire purchase.
(ii) The percentage profit made on the monthly hire purchase if the wholesale cost of a photocopier is 17.5% below the cash prize.

17. Using a ruler and a pair of compasses only,
(i) Construct a triangle ABC where AB = 3cm and AC = 5cm and angle ABC = 90^o
(ii) Bisect the triangle ABC and let the point at which the angle bisector cuts line AC be the centre of enlargement of triangle ABC. Using the centre, enlarge triangle ABC by a linear scale factor of -2 to form $A^1B^1C^1$.
(ii) Determine the area of the figure $ABCA^1B^1C^1$.

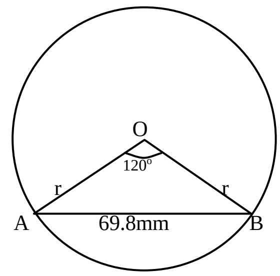
1994 PAPER TWO
SECTION A

1. Convert
i) 006 hours to the 12 hours time
ii) 250 US dollars \$ to pounds sterling £.
If 1 US \$ = Ush 980 and 1£ = Ush 1750

2. Given that $OP = \begin{pmatrix}3\\7\end{pmatrix}$, and $PQ = \begin{pmatrix}5\\1\end{pmatrix}$ where O is the origin, find:
(i) The position vector of Q. ***(mks)***

(ii) $|OQ|$ ***(mks)***

3. Given that $f(x) = ax^2 + bx$, $f(1) = 5$ and $f(2) = 14$, find the values of a and b.
Solution:
4.



In the figure above, AB is a chord of the circle whose centre is O. Angle AOB is 120^0 and $\overline{AB} = 69.8$mm. Calculate the radius of the circle (Give your answer to 3sf).

5. In a certain game Bob scored the following points 3, 12, 2, 8, 0, 3, 5, and 7. Determine the median and mean of the points Bob scored in the game (4 marks)

6. Given matrices $P = \begin{pmatrix}2 & -2\\0 & 1\end{pmatrix}$

$Q = \begin{pmatrix}3 & 2\\4 & -1\end{pmatrix}$ and $R = \begin{pmatrix}5 & -4\\-1 & 2\end{pmatrix}$,
determine:
i) P.Q + R ,
ii) The determinant of (P.Q +R).

7. Given two sets A and B such that n (A) = 12, n (B) = 13, $n(A \cup B) = 20$ and $n(\varepsilon) = 24$, find
i) $n(A \cap B^1)$
ii) $n(A \cup B^1)$ Where is the universal set and B represents the compliment of B (4 marks)

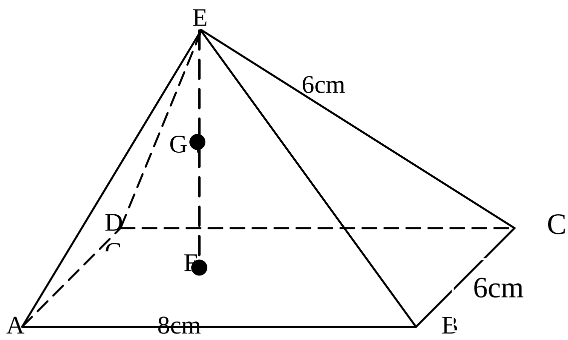
8. Find the solution set of the equation
$2x^2 + x - 10 = 0$. ***(mks)***

9. An observer at a point A sees an object on a bearing of $100^{0.}$ Another observer at a point B sees the same object on bearing of 150^0 given that the distances of the object from A and from B are equal, determine the bearing of A from B.

10. Without using a calculator, evaluate
$\dfrac{3.83 \times 5.96}{(1.96)^2}$ Correct to 3 s.f

SECTION B (60 MARKS)

11. On the same axes draw the graphs of $y = x^3 - 2$ and $y = 3x + 2$ for $-3 \le x \le 3$.
From your graph, estimate
i)The value for $x^3 - 2 = 0$
ii)The solution of the equation
$x^3 - 2 = 3x + 2$



12. In the figure above, a pyramid whose base ABCD is a rectangle of sides 8cm by 6cm has slanting edges $\overline{AE} = \overline{DE} = \overline{BE} = \overline{CE} =$ 6cm .F is the point of intersection of the diagonals of the rectangle. G is a point on $\overline{FE}$ such that

$\overline{FG} = \frac{2}{3}\overline{FE}$. Find

i) angle AEC,

ii) the length $\overline{EF}$ and $\overline{AG}$

iii) the angle which each of the slanting planes makes with the base.

13. The unit square OIKJ where O (0,0) ,I(1,0) ,K(1,1) and J(0,1) is reflected in the line y = -x to give image $OI^1K^1J^1$

(i) Obtain the matrix of transaction R for this reflection

(ii) Use R to find the image points of O"I"K"J" IS then enlarged by a linear scale factor of-2 at the origin to give OI"K"J", find

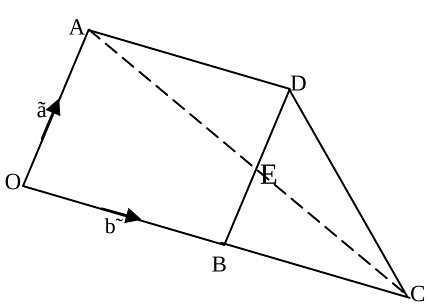
(iii) The matrix E for the Enlargement

(iv) The coordinates of the images OIKJ

(v) The area of OI"K"J"

(vi) The matrix which maps OI"K"J" back OIKJ

14.



In the diagram above AD is parallel to OC and OA parallel to BD. 3OC = 5OB. E is the point where $\overline{AC}$ meets $\overline{BD}$. AE: EC = 3.2.

Find i) in terms of the vectors a and b the vectors AC, DC, ED, AE and OE.

ii) the ratio BE: ED

15 (a) The speed at which water comes out of a pipe is inversely proportional to the cross-sectional area of the pipe. Given that water comes out of the pipe of cross section $5cm^2$ at the speed of $1ms^{-1}$, determine the difference in the cross- section of two pipes from which water comes out at speed of $0.8ms^{-1}$ and $1.2ms^{-1}$

b) A circle of radius 2cm and centre O, has points A, B, and C along its circumference. A and C are joined to form chord $\overline{AC}$ such that it subtends an angle of 80^o at point B, calculate the perimeter of the region enclosed between the chord $\overline{AC}$ and major arc ABC.

16. The distance from Lira to Kampala is 380km A bus leaves Lira at 07 30 hours and travels non stop to Kampala at $60kmhr^{-1}$. At 0850hours a Pajero car leaves Kampala and travels towards Lira at steady speed of $120kmh^{-1}$.

On the same axes, draw distance – time graph showing the journey of both vehicles. Hence or otherwise determine when and at what distance form Lira they meet. If the bus then increased its speed by $10km^{-1}$,

i) Calculate the time at which the bus arrived in Kampala.

ii) Determine the difference in the time of arrival of two vehicles.[use scale of 2cm to represent 50km and 2cm to represent 1hr].

17. The table below shows the tax structure on taxable income of citizens in the working class of a certain country

Income (shs) per annum	Tax rate(%)
(i) 1st shs. 80,000	7.5
(ii)Next shs.80,000(160,001-240,000)	12.5
(iii) Next shs. 80,000(160,001-240,000)	20.0
(iv) 240,001-320,000	30.0
(v) 320,001-400,000	36.5
(vi) 400,001-480,000	45.0
(vii)480,001 – and above	52.6

A man's gross annual income is Shs. 964,000. The allowances including insurance accrued to him were;

i) Housing Shs. 14,500 per month

ii) Marriage : one tenth of his gross annual income

iii) Medical sh 50,700pa

iv) Transport sh 10,000 per month

v) He has to pay an insurance premium of sh 68,900 per annum.

vi) Family allowances for only four children at the following rates Shs 3,400 for each child above 18, 4,200 for each child above 10 but below 18 years and sh 5,400 for each child below 9 years. Given that he has a family of five children with three of them below the age of 8, one 16 and the elder child 20 years, determine;

a)His taxable income.

b) The income tax he pays annually as a percentage of his gross annual income

1995 PAPER ONE
SECTION A

1. Without using tables or calculator evaluate

$$\left(\frac{8}{125}\right)^{-2/5}\left(\frac{5}{8^{1/2}}\right)^{-2}$$

2. The function $f(x)$, and $g(x)$ are defined as

$f(x) = x + 2$ and $g(x) = \dfrac{x^2}{4}$

Find the value of x for which $fg(x) = 3$

3. Juma takes 10 days to dig a certain piece of land Jon takes 15 days to dig the same piece of land assuming that both work at the same rate, determine number of days they will both take do dig same piece of land if they work together

4. Given that $\log_{10} y = \bar{2}.872$

Find the value of $x^{\frac{1}{4}}\ y^{\frac{-1}{2}}$ correct to 2 decimal places

5. Given that $\tan\alpha = \dfrac{15}{8}$ calculate without using tables or calculator calculate the value of $4\cos\alpha - \sin\alpha$

6. Find the equation of the line which is the perpendicular bisector of the line passing through the points A (3, 4) and B (1, 10)

7. If matrices M and N are such that

$M = \begin{pmatrix} 2 & 1 \\ 2 & 3 \end{pmatrix}$ and matrix $MN = \begin{pmatrix} 12 & 0 \\ 0 & 12 \end{pmatrix}$.

8. The mean weight of a class of 30 boys is x kg. When two boys with a total weight of 150 kg are absent, the mean weight of those present is 2kg less than the mean weight of the whole class. Find the value of x.

9. Given $\dfrac{5}{\sqrt{5}} + \sqrt{20} = a\sqrt{5}$

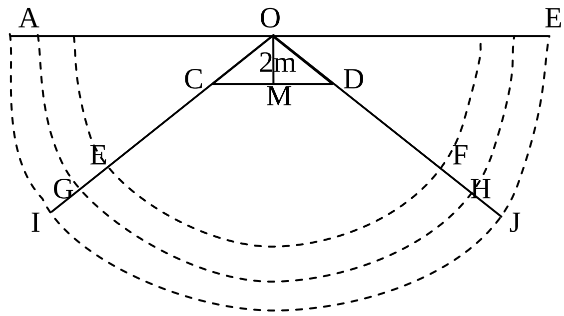
determine the value of a

10. If vector $a = \begin{pmatrix} 3 \\ -2 \end{pmatrix}$, $b = \begin{pmatrix} 1.5 \\ 3 \end{pmatrix}$,

find the length of $\dfrac{1}{2}a + 3b$.

SECTION B

11.



In a seminar, the high table CD which is 3m long is used by guest speaker. The table is placed in front of and parallel to wall AB. Some chairs are arranged behind the high table with the front legs of each chair occupying 0.5m along CD. Participants are seated on chairs arranged in circular form placed in front of the high table along the arcs EF, GF, and IJ of circles whose center are the point O along AB as shown in the diagram above The chairs are also arranged such that each occupies 0.5m of the length along the arcs Given that the perpendicular line from O bisects CD at point M and CE = EG = GI = 2m; find

(i) Find the angle COD.

(ii) The maximum number of guest speakers that can get seated at the seminar.

(iii) The maximum number of participants that can get seated in chairs arranged along the arcs (correct your answers (number of people to the nearest whole number)

12. A circle passes through the points P (0.5,-3), Q (2, 4.7) and R (4.5, 1).

i) Plot and join the points P, Q and R on a graph paper (use 2 cm to represent one unit on the either side.

ii) By construction determine the center and radius of the circle.

iii) Calculate the area of the mirror segment cut off by the chord PQ.

13. The monthly salaries of 300 employees working in a certain company are as follows;

Salary range	Number of employees
26001-36000	56
36001-46000	74
46001-56000	82
56001-66000	38
66001-76000	25
76001-86000	15
86001-96000	10

i) Represent this data on a histogram

ii) Calculate the mean monthly salary

iii) Estimate the median salary

14. On the same axes draw the graphs of the lines y - 2x = 1, and y + 3x = 6 for $-3 \le x \le 3$. Use your graphs to solve the equations.
y – 2x– 1 = 0,
y + 3x – 6 = 0.
Hence determine the Equation of the line passing through the point of intersection of the two equations of the two equations above whose y – intercept is 2.

15. Aggrey And Bob are to travel from town A to town B ridding on a bicycle and motorcycle respectively When Aggrey is 21km away from town A and ridding at a steady speed of 18.5 kmh $^{-1}$ Bob sets off for town B on his motor cycle at a steady peed of 36kmh^{-1} Bob is expected to ride for $3\frac{1}{4}$ hours to reach town B
(a) Calculate:
(i) The distance between A and B
(ii) When and where Bob will catch up with Aggrey.
(iii) How long Bob will take waiting for Aggrey to join him in town B.
a)Represent Aggrey's and Bob's journeys on the same distance time graph.

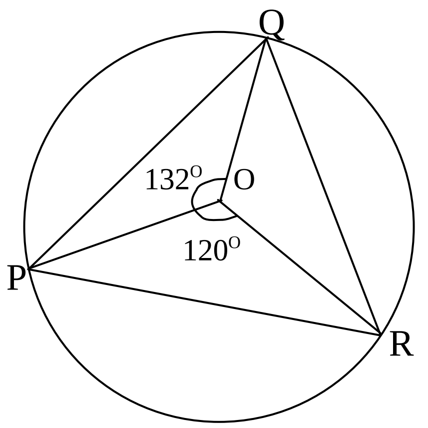
16. A flag mast slants towards the west at an angle of 13^0 to the vertical. From a point M to the east and 20 metres away from the foot F of the mast, the angle of elevation of the top P of the mast is 35^0. From another point N to the west of the mast, the angle of elevation of the top P is 22^0. If M, F and N are on the level ground, determine to 4 significant figures.
i) The vertical distance of the top P from the ground.
ii) The distance of the foot of the mast F from N
iii) The length PF

17. A triangle ABC where A, B, C are points (2, 3), (6, 3) and (4, 6) respectively is given a transformation representative by the matrix
M = $\begin{pmatrix} 0 & -3 \\ -1 & 2 \end{pmatrix}$ followed by the matrix
N = $\begin{pmatrix} 2 & 3 \\ 1 & 0 \end{pmatrix}$ to give the final image A^I B^I and C^I.
i) find the image points A^I, B^I and C^I.
ii) describe the single matrix transformation that is represented by the combined matrix transformation M followed by N.
iii) Obtain a single matrix that would map A^I,B^I and C^I back onto ABC.

1995 PAPER TWO
SECTION A

1. Simplify $\frac{2^x \times 8^{x-1}}{6^{x-1}}$

2.

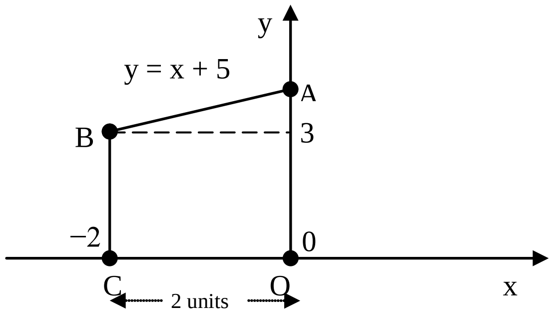


The diagram above shows a circle center O circumscribing a triangle PQR. Given that angle POQ = 132^0 and POR = 120^0, find the angles of triangle PQR

3. Given that $f(x) = \frac{1}{1-x}$

i) Find $f(2)$
ii) State the value of x for which f(x) is not defined.

4. A butcher sells 5 kg of meat at sh 7,000. If the cost of meat is increased by 25 % determine how many kilograms of meat can be bought with the same amount of money after the increase.
.



In the diagram above the Equation of the line AB is y −5 = x and C is 2 units from 0. Find the area of OABC

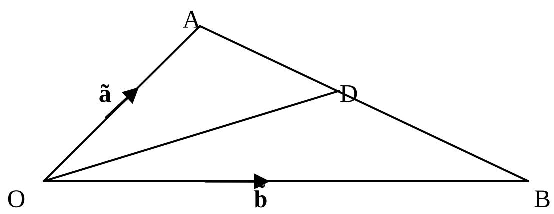
6. Solve the equation $10^{6-x} = (20\times10)^{x^2}$

7. Given the matrices A = $\begin{pmatrix} 4.5 & 1 \\ 0 & 7 \end{pmatrix}$

and B = $\begin{pmatrix} 2 & -1 \\ 3 & 1 \end{pmatrix}$, find matrix M such that

3M – 2I= 2A - B, Where I is an identity matrix of order 2.

8.



In the figure above OA = a; OB = b, 3AD = AB
Find OD in terms of a and b.

9. Determine the solution set of the inequality

$$\frac{x-2}{4x-2x^2} < \frac{2}{3}$$

10. A three digit number is found using each of the digits 2, 4, and 6 only once. List the possible numbers that are formed. Calculate the probability that the number formed is greater than 430.

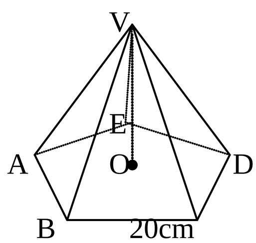
SECTION B

11. The figure below show the marks in percentage obtained by candidates in an English test

43 70 50 35 64 62 50 53
46 62 65 83 59 54 58 64
52 54 32 59 48 54 35 48
40 58 64 40 71 74 55 70
72 48 75 45 55 40 57 55

i) Starting with 30 as the lower class limit of the first class and using equal class intervals of 5 marks, form a frequency distribution table for this data
ii) Plot a cumulative frequency curve for the data. Use your data to estimate the median mark
iii) Calculate the mean mark using an assumed mean of 57%

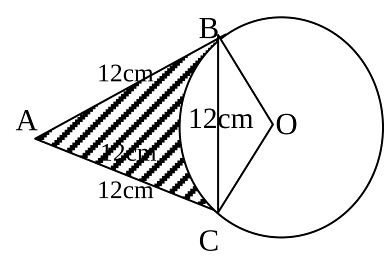
12. a) A line passes through the points (a, 0) and (0, b). Find the Equation of the line b) Given that a line L passing through the point (0, 2) is perpendicular to the line 2y = 5x + 3, find the point of intersection of the line L with the line 2x = 3y -5.



13.
The diagram above shows object with a regular pentagonal base ABCDE of side 20 cm and center 0 the vertex V is vertically above 0 and $\overline{VO}$ = 30 cm.
i) Find angle BCO
ii) Caculate the length OC.
iii) Obtain the length of $\overline{VC}$ and the angle at which it is slanting to the horizontal (Give your answer correct to a decimal of a cm.)

14. Using a ruler and pair of compass only, construct a triangle ABC such that $\overline{AC}$ = 9.6 cm $\overline{BC}$ = 4.8cm and the angle BAC = 30^0 and ABC = 90^0. D is a point on $\overline{BC}$ produced 2.7 cm away from $\overline{AB}$. Construct angle
BDE = 45^0 with $\overline{DE}$ = 10.1cm. Join the points A to D and B to E. Construct a circle circumscribing triangle ACD such that it also passes through the point E.
Measure
i) Length AB and BE,
ii) Angle ADC,
iii) The radius of the circle.

15. Sarah bought a four-inch mattress (a mattress whose thickness is 4 inches). She then went to John, a tailor, and bought a cloth which can exactly fit the mattress as a cover. John sold her 4.6m^2 of cloth was exactly enough to cover all the sides of the mattress
a) Given that 1 inch is approximately 2.5cm; the width of the mattress is w cm and length 2w cm, find w.
b) If she paid the mattress and its cover cloth at sh 52,500 and 36,500 respectively calculate in pounds sterling given that 1 united states dollar($) is equivalent to U sh 95 and 1 Pound = 1.8 ($), the
i) Price of the mattress
ii) Total cost of the mattress and its cover



16.
In the figure above AB and AC are tangents to the circle at point B and C respectively. O is the center of circle. Given that $\overline{AB} = \overline{BC} = \overline{AC}$ =12cm, determine

i) The obtuse angle BOC,
ii) The radius of the circle,
iii) The area of the minor sector BOC and hence the area of the shaded region.

17. A soccer club wishes to intensively train its top and second division players by residential training in preparation for soccer league tournaments the cost of maintaining a player is sh 60,000 and sh 45,000 per

top and per second division player. The club has a maximum of Shs. 1, 8000,000 for the residential training. One and a third times the number of top players must not exceed the number of second division players. Given that the club can only train up to 35 players who must be selected from the two divisions of players.
i) Write down the set of inequalities representing the above information.
ii) Using a scale of 2 cm to represent 10 units on each axis draw on the same axes
Graphs for these inequalities
iii) Shade out the unwanted regions and find the maximum number of players from each division the club can train.

1996 PAPER ONE
SECTION A

1. Without using tables or calculator evaluate

$$\frac{32.135^2 - 17.865^2}{0.7135}$$

2. A cars petrol tank is three quarters full at the beginning of a journey. If the car uses two- thirds of a tank full of petrol for the journey what fraction of a tank full remains at the end of the journey ?
On returning the car refuels such that at the end of the return journey the car is one-fifth tank full. What fraction of a tank full of petrol was bought ?

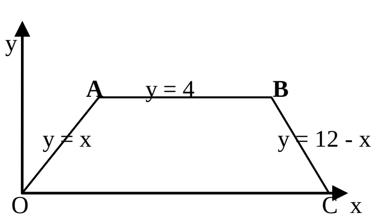
3. Without using tables or calculator simplify

$$\frac{1}{2}\ell og_{10} 16 - 2\ell og_{10}\left(\frac{a}{5}\right) + \ell og 10a^2$$

4. Given that $124_n = 52_{ten}$ determine the value of the natural number n.

5. In a class of boys and girls, the average age is $15\frac{1}{2}$ years. The class has 12 boys whose average age is $16\frac{3}{4}$ years. Find the size of the class if the average age of girls is 15 years.

6.



In the diagram above OABC is a trapezium formed above the axes by the intersections of lines y = x, y = 4, and y = 12 – x.
Find the coordinates of A, B, and C.

7. Find the solution set of the equation
$(x - 3)^2 = 4^2$.

8. Two right cones are similar with linear scale factor 2. If the larger cone has radius of 14 cm and height of 27 cm, calculate the volume of the smaller cone.
(Take $\pi = \frac{22}{7}$,

9. Three points O, P and Q in the plane have positions vectors
$O = \begin{pmatrix} 0 \\ 0 \end{pmatrix}$, $P = \begin{pmatrix} 4 \\ 7 \end{pmatrix}$ and $Q = \begin{pmatrix} 8 \\ 9 \end{pmatrix}$. Find the Coordinates of R, the mid- point of PQ and the distance of R from O.

10. Two mirrors M_1 and M_2 are placed 12 cm apart parallel to each other. An object O is placed 4cm away from $M_{2.}$ If M_1 (O) denotes the image, $O^1$of O after a reflection of O in $M_{1,}$ determine the distance from O of M_2 (M_1 (O)], the image, $O^{11}$of O^1 after a reflection of O^1 in M_2.

SECTION B

11. In a certain trading center there re 56 shops 28 of which sell soft drinks, 24 sell food stuffs and 32 sell textiles. 10 shops sell both food stuffs and soft drinks, 6 sell both food stuffs and textiles and 4 shops sell all the three categories of commodities; both food stuffs and textiles and 4 shops sell all the 3 categories of commodities.
a) i) represent this information on a Venn diagram.
ii) Determine the number of shops which sell both drinks and textiles only.
b) If a customer is to choose a shop at random, what is the probability that the shop he goes to sells
i) At least two of the three categories of commodities.
(ii) Only one of the three categories of commodities

12. Using a ruler pencil and a pair of compasses only
(i) construct a triangle ABC, where BC = 7.2 cm, AC = 8.4 cm and angle ABC = 75°. Measure $\overline{AB}$ and angle ACB.
(ii) draw a circle circumscribing triangle ABC and state the radius of the circle.

13. (a) Two saloon cars A and B are hired to carry people going to attend a wedding ceremony. With six trips each, the two cars can carry 60 people. A total of 62 people can be transported if A makes seven trips and B makes five trips. Determine the number of people each car can carry per trip.

(b) Otim and Mukasa stay in the same home when Otim walks from home to school at a constant speed of 5.4 kmh^{-1}, he arrives 10 minutes early. When Mukasa walks at a constant speed of 3.6 kmh^{-1} he arrives late by 15 minutes Calculate how far the school is from their home.

14. A food Aid Agency carried out a survey to ascertain the average monthly expenditure on food by a family in a certain urban center. The expenses on food were found to be in two parts; a constant expenditure and another part varying as the square of the number of children in the family.
A family of 3 children needed Shs 19,000/= while that of 5 children needed Shs 31,000/=.
a) Write down an expression for the total expenditure on food E, spent per months by a family with n children
b) What is the monthly food expenditure for?
i) A childless family
ii) A family with 4 children
c)How many children are in a family which needs an average food expenditure of Shs 39,250/= per month?

15. Draw on the same co-ordinate axes, graphs of $y = x(2x - 3)$ and $y = 2(x-1)$ for $-3 \leq x \leq 4$.

(i)Using graph determine the point of intersection $y = x(2x-3)$ and $y = 2(x-1)$
(ii)Use your graph to find the roots of
$2x - 3x = 0$

16

Scores	Class mark	frequency	Freq x class mark
40-49	……	………	450
50-58	……	16	……..
59-67	63	………	1575
68-76	……	………	864
77-85	……	13	……..
86-94	90	4	360

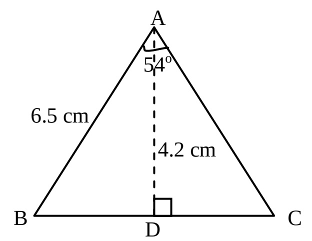
The table above shows the number of students who passed an end of year English promotional examination in terms of mark scores.
a) Study the table and the information available to complete the missing details.
b) (i) State the class interval of the scores.
ii)Calculate the average score of the marks.
c) If all the above students were promoted and represented 4/5 of the class, find the number of students in the class who sat the examination.

17. A plane flew due west from air strip A at a speed of 280 kmh^{-1} for ¾ hours before reaching air strip B. It then altered its course and flew North West to air port C at 220 kmh^{-1}. From there it flew on a bearing of 060° to air strip D at 240kmh^{-1} for 1½ hours. The total time of flight between the four airstrips was 4 ½ hours.
i) By scale drawing determine the distance and bearing of A from D. Use a scale of 1 cm to 50km.
ii) Determine the total distance of flight from A to D and hence the average speed for the journey
i) If the plane flew directly back to A at a speed of 200 kmh^{-1} determine how long it took to fly back to A.

1996 PAPER TWO
SECTION A

1. Given that $a*b = a^2 - b^2$, find the value of x in $x*\sqrt{3} = 7*4$

2.



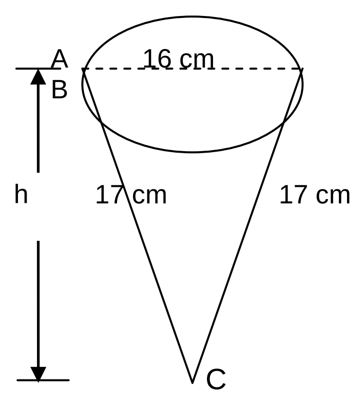
In triangle ABC above, AD = 4.2 cm is the altitude. Angle BAC = 54^0 and $\overline{AB}$ = 6.5cm. Find:
(i) the size of angle CBA,
(ii) length $\overline{AC}$.

3. Given that y varies as the cube of x and y = 8 when x = 4, find the value of x when y = 1.

4. Solve the equation $3x^2 - 7x + 2 = 0$.

5. If x: y: z = 2:3:5, determine the value of z when:
i) $x + y + z = 200$
ii) $y = 84$

6.



The diagram above shows circular cone ABC of vertical height h cm and slant side AC = BC = 17cm and diameter AB = 16 cm.
Find

i) h
ii) The capacity of the cone.

Use π = 3.142, volume of cone = $\frac{1}{3}h$ x (base area)

7. When a cyclist has traveled a distance of 105 km in $1\frac{2}{3}$ hours, he cycles at an average speed of $54kmh^{-1}$ for further 2½ hours. Calculate the average speed for the;

(i) First $1\frac{2}{3}$ hours
ii) Whole journey

8. Using matrix method, determine the values of x and y which satisfy the equations.

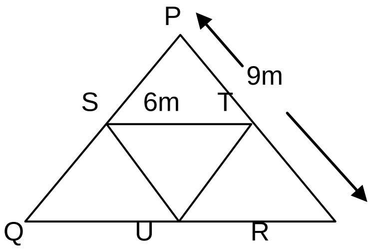
$2y - 4x + 2 = 0$
$3x - 2y = 5$

9. If u = $\begin{pmatrix} -2 \\ 4 \end{pmatrix}$, v = $\begin{pmatrix} 1 \\ -3 \end{pmatrix}$ and w = $\begin{pmatrix} -3 \\ 4 \end{pmatrix}$

Find the value of a and b such that
a (u) + b(v) = w.

10. Express 0.891 as a rational number in its simplest terms

SECTION B
11.



The diagram above shows part of a rafter of a building. QR is parallel to ST. PQR is an isosceles triangle with Q and R as base angles. U is the mid point of QR. $\overline{PS}$: $\overline{SQ}$ = 3:2,

$\overline{ST}$ = 6cm and $\overline{PR}$ = 9m
Calculate the
(i)Lengths of QR,TR and PU
(ii)Size of angle PQU
(iii)Area of PQR

12. (a) If x^3 = 3.375 use tables to find the value of x correct to three significant figures
(b) Given that $\log_{10}2 = 0.3010$ and $\log_{10}3 = 0.4771$ find without using table or calculator the value of
(i) $\text{Log}_{10} 72$,
(ii) x, if $\log_{10}x = 1.6020$.

13. A builder makes concrete blocks by mixing cement and sand in the ratio 1:20. From every 3 buckets of mixture he makes 2 blocks, one bucket of cement cost sh 3,000/= and one bucket of sand shs.25/=. Find the cost of cement and sand required to make 6,300 blocks.
b) A grocery sells two kinds of meat products A and B. Athieno bought 4 kg of A and 6kg of B paying a total of shs. 5280/=, Namusisi bought 5kg of A 3kg of B at a total cost of sh 4,440/=
i) Write down two equations to describe Athieno's and Namusisi's purchases.
ii) By combining the two equations in matrix form, determine the cost of 1 kg of each meat product.
iii) How much would Mugisha pay for 6 kg of A and 5 kg of B.?

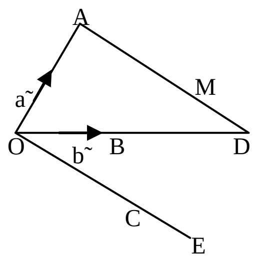
14. In a certain school there are 87 students in S.3. Of these 43 play hockey, 42 play football and 47 play volley ball. 15 play hockey and volleyball. 17 play volleyball and football and 21 play hockey and football. Each student plays at least one of the three games while x students play all the three games.
i) i) Represent this information in a Venn diagram showing clearly the number of students in the each region.
ii) Write down an equation in x and hence find x.
iii) If a student is chosen at random from the class, what is the probability that he plays exactly two games?
iv) Find the number of students who play at least two of these games.

15, (a) Copy and complete the table below of values of S = $t - 3 + \frac{4}{t}$ where S is the distance covered (in m) by a particle from a fixed point P after t seconds.

S	5.5		1.17		1.1	1.33			3.67
t	0.5	1	1.5	2	2.5	3	4	5	6

(b) Draw a graph of S a against t for t = 0.5 to t = 6.0 inclusive. (Use 2cm to represent one unit of t and 4cm to represent one unit of S)
From your graph estimate:
(i) the times when the particle will be 3cm from P.
(ii) For how long the particle will be less than 2m away from P.
(iii) The distance the particle travels between t = 2.5 and t = 4.5 seconds.
(iv) The speed of the particle between t = 0.5 and t = 2.5 seconds.

16.



In the figure above $\underline{OA}$ = a and $\underline{OB}$ = b, $3\underline{OB} = 2\underline{BD}$, M is a point on AD such that MD: AM = 1:2 OC = 3CE = 3AM.

(i)Express the vector AD, BM, DC terms of vector a and b

(ii) Show that AD: OE = 3:8

17. A factory makes two kinds of bottle tops "Coca-Cola" and "Pepsi" tops. That same equipment can be used to make either. In making Coca-Cola tops one man can supervise 10 machines and this batch will give a profit of pounds sterling 50 per week. Pepsi tops yield a profit of £250 a week using 25 machines and 8 men. There are 200 machines and 40 men available by taking x batches of Coca - Cola tops and y batches of Pepsi tops write down inequalities for;

(i) The number of machines used.

(ii) The number of men employed.

(iii) An expression for profit P.

Use these inequalities to draw a suitable graph showing the region which satisfies them. From your graph, determine the numbers of Coca-Cola and Pepsi tops which should be made to obtain the maximum profit. Hence find the maximum profit.

1997 PAPER ONE
SECTION A

1. A teacher awards two marks for each correct answer plus three marks as an incentive for test attendance. If Q is the number of questions attempted and M the total marks a candidate gained in the test;

i) Write down a relation between Q and M

ii) What is the maximum mark score for a test with only nine questions?

2. Solve for x in $\frac{x-3}{5} - \frac{x+2}{3} = \frac{x}{2} - \frac{1}{3}$

3. Otti takes 6 days to plough a certain piece of land. Mpoza takes 12 days to plough the same piece of land.

Assuming that both work at the same rate how long will the two men take to plough the piece of land if they work together?

4, Given that f(x) = px - 4 and f (3) = 14, find:

i) The value of p,

ii) f(1).

5. Factorize $a^2 - 2ab - 5a + 2b + 4$

6. Given the vectors p = $\begin{pmatrix} 2 \\ 3 \end{pmatrix}$, q = $\begin{pmatrix} -5 \\ 3 \end{pmatrix}$ and r = $\begin{pmatrix} 6 \\ -2 \end{pmatrix}$, find the length of (p + q + r).

7. Given that $\log_{10} x = 1.699$ and $\log_{10} y = 1.913$.evaluate without using tables or calculator $\log_{10}x + \log_{10}y^{1/3}$.

8. Simplify $\frac{1}{\sqrt{3}+\sqrt{2}} + \frac{3}{\sqrt{3}-\sqrt{2}}$

9. The number 0, 1 and 2 are arranged in a random order so as to form two digit and three digit numbers. No digit is repeated in a number formed.

(i) Write down the possible numbers that can be formed.

(ii) Find the probability that a two digit number formed has the same numerical value as the three digit number formed

10. Given that H donates half turn about the origin and X denotes reflection in the x - axis, find a single transformation to XH on the points of the unit square.

SECTION B

11. The vertical of triangle ABC A(1,0) B(1,2) C(5,2) are mapped onto the triangle $A^1 B^1C^1$ by the transformation whose matrix M = $\begin{pmatrix} 1 & 0 \\ 2 & 4 \end{pmatrix}$.

(a) Find the:

(i) Co-ordinates of the vertices of the triangle,

(ii) Ratio of the area of triangle ABC to the area of the triangle $A^1 B^1 C^1$.

(b) Plot on the same axes triangle ABC and its image.

c) Determine the matrix of the transformation which maps $A^1 B^1 C^1$ back to ABC.

12. The table below shows the marks scored in an English test marked out of 100 by student of S.2 in a certain school

Score	f(x)
0-19	2
20-39	6
40-49	12
60-79	9
89-89	1

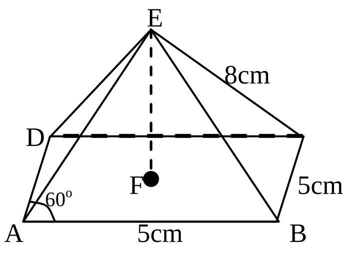
i) Represent this information on a bar chart
ii) Use the frequency table above to estimate median and mean mark score

13. Fifty two students of a certain school were interviewed to find out how many of them had ever visited the town of Arua Kasese or Mbale. Only 4 had visited neither towns. It was found out that an equal number of students had visited Arua and Kasese of whom 12 had visited both Arua and Kasese. 24 students altogether had visited Mbale of whom 11 had visited both Mbale and Arua. 13 had visited Mbale and Kasese. Eight had visited all the towns,
a) Present this information on a Venn diagram
b) How many students in the class had?
i) Visited Kasese
ii) Not visited Arua?
c) Given that three students are taken at random from the class, what is the probability that they belong to the set of students who only visited two towns?

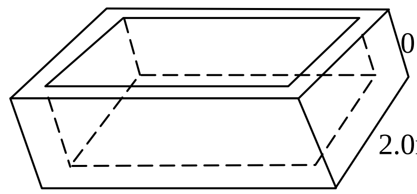
14. Using matrix methods find the values of x and y which satisfy the equations.
$2x - 3y = 12$
$x + 2y + 1 = 0$
b) Given that matrix A $= \begin{pmatrix} 3 & -2 \\ -4 & 5 \end{pmatrix}$

Matrix B is such that AB $= \begin{pmatrix} 7 & 0 \\ 0 & 7 \end{pmatrix}$

Hence otherwise find the inverse matrix of A.



15. The figure shows a pyramid whose base ABCD rhombus of side 5cm and whose acute angle is 60^0. AE = DE = CE =BE = 8cmFis the point of intersection of the diagonals of the rhombus. Find:
i) Length EF, (ii) Angle AEB, (iii) The angle each of the slanting planes makes with the base.
16. a) The length of the side of an equilateral triangle ABC is x units.
i) Show with the help of the triangle that
$\sin 60^0 = \frac{\sqrt{3}}{2}$
ii) Without using tables or calculator, find the value of $\left(\frac{\sin 60^0}{\sin 30^0} + \tan 60^0\right)^2$
b) Draw the graph of
$y = \cos 3x$ for $0 \leq x \leq 150^0$
17.



The figure above shows an open metallic water tank of material which is 2.0 cm (0.020) thick the metal used for making the tank cost shs 100 for every $50cm^3(5 \times 10^{-5}\ m^3)$.
i) Find the cost of making this tank.
ii) If the tank is to be filled with water at a fee of 5 cents (Shs 0.05) per litre determine (in shs) the cost of filling the tank
($1m^3 = 10^6$litres).

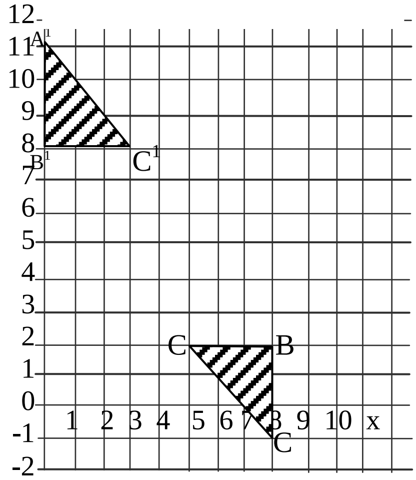
1997 PAPER TWO
SECTION A

1. A musical tape costs pounds sterling £8.95. Given that the exchange rates are US dollars $1.56 = £1.00 and Ug sh.1045 = 1$, find the equivalent cost of the musical tape in
i) U.S dollars
ii) Ug shillings

2. Determine the area of figure enclosed by the x- axis, the k line $2x + y = 8$ and the reflection of this line in the y- axis
3. The scale of a map is 1:200,000. Two trading centers on the map are 4.5 cm a part. Determine in km the actual distance between the two trading centres.

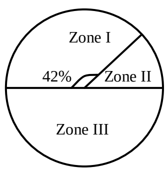
4. Under the matrix transformation $\begin{pmatrix} 1 & a \\ b & -4 \end{pmatrix}$, the point P (3,-2) is mapped on the point P^1(-1,17). Find the value of a and b

5. Four athletes ran a 100m races. Their times taken to complete the race in second(s) were 16.5, 13.6, 10.8, and 12.4.
i) Write down the median in (s) of the four times.
ii) Calculate the time taken by a fifth athlete if the mean of all the five times was 13.4 seconds
6.



In the graph $A^1B^1C^1$ is the image of ABC under an enlargement with scale factor f. Determine the
i) Value of f.
ii) Co-ordinates of the centre of enlargement.

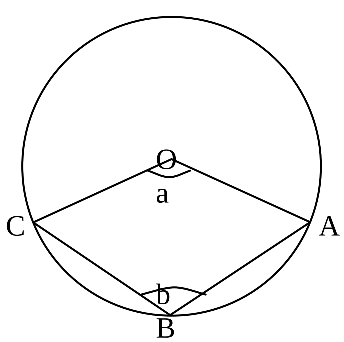
7.



The pie chart shows the percentage of people living in three L.C 1 Zones I, II and III of a certain village. The sector representing people living in zone II is 18% while the one representing people living in zone I is 42%. If the number of people living in zone III is 240, find the
i) Population of the village,
ii) Number of people who live in zone I.

8. A blouse and skirt were each sold at Sh. 12,420-. On the blouse a profit of 15 % was realized while on the skirt a loss of 12.5% was recorded calculate the percentage loss on bought articles

9.

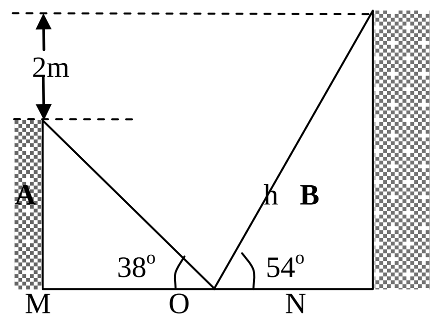


.
In the figure above, O is the center of the circle and b = 118^0 find value of a

10. Mukasa, Kaija abd Obitta are to share 90,000 in the ratio 3:4:5, respectively Calculate the amount each will receive

SECTION B

11. (a)



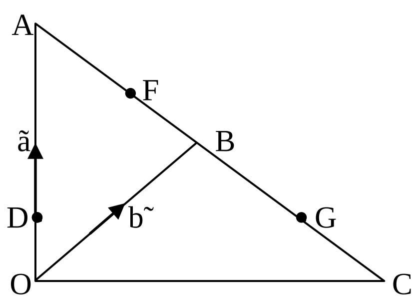
From the points O on level ground MON, between two buildings, A and B, the angles of elevation of the top of building A and B are 38^0 and 54^0 respectively. Building B, h metres high, is 2m higher than building A and $\overline{MO}$ = 24m.
Calculate:
i) The height of building A
ii) How far building B is from point O.

b) A ship is observed moving away from the top of a cliff which is 80m high. Within a time span of 10s the angle of depression decreases from 30^0 to 20^0. Determine the distance covered within this time range. Hence find the speed of the ship in meters per second (ms^{-1})

12a) A dispenser produces medicine in two different sized cylinder plastic cans the cans are similar the area of the bottom of the small can is $12cm^2$ and that of the bottom of the large can is $48cm^2$ given that the small can holds 100ml of the medicine calculate
i) How much medicine is contained in the large can
ii) The height of the large can

a)The dispenser uses exactly half of the medicine of the small can and mixes it thoroughly with 37.5 ml of distilled water to obtain a mixture for treatment of patients. Calculate the height (in cm) of the mixture in the small can.

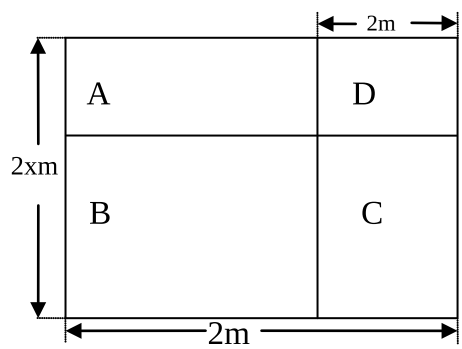
13.



In the figure above OA = b; F and G are points on $\overline{AC}$ such that AF: AB = 3:4 and AG: AC = 2:3, respectively, D is a point on OA such that OD: DA = FB: BG = 1:2
i) Express AG and AC in terms of AB hence find in terms of vectors a and b the vector AB, AC, DG of
ii) Determine the ratio DG: OC

14. a) The line y = 2x meets the line x= 3 at the point A.
i) Give the coordinates of A
ii) If the x-axis is the axis of symmetry of triangle OAB find the coordinates of B
iii) Find the equation of OB
iv) Write down the inequalities for points (x, y) inside the triangle OAB.
b) Calculate the area of triangle PQR where P is (3, 3), Q (4,-1) and R (-8,-4).

15



The diagram shows four rectangles A, B, C, D which together form a square of side 2xm. Given that one side of D is 2 m, and that the area of A+D is $4m^2$, express the other side of D in terms of x. Given also that area of A + B + C is $11m^2$ Show that
$4x^3 = 11x + 4$

16. The position vector of a point (x, y) is written as the column vector $\begin{pmatrix} x \\ y \end{pmatrix}$. A geometrical transformation is represented by the equation.

$$\begin{pmatrix} x^1 \\ y^1 \end{pmatrix} = \begin{pmatrix} a & b \\ c & d \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix}$$

i) Write down the image of (1,0) and (0,1) under this transformation.
ii) Show that the image of (1,0) under a rotation of + 30^0 about the. origin $\left(\frac{\sqrt{3}}{2}, \frac{1}{2}\right)$ is and find the image of (0,1)under the same rotation.
iii) Using your answer to part a) and b) above or otherwise write down the matrix M^2 of this rotation.
iv) Calculate M^2 and write down the coordinates of the image of (1,0) and (0,1) under the transformation of M^2.
Explain your answer geometrically.

17. When traffic flash green two taxis A and B move off from rest in the same direction and on a straight road the speed of taxi Increase at a uniform rate of 2ms while taxi B moves as shown in the table below

Time	0	1	2	3	4	5	6	7
velocity	0	0.5	1.5	4	10	15	18	19.5

Using suitable scale draw on the same axes the velocity time graph find the
c) Time the two taxis have equal speeds and state the magnitude of that speed
i) difference in the speed of the two taxis after a period of 6 seconds
j) distance covered by taxi A by the way of estimating the area under curve described by the motion of taxi A for a period of 8sec.

1998 PAPER ONE
SECTION A

1. Without using tables or calculator evaluate
$14 \times 398 - 198 \times 14$
b) Factorize completely $2a^2 - 32$

2. Given that $\tan\theta = \frac{-12}{5}$ and lies between 0^0 and 180^0. Find without using tables or calculator the values of $\sin\theta$ and $\cos\theta$

3. Kato bought a car and sold it to Tom at a loss of 25%. If his selling price was sh. 3.6 million, find the cost price of the car.

4. The image of the point (4,-7) under an enlargement of scale factor -2 is (1, 2). Determine the coordinates of the centre of enlargement.

5. Given that $f(x) = x^2$ and g(x) = (x-1), determine fg(x) hence evaluate fg(-1)

6. A family spends its income on the following items in months

Item	Food	Rent	Transport	Others
Amount (shs.)	35,000	12,000	10,000	15,000

Show the family‘s expenditure in the pie-chart

7. Use the matrix methods to solve the pair of simultaneous equations.
2x - 3y = 7

$14 + 4y \quad = \quad 5x$

8. Soma college school is located on a stretch of land of area $22.5km^2$. On a certain map its area is $3.6cm^2$. Determine the scale of the map.

9. Two dice are thrown once. Find the probability that both dice show even number.

10. Given that curve $y = 2x^2 + 3x$ and $y = 5x + 4$, determine the coordinates of the points of intersection of the curve and the line.

SECTION B

11. Faces of 52 small wooden cubes are to be painted either grey blue or yellow. Of the cubes, 15 have all their faces painted grey and 9 all faces blue. There are 6 cubes with grey and blue faces, 10 with yellow faces and blue and 7 cubes with grey and yellow face s. the cubes whose faces are all yellow are four more than those whose faces are all yellow are four more than those whose faces are all blue given that G is the set of cubes with at least a grey face B that of cubes with at least a blue face and Y the cube with at least a yellow face.

(a). Represent all the above information in a Venn diagram. Show any remaining information.
(b). Find the number of cubes with
(i) All the three different color faces
(ii) At least one of each of the three color faces.
(c). If a cube is picked at random what is the probability that it is grey or blue only?

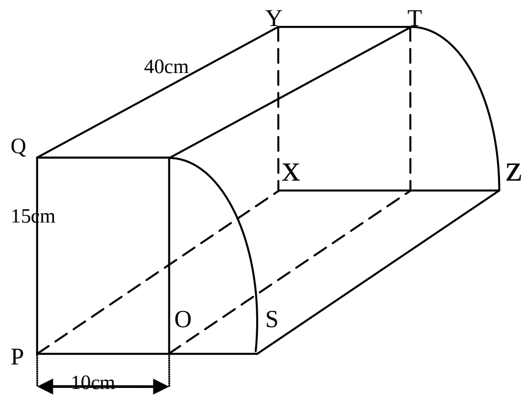
12. Sixty 13 - year old senior one student from certain school were tested to find their resting Pulse-rates and the following figures were obtained for a number of beats per minute:

72	70	66	74	81	70
74	53	57	62	58	64
92	74	67	62	91	73
68	65	80	78	67	75
80	84	61	72	72	69
70	76	74	65	84	79
80	76	72	68	63	82
79	71	86	77	69	72
56	70	67	76	56	86
63	73	70	75	73	89

By arranging the data in classes of 50-54, 55-59, etc make frequency a table.
Draw a bar chart displaying the given data.
Using your grouped data, calculate the mean and median pulse rate.

13. A plane flies from air strip K due north for 350 km to air strip R. It then flies on a bearing of 295º for 250km to airstrip N. From there it flies on a bearing of 090º for 500km to another airstrip M.
a). Draw a sketch diagram to show the route of the plane. Hence draw accurate diagram using a scale of 1cm to represent 50km.
b). From your diagram, find the distance and bearing of air strip K from M.
c). If the plane flies back to airstrip K by the direct route, and it travels at an average speed of $250kmh^{-1}$, find the time (in hours) taken for the whole journey.

14.



The diagram shows a piece of wood of uniform cross- section PQRS in which OPQR is a rectangle and ORS is a quadrant of a circle, centre, O. The other rectangles are PQYK and PXZS.
Given that PQ = 15 cm, PO = 10cm and QY = 40cm, Calculate (giving your answer correct to 3 s.f) the
a) Area of the cross section PQRS,
b) Volume of the wood,
c) Total surface area of the piece of wood.
[Take $\pi = 3.142$]

15. (a) Copy and complete the following table of values for the curve $y = (x - 1)(x - 3)$ between $x = -1$ and $x = 5$.

x	-1	0	1	2	3	4	5
x-1			0		2		
x-3			0		2		
			0		0		

(b) Using the values in a) Draw the graph of $y = (x-1)(x-3)$ for $-1 \leq x \leq 5$.
(c) Use your graph to solve
(i) $x^2 - 4x + 3 = 0$
(ii) $x^2 - 4x + 1=0$
(d) From your graph find the
(i) Range of values for which $(x-1)(x-3) < 0$ion.

16. Towns A and B are a distance of 138km from each other. Dick leaves town A for town B cycling at a steady speed of 24 kmh^{-1}. When he has traveled a distance of 18 km from A, Bob sets off from the same spot Dick started, cycling steadily at 30kmh^{-1}
a) Find when and where Bob over took Dick.
b) If bob maintained his speed even after over taking Dick, determine how long it took him waiting for Dick to join him.
c) Given that dick then increased his speed such that they both arrived in town B at the same time; by how much did Dick increase his speed immediately after he was overtaken?

17. Supporters of a certain soccer team wish to accompany their team for a soccer match. They are to travel by a taxi and a mini bus. The capacity of taxi is 18 people while that of the minibus is 27 people. The number of supporters to go will not exceed 108. Each trip the taxi and minibus make, costs sh. 24,000 and sh. 30,000 respectively. The money contribution for transportation of the supporters is sh 240,000. The number of trips made by the taxi should not exceed those made by the minibus by more than 2. If x and y are the number of trips made by the taxi and minibus respectively.
(a) Write down five inequalities representing the above information.
(b) Plot on the same axes the above inequalities.
(c) By shading the unwanted region, show the region satisfying all the inequalities.
(d) List the possible number of trips each vehicle will make given that all the money for transport is to be used.
(e) What is the greatest number of supporters that was transported?

1998 PAPER TWO
SECTION A

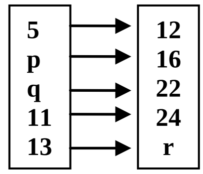
1. Without using a calculator or tables, simplify

$$2\tfrac{1}{2} \div \frac{4\tfrac{1}{3} - 2\tfrac{1}{4}}{4\tfrac{1}{6}}$$

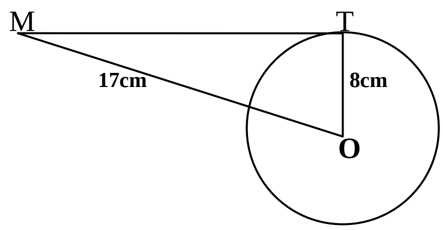
2. By expressing each of the number in the form $a \times 10^n$ where n is an integer, evaluate $\frac{0.24}{0.0006}$

3. Express $\frac{9}{\sqrt{5}-\sqrt{2}}$ in the form $a(\sqrt{b}+\sqrt{c})$, where a, b and c are integers.

4. Find the unknown values in the arrow diagram for the mapping $x \to 2(x+1)$ given below.



5. TM is a tangent drawn from a point T to a circle, centre O, and radius 8 cm. If OM = 17cm, calculate the length of TM.



6. Given tat $A = \begin{pmatrix} 1 & 2 \\ -2 & 1 \end{pmatrix}, B = \begin{pmatrix} 2 & -1 \\ -1 & 2 \end{pmatrix}$,
find AB – BA.

7. If A and B are two sets of objects and n (A) = 10, n(B) = 7, $n(A \cup B) = 13$, $n(A \cup B)^1 = 2$ find
a) $n(\varepsilon)$, where ε, is the universal set.
b) $n(A \cup B)$.

8. M is the mid-point of the line $\overline{PQ}$, where P is (2, 6) and Q (-8, 2), calculate the distance of M from the point R (1, 0).

9. Without using tables or calculator, evaluate $\ell og_{10} 40 + \ell og_{10} 50 - \ell og_{10} 20$

10. OAB is a triangle with position vectors OA = a OB = b. Express in terms of a and b the position vector of OC where C divides $\overline{AB}$ in the ratio 1:2

SECTION B

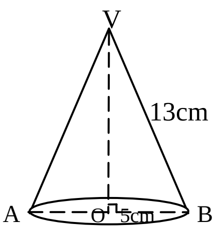
11. By using a ruler and a pair of compasses only, construct a quadrilateral ABCD in which $\overline{AB} = \overline{AC} = \overline{AD}$ = 8cm angle ABC = 60^0 and BAD = 120^0
a) Identify the type of quadrilateral. Bisect angle ACB. Let the bisector meet $\overline{AB}$ at E and DA produced at F. Construct a circle circumscribing triangle AEF.
b) Measure the distance from the centre of circle, O, to the vertex B. What is the radius of the circle?

12. Mbarara is about 260km away from Kampala. An express bus leaves Kampala for Mbarara at 6.45a.m traveling at a steady speed of 52kmh^{-1}. A commuter taxi leaves Kampala 1⅓ hours later and travels non-stop at a speed of 84kmh^{-1}. Draw on the same axes

distance-time graphs showing the journey of the two vehicles.
(Use scales of 2cm to represent 30 km and 2cm to represent 1hour). Hence or otherwise determine the time and distance from Kampala when the commuter overtakes the bus. If the bus then increases its speed by 20kmh^{-1}
Calculate the
(a) Time when the bus arrives in Mbarara.
(b) Differences in the times of arrival of the two vehicles.
Solution:
Express Bus

Time	6.45	7.45	8.45	9.45	10.45	11.45
Distance from K'la(km)	0	52	104	156	208	260

13.

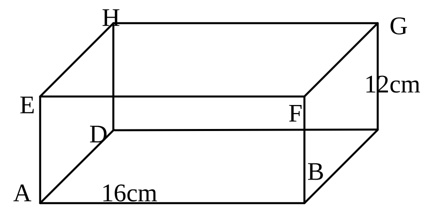


The figure above shows a right circular cone AVB. The radius of the base is 5cm and the slanting edge 13cm.
(a). (i) Calculate angle AVB.
ii) Find the:
(a). Volume of the cone
(b). Total surface area of the cone
(take π = 3.142)
14. The points A(-2,1), B(-2,4), C(1,4) and D(1,) are vertices of a square ABCD. The images of A,B,C and D under a reflection in the line x-y =0 are$A^1 B^1 C^1 D^1$
The points A^1,B^1,C^1 and D^1 are then mapped onto the points A^{11},B^{11},C^{11} and D^{11} respectively under an enlargement with scale factor 2 and centre of enlargement the origin O(0,0).

(a) write down the matrices of the reflection and enlargement
(b) Find the coordinates of the points
(i).$A^1B^1C^1D^1$
(ii).$A^{11}B^{11}C^{11}D^{11}$
(c) Determine the matrix c of a single transformation that would map A B C D onto $A^{11}B^{11}C^{11}D^{11}$

15. Three points A, B and C lie on the same level ground. A vertical pole NP stands in between points A and B such that $\overline{AN}$ = 21m. Angle BAC = 72^0 and $\overline{AC}$ = 21m. The angles of elevation of the top of the pole, P from A and B are 18^0 and 57^0 respectively
Calculate the
(a) Height of the pole NP.
(b) Length AB.
(c) Angle of elevation of P from C.

16.



The Figure ABCDEFGH is rectangular box with square ends BCGF and ADHE of side 12 cm. AB = 16cm. Calculate the
a) Lengths BD and BH.
b) Angle between lines BH and plane ABCD.
c) Angle between planes CFH and BCGF.

17. A certain country's income tax structure is such that a person's gross monthly income has certain allowances deducted from it before it is subjected to taxation. The allowances spelt out are as follows;
Marriage allowances one- twentieth of the gross monthly income.
Family relief and Insurance sh. 120.000 per annum.
Water and electricity sh. 12,500 per month
Housing sh. 35,000 per month.
Medical (self and family) sh. 240,000 per annum.
Transport sh 800 per day.
Family allowances for four children only at the following rate; sh 5,800 for each child above the age of 16, sh 7,200 for a child above 10 years but below 16 years and sh 9,000 for a child below 10 years. Joy has a family of four children with two of them below the age of 9, the elder child is 20 and the other 14 years given that she earns sh. 680,000, calculate
a) The taxable income and the income tax she pays under the income tax rates below.

Taxable income (sh)	tax rate %
0-15,000	8.50
15,001-84,000	16.50
84,001-170,000	24.00
170,001-285,000	30.00
285,001-435,000	37.50
Above 435,000	48.50

b) Determine the percentage of her gross monthly income paid in tax.

1999 PAPER ONE
SECTION A

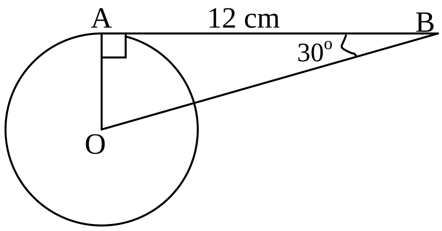
1. Without using a calculator or tables, simplify
$4(0.04)^{-½} – 8(4^{-1}) (16)^{¾}$

2. By writing each of the number in the for m a x 10^n where n is even find the square root of
0.25 x 0.64

3. Show that $\sqrt{18}+\sqrt{50}-\sqrt{72}=2\sqrt{2}$

4. Given that f(x) =ax^2 + 4x and f (3) = 21
Find the value of a. Hence find f (-1)

5.

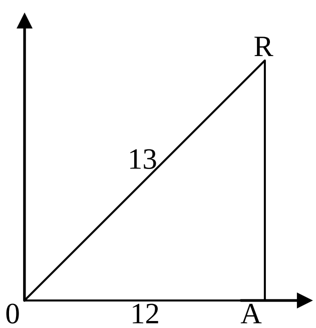


In the figure above, AB=12 cm is a tangent to a circle at A. Angle OBA =30° find the
i) length of OB
ii) radius of the circle

6. Matrices P = $\begin{pmatrix} 0 & 1 \\ -1 & 1 \end{pmatrix}$ and Q = $\begin{pmatrix} 1 & 2 \\ 0 & -1 \end{pmatrix}$ are used to map the point A (3,-2) onto A^1 .What are the coordinates of A^1 under the matrix transformation Q followed by P^1 ?

7. P and Q are two sets of object such that n($\square$) = 12, n(P∩Q) = 5, n(Q) = 8 and that $n(P\cup Q)^1$ = 3. Find
a). n(P∪Q)
b). n (P)

8. R is a point which is 13 units from the origin O. If its x-coordinates is 12, Find the possible values of the y-coordinate.



9. Evaluate log a^5 b^2 without using tables or calculator, if log a = 0.234, log b = 1.185

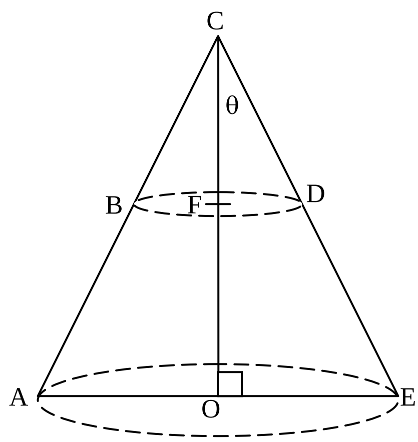
10. Given that OA = a = $\begin{pmatrix} 12 \\ 16 \end{pmatrix}$ OB = b = $\begin{pmatrix} 4 \\ 1 \end{pmatrix}$.
Calculate the length of AB

SECTION B

11. Using a ruler and pair of compasses only, construct;
a) A quadrilateral PQRS such that QRS = 45° $\overline{QR}$ = 4.5cm, $\overline{RS}$ = 6.0 cm, $\overline{SP}$ = 7.5cm and $\overline{PQ}$ = 10.5 cm .
b). Point T on $\overline{QR}$ produced such that $\overline{PT}=\overline{ST}$.
Join the point P,S and T. Measure length $\overline{PT}$ and angle PTS
c). A circle passing through the points P,T and R. Measure the radius of the circle.

12. Kampala and Mbale are about 229km a part. A mini-bus heading for Kampala leaves Mbale at 8.55 am with a steady speed of 56kmh^{-1}. At 9.40 am, a saloon car traveling at 80kmh-¹ leaves Kampala and travels steadily towards Mbale. Using scales of 2 cm to represent 20km and 2cm to represent 1 hour, draw on the same axes distance-time graph showing the journeys of the minibus and the car. Hence or otherwise determine when and at what distance from Kampala the two vehicles will meet given that the mini-bus then increase its speed by 14km-¹, calculate the Time when the minibus arrives in Kampala Difference in the time of arrival of the two vehicles.

13.

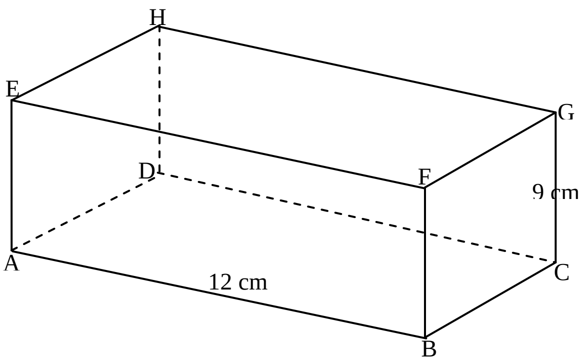


ABCDE is a right sold cone CE = 10 cm, $\theta = 30^0$
CD: DE = 2:3. The cone BCD was cut off.
Calculate the:
(i) Total surface area of the remaining portion ABDE.
(ii) Volume of the cone BCD.

14. The points P(0, 2) Q(1, 4)and R(2, 2) are vertices of a triangle PQR. The images of P,Q and R under a reflection in the line x - y =0 are P^1,Q^1 and R^1 respectively. The points P^1,Q^1 and R^1 are then mapped onto the points P^{11},Q^{11} and R^{11} respectively, under the enlargement with scale factor -2 and centre of enlargement O(0,0).
a) Write down the matrix for the
(i) Reflection
(ii) Enlargement
(b) Determine the coordinates of the points
(i) P^1 Q^1, R^1
(ii) P^{11}, Q^{11}, P^{11}
(c) Find the matrix of a single transformation which would map triangle PQR onto P^{11}, Q^{11}, and R^{11}

15. The points P, Q and R are on level ground, a vertical flag pole ST stands between P and Q such that Q is 12m away from S, the base of the pole. The angles of elevation of T from P and Q are 61^0 and 15^0 respectively. If angle PQR = 22.6^0 and $\overline{QR}$ =13cm, calculate the
a) Height of the flag pole ST.
b) Length PQ
c) Angle of elevation of T from R.

16.



The figure ABCDEFGH is a rectangular box with square ends BCFG and ADEH of side 9cm, AB=12 cm.
Calculate:
a) Length AC and AG.
b) The angle between the line AG and plane ABCD.
c) The angle between the planes DEG and ADEH.
s
17. The table shows the tax structure on taxable income of a certain working class of people.

Income (sh) per month	Tax rate %
0-30,000	10.0%
30,000-90,000	16.5%
90,000-190,000	23.5%
190,000-340.000	32.0%
340.000-500,000	40.0%
Above 500,000	49.5%

An employee earns sh 750,000. His allowances include;
Marriage allowances one-fifteenth of his gross monthly income
Water and electricity sh.15,000 per month
Relief and insurance sh.180,000 per annum
Housing allowances sh 40,000 per month
Medical sh 300,000 per annum
Transport allowance sh 36,000 per month
Family allowances for four children only.
For children in the age bracket 0 to 10 years sh 12,500/= per child; between 10 and 18 years sh 8,250/= per child; and over 18 years sh 5,000 per child.
Calculate the man's taxable income and the income tax he pays given that he has three children, two of whom are aged between 0 and 10, and the other child 13 years.
What percentage of his gross income goes to tax?

1999 PAPER TWO
SECTION A

1. Without using a calculator or tables, simplify
$0.25 \times 2195 - 1795 \times 0.25$

2. Given that $\sin\theta = 0.500$, find the two possible values of θ. What would be the two values of θ if $\sin\theta = -0.500$.

3. The price of a car in a show room is sh 6.4 m. A 7.5% cash discount is allowed when a customer pays cash for the car, while on hire purchase basis a customer pays sh 1.65 m per installment for four months. Determine how much a customer saves by paying cash for the car than purchasing it by hire purchase.

4. Under enlargement of scale factor 3, the image of (1, 3) is (4, 5). Find the coordinates of the centre of enlargement.
Hence (1, 2)

5. If g(x) = 2x and f(x) = x + 3, find gf(x). Hence evaluate gf(2)

6. The number of visitors accommodated per night by a certain hotel was recorded over a period of a month. The figures are given in the table below.

No of visitors	No. of nights
0 −< 10	2
10 −< 20	8
20 −< 30	12
30 −< 40	5
40 −< 50	3

Using a scale of 1 cm to represent 2 nights and 1 cm to represent 10 visitors, display the given data on a bar-graph. Use your bar graph to estimate the modal number of visitors accommodated by the hotel.
Solution:

7. Use the matrix method to solve the pair of simultaneous equations.
$x + 4y = 4$
$9y - 5x = 9$

8. A piece of land measures 33.6m by 16.5 m. Find the area of the land, in cm² on a map whose scale is 1:120.

9. In certain game a die is thrown once. When a 1 or 6 appears that player wins and when a 3 or 4 appears the player loses. Determine the probability that a player neither wins nor loses.

10. Find the coordinates of points of intersection of the curve $y = x^2 - 3$ and the line $y = 5x - 9$.

SECTION B

11. Faces of 36 small wooden cubes are to be painted either green or black or white. Of these, 10 cubes have all their faces painted green and 6 have all their faces painted black. There are 5 cubes with green and white, 8 white and black and 4 green and black. Cubes with all faces painted white are three more than those with all faces black.
Given that G represents the set of cubes with at least a green face, W represents that of cubes with at least a white face and B represents the cubes with at least a black face.
(i) Represent the above information in a Venn diagram, showing the remaining information.
(ii) Find the number of cubes with
(a) All the three different colour faces
(b) At least one of each of the three colour faces
(iii) If the cube is picked at random, what is the probability that it is black or white only?

12. The table below shows ages of 120 students entering senior one.

Age: years	No of students
12.5-12.9	8
13.0-13.4	35
13.5-13.9	52
14.0-14.4	17
14.5-14.9	8

a) State the i) class with
ii) Modal class
a)Determine the mean and median age of the students.

13. Three points A, B and C on the same horizontal level are such that B is 150 km from A on a bearing of $060^{0.}$ The bearing of C from A is 125^0. The bearing of C from B is 160^0.
(i) By scale drawing using 1 cm to represent 25 km find the distance of C from
(i) A
(ii) B
(ii)An aeroplane flies from A on a bearing of 340° at 300 kmh^{-1}. After 40 minutes of flying, the pilot changes course at point D and flies directly to C at the same speed. Include in your diagram in a) above the route of the plane. Hence find the
(i) Time (in hours) the plane takes to travel from A to C.
(ii) Bearing of D from C.

14. Three solids, a sphere, a right cone and a right cylinder are of equal surface area and the radii of their circular sections are also equal. Given that the volume of the sphere is 288π cm², find the
(i) Radius of the sphere
(ii) Height of the cylinder
(iii) Length of the slant slide of the cone
Hence calculate the volume of the:
(i) Cylinder
(ii) Cone
(Take $\pi = 3.142$ volume of sphere $= \frac{4}{3}\pi r^3$

And volume of the cone $= \frac{1}{3}\pi r^2 h$

Surface area : sphere $= 4\pi r^2$;
Cone (curved surface area) $= \pi r\ell$; where ℓ is length of the slant side)

15.a) Copy and complete the following table of values for the curve $y = x^2 - 2x - 6$ and $y = 4x - 5$ for values of x between $x = -4$ and $x = 7$

x	-4	-3	-2	-1	0	1
x^2	-	9	-	-	-	1
-2x	8	-	4	2	-	-2
$x^{2-}2x$- 6	18	-	2	-	-	-
4x	-	-	-8	-4	0	-
y = 4x-5	12	-	-13	-	-5	-

x	2	3	4	5	6	7
x^2	-	-	-	-	36	49
-2x	-	-	-	-	-12	-14
$x^{2-}2x$- 6	-				18	29
4x	8				24	28
y = 4x-5	-	-	-	-	19	23

a) On the same axes plot the graph of the curve $y = x^2 - 2x - 6$ and the line $y = 4x - 5$ for $-4 \leq x \leq 7$
b) Using your graph estimate the
i) Coordinates of the points of intersection of the curve and the line.
ii) Roots of the equation $y = x^2 - 2x - 6 = 0$

16. Otim and Mukasa wish to travel to the next trading centre which is 30.8km away. They will travel by their bicycles. When Otim had covered 9km, traveling steadily at 4 kmh^{-1}, Mukasa started riding at a steady speed of 7kmh^{-1} from where Otim started. Both Mukasa and Otim maintained their cycling speeds until Mukasa overtook Otim.
a) Find the time and distance at which Mukasa overtook Otim.
b) Given that Mukasa then reduced his speed and maintained the new speed till he arrived at the

trading centre, there by arriving 0.6 hours later than if he had maintained the 7kmh-¹ speed.
i) Calculate by how much he reduced his speed.
ii) For how long was he in the trading centre before Otim joined him?

17. A wildlife club in a certain school wishes to go for an excursion to a national park. The club has hired a minibus and a bus to take the students. Each trip for the bus is sh.50,000 and that of the minibus sh 30,000. The bus has capacity of 54 students and the minibus 18 students. The maximum number of students allowed to go for the excursion is 216. The number of trips the bus makes do not have to exceed those made by the minibus. The club has mobilized as much as sh 300,000 for transportation of the students. If x and y represent trips made by the bus and minibus respectively.
(i) Write down five inequalities representing the above information.
(ii) Plot these inequalities on the same axes.
(iii) By shading the unwanted region show the region satisfying all the above inequalities
(iv) List the possible number of tips each vehicles can make
(v) State the greatest number of students who went for the excursion.

2000 PAPER ONE
SECTION A

1. Without using a calculator or tables, simplify

$$\frac{30.25^2 - 30.15 \times 30.25}{0.0025}$$

2. Given that $x^2 - y^2 = 135$ and
$x - y = 9$ find the values of x and y.

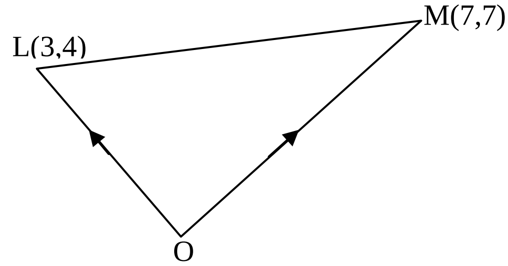
3. Given the set
A = (all natural number less than 30)
B= (all prime numbers between 10 and 30)
Find (i) $n(A \cap B^1)$
(ii) $n(A^1 \cap B)$ where A^1 and B^1 are complements of sets A and B respectively

4. Solve the simultaneous equations
$4y - 3x = 2$
$2y + 1 = 2x$

5. A straight line passes through the origin and the point (1,-1). Find the equation of the line.

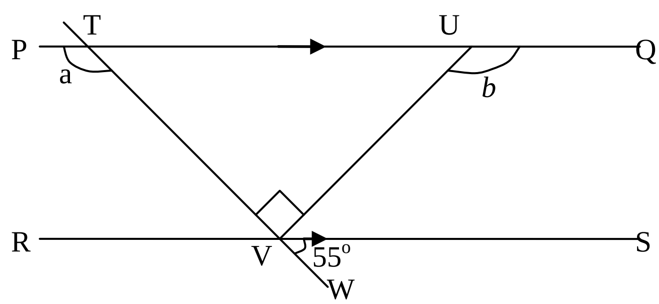
6. Shs 6,000 is to be shared among David, Daniel and Diana. Daniel is to get one and half times as much as David while Diana is to get three and half times as much as David. Determine the ratio in which the money is to be shared.

7. Given the points L (3, 4) and M (7, 7) Find the:
(i) Vector LM
(ii) Length of LM



8. By removing the brackets factorize completely
$y(ay - x) + x(y - ax)$

9. In the figure below PQ is parallel to RS angle SVW = 55^0. UV is perpendicular to TW. Determine the values of the angles labeled a and b.



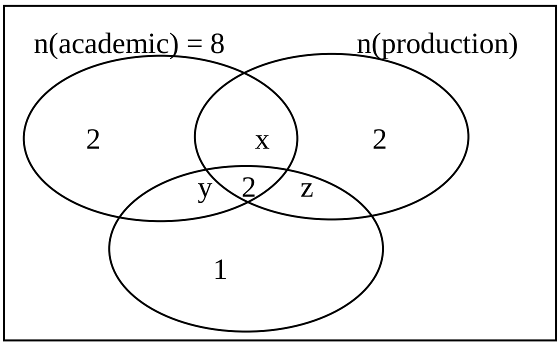
10. Find the value of x, correct to 2 decimal places given that $3^x = 5$

SECTION B

11. Using a ruler, pencils and a pair of compasses only,
Construct a triangle PQR, where angle QPR = 135^0, PQ = 8.4 cm and QR = 12.5cm. State the length of PR.
S and T are points such that TS bisects QR where T is on QR and, S on the same side as PQ. Draw circle to circumscribe the points P, Q, R and S. Measure and state the
(i) Length ST
(ii) Radius of the circle.

12. (a) Express $1.\overline{24}$ as a fraction in its simple form
(b) If $S = \sqrt{kd(\ell - d)}$ express ℓ in terms of d, k and s .
(c) Express $\frac{\sqrt{3} - \sqrt{2}}{\sqrt{3} + \sqrt{2}}$ in the form $p + q\sqrt{r}$, where p, q and r are constants.

13. The diagram below shows the allocation of the members of the board of governors of a school to different committees?



(i) Determine the values of x, y and z
(ii) What is the total number of members on the board of governors?
(iii) What is the probability that a member chosen at random from the members of Board of governors belong to;
(a) Both finance and production committee
(b) Only one committee

14. The data below represent the times in second of an oscillation of a given pendulum as recorded by different students

10.3	9.7	10.2	9.8	10.1
9.9	10.1	9.9	10.1	10.2
10.3	10.0	10.2	10.1	9.8
9.9	10.1	10.0	10.1	9.9
10.1	11.0	10.1	10.1	9.9
9.8	9.8	10.0	9.9	10.2

(a) The frequency table below was drawn out to represent the above data.
Copy and complete the table

Time (s) x	Freq. (f)	Cum. Freq	x(f)
9.7	__	1	__
9.8	4	5	__
9.9	__	__	__
10.0	3	__	__
10.1	__	__	__
10.2	__	__	__
10.3	__	__	__
	$\sum f =$ ___		$\sum fx =$ ___

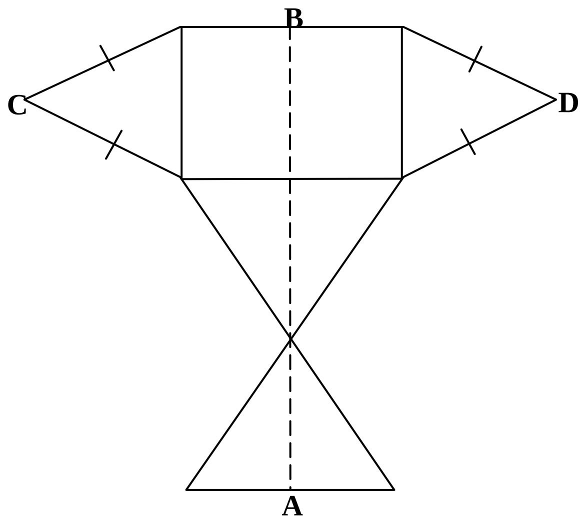
b) Use the table to
i) State the modal time of oscillation.
ii) Calculate the mean and median times of oscillation.

15. The table below shows the speed (vms^{-1}) of a car after time (ts)

V m/s	0	15	28	42	48	48	35	0
Time(s)	0	2	4	8	10	14	17	20

(a) Plot a speed- time graph showing the motion of the car.
(b) Use the graph to estimate the
(i) Speed of the car at t = 6s
(ii) Timers when the speed of the car is 32.5 ms^{-1}
(iii) Distance traveled between time intervals t = 10s to t = 14s
(c) Describe the motion of the car between
(i) t =10 s and t = 14 s
(ii) t =14s and t = 20 s
(d) By drawing a tangent to the curve at t = 17s, estimate the rate of change of speed at that instant.

16. The diagram below shows a square of side 12cm and four congruent isosceles triangles, representing the net of a pyramid on a square base.



Given that $\overline{AB} = \overline{CD} = 40$ cm, calculate the:
(a) (i) height of the vertex of the pyramid from the square base
(ii) Angle between a triangular face and the base of the pyramid
(iii) Volume of the pyramid.
(b) If the pyramid is cut horizontally at a vertical height of 2.6 cm from the square base, and the upper part of the pyramid containing the vertex is thrown away, what volume remains?

17. (a) Customs duties and purchase tax are levied on certain imported goods
as follows
Customs duty = 35 of the value of the goods.
Purchase tax = 15% of (value + duty)
Find the total amount levied on an electric kettle valued shs 40,000. Hence calculate the percentage rate for the two taxes combined.
(b) A man borrowed Shs. 39.6 million from a housing finance many to build a commercial house at a compound interest rate of 10.5% per annum. He has to repay the loan and interest within two years in 8 equal installments
Calculate;

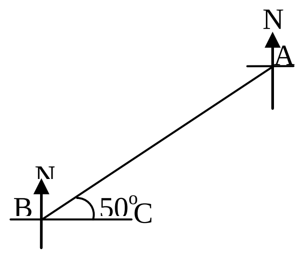
(i) Total amount of money the man paid the company.
(ii) Interest he paid on the loan.
(iii) Amount he paid per installment.

2000 PAPER TWO
SECTION A

1. Given that $a*b = \dfrac{a^2+b^2-2ab}{a-b}$

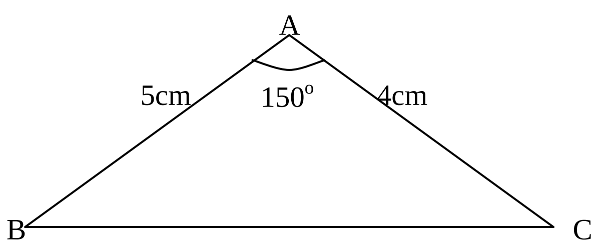
Find the value of:
(i) 4 *3
(ii) 8* (4 *3)

2. In the diagram below angle ABC =50^0 what is the



3. Solve the inequalities $\frac{1}{2} - \frac{x}{6} > \frac{-5}{2}$

4. In a triangle ABC angle BAC = 150^0 , $\overline{AB}$ = 5cm and $\overline{AC}$ = 4cm, calculate the area of the triangle ABC.



5. Given that $\cos\theta = \dfrac{-8}{17}$ for $0^0 \leq 9^0 \leq 180^0$
Find without using tables or calculator, values of sinθ and tanθ.

6. Given that f (x) = $x^2 + 3$ and g (x) = x -1 find the value of a for which fg (a) = gf(a) .

7. Without using tables or calculator evaluate $(0.008)^{⅓}$

8. A pole is fixed on horizontal ground. The angle of depression of the foot of the pole from the top of a cliff 57.7m high is 30^0. Find how far away the foot of the cliff is from the pole.

9. Two coins have each one side labeled H and the other T. They are together tossed once. Write down the possibility space.
Find the probability that the labels on the two coins are different.

10. Given the matrix $M = \begin{pmatrix} 3a & a-6 \\ -6 & a+2 \end{pmatrix}$, find the values of a for which the determinant of M is zero.

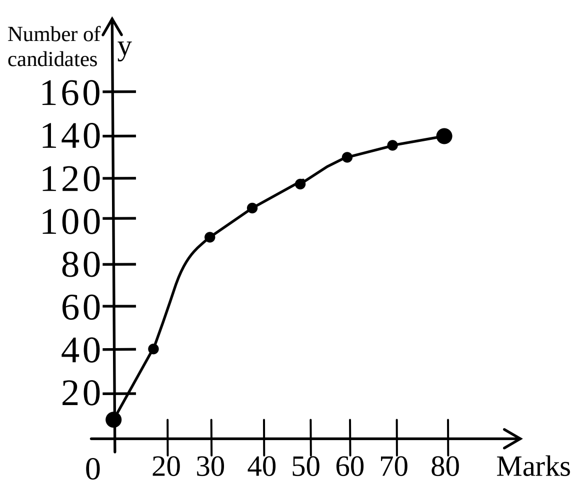
SECTION B

11. Draw the graph of the curve $x^2 - 2x + 1$ for $-3 \leq x \leq 3$. Use your graph to find the solutions of the following equations.
(i) $x^2 -2x + 1$ 0
ii) $x^2 - x - 6 = 0$

12. The image of the vertices P (2, 3); Q (2, 2) and R (4, 2) of a triangle PQR under a rotational transformation $P^1(-1,2)$, $Q^1(0,2)$ and $R^1(0,4)$ respectively. The image of PQR, $P^1Q^1R^1$ then undergoes a further rotation of 52º to give the image $P^{11}Q^{11}R^{11}$.
(i) Represent triangle PQR and its images on the same coordinate axes (use a scale of 2cm to 1 unit).
(ii) Determine the centre and angle of rotation of PQR.
(iii) Find the coordinates of the final image $P^{11}Q^{11}R^{11}$. State the angle formed between PQR and $P^{11}Q^{11}R^{11}$.

13. In triangle ABC L, M, N are the mid- points of $\overline{BC}, \overline{CA}$ and $\overline{AB}$ respectively. AM = m; AN = n and 3 AG = 2AL.
a) Express in terms of vectors m and n the vectors
(i)AB
(ii)AC
(iii)BC
(iv)BG
(v)GM
(b) Show that B,G and M lie on a straight line and $\overline{3BG} = \overline{2BM}$

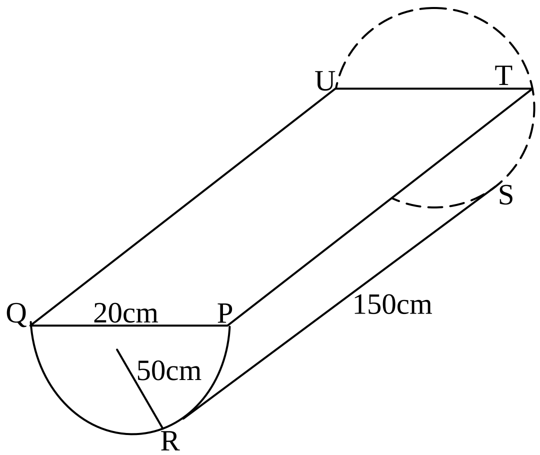
14. The cumulative frequency graph below shows the marks scored by 150 students in an end of term examination marked out of 80 marks. Study the graph and use it to



(a) Estimate the;
(i) Median mark

(ii) Number of students who obtained distinction if 60 marks and above are distinction scores.
(iii) Number of students who scored 30 or less marks.
(v) Pass mark if 92 students passed the examination.
(b) Construct a table of the frequency distribution of the students' performance. Hence calculate the mean mark.

15. The diagram below shows a hollow right cylinder PQRSTU of negligible thickness, part of which has been cut off as shown below;
If the radius of the circular end is 50cm, $\overline{RS}$=150 cm and $\overline{PQ}$ = $\overline{TU}$ = 20cm



Find the area of the cross section PQR
How much water (in liters) would fill this container (use π =3.14)

16. On a shore running from east to west are two points P and Q which are 18 km apart. A town R on an island on the same level as P and Q is on a bearing of 230^0 from P and 140^0 from Q respectively. A pilot flying a plane above port P observes town R at an angle of depression of 6^0 calculate
(i)Distance $\overline{PR}$ and $\overline{QR}$
(ii)Vertical height of the plane above P.
(iii)Angle of elevation of the plane from port Q.

17. The table below shows the tax structure on taxable income of employees of a certain industry.

Income (sh) per month	Rate %
18.001-36.000	8.75
36,001-54,000	2.15
54,001-72,000	18.00
72,001-108,000	24.50
108,001-180,000	30.00
Above 108,000	40.50

An employee earning a gross income of sh 425,000 a months is allowed the following.

Allowance	Amount (sh)
Transport and lunch	45,000 per month
Housing	80,000 per month
Water and electricity	2100 per month
Annual medical	900,000 per annum
marriage	$\frac{1}{20}^{th}$ of gross monthly income

NB. [A month is taken to be 30 days and a year 360 days]. The employee is allowed a family allowance for any three of his children according to age distribution.

Age	shs
0 - 12	6,000
13 - 18	4,500
19 - 21	2,500

Given that this employee has a family of five children with the older child aged 22, the other 15 years and the rest aged between 2 and 12 years, calculate the employee's.
(i) Total monthly allowance
(ii) Taxable income
(iii) Income tax
Determine the percentage of the employee's income that goes to tax.

2001 PAPER ONE
SECTION A

1. Given that Q = 1^2Rt, make I the subject. Hence evaluate I for Q = 1000, t = 20 and R = 2 ()

2. In the figure below, $\overline{AC} = \overline{AD} = \overline{BD}$, angle DAC = 48^0.Find the size of angle x.

3. Given that $\begin{pmatrix} 1 & x \\ 1 & 1 \end{pmatrix}\begin{pmatrix} 3 \\ y \end{pmatrix} = \begin{pmatrix} 23 \\ 7 \end{pmatrix}$, Find the values of x and y.

4. A floor measuring 2.5m by 2.0m is to be covered by square tiles measuring 25 cm each. Find the number of tiles that will be needed to cover the floor.

5. A chord of length 6cm is 4cm from the centre of a circle. Determine the circumference of the circle.

6. Without using tables or calculator, solve for x in the equation

7. Find the discount on a bicycle priced shs 64,000 but sold off at a discount of 7½ %. How much was paid for it?

8. In a parallelogram OBCA,
OA = $\begin{pmatrix} 4 \\ 1 \end{pmatrix}$ and

OB = $\begin{pmatrix}1\\3\end{pmatrix}$, where O is the origin.

Find(i) Vector BC
(ii) The coordinates of C

9. Given that $\log_{10} x = 2.852$, and

$\log_{10} y = \bar{2}.581$ use tables to evaluate $\frac{x^{\frac{1}{2}}}{y}$

Correct to 3 significant figures.

10. A triangle PQR whose area is $12cm^2$ is mapped onto its image A^1, B^1, C^1, by a transformation represented by the matrix $\begin{pmatrix}2 & 1\\3 & 4\end{pmatrix}$.Find the area of A^1, B^1, C^1

SECTION B

11.(a) Given that functions

$f(x) = \frac{x+3}{2}$, $g(x) = \frac{1-2x}{5}$, determine the value of x for which $fg(x) + gf(x)=0$.

(b) Express $x^2 - x - ¾$ in the form $(x + p)^2 + q$

Hence solve the equation $x^2 - x - ¾ = 0$

12. (a) Find the point of intersection of the lines $y = 2x - 3$ and $y = - x - 3$. Calculate the area of triangle enclosed between the two lines and the x-axis.

(b) Find the Equation of the line which is a perpendicular bisector of the line passing through points A (5, 4) and B (3, 8).

13. Using a ruler, pencil and pair of compasses only,

Construct triangle ABC such that AB = 8cm, angle ABC = 60º and BAC = 45º.

Construct the perpendicular from C onto AB to meet it at D. Measure the length CD.

Draw a circle circumscribing triangle ABC. Measure its radius.

Find the area of triangle ABC.

14. The following table shows the marks obtained in a mathematics test by S.5 students in a certain school.

50	53	31	56	38
33	39	51	38	41
69	57	63	50	54
40	41	45	48	64
59	61	55	36	52

(i)Using class internal of 5 marks, make a frequency distribution table starting with the 30 – 34 class.

(ii)Use your table in (i) above to estimate the mean mark. State the modal class.

(iii)Draw a histogram for the data. Use it to estimate the modal mark.

15. In a certain school there are 50 students who play three games namely; Chess, Tennis and Volleyball, 24 play Chess, 26 play Tennis and 29 play Volley ball, 9 play both Chess and Volleyball, while 13 play both Tennis and Volley ball, 11 play both Chess and Tennis. Each of these students play at least one of the three games.

(a) Represent the above information on a Venn diagram.

(b) Find;

(i)How many students play all three games?

(ii)The number of students who play only one game.

(iii)The probability that a student selected at random plays only tennis.

(iv)The probability that a student selected at random plays only two of the games.

16. A transformation represented by the matrix $\begin{pmatrix}6 & -4\\2 & -1\end{pmatrix}$ maps the vertices of triangle KLM onto its image vertices $K^1(8,3)$, $L^1(32,11)$ and $M^1(2,2)$ respectively. The image of triangle KLM further under goes transformation respectively by matrix $\begin{pmatrix}2 & 0\\0 & 2\end{pmatrix}$ Find

(i) The coordinates of Vertices K, L and M.

(ii) The coordinates of $K^{11}L^{11}M^{11}$

(iii) A single matrix of the transformation would map triangle $K^{11}L^{11}M^{11}$ back onto triangle KLM.

17. A whole seller wishes to transport 870 crates of soda from a factory. He has a lorry which can carry 150 crates at a time and a pickup truck which can carry 60 crates at a time. The cost of each journey for the lorry is Shs 25,000 and for the pickup Shs 20,000. The pick-up makes more journey than the lorry because it travels faster. The amount of money available for transporting the soda is Shs. 220,000. Write down five inequalities, representing the above information.

Plot a graph for the inequalities, shading out the unwanted regions.

How many journeys should the lorry and the pick-up make so as to keep the transport cost as low as possible. State how much money the wholesaler saves by making these journeys.

2001 PAPER TWO
SECTION A

1. Find the HCF of 18, 42 and 48

2. Without using tables or calculator evaluate

3. A television set costs British pound sterling (£) 220. Given the exchange rates
One United States dollar (1US$) =£0.75, and 1US$ = USh.1,800, determine the costs of the set in Ugandan shillings.

4. Using a number line, find the integral values of x which satisfy the sets
$\{3x > 2x + 5\} \cap \{3x < 32 - x\}$

5. In the table below, y is known to be inversely proportional to x.

y	p	45	12
x	5	8	q

Find the values of p and q

6. Olga bought a motor cycle and solid it to Okello at a loss of 25%. If he sold it at Shs. 1,200,000, find how much money Olga paid for it.

7. Solve the equations $\frac{x+1}{2x+5} = \frac{x-1}{3}$

8. Express $0.\overline{321}$ as a fraction

9. A cylindrical tank of diameter 1.4 m and height 2m has a capacity of 3.08 m^3 find the radius and height of the similar tank of capacity 83.16m^3.
(VSF = Volume Scale factor)

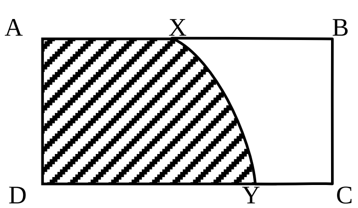
10. The table below shows the age of pupils in a certain class.

Age (years)	11	12	8
No. of pupils	a	10	a

If the mean age of the pupils is 10, find the value of a.

SECTION B

11 (a) The length of a rectangular floor is 8 meters more than its width. If the area of the floor is 65m^2, find the dimensions and perimeter of the floor.
b) In the figure below ABCD is a rectangle.
$\overline{AB}$ =10cm, $\overline{AD}$ = $\overline{AX}$ =6cm and XY is an arc of a circle, center D.



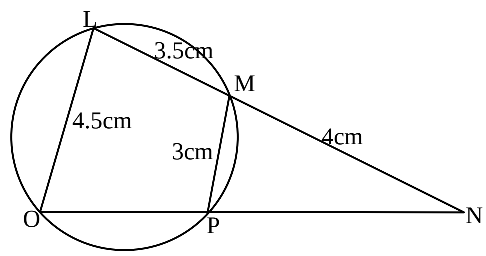
Calculate the area of the shaded region.
(Take π = 3.14)

12. Given the Equation of a curve
$y = 2x^2 + 5x - 3$
i) Copy and complete the table below.

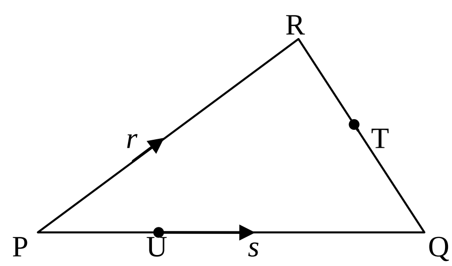
x	-4	-3.5	-3	-2.5	-2	-1.5	-1	-..5	0	0.5	1
$2x^2$					8					0.5	
5x					-10					2.5	
-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3
y					-5						

(ii) On the same axes and using the same scales plot the graph of $y = x + 1$ and
$y = -2x^2 + 5x - 3$
(iii) Using your graph solve the equation
$x^2 + 2x - 2 = 0$

13. In the figure below $\overline{OL}$ = 4.5 cm,
$\overline{PM}$ = 3cm, $\overline{NM}$ = 4cm and $\overline{LM}$ = 7.5cm.



Find:
(i)Lengths ON and OP,
(ii)The radius of the circle,
(iii)Area of OLMP .
14. In the figure below, vector PQ = s, PR = r,
15. $2\overline{QT} = \overline{TR}$ and $\overline{PU}:\overline{UQ}$ =2:3



a)Find in terms of vector r and s vectors
(i) QR (ii) QT (iii) PT
(b) Show that UT is parallel to PR
15. In a certain country income tax is computed after deducting the following allowances.

Type of allowances	Amount U.shs.
Marriage	10,000
Single	4,000
Each child above 10 but below 20 years	3,000
Each child under 10 years	2000

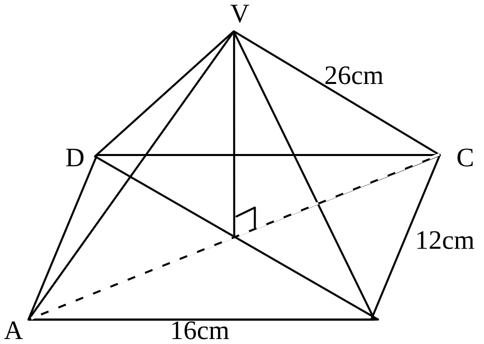
Omoja is married with 3 children, two below 10 years of age and the other child 12 years old. Mbili is single but has two dependants aged 11 and 15 years. Each months Omoja and Mbili earn gross incomes of Shs 130,000 and 120,000 respectively. The income tax is calculated as follows.

Ush	%age tax
1st :01-10,000	20%
Next 10,001-50,000	15%
Rest 50,001 and above	10%

a)Calculate the
Taxable income for Omoja and Mbili.
Income tax for Omoja and Mbili.
b) Express the total income tax for each man as percentage of their respective taxable incomes.

16. A helicopter flies from Moroto due south for 300 km. It then flies on a bearing of 255^0 for 350km. From there it flies on a bearing of 020^0 for 400 km. Draw an accurate diagram showing the journey of the helicopter using a scale of 1 cm to represent 50km. From you diagram, find the distance and bearing of Moroto from the final position of helicopter. Given that the helicopter flies at a steady speed of $200kmh^{-1}$, find how long the whole journey took.

17. The diagram below shows a right pyramid with a rectangle base ABCD
$\overline{AB} = 16$ cm, $\overline{BC} = 12$ cm and each slant edge of length 26cm.



Calculate the
(i) Height of OV above the base.
(ii) Angle between line VB and the base
(iii) Angle between the planes BCV and ABCD

2002 PAPER ONE
SECTION A

1. Without using tables or calculator evaluate
a) $3.1422^2 - 3.04 \times 3.142$
b) $\dfrac{1.21 \times 10^{-2} \times 40}{2.2 \times 11}$

2. Given that $a^2 - b^2 = 63$ and $(a + b) = 21$ find the values of a and b.

3. Given that P = (the square of all prime numbers) and Q = {the first ten square numbers}.
Write down the members of (P∩Q)

4. Solve the pair of simultaneous Equations
$2x + 3y = 8$
$2y - x = 3$

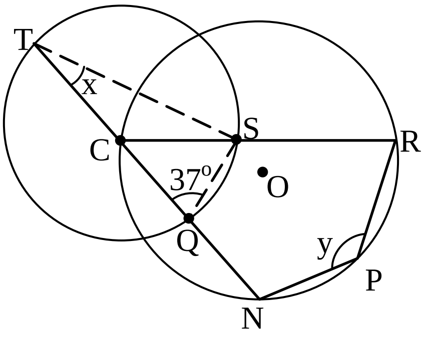
5. A straight line of gradient -1, passes through the point (3,-2)
a) Determine the Equation of the line.
(b) Through which point does the line cut the y- axis?

6. Three boys John, Michael and Tom share Shs 4,000. Given that Tom gets six times as much as Michael and John gets half of what Tom gets, find how much money each boy gets.

7. Two points P (5, 2) and Q (2, 4) are in the plane. Find the
(a) Coordinates of M, the mid point of PQ
(b) $|OM|$, where O is the origin

8. Factorize completely $16x^3y + 2y$

9. In the diagram below, C and O are centers of two intersecting circles. Angle CQS = 37º



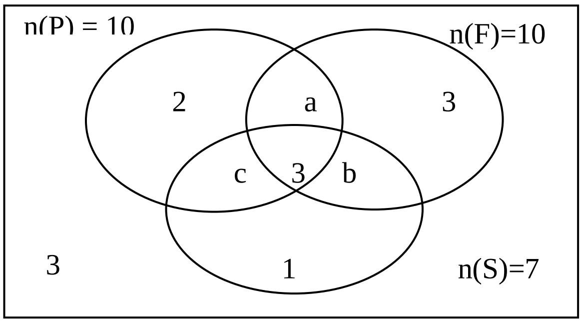
Find the values of x and y

10. Without using tables or calculator, evaluate
$4 \log_{10}2 - \log_{10} 48 + \log_{10}30$

SECTION B

11. Using a ruler pencil and pair of compasses only
(a) Construct a triangle ABC where angle ABC = 105^0, BC = 9.2cm and AC = 12cm .Measure and state length AB and angle BAC
(b) Draw a circle circumscribing triangle ABC. State the radius of the circle

12. The Venn diagram below shows representation of members of community council to three different committees of finance F, production P and security S



(a)Determine the values of a, b, and c.
(b)Find the total number of members that make up
(i)the community council.
(ii)Number of members who belong to more than one committee.
(c)Given that a member is chosen at random from the council members, what is the probability that the member belongs to
(i)only one committee,
(ii)Not more than two committees

13.(a) Express1.252525 as a fraction.
(b) Given that 2g – e = 3g (g – e), express g in terms of e in its simplest form.
(c) Express $\frac{\sqrt{4}+\sqrt{3}}{\sqrt{4}-\sqrt{3}}$ in the form a + b$\sqrt{c}$,
Where a, b and c are constants.

14. The distance d (m) traveled by a car after time t(s) is given by the following table.

d(m)	0.0	10.0	22.0	29.0	31.5	36.0
t(s)	0	2	55	7	8	10

(a) Plot a distance – time graph to show the motion of the car. (Use scale 2.0cm to 1.0sec and 2.0cm to 5.0m on the holizontal and vertical axes respectively)
(b) Use your graph to estimate
(i) The distance the car had traveled after t = 4s.
(ii) At what time the car had covered 34.0m
iii) The average speed of the car between t = 3s and t = 7s.

15. The marks obtained by a class of 40 Pupils in an English test are given below.

50	71	40	48	61	70	30	62
44	63	60	51	55	25	32	65
54	62	65	50	45	40	25	45
48	45	30	38	30	28	24	48
30	48	28	35	50	48	50	60

(a) Using class intervals of 5 marks, construct a frequency table starting with the 20-24 class group. Represent this information on a histogram Use the histogram to estimate the modal mark.
Estimate the mean using a working mean of 47.

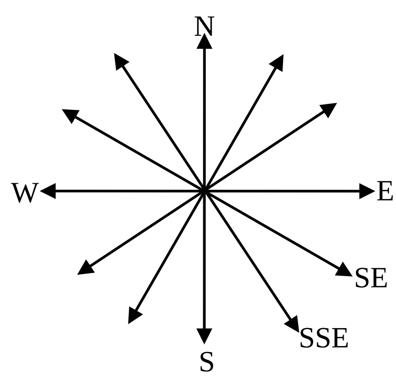
16. The base of a right pyramid is a rectangle 10.0cm by 8.0 cm and the slant edges are each 13cm. Calculate the;
(a)Total surface area of the pyramid
(b)Angle between two opposite slanting sides of the pyramid whose base length is 10.0cm.

17. a) Customs duty and purchase tax levied on certain imported commodities are calculated as follows;
Customs duty: 30% of the value of the commodity
Purchase tax: 20% of (value + duty)
Calculate the total amount of money levied on a commodity valued at Shs. 18,600. Hence determine the percentage rate for the two taxes combined.
(b) A company borrowed 14.85 million shillings to boost its business. The bank rate is 12% compound interest per annum. The company had to repay the loan and interest within two years. It is to repay these bank dues in six equal installments. Calculate the Total amount the company paid to the bank.
Amount of money the company paid per installment.

2002 PEPER TWO
SECTION A

1. Given that r * s $= \frac{r^2+s^2}{10s}$ find
a) 4 * - 8
b) 7*(4*- 8)

2. Express the bearing South South-East (SSE) in degrees.



3. Solve the inequality $\frac{1}{4}x + 5 \geq 1 + \frac{x}{2}$

4. Given that OA = $\begin{pmatrix}3\\3\end{pmatrix}$, OB = $\begin{pmatrix}2\\0\end{pmatrix}$ where $\overline{OA}$ and $\underline{OB}$ are position vectors of A and B respectively, find the area of triangle OAB.

5. Given that $\tan\theta = \frac{5}{12}$, without using tables or calculator, find the value of $\cos\theta - \sin\theta$.

6. Given that $f(x) = \frac{1}{2}(3x + 5)$ find the value of x such that f(x) =10.

7. Without using tables or calculator find $\sqrt[4]{40.0081}$

8. K, L and M are three points on a circle of radius 8cm such that KLM is an equilateral triangle. What is the shortest distance of any side of the triangle from the centre of the circle?

9. Two dice are thrown up at once. What is the probability that the sum of the scores on the dice is less than 8?

10. Given that matrices :

$A = \begin{pmatrix} 1 & 3 \\ 4 & 11 \end{pmatrix}$, $B = \begin{pmatrix} -1 & 2 \\ 1 & 3 \end{pmatrix}$

Find a) P = A.B

b) P^{-1}

SECTION B

11 (a) Copy and complete the table below

x	-4	-3	-2	-1	0	1	2	3	4
$x^2 - 2$									
$-x^2 + 6$									

(b) Plot on the same axes the graphs of

$y = x^2 - 2$ and

$y = 6 - x^2$, for $-4 \leq x \leq 4$

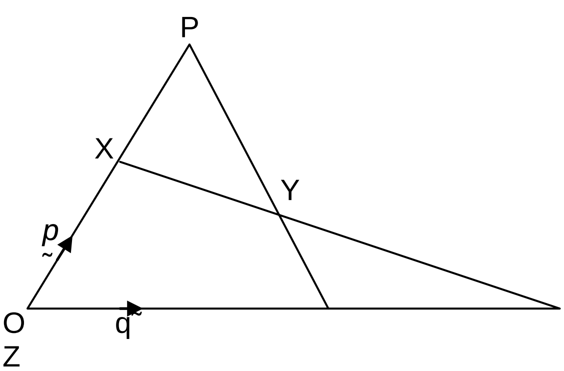
Using your graphs solve the equation $x^2 - 2 = 6 - x^2$

12. In a triangle OPQ, x is a point such that

$\overline{OX} = \frac{2}{3}\overline{OP}$ and Y the mid point of $\overline{PQ}$

The point Z on OQ is such that $\overline{OQ} = \overline{OZ}$. Given that OP = p and OQ = q

(a) Determine in terms of p and q the vector i) OX (ii) OY (iii) OZ (iii) XY (iv) YZ



b) Hence or otherwise show that x, y and z lie on a straight line state the ratio of the length $\overline{XY}$ and $\overline{YZ}$

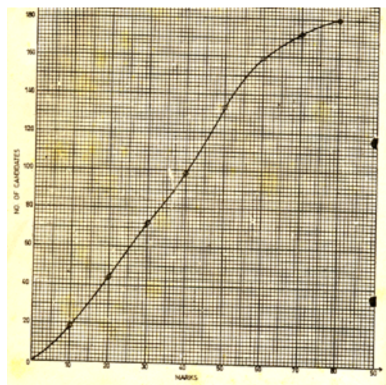
13. The end points of line AB whose coordinates are A (3,-1) and B (4,-3) undergo a rotational transformation it give the image line A^1B^1 with A^1 (1, 3) and B^1 (3, 4) respectively

(a) Plot the line AB and its image on the same set of axes using a scale of 2 cm to 1 unit.

(b) Determine the centre and angle of rotation of the line.

(c) Find the new image $A^{11}B^{11}$ of AB when its image A^1B^1 further undergoes a rotation of 128º. State the size of the angle formed between AB and $A^{11}B^{11}$.

14. The cumulative frequency graph below shows marks scored by 180 students in an end of year examination marked out of 80 marks. Study the graph and use it to.



a) Estimate the

(i)Median mark.

(ii)Number of students who cored 30 or less marks.

(iii)Number of students who obtained distinction if 61 or more marks were distinction scores.

(iv)Pass mark of the examination if 94 students passed.

(b) Construct a table of the frequency distribution of the students' performance. Hence calculate the mean mark.

15. Three towns A, B and C lie on the same level ground. Town B is 15km away from town C. The bearings of towns B and C from A are 060º and 150º respectively. The bearing of C from B is 200º. To a pilot flying an aircraft above A, the angle of depression of C is 7.5º. Calculate the:

(a) Distances $\overline{AB}$ and $\overline{AC}$.

(b) Vertical height of the aircraft above A.

(c) Angle of elevation of the aircraft from B.

16. A rectangular swimming pool is constructed such that when the pool is completely full the shallow end is 1 meter deep and the deeper end is 4 meters deep. The pool is 25 meters long from the shallow end to the deep end and 20 meters wide.

(a)Calculate the:

(i)Inclination of the floor of the swimming pool to the horizontal.
(ii)Volume of the water (in m³) that can fill the pool.
(b)Starting with the pool empty, a tap which delivers water at a rate of 400 liters per minute is used to fill the pool. How long (to the nearest hour) will the pool take to fill?

17. In a certain school a teacher's salary includes the following tax-free allowances.

Type of allowances	Amount (shs)
Legally married teacher	Shs. 10,000
Each child under 10 years	Shs 2,5000
Each child above 10 years	Shs 2,000
PTA	Shs 50,000
Head of department/subject	Shs 10,000
Class teacher	Shs 5,000
House master/ mistress	Shs 50,000
Unmarried teacher	Shs 60000

Mr. Mugisha and Ofuti are senior teachers in this school. Mr. Mugisha is married with two children under 10 years and one child above 10 years. He is also a class teacher and a head of mathematics department. Mr. Ofuti is single but has two children under 10 years and is also a house master and a class teacher. Their gross incomes t the end of the month are each subjected to a "PAYEE" (Pay As You Earn) which has the following rates.
For the first Shs. 10,000 taxable income, the tax is 20% while the rest is taxed at 15%. At the end of the month Mr. Mugisha's gross income was Shs 150,000 and Ofuti's gross income Shs 130,000.
Calculate the :
a)Taxable income for each teacher
b) Tax paid by each teacher.
c) Tax paid as a percentage of the gross income for each teacher.

2003 PAPER ONE
SECTION A

1.Simplify $\frac{2^{-2}\times 3^{-3}}{2^{-4}\times 3^{-6}\times 18}$

2.Simplify $\frac{\sqrt{63}+\sqrt{28}}{\sqrt{175}-\sqrt{63}}$ as far as possible.

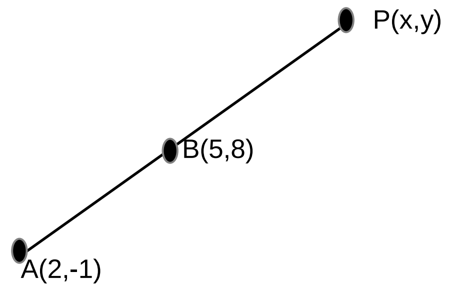
3.. The diagonals of a rhombus are 20 cm and 48cm respectively. Determine the length of the side of the rhombus.

4. Factorize $8a^2 - 18\,b^2$ completely

5. Use logarithm tables to evaluate $\frac{780 \text{ x } 0.25}{1.09}$ correct to 2 decimal places.

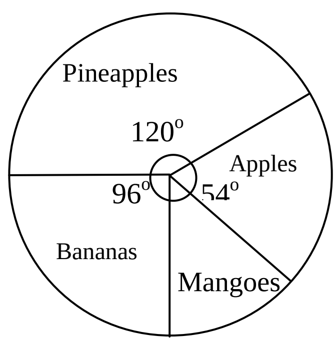
6. If A = $\begin{pmatrix} 2 & 0 \\ 0 & 2 \end{pmatrix}$, B = $\begin{pmatrix} 4 & 8 \\ 2 & 6 \end{pmatrix}$.
Find det(A,B)

7. Find the equation of the line passing through the points (2,-1) and (5, 8)



8. Given that f(x) = ax - 7 and f (8) = 17 find the value of :
(i) a
(ii) f(4)

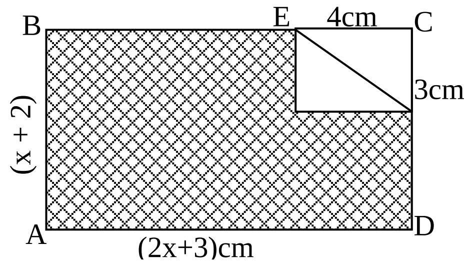
9. The pie chart below shows the fruits popularity sold in a daily super market in Kampala



If 420 apples were sold on a given day, determine
(i)The total number of fruits that were sold that day.
(ii)How many mangoes were sold that day?
10. There are enough chicken feeds to feed 360 chicken for 21 days. find how many more chicken would be needed for the same feeds to last 15 days

SECTION B

11. The figure below shows a rectangular piece of paper ABCD which has been folded a long EF such that C maps onto G.



Given that EC = 3cm and FC = 4cm, AB = (x + 2) cm and AD = (2x + 3) cm.
(a)Find
(i)The area of triangle ECF
(ii) an expressed for the area of shaded region ABFGED in terms of x.

(b)If the shaded area is 43cm², show that $2x^2 + 7x - 49 = 0$. Hence find the length of $\overline{AD}$

12. Using a pair of compasses and a ruler only,
(i)Construct triangle PQR, such that angle PQR = 60°, $\overline{QR}$ = 9.0 cm, $\overline{PR}$ = 8.5cm. Measure the length $\overline{QP}$,
(ii)Bisect the sides $\overline{PQ}$ and $\overline{PR}$, Produce the line bisectors to intersect at point M.
(iii)Using M as the centre, draw a circle to circumscribe triangle PQR. Measure the radius of the circle. Hence calculate the area of the circle. (Correct to 2 significant figures)

13. A retail trader ordered for shirts from a Kampala wholesale shop as follows;

	Size			
Colour	Small	Medium	Large	Extra large
Blue	0	40	20	0
Green	30	0	25	0
Yellow	0	20	0	10

Given below is the cost for each size of shirt.

	Size			
	Small	Medium	Large	Extra large
Cost (Ushs)	3000	3600	4200	4800

(a) Write down a
(i) 4 x 3 matrix for the order of the shirts made.
ii) 4 x 1 cost matrix.
(b) Given that the trader had to pay a tax of 17% of the cost of shirts purchased, find his expenditure on the order.

14. The table below shows the marks scored by 90 students in the test marked out of 50 marks.

Marks	Frequency(f)
15 - 19	1
20 - 24	13
25 - 29	29
30 - 34	25
35 - 39	19
40 - 44	3

(a)Represent the above on a histogram. Use your histogram to estimate the mode.
(b)Calculate the mean mark of the test using a working mean of 27.

15. A school has a teaching staff of 22 teachers. 8 of them teach Mathematics, 7 teach Physics and 4 teach Chemistry. Three teach both Mathematics and Physics and one teaches Mathematics and Chemistry. No teacher teaches all the three subjects. The number of teachers teaches who teach Physics and Chemistry is equal to that of those who teach Chemistry but not Physics.
(a) Represent the above information on the Venn diagram.
(b) Find the number of teachers who teach
(i) Mathematics only.
(ii) Physics only.
(iii) None of the three subjects.
(c)Find the probability that a teacher picked at random teaches only one or more of these subjects.

16. The distance between two towns A and B is 432 km. A lorry traveling at a steady speed of 72 kmh^{-1} leaves town A at 6.45a.m for town B. One and a half hours later, a minibus leaves town A at a steady nonstop speed of 108 kmh^{-1} heading for town B.
On the same axes show the journeys of the two vehicles (use scales of 2cm to represent 40km and 2cm to represent 1 hr)
Use your graph to estimate the:
Time and distance from town A when the minibus over takes the lorry.
Times when the two vehicles arrive in town A.
Differences in the time of arrival of the two vehicles.

17. A farmer plans to plant an 18hectare field with carrots and potatoes. The farmer's estimates for the project are shown in the table below.

	Carrots	Potatoes
Harvesting cost per hectare	Shs 95,000	Shs 60,000
Number of working hours	12 days	4 days
Expected profits per hectare	Shs 228,000	Shs 157,000

The farmer has only Shs 1,140,000 to invest in the project. The total number of working days is 120. By letting x represent the number of hectares to be planted, with carrots and y the number of hectares to be planted with potatoes,
(a) Write down inequalities for;
(i) Cost of the project
(ii) Working days
(iii) Number of hectares used in the project
(iv) The possibility that the field will at least be used for planting either carrots or potatoes.
(b) Write down an expression for the profit P, in terms of x and y
(c) (i) On the same axes plot graphs of the inequalities in a) and b) above, shading out the unwanted regions
d) Use your graph to determine how the farmer should use the farmer's maximum profit.

2003 PAPER TWO
SECTION A

1. With out using table or calculator, evaluate

$\left(\frac{1}{16}\right)^{\frac{-1}{2}} \text{x} \left(\frac{1}{64}\right)^{\frac{-1}{3}}$

2. Without using tables or calculator, evaluate $7.46^2 - 2.54^2$

3.Use logarithm tables to find the square root of 0.0576

4.Given that y is directly proportional to x^3 and that y is 250 when x = 10, find the equation connecting x and y. Hence find the value of y when x = 4

5.Given that A ={x: - 2 $\leq$x $\leq$1} and B ={x: 0 $\leq$x$\leq$ 5} represent A$\cap$B on a number line. State A$\cap$B.

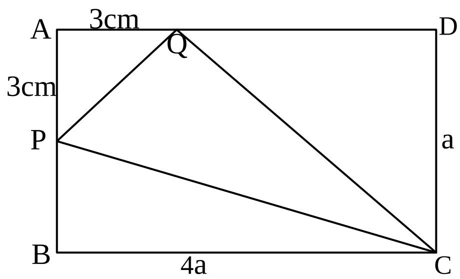
6.A student wrote $(p + q)^2$ as $p^2 + q^2$. Find the percentage error the student made in evaluating. $(p + q)^2$ when p = 7 and q = 3.

7. Lake of area 120 km^2 is represented by area of 4.8 cm^2 on a map. Find the length (in km) of a horizontal road measuring 6 cm on the map.

10. A box contains green, blue and red balls the probability of picking a green ball from the box is $\frac{1}{5}$ and that of a blue ball $\frac{1}{2}$. What is the probability of picking a red ball from the box?

SECION B

11. In the diagram ABCD is a rectangle in which BC = 4acm and CD = a cm. P and Q are points on AB and AD respectively. such that AP = AQ = 3 cm.



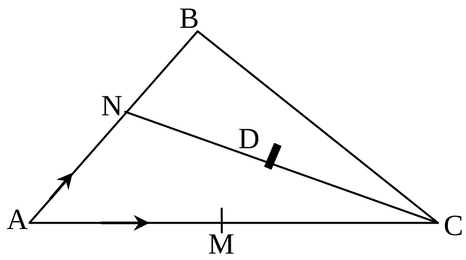
(i) Find the sum of the areas of the triangles BCP and CDQ in terms of a.
(ii) Given that the area of triangle PQC is 40.5 cm², find the value of a.
(iii) Express the area of triangle PCQ as a ratio of the area of the rectangle ABCD.

12. On the same coordinate axes, draw the curve $y = 4 - x^2$ for $-2 \leq x \leq 2$ and the line y = 1.
Show by shading the unwanted region, the region represented by
$y > 1$
$y < 4 - x^2$
Hence state the integral coordinates of the points which lie in the region $\{y > 1 \cap y < 4 - x^2\}$

x	-2	-1	0	1	2
4	4	4	4	4	4
$-x^2$	-4	-1	0	-1	-4
$x = 4 - x^2$	0	3	4	3	0

13.In a sport field, four points A,B,C and D are such that B = 18.8m, CD = 16.6m. <BAD = 60^0, < CDB = 40^0 and < BCD = 80^0. A vertical pole erected at D has a height of 4.8m.
(a)(i) Draw a sketch of the relative positions of the points on the sports field.
(ii) Using a scale of 1cm to represent 2m, draw an accurate diagram to show the relative position of the point and the pole.
(b)Find the
(i)distance BC and AD
(ii)Bearing of B from C.
(iii)Angle of elevation of the top of the pole from B.
(c)If an athlete runs from point A through points B, C and D and back to A in 16 seconds, find the athlete's average speed.

14. In a triangle ABC, M and D are mid pints of AC and CN respectively. N is a point on AB such that AN = 3NB
(a)If AB = p and AC = q, express the following vector in terms of vectors p and q
(i)AM
(ii)AN
(iii)ND
(b)Show that MD is parallel to AB and that MD: AB = 3 : 8

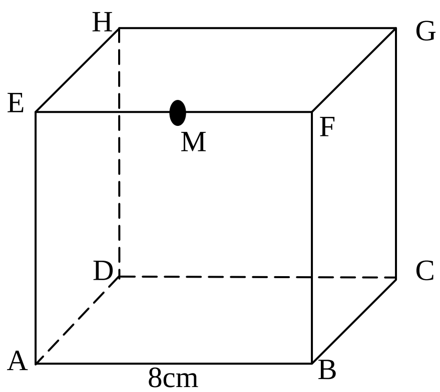


(i)

15. Town B can be reached using two different routes. Using a shorter route, it takes the driver 2hrs 26min. The driver covered the first xkm at an average speed of $54kmh^{-1}$ and then covered the remaining y km at an average speed of $37.5kmh^{-1}$ using the second route which is 5 km longer than the shorter route, it takes the driver 2hrs 12min at an average speed of $60kmh^{-1}$.
(i)Show that the time taken using the shorter route is given by the equation 25x + 36y = 3285.

(ii)Form an equation in terms of x and y that represents the time taken using the second route.
(iii)Find how long it would take a driver traveling at a steady speed of $65kmh^{-1}$ to move from town A to town B by the shorter route.

16. The diagram below shows a cube ABCDEFGH of sides 8cm and EM= MF. A tetrahedron AMHE is cut off the cube.



Find the :
Area of triangle HAM
Angle between HAM and the plane AEHD volume of the remaining part of the cube after the tetrahedron has been cut off

17. The monthly income tax system of the country is given as below

Basic pay (U Shs.)	Tax (%)
1st 0-150,000	Free
Next 15,1000-250,000	10.0
Next 251,000-350,000	12.5
Next 351,000-450,000	16.0
Next 451,000-550,000	22.5
Next551,000-650,000	30.5

An allowance in the excess of shs 80,000 is subjected to the tax of 25% of the monthly allowance. Two employees A and B are such that A earns a basic monthly pay of Shs. 355,000 and a top up allowance of Shs. 185,000 per month while B earns only a basic monthly pay of shs 540,000.
Who of the two employees pay more monthly income tax than the other and by how much ?
Express employee A 's income tax as a percentage of his monthly earnings
For employee A
Gross pay = 355,000/-
Allowances = 185,000/-

2004 PAPER ONE
SECTION A

1. Simplify $\dfrac{3^3 \times 9^2 \times 125^{1/3}}{9^3}$

2. If $\dfrac{\sqrt{2}}{\sqrt{3}+\sqrt{2}} = a + \sqrt{b}$,
Find the values of a and b

3. ABCD is a quadrilateral in which angles ABC and CDA are 90^0 each. If AB = 6cm AC = 10cm and CD = 5cm Find
(a) Length BC
(b) Angle ACD

4. Factorize $x^3 - 9xy^2$completely

5. Given that $A = \begin{pmatrix} 2 & 2 \\ 1 & 3 \end{pmatrix}$ and $B = \begin{pmatrix} 1 & 1 \\ 1 & 2 \end{pmatrix}$ Find
(a) The matrix P such that AB = P
(b) P^{-1}

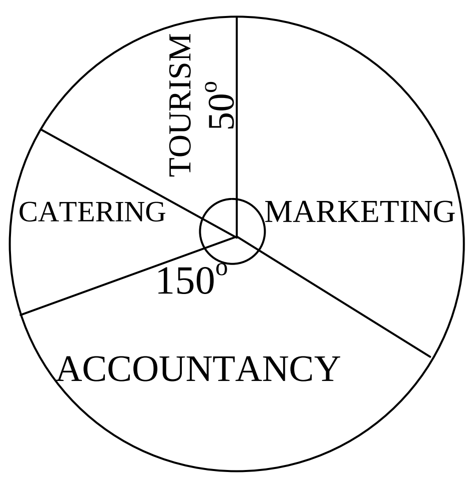
6. Use the fact that $\log_{10} 2 = 0.301$ and x = 4, to find the value of $\log_{10} x^2$

7. Given that $f(x) = \dfrac{x^2}{3} + 5$, find the value of x for which f(x) = 17

8. Find the equation of the line passing through the point (-1, 3) and (4, 2)

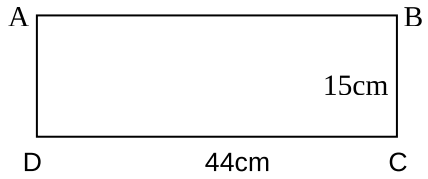
9. A food store has enough food to feed 200 students for 15 days. For how long will the foods last if 50 students join the group?

10. The pie chart below represents the number of students who attend various courses in a commercial college.



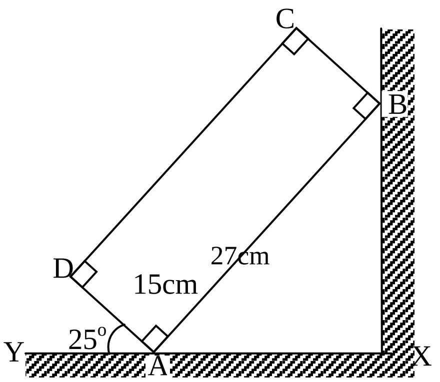
If the number of students studying accountancy is 120.
a)Determine the student population of the college.
b) Find the number of students who study marketing.

SECTION B
11. (a) The diagram below shows a rectangle ABCD of length 44 cm and width 15 cm.



If it was curved in such a way that AD and BC come together to form a hollow cylindrical figure, find the volume of the cylindrical figure formed.

(b) A rectangular piece of cardboard measuring 27cm long and 15cm wide rests against a vertical wall as shown in the diagram below.



If angle DAY = 25^0, find the length of C above.

12. Using a pair of compasses and ruler only
Construct triangle ABC such that BC = 10.6cm and angles ACB = 75^0 and
ABC = 60^0
Construct a cicumcircle of triangle ABC with O as its centre.
Measure lengths AB and AC and the radius of the circle.

13. Three secondary school football teams X, Y, and Z qualified for a football tournament which was played in two rounds with other teams. In the first round:
Team X won one game, drew one and lost three games.
Team Y won three and lost two games.
Team Z won two, drew and lost one game in the second round.
Team X won two, drew two and lost one game.
Team Y won four and drew one game while team Z won three games, drew one and lost one.

a) Write down
A3 × 3 matrix to show the performance of the three teams in each of the two rounds
A matrix which shows the overall
Performance of the teams in the two rounds
b) If three points are a warded for a win two points for a draw and no point for a loss, use matrix multiplication to determine the winner of the tournament
c) Given that Shs 475,000 is to be shared by the three teams according to the ratio of their points scored in the tournament. Find how much money each team will get.

14. The distance from town A to town B is 360 km An express bus leaves town A at 6:30a.m and travels at a steady speed of 80 kmh^{-1} towards town B. At the same time, a taxi Omnibus leaves town B traveling non-stop towards town A at a steady speed of $100kmh^{-1}$. On the same axes draw a distance time graph for the journeys of the two vehicles. Use a scale of 2cm to represent 1 hr and 2 cm to represent 50 kmh^{-1}.
From the graph;
Find the difference in the time of arrival of the bus and the taxi.
Determine when and at what distance from town A the two vehicles will meet.

15 A packet has 60 different vitamin tablets. Each tablet contains at least one of the vitamins A, B and C. Twelve of the tablets contain only vitamin A. Seven contain vitamin B only and eleven contain only vitamin C. Six contain all the three vitamins.
Given that
$n(A^1 \cap B \cap C)$ = $n(B^1 \cap A \cap C)$
= $n(C^1 \cap A \cap B)$
Find the:
Numbers of tablets that contain vitamin A.
Probability that a tablet picked at random from the packet contain vitamin C.
Probability that a tablet picked at random from the packet contains both vitamins A and B.

16. The table below shows the weight (in kg) of 40 students of a class and their corresponding cumulative frequencies.

Weight (kg)	Cumulative Freq.
30-34	2
35-39	7
40-44	12
45-49	21
50-54	28
55-59	34
60-64	38
65-69	40

a) Draw a cumulative frequency curve, use your graph to estimate the
Median weight of the students.
25^{th} and 75^{th} percentile weights
b) Calculate the mean weight of the students.

17. A private car park is designed in such a way that it can accommodate x pick-ups and y mini-buses at any given time. Each pick-up is allowed 15m² of space and each mini-bus 25m² of space. There is only 400m² of space available for parking. Not more than 35 vehicles are allowed in the park at a time. Both types of vehicles are allowed in the park. But at most 10 mini-buses are allowed at a time.

a) i) Write down all the inequalities to represent the above information.

ii) On the same axes plot graphs to represent the inequalities in (i) above, shading out the unwanted region.

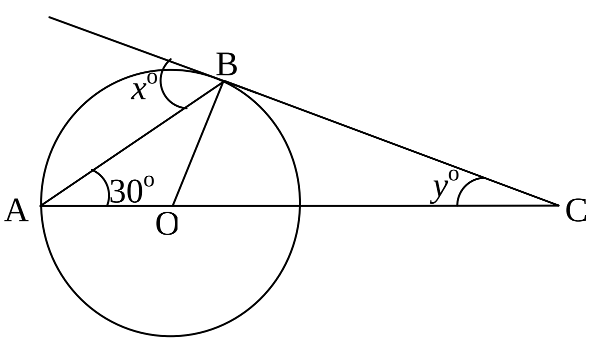
b) If the parking charges for a pickup is Shs 500 and that for a minibus is Shs 800 per day, find how many vehicles of each type should be parked in order to obtain maximum income. Hence find the maximum parking income per day.

2004 PAPER TWO
SECTION A

1.Express 784 as a product of prime factors. Hence find the square root of 784.

2.If the exchange rte of a Kenya shilling to Uganda shilling is 1K.sh =24Ush, and an American dollar to Uganda shillings is $ 1 = Ugh 1,950. How many American dollars would one get in exchange for Ksh 9,750?

3. In the diagram below, $\overline{BC}$ is a tangent to the circle with centre O and angle BAO = 30^o

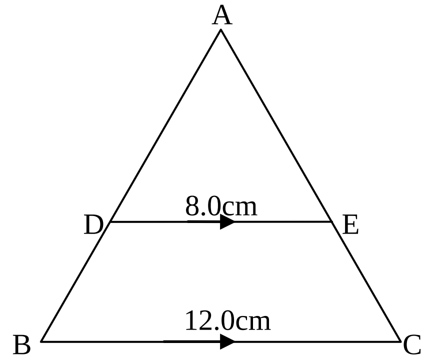


Find the size of the angle x and y.

4. Given that the representative fraction of a map is $\frac{1}{250,000}$, find the length of a horizontal road on the map whose length on the ground is 66.25 km long.
Solution:

5. The transformation described by the matrix $\begin{pmatrix} 2 & b \\ c & 3 \end{pmatrix}$ maps the point P(-1, 3) onto its image p¹(10, 8). Find the values of b and c

6. In the figure below, $\overline{DE}$ = 8.0 cm $\overline{BC}$ = 12 .0cm and $\overline{BD}$ = 5.0cm



Given that $\overline{DE}$ is parallel to $\overline{BC}$ find length $\overline{AD}$.

7. Solve the equation $3x^2 + 10x = 8$

8.Given that $133_n = 43_{ten}$, find the value of n.

9. A fair die with faces marked 1,2,3….,6 and a fair coin with one side showing a court of arms (C) and the other side a fish (F) are tossed together once. Construct a possibility space showing all the possible out comes.
Find the probability that a six and a fish will the show up.

10. The angle of depression of the sun's rays to a man's head is 14º. If the man whose height is 1.7m, is standing up right on horizontal ground. Find the length of his shadow correct to 2 significant figures.

SECTION B

11 (a) At the beginning of the year, a customer deposits sh 1,9000,00 in a bank which offers a compound interest rate of 2.75% per four months. Find how much interest he earned at the end of the year.

(b) A cooking oil factory offers a trade discount of 2% to its customer. It also offers a 1 % cash discount to its customer. It also offers a 1% cash discount to any customer who pays cash for the oil bought. If the factory price for a 20 litre jerrican of cooking oil is sh 30,000, find the amount of money a customer saves by paying for 100 jerricans for the oil.

12. The coordinates of the vertices of the triangle OAB are O (0, 0) A (1, 0) and B (1, 1)
a) Find the coordinates of the image formed when:

i) Triangle OAB undergoes a translation of $\begin{pmatrix}3\\2\end{pmatrix}$ to form $O^1A^1B^1$

ii) OAB is transformed by the matrix $\begin{pmatrix}-2 & 0\\0 & -3\end{pmatrix}$ to form $O^{11}A^{11}B^{11}$.

i) Plot triangle OAB and its images on the same graph

ii) Use your graph to find the area of $O^{11}A^{11}B^{11}$.

13. Two cyclists C_1 and C_2 start at the same time from trading centre P traveling to trading centre Q which are 24 km apart. Cyclist C_1 starts at a steady speed of 10kmh-¹ greater than that of cyclist C_2 who also travels at a steady speed. When C_1 has covered half the distance, he delays for three quarters of an hour, after which he travels at a speed 25% less his original speed and arrives in trading centre Q fifteen minutes earlier than cyclist C_2

a) Determine the speeds of cyclist C_1 and C_2.

b) If cyclist C_2 started from trading centre Q at the same time as cyclist C_1 started from trading centre P, both of them traveling non stop on the way, find how far from Q the two cyclists would meet. After how long would they meet?

14. a) Plot the graph of $y = 3x^2 + 2x - 16$ for values $x: -3 \le x \le 3$

(b) Use your graph to solve the equation

$3x^2 + 2x - 8 = 0$

15. The bearing of tower A from point O is 060^0 and that of tower B from O, 200^0 $\overline{OA}$ =24 km and $\overline{OB}$ = 33 km. Tower C is exactly half way between towers A and B.

Using a scale of 1 cm to represent 5 km, draw an accurate diagram showing the positions of the towers.

Use you diagram to find:

Distances $\overline{AB}$ and $\overline{OC}$.

The bearing of tower B from tower A.

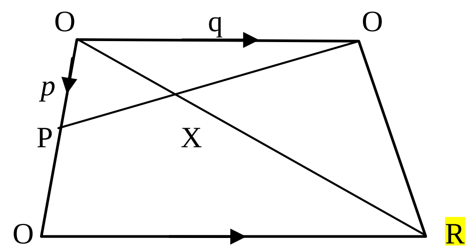
The bearing of tower C from O.

c)Find:

The average speed of a cyclist who takes $2\frac{1}{4}$ hours to travel directly from A to B.

How long it takes another cyclist to travel from A and B via O at a steady speed of 4.5kmh-¹ faster than that of the cyclist in c) i) above.

16. The diagram below shows a quadrilateral OSRQ. OS = q, OP = p and SX = k (SP)



i) Express vectors SP and OX in terms of p, q and k.

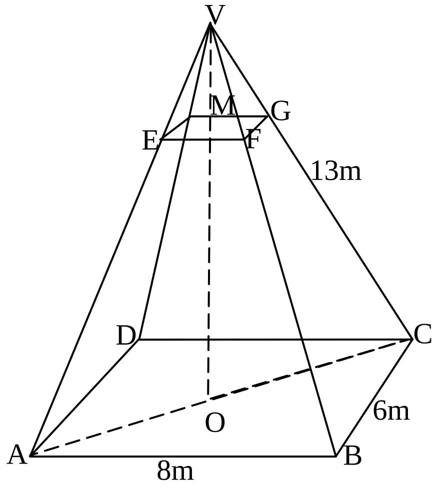
ii) If OQ = 3 p and QR = 2OS and OX = ℓ OR, find the values of k and l. hence find the ratio SX: XP

17. In the diagram below VABCD is a pyramid with a rectangular base ABCD and V, the vertex, O is the centre of the base ABCD.

$\overline{AB}$ = 8m, $\overline{BC}$ = 6m $\overline{VC}$ = $\overline{VB}$ = $\overline{VA}$ = $\overline{VD}$ = 13m.

M is a point on VO such that 3 MV = OV.

M is also the centre of base EFGH of a small pyramid VEFGH similar to VABCD which is to be cut off from the original pyramid VABCD.



Find the i) Dimensions of the base EFGH.

ii) Height of pyramid VABCD

iii) Volume of the remaining part of pyramid VABCD when VEFGH is cut off.

2005 PAPER ONE
SECTION A

1. Write down the next term of each of the given sequences.
 (i) 2, 3, 1,4, 0….
(ii) 1, 4, 20,120….

2. Without using tables or calculator, find the value of:
(i)cos 780^0
(ii)sin 390^0

3. With out using tables or calculator

Simplify $\frac{\sqrt{30}}{\sqrt{6}}+\frac{\sqrt{35}}{\sqrt{7}}$

4. At lunch time a certain hotel received 80 customers. Of these, 45 had a posho (P) meal and 50 had matooke (M).
(i) Represent this information in a Venn diagram.
(ii) Find the number of people who had a meal of the both P and M.

5. If the point (2,-1) undergoes a translation represented by the matrix $\begin{pmatrix}11\\-4\end{pmatrix}$, find the image of P.

6. Calculate the simple interest on Shs. 96,000 for 10 months at rate of 8 $\frac{1}{3}$% per annum.

7. Using mathematical tables, evaluate $(0.48)^{3/5}$ correct to 2 dp.

8. A stretch of land on a map of scale 1:15,000 has an area of 300cm². Determine the actual area of the land in km².

9. A floor measuring 6m x 4m is to be covered with square tiles measuring 50cm each. Find the cost of covering the floor, if the price of a dozen of tiles is Shs. 15,000.

10. Show that the points (3x,-2y), (2x, y) and (0,7y) lie on the straight line.

SECTION B

11. a) Express $x^2 + x - 12$ in the form $(x + a)^2 + b$. Hence solve the Equation $x^2 + x - 12 = 0$

b) Given that functions $f(x) = \frac{x+3}{2}$, and $g(x) = \frac{1-2x}{5}$, determine the values x for which

$fg(x) = \frac{9+24x+8x^2}{10}$

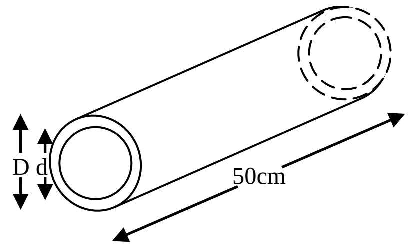
12 (a) Use matrix method to solve the following pair of simultaneous Equations.

$x + y = 3$
$3x - 2y = -1$

(b) A transformation maps (1, 2) onto (-1,4) and (2,3) onto (-1,7). Find the matrix of this transformation. Hence determine the image of (3, 0) under the transformation.

13. Using a ruler, pencil and a pair of compasses only,
Construct a triangle ABC such that $\overline{AB}$ =8.7 cm, $\overline{AC}$ =10.6cm and angle BAC=60º.
Inscribe a circle on the triangle ABC
Construct a perpenduindular from B onto $\overline{AC}$ to meet it at point D
Measure length $\overline{BC}$ and the radius of the cycle
Measure $\overline{AB}$ and calculate the area of triangle ABC.

14. The figure below shows a hollow pipe of external diameter 16mm, internal diameter 10mm and length 50cm.



i) Calculate the surface area (in cm²) of the pipe correct to 2 dp. (use π = 3.142)
ii) What would be the surface area of a similar pipe of length 150cm, external diameter 48mm and internal diameter 30 mm?

15. The table below shows the marks obtained in a chemistry test by 54 students in certain school.

54	49	60	58	54
60	51	57	56	54
53	59	56	52	55
57	62	54	54	56
48	51	52	55	58
65	55	54	57	61

a)Using class width of 3 marks and starting with the class of 48-50 make a frequency distribution table.
b) Use your table to
(i) Draw a histogram.
(ii)Determine the median and mean mark.

16. a) Okello bought 3 pens and 2 rulers from a bookshop at shs. 3,150. Mukasa bought 2 pens and 3 rulers from the same bookshop at shs. 2,850.
i) Find the cost of each pen and a ruler.
ii) If Mugisha spends sh 6,000 to buy n pens and n rulers. Find the value of n.

b) A pick up van can be bought by cash at Shs. 8,750,000 or can be bought on hire purchase by paying 25% deposit of cash price and 12 monthly installment of sh. 600,000 per month.
Calculate
(i) Cost of pick up by hire purchase.
ii) Extra money paid for the pick-up by hire purchase than by cash.

17. A transport company has 8 lorries of 8 tonnes carrying capacity each, and 5 lorries of 10 tonnes

capacity each. There are 12 drivers available. The company was contracted to transport 480 tonnes of cement from the factory to a town on a given day. The 8-tonne lorries can make 6 journeys in a day. The costs of using an 8-tonne lorry and a 10-tonne lorry are sh. 40,000 and sh. 60,000 respectively. Write down the inequalities to represent the above information.
Plot a graph for the inequalities, shading out the unwanted regions.
From the graph, find the number of 10- tonne and 8-tonne lorries the company used, keeping its costs as minimal as possible.

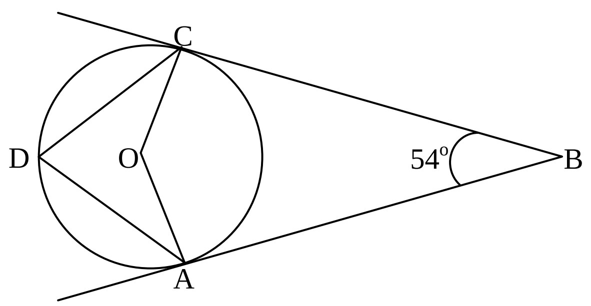
2005 PAPER TWO
SECTION A

1. Find the highest common factor of 18, 45 and 42.

2. When thirty times a number is increased by 32, the result is equal to twice the square of the number. Find the number.

3. If the exchange rate for a French Franc to a pound sterling is £1=9.00 francs and £1 pound = \$1.53 (American dollars), find how many American dollars one would get in exchange for 1,000francs.

4. In the diagram below O is the centre of the circle. $\overline{AB}$ and $\overline{CB}$ are tangents to the circle. Angle ABC = 54^0



Find angle ADC

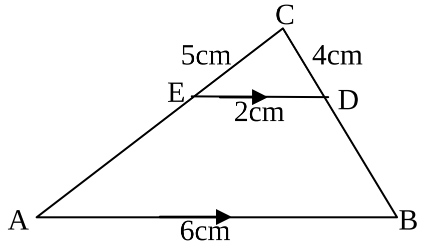
5. The representative fraction of a map is $\frac{1}{250,000}$.
Find the area of a lake (in km²) which is represented on the map by an area of 4.6 cm^2 .

6. If $135_n = 75_{ten}$ find the value of n

7. Use matrix to solve the pair of simultaneous equations.

$2x - y = 8$
$4x - 3y = 14$

8. In the figure ABC, $\overline{AB}$ = 6cm, $\overline{ED}$ = 2cm, $\overline{CD}$ = 4cm and $\overline{CE}$ = 5cm.



If $\overline{ED}$ is parallel to $\overline{AB}$, find length $\overline{AE}$

9. A fair coin with one side showing court of arm (A) and other side showing a cow (C) is tossed twice. Find the probability that at least a cow (C) will show up in the two tosses.
10. The angle of elevation of the top of the flag pole to a policeman of height 1.7m is 20°. If the policeman is standing at a distance of 16m from the pole on level ground, find the approximate height of the flag pole, correct to 2 significant figures.

SECTION B

11. Mr Lwanga and Okot were each given Uganda shillings 980,000 at the beginning of 1999. Mr. Lwanga exchanged his money to United States dollars and then banked it on his foreign currency account at a compound interest rate of 2% per annum, while Mr Okot banked his money without exchanging it at a compound interest rate of 12% per annum. The exchange rates in 1999 and 2000 were Ug. Shs. 1,250 and Ug. Shs.1,500 to a dollar respectively. If Mr Okot withdrew sh. 120,000 at the end of 2000.

(i)Calculate the amount of money (in Ug. Sh) each man had in the bank at the end of 2000.
(ii)Who had more money and by how much?

12. Two cyclists C_1 and C_2 begin traveling at the same time from town A to town B, 18 km apart. C_1 travels at a steady peed of 15 kmh^{-1} faster than that of cyclist C_2 who also travels at a steady speed. When C_1 has covered half the distance, he delays for half an hour, after which he travels at a speed 20 % less his original speed. He arrives in town B 15 minutes earlier than cyclist C_2.
Determine he speeds of the two cyclists C_1 and C_2.
If cyclist C_2 started from town B while C_1 at the same time started from town A and all the two travel non stop, determine the distance from town A where the two cyclists will meet. After how long will they meet?

13. Using suitable scales, plot on the same axes the graphs of $y = 2x^2$ and $y = \frac{5x}{2}+5$

For $-2 \le x \le 3$. Use your graphs to estimate the solutions of the equations.

i) $4x^2 - 5x - 10 = 0$

ii) $6x^2 + 10x - 30 = 0$ Correct to 2dp

14. Town B is 100km away from town A on bearing of 135^0. Town D is on a bearing of 090^0 from town B, 124km apart. Town C 160 km away from town D is on bearing 030^0 from D.

Using a scale of 1cm to represent 20 km, make an accurate drawing to show the relative positions and distances to towns A, B, C, and D.

Determine the:

Shortest distance and bearing of town C from A.

Distance and bearing of town B from town C.

15. a) Find the image of the points A(1,4) B(1,1) and C (2,1) of a triangle ABC under a transformation L whose matrix is $\begin{bmatrix}-1 & 0\\ 0 & 1\end{bmatrix}$

(ii) Plot triangle ABC and its image $A^1B^1C^1$ on the same graph. Describe the matrix transformation L. Hence deduce the matrix transformation which would map triangle $A^1B^1C^1$ onto triangle ABC. b) Triangle $A^1B^1C^1$ is mapped onto triangle $A^{11}B^{11}C^{11}$ by matrix transformation

$M=\begin{bmatrix}1 & 0\\ 0 & -1\end{bmatrix}$

(i) Find the coordinates of $A^{11}B^{11}C^{11}$

(ii) Plot $A^{11}B^{11}C^{11}$ on the same graph in (a)(ii) above. Use your graph to describe a single transformation that will map triangle ABC onto triangle $A^{11}B^{11}C^{11}$. Hence find the single matrix transformation which maps triangle ABC onto $A^{11}B^{11}C^{11}$.

16. In a triangle OAB, OA = a, OB = b, A Point L is on the side AB and M on the side OB.OL and AM meet at S. AS = SM and OS = $\frac{3}{4}$OL

Given that OM = x OB and AL = y AB

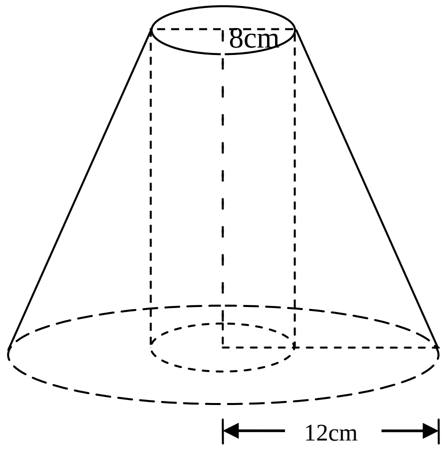
Express the vectors

i) AM and OS in terms of a, b, and x

ii) OL and OS in terms of a, b and y

Hence find x and y

17. The figure below shows part of a solid right circular cone whose original height was 20 cm before part of its top was cut off the radius of the base is 12 cm and that of the top is 8cm a circular hole of radius 8cm was drilled through the center of the solids a shown



Calculate the volume of the remaining solid (Use $\pi = 3.142$)

2006 PAPER ONE
SECTION A

1. Simplify $\frac{(12)^{3/2} x (16)^{\frac{1}{8}}}{(27)^{1/6} x (18)^{1/2}}$

2. Solve for x in the equation $(x + 2)(x-4) - x^2 < -6$

3. Express $\frac{1+\sqrt{3}}{2+\sqrt{3}}$ in the form a + b$\sqrt{3}$.

Hence evaluate $\frac{1+\sqrt{3}}{2+\sqrt{3}}$ correct to 3 significant figures

$\sqrt{3} = 1.732$

4. A trader made a 35 % profit after selling a goat at h 45,900. How much profits did the trader get?

5. Simplify ℓog 75 + 2 ℓog 2 - ℓog3.

6. Find the values of a and b such that

$\begin{pmatrix}3 & b\\ 4 & a\end{pmatrix}\begin{pmatrix}-7a\\ 2\end{pmatrix} = \begin{pmatrix}43\\ 30\end{pmatrix}$

7. A line of gradient $\frac{7}{9}$ passing through the point Q(3,4) cuts the y- axis at a pint P. Find the coordinates of P be (0,y).

8. The height of a small box is 2cm and its volume $10cm^3$ if the height of a similar box is 6cm what is its volume

9. The points A, B, and C and D are on the circumference of a circle of center O and < ADC = 30^0 find the values of the marked angle a and b

SECTION B

11. Shown below are marks obtained by 50 candidates in a certain S.4 mathematic mock examination.

25	30	29	60	72	59	40	40	62	70
40	39	62	65	40	59	39	43	80	21
58	29	19	25	30	32	56	59	40	55
69	90	81	50	31	45	60	20	51	49
31	30	56	58	50	50	50	60	40	70

(a) (i) Construct a grouped frequency table having class intervals of 10 mark, beginning with the 15 — 24 class group.
ii) Use your grouped frequency table to calculate the mean mark of the mock examination.
(b) Represent the above results on a histogram and use it to estimate the mode.

12. a.(i) Plot on a graph the triangle ABC whose vertices are (1, 1),(3,2) and (2,4) respectively.
(ii) On the same graph enlarge the triangle ABC using (-1,-1) as the center of enlargement and a scale factor of 2 to obtain its image $A^1B^1C^1$.
iii) State the coordinates of $A^1B^1C^1$ the image of triangle ABC.
(b) Using your graph, find the area of the triangle ABC. Hence, determine the area of the triangle $A^1B^1C^1$.

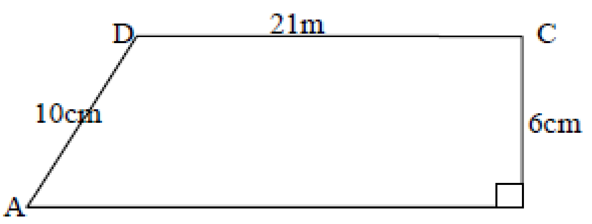
13. Using a pair of compasses and ruler only:
(a) Construct triangle ABC, such that $\overline{AB}$ = 10.0cm, $\overline{BC}$ = 9.2cm, < ABC = 105^0,
(i) measure length $\overline{AC}$.
(b) (i) construct an inscribed circle of triangle ABC with centre O,
(ii) Measure the radius of the circle.

14. A poultry farm has three units A, B, C. Unit A produces 30 trays of eggs and 20 broiler every month. Unit B produces 40 trays of eggs and 15 broilers and unit C 35 trays of eggs and 10 broilers during the same period. If a tray of eggs cost shs 3,000 and a broiler shs 4,000.
(a) (i) represent the above information in matrix form of order 3 x 2 for the eggs and broilers,
(ii) Form a 2 × 1 cost matrix produced on the farm for the eggs and broilers,
iii) Find the sales of the farm if all eggs and broilers were sold.
b) If the farm charges a 17% VAT, find the total income from the sales of the farm every month.

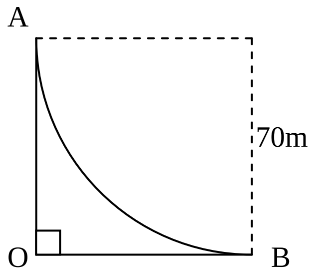
15.a) An FM radio commercial section charges fees for any radio announcements as follows:
The first ten word shs 5,000 and any additional word shs 100 each.
Find the total charge for the announcement below:
"Mr. John Musoke the chair man organizing committee of the wedding preparatory meetings of Mr James Lima and his Miss Vanesa Tukko announces the collection of the wedding meetings which were scheduled to begin on Wednesday 11^{th} august 2004 at Kalori Gardens national theater Kampala. Any inconveniences caused are highly regretted. A new date and venue for the meeting will be announced later. "
b) Mr Ronald Anguyo bought a car at shs 4,500,000. The car depreciates at rate of 12 % per annum. After 2 years, Ronald decided to sell the car to his friend at 25% less of the value of the car then. Find the price at which his friend bought the car.

16. At a graduation party, the guests are to be served with beer and soda. At least twice as many crates of beer as crates of soda are needed. A crate of beer contains 25 bottles and a crate of soda contains 24 bottles. More than 200 bottles of beer and soda are needed. A maximum of shs.50, 000 may be spent on beer and soda. Assume a crate of beer costs shs 40, 000 and that of the soda costs shs 15,000.
(a) (i) Form inequalities to represent the above statements.
(ii) Represent the above inequalities on the same axes.
(iii) By shading the unwanted region, represent the region satisfying the inequalities in (a) (i) above.
a)From your graph, find the number of crates of beer and soda that should be bought if the cost is to be as low as possible.
Find the amount that was paid for these crates of beer and soda.

17.



The figure ABCD shows a plot of land in form of a trapezium. Length BC = 6cm, CD =21m and DA = 10m
a) Find the:
i) Length BA of the plot.
ii) Area of the plot.
b) The diagram below shows road AO interesting road OB at 90^o at point O. The two roads are also connected to A and B by an arc-like shaped road measuring a quarter of a circle 70 m in radius.



Find the distance saved by motorists who goes through the arc shaped road instead of going through AO and OB

2006 PAPER TWO
SECTION A

1. Simplify i) $1\frac{1}{4}+2\frac{1}{2}-1\frac{3}{4}$

ii) $2\frac{1}{2}\text{x}3\frac{2}{3}\div 1\frac{5}{6}$

2. Solve for x in $\frac{x^2}{2}=\frac{4}{x}$

3. An examination is marked out of 130 marks. If Rita obtained 60 % in the examination, how many marks did she get out of 130?

4. Given that P $\{(x, y):2x - 3y \le 6)\}$ and Q= $\{(x, y): x + y < 0\}$, show by shading the unwanted region the region representing PQ.

5. Use logarithm tables to evaluate

$$\frac{22.60}{47.80\text{x}0.329}$$

Correct to 2 decimal places

6. Evaluate 5600 $\div$ 80,000 leaving your answer in the form a x 10^n where $1 \le a < 10$ and n is an integer.

7. In the home work marked out of 20, a group of pupils obtained the following marks: 15,20,18,17,8,18,16,20,18,17,12 and 19. Find the mode and median marks.

8. Under an enlargement of scale factor 3 the image of the point P (0, 3) is P^1 (4, 5).
Find the coordinates of the centre of enlargement.

9. Express 0.38 as a fraction in its simplest form
10) A fair die is tossed only once and the number which appears on its top face noted. What is the probability of a top face showing
i) a number greater than 4?
ii) an old number or prime number?
SECTION B

11. Draw graphs $y = 2x^2 + 3x - 3$ and $y - 7x + 3 = 0$ for $-3 \le x \le 3$ using a scale of 1cm 2 units for the vertical axis and 1 cm 0.5 units for the horizontal axis. Using your graph, find the:
a) Point of intersection of the line and the curve,
b) Gradient of the curve between the points of intersection of the line and the curve.

12. (a) At a certain point on the level ground the angle of elevation of the top of a tower, T, is 28^0. At another pint 100 metres away from the first point, the angle of elevation is 35^0. Find the two expressions for the height of the tower, hence find the height of the tower, and give your answer to the nearest metre.
(b) If cos x = −0.634 for $90^0 < x < 270^0$, find the two possible values of x.

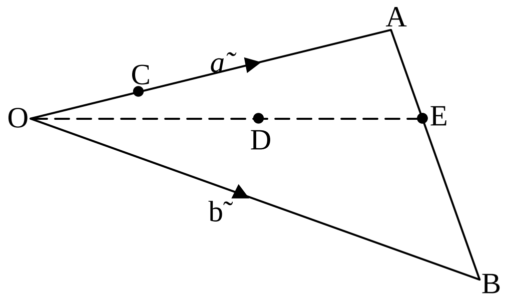
13. A helicopter left Kampala at 0600 hours and flew on bearing of 090^0 at a velocity of 300kmh^{-1}. It landed at Nairobi airport at 0830hours. At exactly 0900 hours, it left Nairobi airport and flew on a bearing of 340^0, at the same original velocity. It then landed at Kitgum Airstrip at 1200 hours. Using graphical construction and a scale of 1cm: 100km, find the:
a) Distance of Kitgum from Kampala,
b) Bearing of Kampala from Kitgum.

14. Two cars A and B start off from rest at the same time moving in the same direction on a straight road. The speeds of the two cars in ms^{-1} are shown in the table below:

T(s)	0	2	4	6	8	10	12
Speed of car A(ms^{-1})	0	4.5	9.0	13.5	18.0	22.5	27.0
Speed of car B(ms^{-1})	0	2.0	5.0	10.5	23.0	27.0	28.5

Using a suitable scale, draw on the same axes the velocity time graphs of cars A and B. From your graph find the:
a) Time when the two cars have equal speed and the magnitude of that speed
b) Difference in speed after a period of 9 seconds,
c) Distance covered by cars A by way of estimating the area under the curve described by car A for the 12 seconds.

15. OAB is a triangle, OA = a and OB =b. Points C and E are points on lines OA and AB such that they divide the lines OA and AB in the ratio 1: 2 and 3 : 1 respectively. Point D lies on OE such that OD = 2DE



a) Find the vector AB and CB in term of vectors a and b.
b) Show that the pints B, D, C lie on a straight line.

16. A man earns a gross annual income of shs 10,500,000. He is entitled to the following monthly allowances:

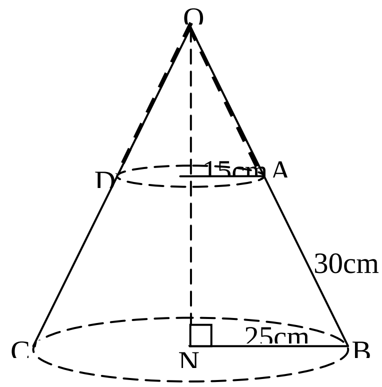
Children	Shs 15000 for each child aged 12 & below. Shs 12,000 for each child between age 13 & 18 inclusive
Lunch	Shs 60,000
Transport	Shs 110,000
Medical	$\frac{1}{10}$ th of gross monthly income.
Marriage	$\frac{1}{25}$ th of gross monthly income.
housing	$\frac{1}{100}$ th of gross annual income

The man is married with five children of whom two are aged 12 and below, the other two aged 21 and 24 and the other aged 17. The following tax structure is a applicable on the taxable income in excess of shs 30,000

Taxable income (shs)	Rate(% ages)
00001 -30,000	Free
30,001-130,000	8.0
130,001-260,000	14.5
260,001-380,000	23.0
380,001-490,000	28.5
490,001- 590,000	35.0
590,001 and above	42.5

(NB: A month has 30 days and a year 360 days)
Calculate:
a) The man's i) total monthly allowance,
ii) Monthly taxable income,
iii) Monthly income tax.
b) The percentage of his gross annual income that goes to tax.

17.



The figure above (in thick heavy lines) shows a lamp shed ABCD bounded by circles of radii 15cm and 25cm. The slanting side AB is 30cm. If the lamp shed was cut from an original figure OABCD, of a complete cone,
calculate the:
(a). (i) slanting length of the cone OAB,
(ii) The angle formed by producing CD and BA to O.
b.(i) vertical height of the lamp shed,
ii) Volume of the lamp shed.

2007 PAPER ONE
SECTION A

1. Express 2.36 as an improper fraction in its simplest form

2. If a = 14, b =8 and $\frac{a}{c} + \frac{a-1}{2c}$ = b, find the value of c.

3. A line is given by the equation 45 – 15x + 3y = 0. Find the co-ordinates of its x – intercept.

4. Given that f(x) = 2x + 4 and g(x) = x + 5, find fg(x). Hence evaluate fg(4).

5. Expand the expression: $a\left(1-\frac{ax}{2}\right)^2$

6. A butcher sells 5 kg of meat at Shs 10,000. If the cost of meat is increased by 20%, find the weight of meat which can be bought at Shs 3,600.

7. The data given below represents the ages in years of 30 senior four students of a certain school:

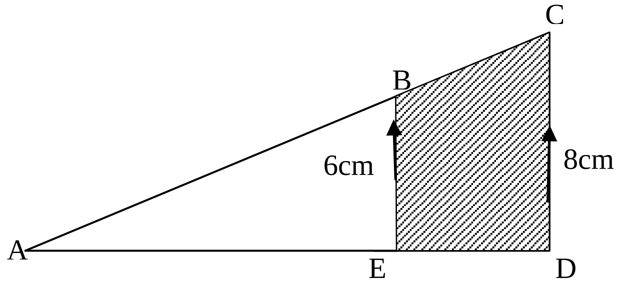
Ages	15-17	18-20	21-23	24-26
No. of students	7	11	9	3

Use the table above to draw a histogram and state the modal class.

8. Triangle ABC with vertices A(0,0), B(1,0) and C(1,1) underwent two transformations represented by T_2T_1. If T_1 is a translation represented by $\begin{pmatrix} 2 \\ 3 \end{pmatrix}$ and T_2 is a reflection in the x-axis, find the coordinates of the final image of the triangle.

9. Given A = $\begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$ and

10. Study the diagram below:



If AD = 12cm, find the area of the shaded region.

SECTION B

11.a) Given that $\frac{1}{3x-4} + \frac{x}{x+1} = 1$, solve for x.

b) Solve the simultaneous equations

$x^2 + 4y^2 = 4$

$y = x - 1$

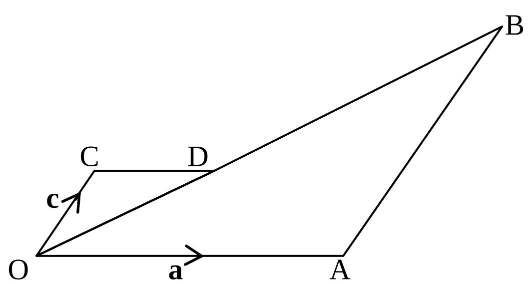
12. Using a pencil, a ruler and a pair of compasses only, construct a triangle ABC in which $\overline{AB} = 9.2$ cm, angle CAB = 45^0 and angle ABC = 75^0.

a) Measure the length of $\overline{BC}$.

b) Draw a circumscribing circle through the points A, B and C.

c) Measure the radius of the circle.

13 a) In the figure below, vectors OA = a and OC = c, $\overline{CD} = \frac{1}{3}\overline{OA}$ and $\overline{AB} = 3OC$.



(i) By expressing vectors in terms of a and c.Find OD, AB and OB.

(ii) Show that points O, D and B are collinear.

b) Points A and B have coordinates (0,-1) and (-6, 7) respectively.

Find:

(i) AB

(ii) the magnitude of AB

14. In a certain school, a sample of 100 students was picked randomly. In this sample, it was found out that 78 students play Netball (N), 82 play Volleyball (V), 53 play tennis (T) and 2 do not play any of the three games. All those that play tennis also play Volleyball. 48 play all the three games.

(a) Represent the given information on a venn diagram.

(b) How many students play both Netball and Volleyball but not tennis?

(c) If a student is picked at random from the sample, what is the probability that the students play two games only?

15. a) Draw a table showing the values of sin 2θ for $0^0 \leq \theta \leq 90^0$, using values of θ at intervals of 15^0

(b) Use the table in a) above, a horizontal scale of 2cm for 15^0 and a vertical scale of 2cm for 0.5 units to draw a graph of sin 2θ.

(c) From the graph find the values of θ for which sin 2θ = 0.6.

16. A manager of an industry earns a gross salary of Shs. 2,000,000 per month, which includes an allowance of Shs. 500,000 tax free. The rest of her income is subjected to an income tax which is calculated as follows:

7.5% on the first Shs 800,000

12.5% on the next Shs 500,000

20% on the next Shs 100,000

30% on the next Shs 60,000

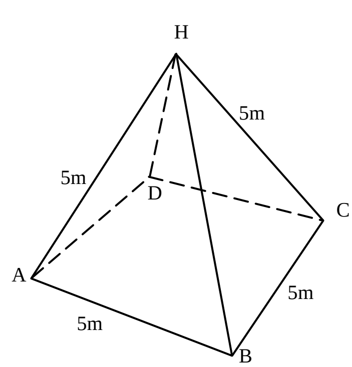
35% on the remainder.

(a) Find her taxable income

(b) Calculate her monthly income tax.

(c) Express her monthly income tax s a percentage of her monthly gross salary.

17. In the figure below, ABCDH is a right pyramid on a square base ABCD of side 5m. Each of the slanting edges is 5m.



Calculate the:
a) Height of the pyramid, correct to two decimal places.
b) Angle between the plane HBC and the base.
c) Volume of the pyramid, correct to one decimal place.

2007 PAPER TWO
SECTION A

1. If $a * b = \frac{a}{b} + \frac{b}{a}$ evaluate $\frac{1}{2} * \frac{2}{3}$.

2. Make c the subject from the expression:
$a = b - \left(\sqrt{b^2 + c^2}\right)$

3. The point R (10, 7) is reflected in the line y = x to give point S. Given that M is the mid-point of RS. Find the co-ordinates of M.

4. Find the area of a triangle whose sides are 13 cm, 24cm and 13cm.

5. Given the sets:
A = {all natural numbers less than 30}
B = {all prime numbers between 10 and 30}
Find:
(a) $n(A \cap B^1)$
(b) $n(A^1 \cap B)$
Where B^1 stands for the complement of the set B.

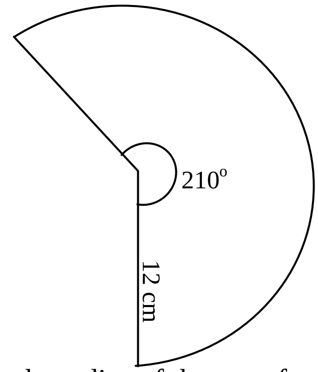
6. If $\begin{pmatrix} 2 & 4 \\ -3 & 3 \end{pmatrix} + k\begin{pmatrix} 3 & 1 \\ 0 & n \end{pmatrix} = \begin{pmatrix} 8 & 6 \\ -3 & -1 \end{pmatrix}$,
Find the values of k and n.

7. Use the prime factor method to find the cube root of 3375.

8. In a Revenue Authority Department, the tax earned income is calculated as follows:

The first Shs. 120,000 is tax free and the remaining income is taxed at 25%. Find the tax payable on an earned income of :
a) Shs 100,000,
b) Shs 440,000.

9. Given that V is inversely proportional to t^2 and V = 25 when t = 2, find V when t = 5.
10. The figure below shows a net of a cone which can be folded to form a right circular cone.

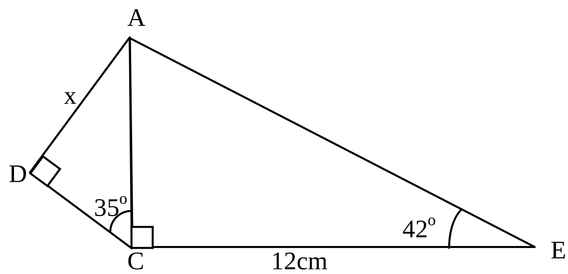


Calculate the radius of the cone formed.

SECTION B:

11. a) Given that $212_n = 25_{nine}$.
Find the base that n represents.
b) A positive integer r is such that $Pr^2 = 168$, where p is such that $3 \leq p \leq 5$. Find the integral values of r.

12. a) Find the length marked x in the diagram below correct to two significant figures.



b) A dog tied a silk rope 4.5m long is tethered to a tree stamp 2.5m from a straight path. For what distance along the path is one in danger of being bitten by the dog?

13. By shading the unwanted regions, show the region which satisfies the inequalities.
$x + y \leq 3$
$y > x - 4$
$y + 7x \geq -4$
Find the area of the wanted region

14. The table below shows the weight in kilograms of 28 children sampled in a Primary School:

Weight (kg)	Number of children
15-19	2
20-24	4
25-29	7
30-34	3
35-39	5
40-44	6
45-49	1

a) State the modal class

b) (i) Calculate the cumulative frequency and hence, estimate the median weight correct to one decimal place.
ii) Calculate the mean weight of the children
iii) Find the probability that a child selected at random from the school weighs 40 kg and above.

15 (a) Musa is a businessman who deals in an agricultural produce business. He visited four markets in a certain week:
In market A he bought 3 bags of beans, 5 bags of maize, 10 bags of potatoes and 3 bags of millet.
In market B, he bought 1 bag of beans, 4 bags of potatoes and 2 bags of millet,
In market C, he bought 5 bags of beans, 1 bags of maize.
In market D he bought 4 bags of beans, 3 bags of maize, 6 bags of potatoes and 1 bag of millet.
He bought each bag of beans at Shs. 45,000, a bag of maize at Shs 30,000, a bag of potatoes at Shs 15,000 and a bag of millet at Shs 50,000. He later sold all the produce he had bought at Shs. 50,000 per bag of beans; Shs 35,000 per bag of maize, Shs 18,000 per bag of potatoes and Shs 55,000 per bag of millet.

a) Form a 4×4 matrix to show the produce Musa bought from the four markets.

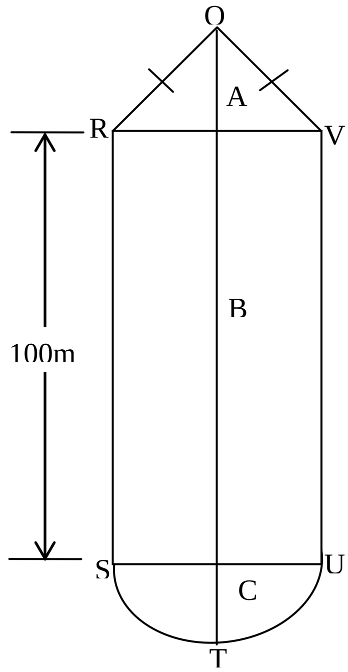
b) i) Form a cost matrix for the price of the produce,

(ii) By matrix multiplication, find the amount of money spent on the produce in each market.

(c) Find also the amount of money he got from the sale of the produce.
(d) Find Musa's profit.

16. Town A is 170 km from B. A Tata lorry left town B for town A at 8:25am and traveled at a steady speed of 40kmh^{-1}. A saloon car left town A for town B at 8:55am and traveled at a steady speed of 80 kmh^{-1}.
a) Calculate the:
i) distance from town A to the point at which the two vehicles met.
ii) time at which the two vehicles met
b) Just as they met, the Tata lorry driver increased the speed by 10kmh^{-1}. Find the difference in their times of arrival at their destinations.

17. The figure QRSTUV below, is a plan of Mr. Rukidi's farm. The area marked A is in form of an equilateral triangle, area B is rectangular and C is a semi- circle. $\overline{RQ}$ = 14m and $\overline{RS}$ = 100m



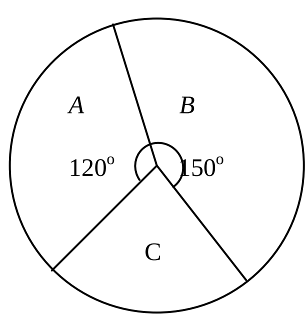
Find the:
(a) length $\overline{QT}$ which divides the farm into two equal parts,
(a) area of the farm,
(b) length of barbed wire required to fence Rukidi's farm.

2008 PAPER ONE
SECTION A

Answer all questions in this section

1. Find the Lowest Common Multiple (LCM) and the Highest Common Factor (HCF) of 54 and 84.

2. The Pie-chart represents yields of beans from three fields A, B and C.



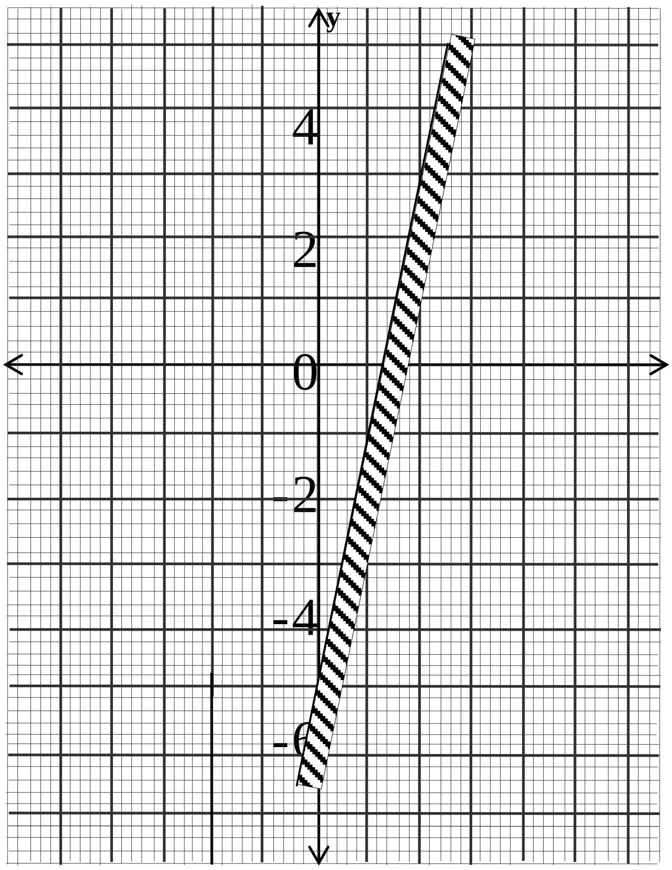
If the total yield of beans was 300 sacks, calculate the number of sacks got from field C.

3. Express $2\log_3 18 + \log_3 3^{-1} - \log_3 6^2 + 1$ as a single logarithm $\log_3 Q$.

4. Given that $P = \begin{pmatrix} 3 & 1 \\ -1 & 3 \end{pmatrix}$, find a matrix P^{-1} such that $PP^{-1} = I$ where I is the identity matrix of

order 2.

5. Study the graph below:



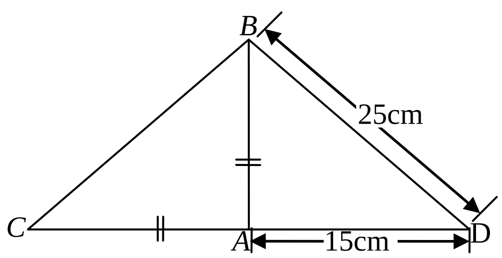
Find the inequality representing the shaded region.

6. Evaluate $\left(\frac{16}{81}\right)^{-3/4}$

7. Solve for w: $\frac{1}{5}(w + 6) - \frac{1}{15}(2w - 5) = \frac{1}{3}(1 - w)$

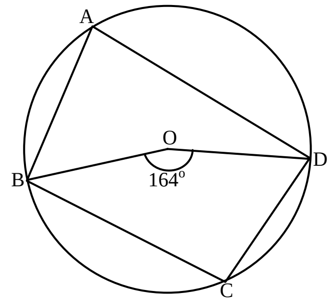
8. Given that f(x) = 2x – 5, find:
(a) f(-2),
(b) $f^{-1}(x)$

9. In the triangle BCD, AD = 15cm, BD = 25cm, AB = AC and AB is perpendicular to CD.



Find the length of CB (ie BC) correct to one decimal place.

10. In the diagram below, O is the centre of the circle and angle BOD = 164°.



Find:
(a) angle BAD,
(b) angle BCD.

SECTION B:

11. (a) The points (-1, q) and (r, 2) lie on the line y = 2 – x. Find the values of q and r.

12. (a) Adikini bought a television set for which the cash price was Shs 599,000. She bought the television set on a hire purchase scheme and had to pay an extra Shs 71,000. If she made eight equal monthly installments, how much did she pay per month?
(b) Mukasa wants to buy a house which is priced at Shs 56,000,000. A deposit of 25% of the value of the house is required. A bank will lend him the rest of the money at a compound interest of 15% per annum and payable after two years.
Calculate the:
(i) Deposit Mukasa must make.

13. A club held swimming tests in Crawl (C), Backstroke (B) and Diving (D) for 72 members. Those who passed Crawl were 49, 30 passed Backstroke and 30 passed Diving. 5 passed Crawl and Backstroke but not Diving. 4 passed Backstroke and Diving but not Crawl. 6 passed Crawl and Diving but not Backstroke. 14 passed all the three tests.
(a) Draw a Venn diagram to represent the given information.
(b) Use the Venn diagram to find the members who:
(i) Passed the Crawl test only.
n(C only = 24
(ii) Did not pass any test
(c) If a member is picked at random, what is the probability that the member passed two tests only?

14. Given that the point A has co-ordinates (-8, 6).
Vectors AB = $\begin{pmatrix} 12 \\ 4 \end{pmatrix}$ and M is the mid-point of AB.
(a) Find the:
(i) column vectors AM,
(ii) co-ordinates of M,
(iii) magnitude of OM.

(b) (i) Draw the vector AB on a graph paper

15. (a) A unit square whose vertices are O(0,0), I(1, 0), J(0, 1) and K(1, 1) is transformed by rotating through a positive quarter turn about the origin. Find the matrix for this transformation.

b) Given T = $\begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$ and M = $\begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix}$, find the:

(i) Image of the points A (0, 3) and B (5, 3) under the transformation TM.

(ii) Matrix of transformation which will map the images of A and B back to their original positions.

16. (a) Copy and complete the table for the equation $y = 2x^2 – 3x – 7$.

(b) Plot the points (x, y) obtained from the completed table on a graph paper using 2cm to represent 1 unit on the x – axis and 1cm to represent 1 unit on the y - axis

Hence draw a graph for $y = 2x^2 – 3x – 7$.

(c) Use your graph to solve the equation: $2x^2 – 3x – 8 = 0$.

17. (a) The dimensions of a rectangle are 60cm by 45cm. If the length and width are each reduced by 10%, calculate the percentage decrease in area.

(b) A container has a volume of 6400cm^3 and a surface area of 8000cm^2. Find the surface area of a similar container which has a volume of 2700cm^3.

2008 PAPER TWO
SECTION A

Answer all questions in this section

1. Simplify: $\dfrac{1\frac{1}{2} - \left(8\frac{1}{3} \div 2\frac{1}{2}\right)}{1\frac{1}{5} \text{ of } \left(1\frac{1}{4} + 1\frac{2}{3}\right)}$

2. Factorize completely:
$2p^2q^3 - pq^3 + pq - 2p^2 q$

3. Simplify: $\dfrac{3\times10^{-3}\times\left(6\times10^{5}\right)^2}{80}$. Give your answer in standard form.

4. Given the vectors **QR** = $\begin{pmatrix} 2 \\ 4 \end{pmatrix}$, **ST** = $\begin{pmatrix} 1 \\ 6 \end{pmatrix}$ and **SR** = $\begin{pmatrix} -4 \\ 3 \end{pmatrix}$, find the vector **QT.**

5. If $\dfrac{4^x \times 2^y}{2^{x+2y}} = 2^p$ express p in terms of x and y.

6. Given that
D = {All odd numbers less than 20} and
M = {All multiples of three less tan 20},
find n(D $\cap$ M).

7. Find the equation of the line of gradient $\dfrac{-3}{5}$ and passing through the point (3, 4).

$5y = -3x + 9 + 20$
$5y = -3x + 29$
$y = \dfrac{-3}{5}x + \dfrac{29}{5}$

8. A farm is on a piece of land whose area is 5.6km². What would be the area of this farm in cm² on a map whose scale is 1:40,000?

9. A forex Bureau buys one US dollar at Ug.shs1,900 and sells one pound sterling at Ug.shs3,450. Atim wants to exchange 3,000US dollars to pound sterlings. How many pounds sterling will she get?

10. Two points A (5, 1) and B (6, 0) are given a transformation defined by the matrix $\begin{pmatrix} 3 & 1 \\ 1 & 0 \end{pmatrix}$. Find the co-ordinates of their images.

SECTION B:

11. (a) A man gave half of his welfare allowance to his wife, $\frac{1}{5}$ to each of his two sons and the rest to his daughter.
Find:
(i)The fraction given to the daughter
(ii)His welfare allowance if each son was given Shs. 16,000.

(b) The difference between the values of y when x = 10 is 16. Given that y is inversely proportional to the square of x, find the equation relating x and y.

12. The table below shows the weights in kilogrammes of thirty pupils.

48	44	33	52	54	44
53	38	37	35	53	46
59	51	32	37	49	42
48	59	52	40	54	46
45	62	35	54	48	35

(a) Construct a frequency table with a class width of 5 staring from the class of 30 – 34.

(ii) Draw a histogram and use it to estimate the modal weight of the pupils.

N

13. Four students; Kale, Linda, Musa and Naana went to a stationery shop.
Kale bought 4 pens, 6 counter books and 1 graph book.
Linda bought 10 pens and 5 counter books.
Musa bought 3 pens and 3 graph books.

Naana bought 5 pens, 2 counter books and 8 graph books.
The costs of a pen, a counter book and a graph book were shs 400, shs 1,200 and shs 1,000 respectively.
(a) (i) Write a 4×3 matrix for the items bought by the four students.
(ii) Write a 3 x 1 matrix for the costs of each item

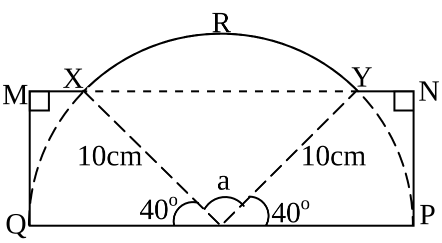
(b) Use the matrices in (a) to calculate the amount of money spent by each student.

(c) If each student was to buy 4 pens, 10 counter books and 6 graph books, how much money would be spent by all the four students?

14. (a) The lines $ax + 2y = 3$ and $ax - by = 5$ intersect at (1, 2). Find a and b.

ermine the values of x and y.

15. In the figure below, QXRYP is a semi-circle centre O and radius 10cm. MN is parallel to the diameter QP. Angle XOQ = 40^o.

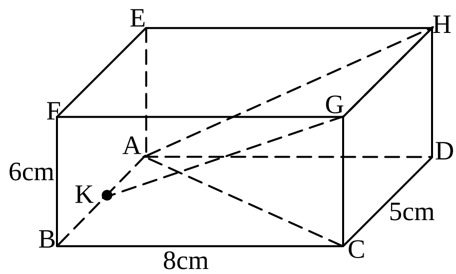


Find the
(a) length of:
(i) the arc XRY. [Take $\pi = 3.14$]
(ii) MQ
(iii) MX
(b) Perimeter of the given figure.

16. A school constructed an office block which required 34 tonnes of sand. The school hired a lorry and tipper trucks with capacities of 7 tonnes and 5 tonnes respectively to transport the sand. The cost per trip either by lorry or by tipper truck was shs30, 000. The money available for transportation was shs.180, 000. The trips made by the lorry did not exceed those made by tipper truck.

(a) If x and y represent the number of trips made by the lorry and the tipper truck respectively;
(i) Write down five inequalities to represent the given information.
(ii) Plot these inequalities on the same axes, shading the unwanted regions.
(b) (i) From your graph in (a) (ii) above, list all the possible numbers of trips, that each vehicle can make so as to maximize the total tonnage of sand transported.
(ii) Find the number of trips by each vehicle that made the greatest total tonnage.

17. The Figure below shows a cuboid ABCDEFGH in which BC = 8cm, BF = 6cm and CD = 5cm. K is the mid-point of AB.



Find the:
(a)(i) length AG.
(ii) Angle which AG makes with the plane ABCD
(b) Angle between planes KGH and FGHE

<Between AG and ABCD

2009 PAPER ONE
SECTION A

1.Use factors to evaluate
$617\times793 + 786 \times 793 + 597 \times793$

2. Determine the solution of the inequality
$x^2 - x - 6 \quad < \quad 0$

3. Given that log p = 2.476 and log q = 1.811
Find $\ell og\left(\frac{p}{q^2}\right)$

4. Solve for p in the equation
$$\frac{4p-1}{3} - \frac{3p-1}{2} = \frac{5-2p}{4}$$

5. Find g(3) given that $g^1(x) = \frac{x+1}{x}$

6. Evaluate $\frac{(y^2)^{1/6}}{(9x)^{1/2}}$ when x = 16 and y = 8

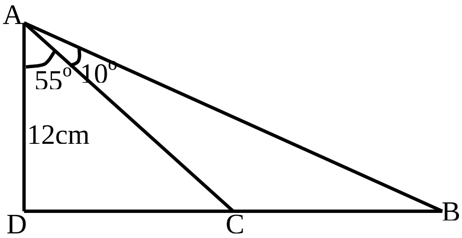
7. Given matrix $A = \begin{pmatrix} 2 & 3 \\ 5 & 7 \end{pmatrix}$, find a matrix B such that $A + B = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$

8. The table below shows the number of goals scored by a team in a series of football matches.

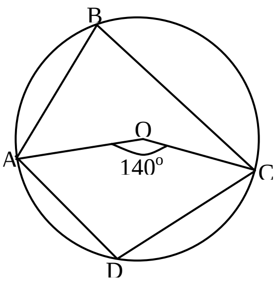
Number of goals	1	2	3	4	5
Number of matches	3	4	1	x	2

If the mean number of goals is 3, find x

9. Find the length of BC in the diagram below



10. In the figure below, O is the centre of the circle and angle AOC = 140°



Find
(i) angle ABC
(ii) angle ADC

SECTION B

11. A group of 55 students were asked if they liked the food; matoke (m), posho (p) or rice ®. 19 liked matoke, 24 liked posho, and 25 liked rice. 3 liked matoke and rice only. None of the students liked matoke and posho only. 4 students disliked all foods.
(a) Represent the given information on a Venn diagram
(b) find the number of students who liked;
(i) All the three types of food
(ii) Matoke only
(iii) Posho only
(iv) Rice only
(c) Find the probability that a student selected at random from the group liked only one of the foods

12. Triangle ABC with vertices A (2, 1), B (4, 4) and C (2, 4) is reflected in he line y = 0 to get triangle $A^{11}B^{11}C^{11}$
(a) (i) draw the three triangle on the same graph paper
(ii) Write down the coordinates of $A^1B^1C^1$ and $A^{11}B^{11}C^{11}$

13.(a) given the points P(2,4) and Q (-4 ,8), find the
(i) coordinates of the mid point of the line segment $\overline{pQ}$
(ii) Equation of the line with gradient $\frac{3}{2}$ passing through the midpoint of $\overline{pQ}$
b) Find the coordinates of the point of intersection of the line y – 5x = 2 and the curve $y = 2x^2 + 5$

14. A motor company had an advertisement as shown below:

EASY TERMS ON SALOON CARS MADE IN JAPAN
CASH: SHS. 8.5 MILLION
CASH DISCOUNT: 8% OF THE CASH VALUE
HIRE PURCHASE: DEPOSIT 60% OF THE VALUE AND PAY 7 MILLION PER MONTH FOR 3 MONTHS

a)Calculate the saving Chris would make if he bought the vehicle by paying cash rather than by hire purchase.
b) Chris bought the vehicle by hire purchase and then sold it at 35 million after one year.
Find the percentage loss he made.

15. (a) Copy and complete the table below

x	-2.0	-1.5	-1.0	-0.5	0	0.5	1	1.5	2	2.5	3
$2x^2$	-8		-2	-0.5	0			-4.5	-8		-18
3x	-6		-3	-1.5	0			4.5	6		9
6	6	6	6	6	6	6	6	6	6	6	6
y	-8		1	4	6			6	4		-3

(b)(i) Use the complete table in (a) above to draw a graph of $y = 6 + 3x - 2x^2$ for values of x for $-1 \leq x \leq 3$.
Use 2cm to represent one unit on the x-axis
And 1cm to represent one unit on the y-axes
(ii) On the same axes, draw a line whose equation y = 2x
(c)Use the graph in (b) above to solve the equation
$6 + x - 2x^2 = 0$

16. Given the vectors a = $\begin{pmatrix} -2 \\ 7 \end{pmatrix}$, b = $\begin{pmatrix} 8 \\ 11 \end{pmatrix}$ and c = $\begin{pmatrix} 4 \\ -5 \end{pmatrix}$, find:
(i) a + 2b + c
(ii) the length of a + 2b + c
(b) the position vectors of D and F are $\begin{pmatrix} 6 \\ 4 \end{pmatrix}$ and $\begin{pmatrix} 12 \\ -11 \end{pmatrix}$ respectively. M is on $\overline{DE}$ such that $\overline{DM} : \overline{DE} = 2:3$.
Find:
(i)DE
(ii)DM

(iii)The position vectors of M

17. A rectangle of length $(4x - 1)$ cm and breadth $2x$ cm has an area of 10 cm².
Find:
a)the value of x
b) its length and breadth
c)its perimeter

2009 PAPER TWO
SECTION A

1.Simplify $\dfrac{3\frac{1}{6}+1\frac{2}{3}}{\frac{2}{3}\times\frac{5}{12}}$

2. Find the equation of a line which passes through the point (0,5) and is parallel to the line $3x - y = 7$

3. Given $A = 2\pi\sqrt{\dfrac{C}{B}}$
(i) Express B in terms of A, π, and C
(ii) Find the value of B if C = 240, π =3.14 and A = 12.56

4. If set F = {All factors of 12} and set T = {All triangle numbers less than 20}
F = {1, 2, 3, 4, 6, 12}
Find the members of $F \cap T$. Hence find $n(F \cap T)$.

5. Factorize completely $2ab - 3 + 2a - 3b$

6. A translation T maps A (−2, 3) onto A^1 (−6, 10). Find the image B^1 of B (5, 4) under the translation T.

7. Express $\dfrac{1}{\sqrt{5}-\sqrt{2}}$ with a rational denominator

8. The price of an article is shs 24,000/=. If a discount of 12% is given, calculate the selling price of the article.

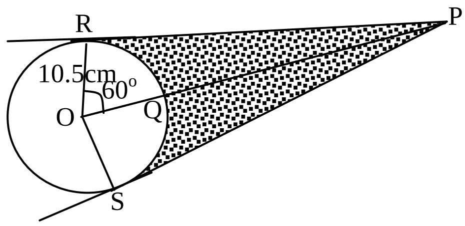
9. Given that $OA = \begin{pmatrix}-2\\2\end{pmatrix}$, $OB = \begin{pmatrix}8\\4\end{pmatrix}$ and M is a point on $\overline{AB}$ such that $\overline{AB} : \overline{MB} = 1 : 1$ find
(i) AB
(ii) AM

10. If an area of 4cm² on a map represents an area of 576km² on land, find the Representative Fraction (R.F) of the map?

SECTION B
11. (a) The ages of Lacor and Nankya are in the ratio 4 : 1. After 6 years. The ratio of their ages will be 5 : 2. Find their present ages.

(b) Ouma takes 20 days to plough a garden. Mukasa takes 30days to plough the same garden. How long will take the two men to plough the garden if they worked together ?

12. The diagram below shows a circle with centre O and radius 10.5cm . Two tangents PR and PS are drawn from a point ouside the circle. Angle POR = 60^0 and PO = intersects the circle at Q



Calculate the;
(a) length the tangents
(b) area bounded by the tangents and are SQR.
$\left(\text{Use}\pi = \dfrac{22}{7}\right)$

13. A group of students obtained the following marks in a Math test.

28	35	94	78	70	56	57
58	60	76	77	62	84	66
67	68	69	70	51	64	73
74	75	61	62	54	80	83
88	90	41	47	64	70	75

a) (i) Form a grouped frequency table for the data starting from the Class 20−29.

(ii) Represent the marks obtained in the Math test on a bar chart

a)(i)

Marks	Tally	f	x	fx
20 − 29	/	1	24.5	24.5
30 − 39	/	1	34.5	34.5
40 − 49	/	2	44.5	89
50 − 59	##	5	54.5	272.5
60 − 69	## ##	10	64.5	645
70 − 79	## ##	10	74.5	745
80 − 89	////	4	84.5	338
90 − 99	//	2	94.5	189
		$\sum f = 35$		$\sum fx = 23375$

14. (a) Solve the following simultaneous equations
$x - 2y = 12$
$x = 12 + 2y$
(b) In a certain supermarket, a school bag costs B shilling and a pair of shoes costs S shillings. Kato bought 3 school bags and 2 pairs of shoes at shs 103,000 and Atim bought 5 school bags and 1 pair of shoes at shs 132,000.
Find the cost of :

(i) a school bags
(ii) a pair of shoes
(a) Using substitution method
y + 3x = 1
y + 3x = 1

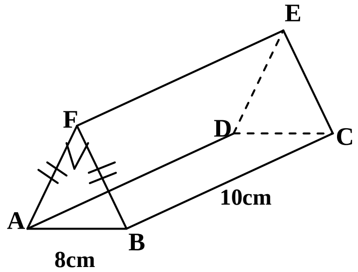
15. A bicycle factory assembles two types of bicycles; Roadmaster and Hero on different assembly lines. An assembly line for Roadmaster occupies an area of 60m² and that of Hero occupies an area of 30 m² of the floor space. The floor space available for all the assembly lines is 420 m². The assembly line for Roadmaster needs 10 men to operate it and that of Hero needs 16 men to operate it. The assembly lines need a maximum of 120 men to operate them.
(a) If x and y represents the number of assembly lines for Roadmaster and Hero respectively.
(i) From four inequalities to represent the given information.
(ii) Draw graphs on the same axes to represent the inequalities in (i) a above. Shade the un wanted regions.
(b) The assembly line for Roadmaster produces 30 bicycles per day and that of Hero produce 20 bicycles per day. Find the:
(i) Number of assembly lines for each type of bicycle that should be operated so as to produce the highest total number of bicycles per day
(ii) Highest total number of bicycles that can be produced per day

16. (a) Find the values of x and y given that:

$$(1\ 3\ 2)\begin{pmatrix} 4 & 3 \\ x & 2 \\ 10 & y \end{pmatrix} = (39\ 25)$$

(b) Given that matrix $\begin{pmatrix} 2 & -2 \\ -3 & 4 \end{pmatrix}$, find a matrix Q such that PQ = $\begin{pmatrix} 2 & 0 \\ 0 & 2 \end{pmatrix}$. Hence find the inverse of matrix P

17. The figure below shows a prism ABCD with an isosceles right – angled triangle as the cross – section and a horizontal rectangular base ABCD.



Calculate the
(a) Lengths of
(i) AF
(ii) BE
(b)angle between BE and the base ABCD
(c) Volume of the Prism

2010 PAPER ONE
SECTION A

1. If $125_n = 85_{ten}$, find n

2. In a group of 29 girls, 22 liked Rice (R) and 18 liked Matooke (M). All the students like at least one of the foods. How many liked both?

3. Solve the inequality: $10 - 3x < 4(x - 1)$.

4. Without using mathematical tables or a calculator, evaluate:

$$\frac{21.35 \times 41.35 - 21.35^2}{0.02}$$

5. Two quantities y and x are related by the equation y = a + bx. When y = 4, x = 2 and when y = 6, x = 4. Find the values of a and b.

6. Given that $\sin\alpha = \frac{3}{5}$ and α is abtuse, without using mathematical tables or calculator, find the values of cosα and tanα.

7. A shopkeeper bought an item at Shs.5,500 and sold it at 30% more than the buying piece. Find the shopkeeper's:
(a) Selling price,
(b) Profit.

8. Given the matrix P = $\begin{pmatrix} -5 & 6 \\ -2 & 2 \end{pmatrix}$, find P².

9. Use tables or logarithms to evaluate:

$$\frac{0.0875 \times 0.0243}{0.003142}$$

10. Solve the following pairs of simultaneous equations:

$$5x - 9y = 1$$
$$4y - 2 = x$$

SECTION B

11. The following table shows marks obtained by 40 pupils in a Mathematics test.

11	17	35	34	42	45	28	46
16	21	14	36	41	31	49	37
20	33	37	38	18	38	39	27
26	28	40	33	43	32	29	47

29 32 41 24 44 35 36 23

(a) Draw a frequency distribution table for marks starting with a class of 10 − 14.

(b) State the
 (i). class interval,
 (ii). Modal class.

(c) Calculate the:
 (i). mean mark,
 (ii). Median mark.

12. (a) (i) Determine the range corresponding to the domain {-3, -2, 0, 1, 3, 4} for mapping $x \rightarrow x^2 + 1$

(ii) Represent the mapping in (i) on an arrow diagram.

(b) Given the functions $h(x) = x + 2$, $g(x) = x^2$ and $f(x) = -x$; find the values of x for which $g[h(x)] = f(x)$.

13. A triangle with vertices A(2, 4), B(6, 4) and C(1, 6) undergoes two successive transformation P_1 and P_2. The transformation P_1 is represented by the matrix $\begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$ and P_2 by matrix $\begin{pmatrix} 0.5 & 0 \\ 0 & 0.5 \end{pmatrix}$.

(a) Find the coordinates of the vertices of:

(i)Triangle $A'B'C'$ the image of ABC under P_1,

(ii) Triangle $A''B''C''$ the image of ABC under P

(b) Show on the same axes the three triangles. ABC, $A'B'C'$ and $A''B''C''$.

(c) Use your graph in (b) a above to describe fully the transformations represented by

(i) P_1,

(ii) P_2.

14. (a) A student had his photograph of dimensions 30cm by 20cm framed with uniform border. If the area of the border is 216cm², how wide is the border?

(b) A cone has a radius of 7cm and vertical height of 30cm. Find:

(i) it's volume,

(ii) the volume of another similar bigger cone which has linear scale factor 2. [use $\pi = \frac{22}{7}$]

15. (a) Find the equation of the line passing through point (2, 0) and perpendicular to the line joining points $(^-10, 3)$ and $(6, ^-9)$

(b) A triangle PQR has vertices with coordinates P(3, −1), Q(7, 6) and R(0, 2). Find the equation its line of symmetry.

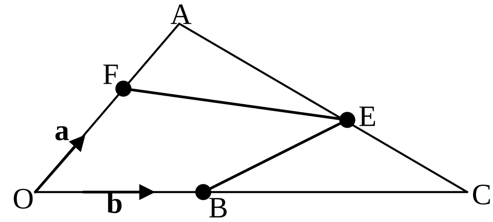
16. A hawker sells handkerchiefs at Shs500 each. He sold 50 handkerchiefs in the first week. In the second week, he sold 20% more than in the first week. In the third week he sold 10% more than in the second week. Each week he receives a commission of 8% on the price of the first 20 handkerchiefs sold, and 12% for any handkerchief sold in excess of 20.

(a) Express the number of handkerchiefs sold in the 3rd week as a percentage of the number sold in the first week.

(b) Calculate the commission he received in the third week.

(c)If in the fourth week the hawker received a commission of 2,000/-, calculate the number of handkerchiefs he sold in that week.

17. In the diagram below, OA =a, OB = b, $\overline{OB} = \overline{BC} = 1 : 3$, 3OF = 2OA and E divided AC in the ratio 3: 2.



Express the following vectors in terms of a and b:
 (a) BC.
 (b) CA
 (c) BE
 (d) FE

2010 PAPER TWO
SECTION A

1. Express 0.341666… in the form p/q, where $q \neq O$

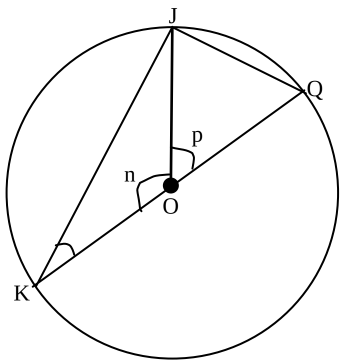
2. Solve for x in $32^{3/5} \div x^{\frac{1}{2}} = 2$

3. Given two points P (4, 5) and Q (-2, 9), find the equation of the line through P and Q.

4. Simplify $\sqrt{20} - \sqrt{45} + \sqrt{125}$. Give your answer in the form $a\sqrt{b}$ where a and b are constants.

5. A rectangle 6cm long and 5cm wide is enlarged so that its area becomes 270cm². Find the linear scale factor of the enlargement.

6. In the figure below, O is the centre of the circle, angle JKQ = 40° and KOQ is a straight line.



Find the angles marked n and p.

7. Give that **a** = $\begin{pmatrix}-2\\-9\end{pmatrix}$, **b** = $\begin{pmatrix}7\\2\end{pmatrix}$ and m = **a** + 2**b**, find the magnitude of m.

8. If $n = x\sqrt{\left(\frac{2}{4m^2-1}\right)}$, express m in terms of n and x.

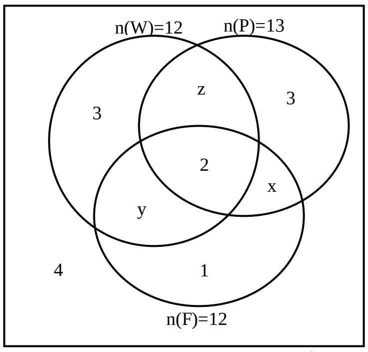
9. A function $f(x) = \frac{3}{1-x^2}$. Find the values of x for which f(x) = 4.

10. Three girls; Auma, Asiimwe and Nakato shared Shs.10,500. Nakato got twice as much as Asiimwe and Asiimwe got twice as much as Auma. Find how much money Asiimwe got.

SECTION B

11. A speed-boat sets off from an island M on a bearing of 080° to an island X at an average speed of 150kmh $^{-1}$. Island X is 450 km from island M. At X, it alters its course to a bearing of 200° and maintains the average speed of 150kmh $^{-1}$ for 3 hours until it reaches island Y. It then moves to island P which is west of island M at an average speed of 200kmh $^{-1}$. Island P is 400 km from island M.
(a) Using a scale of 1cm to represent 50km, construct a scale drawing to show the route of the speed-boat.
(b) Use the scale drawing in (a) above to find the distance PY.
(C) Calculate the
(i) total time taken for the speed-boat to move from M to P.
(ii) speed-boat's average speed for the whole journey.

12. The Venn diagram below shows the members of a District Council who sit on three different committees of works (W), Production (P) and Finance (F).



(a) Determine the value of x, y and z
(b) Find the total number of members who
(i) make up the District Council
(ii) belong to more than one committee
(c). Given that a member is selected at random from the District Council, find the probability that the member belongs to only two committee.

13. (a) Express $\frac{2}{x+4}+\frac{4}{x-3}-\frac{4(x+4)}{x^2+x-12}$ in the form $\frac{a}{(x+b)}$.
(b) A mini-bus travels from Migyera to Kampala, a distance of 156km, at a certain average speed of Vkm/hr. On the return journey, it increases the average speed by 4km/hr and takes 15 minutes less. Find the average speed V from Migyera to Kampala.

14. The table below shows the time (t) in seconds and velocity (V) in m/s of an object.

t(s)	0	1	2	3	4	5	6
V(m/s)	0.0	1.0	1.7	2.0	1.7	1.0	0.0

(a) Using a scale of 2 cm to represent one second on he horizontal axis and 4 cm to represent 0.5 m/s on the vertical axis, plot the values of t and V and join the points with a smooth curve.
(b). Use your graph in (a), to find the
(i) times at which the speed of the object is 0.8m/s,
(ii) acceleration of the object when the time is 2 seconds.
(c). If the total distance covered by the object was 7.5m, what was its average speed?

15. (a) Without using mathematical tables or calculator, find the value of
$2\log_{10}50+\log_{10}80-\log_{10}2$.
(b) (i) Find the prime factors of 150.
(ii) Use your result in (i), find $\log_{10}150$, given that $\log_{10}5 = 0.6990$, $\log_{10}3$ = 0.4771 and $\log_{10}5 = 0.6990$

16. (a) Solve the following simultaneous equations using the matrix method.
$$5x + 2y = 5$$
$$3x - 0.2y = 10$$

(b) Given that $P = \begin{pmatrix} 2 & -1 \\ 3 & -2 \end{pmatrix}$, $Q = \begin{pmatrix} 1 & 5 \\ 2 & -3 \end{pmatrix}$ and $R = \begin{pmatrix} 4 & 3 \\ 1 & -2 \end{pmatrix}$, find:

(i) $QR - P$,
(ii) the determinant of $QR - P$.

17. Mr. Oketcho's monthly salary is shs900,000 which includes the following allowances:

Water and electricity	20,000
Relief and insurance	30,000
Housing allowance	50,000
Medical allowance	25,000
Transport allowance	28,000
Marriage allowance	20,000
Family allowance	(for only 4 children):
– From 0 to 9 years	20,000 per child
– From 9 to 16 years	15,000 per child
– Over 16 years	10,000 per head

Mr. Oketcho has five children; two of whom are aged between 0 and 9 years, one aged 14 years and the other two are over 16 years. The income tax structure is shown in the table below:

Taxable income per month in shilling	Tax rate %
01 – 50,000	10.0
50,001 – 110,000	20.0
110,001 – 200,000	24.5
200,001 – 350,000	35.0
350,001 – 600,000	40.0
Above 600,000	49.0

(a). Calculate Mr. Oketcho's
(i) taxable income,
(ii) income tax.
(b). Express the income tax as a percentage of his monthly gross salary.
Note: In order to maximize allowance(minimize taxable income), the elder child is NOT considered, because his allowance is minimal.

2011 PAPER ONE
SECTION A

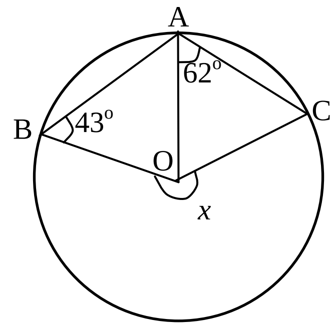
1. Make p the subject of the formula

$$s = \frac{3x}{2y - p} - 1$$

2. Solve for n in the inequality

$$\frac{n+1}{2} - \frac{n-3}{4} < \frac{n-2}{3}.$$

3. In the figure below O is the centre of the circle. Angle ABO = 43^o and angle OAC = 62^o.



Find the value of x.

4. Point A(0,3) is reflected in the line $y + x = 0$. Find the coordinates of its image A'.

5. A box contains 5 black balls and 3 red balls. Two balls are randomly picked one after the other without replacement. Find the probability that both balls are red.

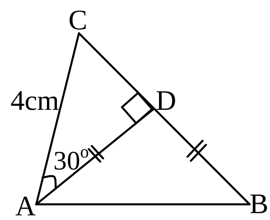
6. Given that $a * b = ab^2$, find the value of
(i) $2 * 5$
(ii) a if $a * 3 = 63$.

7. Solve the equation: $2x^2 + x - 1 = 0$

8. Find the inverse of matrix

$$B = \begin{pmatrix} 5 & 4 \\ 3 & 2 \end{pmatrix}.$$

9. In the figure below, AD is perpendicular to BC, AD, Ac = 4 cm and angle CAD = 30^o.



Find the length of AB.

10. Use the grouped frequency distribution below to answer the question that follow.

Class	Frequency	Cumulative frequency
30-39	19	-
40-49	21	-
50-59	19	-
60-69	2	-
70-79	08	-
80-89	01	-

(a) Complete the cumulative frequency column.
(b) Determine the medium class.

SECTION B

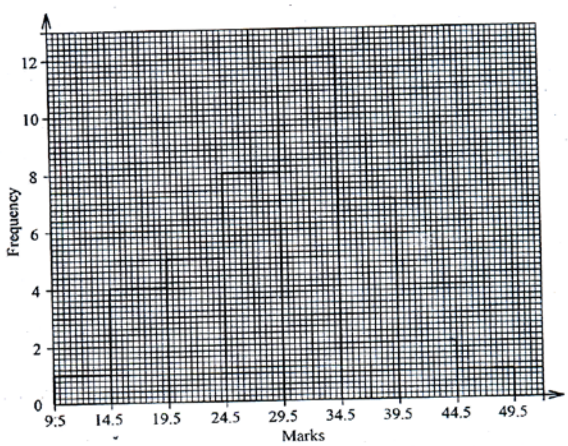
Answer any five questions from this section.

All questions carry equal marks.

11.(a) Given that $a^2 - b^2 = 16$ and $a + b = 8$, determine the values of a and b.
(b)Two taxis, a Nissan and a Toyota transported students from Jinja to Kampala When the Nissan had made 3 journeys, the Toyota had made 4, and they had transported 116 students although, when the Nissan had made 2 journeys and the Toyota 5, they had transported 110 students. If each journey made was at full capacity find the capacity of each taxi .

12. Using a pencil, a ruler and a pair of compasses only,
(a) (i) construct triangle PQR in which PQ = 6.5 cm, angle PQR = 30^o and angle QPR = 120^o. S is a point on the opposite side of RQ as P such that angle RQS = 90^o and RS = 12 cm.
(ii) Measure the lengths of RQ and SQ.
(b) (i) Draw a circle that passes through the points P,Q and S.
(ii) Measure the radius of the circle.

13. The histogram below shows the marks scored by students in a test .



(a) Use the histogram to construct a grouped frequency distribution table.
(b) Calculate the mean mark.

14. (a) Factories completely the following expressions:
(i) $a^2 + b^2 - 4 + 2ab$,
(ii) $a^2 - 5a - 36 + am + 4m$.
(b) Given that x + y = 10 and xy = 5, find the values of:

15. (a) The metric $\begin{pmatrix} 0 & 4 \\ 3 & -1 \end{pmatrix}$ is pre-multiplied by the column matrix $\begin{pmatrix} x \\ y \end{pmatrix}$ to give $\begin{pmatrix} -8 \\ x \end{pmatrix}$.
Find the values of x and y.

(b) Given that matrix p = $\begin{pmatrix} 2 & 3 \\ 1 & 2 \end{pmatrix}$ and Q = $\begin{pmatrix} 2 & -3 \\ 1 & 2 \end{pmatrix}$ find
(i) PQ
(ii) A2 × 2 matrix R such that QR = P .

16. A rectangular ABCD has vertices A (1, 0) B(3,0) C(3,1) and D 1,1). Rectangular ABCD is mapped onto rectangle A'B'C'D' by the transformation matrix $\begin{pmatrix} 2 & 0 \\ 0 & 2 \end{pmatrix}$.
(a) Find the coordinates of A′B′C′D′
(b) Rectangle A′B′C′D′ is mapped onto A″B″C″D″ with vertices at A″(2,0) B″(6,0), C″(10,2) and D″(6,2).
Find the matrix of transformation.

(c) Find a single transformation matrix which maps rectangle ABCD onto A″B″C″D″.

17. A company wishes to transport at least 480 mattresses from its stores to one of its sales points. It has two types of trucks, A and B. Truck A can carry 40 mattresses at a cost shs 30,000 per trip. Truck B can carry 60 mattresses t a cost of shs 45,000 per trip. There is shs 600,000 available for transport. The number of trips made by A should not exceed 12. Those made by B should not exceed twice the number of trips made by A.
(a) If x and y are the trips made by A B respectively, write down four inequalities satisfying the given conditions.

(b) (i) On the same axes, draw the graphs of the inequalities and shade the unwanted regions.
(ii)Find all the possible number of trips made by each truck so that the transport cost is minimized.

2011 PAPER TWO
SECTION A

1.Convert 5.272727……… to a fraction.

2.Given that F = {all factors of 24} and G = {all factors of 30}, find n(F ∩ G) where F' is the complement of F.

3.Find the equation of a line whose gradient is $-\frac{1}{2}$ and passes through the point (-4, 5).

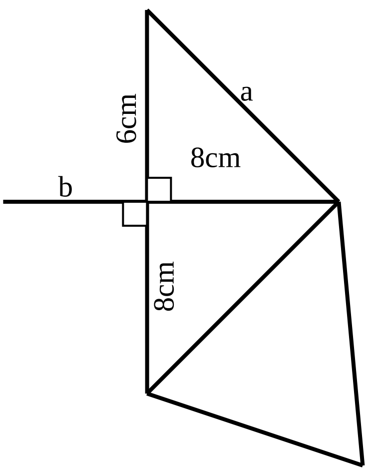
4. A saleswoman earns a basic salary of Shs 120,000 and a commission of 8% of the month's total sales. If the month's total sales were Shs 1,350,000, find her income for that month.

5. Simplify: ℓog 15 – 2 ℓog 10 + ℓog 60.

6. If m is directly proportional to the square of n and n = 2 when m 1 find the value of m when n= -5.

7. Find the point of intersection of the lines $3x + 2y = 6$ and $x + y = 4$.

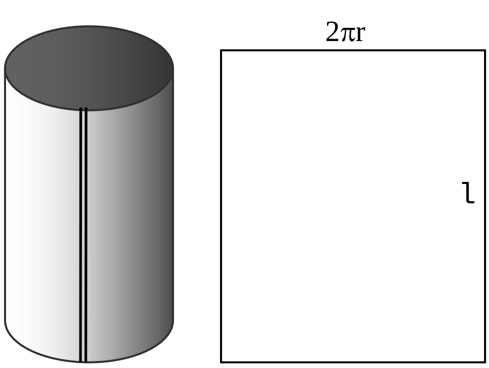
8. The diagram below shows the net of a right triangular pyramid.



Find the lengths marked a, b and c.

9. Given that S(-2,6) and T(3,3) are two points, find the coordinates of R if OR = 40 S + $\frac{1}{3}$ OT and O is the origin.

10. A cylinder has a radius of 3 cm and a height of 5 cm. find the area of the curved surface.



SECTION B: (60 MARK)

11. (a) Hellen won shs 42 million in a lottery. She shared the money with her parents in the ratio 5:2 respectively. Find how much money she gave her parents.

(b) Without using mathematical tables or a calculator, simplify $\dfrac{64^{-\frac{1}{3}}}{27^{-\frac{1}{3}}}$

(c) Given that $\dfrac{\sqrt{3}-\sqrt{2}}{\sqrt{5}-\sqrt{2}}$.

12. A group of students was asked what games they play. It was found out that 20 plays Rugby(R), 30 play Soccer(S) and play Basket ball (B). 6 play both Rugby and Soccer, 4 play both Soccer and Basket ball and 5 play both Rugby and Basket ball. The number of students who play Soccer only is equal to write the number of students who play Rugby only. All the students play at least one of thee games.

(a)Represent the above information on a Venn diagram.
(b)Find the number of students:
(i)who play all the three games.
(ii)in the group.
(c)If a student is chosen at random from the ground. Find the probability that the student plays at least two games.

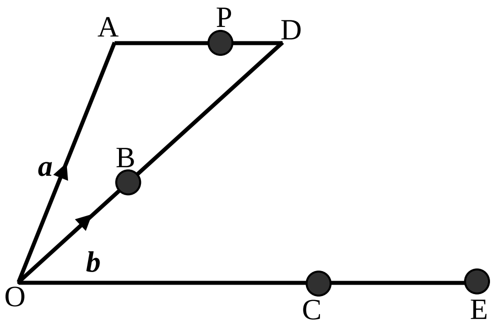
13 (a) Given that f(x) = 4x-3, find
(i) f(2),
(ii) $f^{-1}(x)$,
(iii) $f^{-1}(-1)$.
(b) Given that g (x) = $x^2 + 1$ and h (x) = x-3, find the value of x for which gh (x) = hg(x)

14. Lugazi is 45 km from Kampala, Kintu set off at 0815 hours from Kampala riding a bicycle at 15 km/hr. Kintu's bicycle broke down at 0915 hours and he was delayed for 45 minutes. He then walked back to Kampala and reached at 1230 hours. Ojok set off at 0915 hours from Kampala, riding a bicycle and reached Lugazi at 1200 hours.
(a) On the same axes, draw the graph showing the journeys of Kintu and Ojok.

(b) Use your graph in (a) to find:

(i)how far from Kampala Kintu was when bicycle broke down
(ii)the speed at which Kintu walked back back to Kampala.
(iii)Ojok's average speed.
(iv)the time when the two men met.
(v)The distance from Kampala where the two men met.

15. In the figure below. OA = A and OB = b. 3 OB = 2BD. P is a point on $\overline{AD}$ such that $\overline{PD}$: $\overline{AP}$ = 1:2. OC = 3CE =3AP.

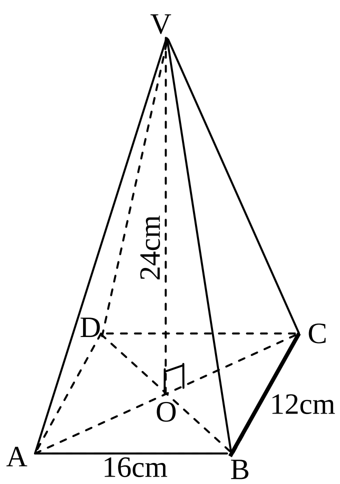


(a) Express the following vectors in terms of vectors a and b:
(i) AD
(ii) AP
(b) Show that $\overline{AD} : \overline{OE} = 3:8$

16.Paul and Mary invested Shs 600,000 each in savings society for 2 years. Paul opted for simple interest while Mary opted for compound interest. Both interest rates were at 12% per annum.

(a) Find the interest earned by each of them.
(b) Who earned more interest and by how much?

17. The figure below shows a right pyramid on a rectangular base ABCD. $\overline{AB}$ = 16 cm and $\overline{BC}$ = 12 cm V is 24 cm vertically above the base ABCD.



Calculate the:

(a) volume of the pyramid.
(b) angle between $\overline{AV}$ and the base ABCD.
(c) angle between the planes ADV and BCV.

2012 PAPER ONE
SECTION A

1. Factorise $4xy^2 - yx^2 + 4y^3$ completely ***(4 marks)***

2.Given that $a*b = \frac{a+b}{a-b}$,
find the value of (5 * 3) * -2***(4 marks)***

3. Solve the quadratic equation
$2x^2 - 3x - 20 = 0$ ***(4 marks)***

4. Make Q the subject of the expression
$\frac{P + 3Q}{Q - 3P} = \frac{X}{Y}$. ***(4 marks)***

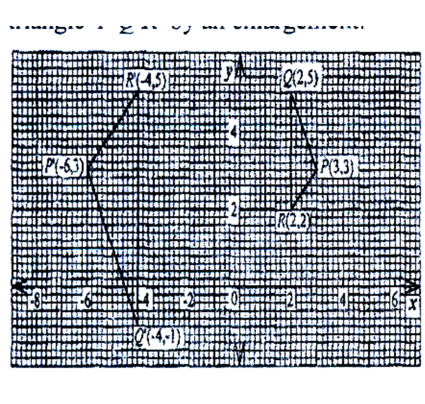
5. Find the inverse of the matrix $\begin{pmatrix} 2 & -1 \\ 3 & 6 \end{pmatrix}$ ***(4 marks)***

6.The length of a rectangular carpet is 5 metres more than its width.
If its area is $24m^2$, find the width of the carpet.
But the length or width of the carpet cannot be negative.
Hence the width of the carpet is 3m

7.Solve the equation $\frac{x}{2} - \frac{x+1}{4} = \frac{x}{3} + 2$***(4 marks)***

8. A box contains red, white and black balls.The probability of picking a red ball is $\frac{2}{5}$ and that of a white ball is $\frac{1}{6}$. What is the probability of picking a black ball from the box? ***(4 marks)***

9.In the diagram below, triangle PQR is mapped onto triangle P'Q'R' by an enlargement.



Use the diagram to find:
(a) the coordinates of the center of enlargement.
(b) the enlargement scale factor.

10. Building A is 40 m high. The angle of depression of the top of building B from the top of A is 260. If

the two buildings are 10m apart, find the height of building B. (Give your answer to two decimal places.)

SECTION B

11.(a) Peter's present age is $\frac{1}{3}$ of his father's age. In ten years' time, he will be $\frac{1}{2}$ of his father's age then. How old is his father?

(b) A two digit number in base ten is equal to five times the sum of the digits. It is nine less than the number formed by interchanging the digits. Find the number.

12. (a) Given that matrix P= $\begin{pmatrix} 1 & 2 \\ 4 & 5 \end{pmatrix}$,

Q = $\begin{pmatrix} -1 & 1 \\ 3 & 2 \end{pmatrix}$ and R = $\begin{pmatrix} 4 & 6 \\ 10 & 15 \end{pmatrix}$

Find matrix T such that T = P^2 + 3Q – R.

(b) Use the matrix method to solve the simultaneous equations

$y = 2x + 3$

$2y + x = 11$

13..The table below shows the marks scored by 50 students in a Mathematics test.

Marks	20 – 29	30 – 39	40 – 49	50 – 59	60 – 69	70 – 79	80 – 89
Number of students	3	7	16	14	6	3	1

(a) (i) Represent the information on a histogram.

(ii) Use your histogram to estimate the modal mark.

(c) Use the table to estimate the mean mark using a working mean of 44.5 (07 marks)

14..Using a ruler, a pencil and a pair of compasses only,

(a) construct a triangle ABC, with AB = 8 cm, BC = 12 cm and angle BAC =120^0

15..Use the graphical method to solve the simultaneous equations

$y = 3x^2 - 3x$ and $y = 10 – 5x$ for $-3 \le x \le 3$.

16.. A triangle ABC has vertices A (0,0), B(0, -2), and C(2,0). Its image under a transformation matrix M has vertices A'(0,0), B' (0, -4) and C' (4,0)

(a) Find matrix M and describe fully the transformation.

(b) Triangle A"B"C" is then transformed by matrix N = $\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$ to triangle A"B"C find the coordinates of A", B" and C''

(c) Determine a single transformation matrix which would map triangle A''B"C" back to triangle ABC.

17.. A trader has shs 250,000. He buys boxes of books at shs 25,000 each and boxes of candles at shs 10,000 each. The money spent on books is at least shs 50, 000 more than that spent on candles. He buys at least 5 boxes of books and at least 7 boxes of candles.

(a) Write down four inequalities to represent this information.

(b) (i) On the same axes, plot the graphs of the inequalities and shade the unwanted regions.

(ii) List all the possible numbers of boxes of books and candles he can buy.

(c) Find the number of books and candles that the trader should buy so as to spend all the money.

2012 PAPER TWO
SECTION A

1. Find the Highest common Factor (HFC) of 9, 12, and 15. ***(4 marks)***

2.A senior three class had 120 girls. 76 opted to take commerce © .25 took Political Education (P) only. 60 girls took P and C. How many girls took neither P nor C? ***(4 marks)***

3. Find the equation of the line passing through the points (-7, -2) and (-3, 4) ***(4 marks)***

(05 marks)

4. Given the vectors a = $\begin{pmatrix} 2 \\ 1 \end{pmatrix}$, b = $\begin{pmatrix} 0 \\ 3 \end{pmatrix}$ and c = $\begin{pmatrix} 8 \\ 13 \end{pmatrix}$, find the values of the constants P and q such that c = pa + qb. ***(4 marks)***

5.A wooden box is 2 m long, 50 cm broad and 3 m high. Find the surface area in m^2 of the box. ***(4 marks)***

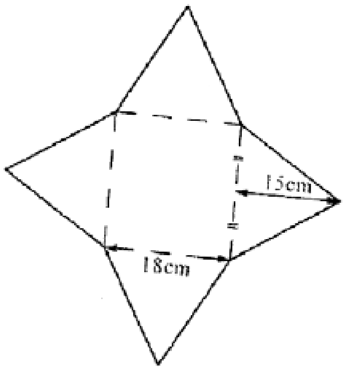
6. Ali deposited shs 56,000 in a bank. The bank gives a compound interests of 15% per annum. Find the amount of money he had in the bank after two years. ***(4 marks)***

7. Without using a calculator or mathematical tables, evaluate $\dfrac{68.75^2 \; -31.25^2}{3.75}$ ***(4 marks)***

8. Given that $g(y) = 9y^2$ -12y – 4, find the value of g(-2)

9. (a) Find the gradient of a line whose equation is $2y + 3x - 8 = 0$
(b) Write the coordinates of the point where the line in (a) cuts the y – axis.

10. The diagram below shows a net of a right pyramid on a square base. The sides of the square base are 18 cm each.



(a) Draw the pyramid.
Calculate the height of the vertex of the pyramid from the base. ***(4 marks)***
(b)

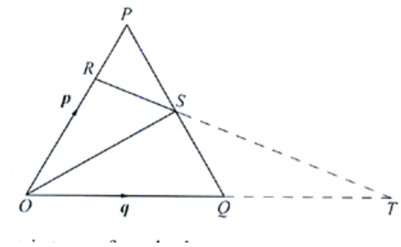
SECTION B

11..The cost © of printing a copy of a newspaper is partly constant and is also inversely proportional to the number (n) of copies printed. When 200 copies are printed the cost per copy is Shs850. When 300 copies are printed the cost per copy is shs750.
(a) Form an equation relating c and n.
(b) Calculate the cost per copy when 150 copies are printed.

12..A quadrilateral has vertices A (4, 3), B(4, 7) , C(10, 1) and D (6, 1)
a) Using a scale of 1 cm for. I unit on the x – and y – axes, plot the points A.B.C and D on a graph paper. Draw the quadrilateral.

b) Draw the line of symmetry of the quadrilateral.
(c) Find the equation of the line of symmetry.

13..In the figure below, OP = p, OQ =q, $\overline{20P} = \overline{50R}$, and $\overline{54PQ} = \overline{5PS}$.
When RS and 0Q are produced, they meet at T.



(a) express in terms of p and q the vectors
(i) OR.
(ii) OS.
(iii) RS.
(b) Given that $\overline{0T} = n\,\overline{OQ}$ and $\overline{RT} = m\,\overline{RS}$, find the values of m and n.
(06 marks)

14..The table below shows the income tax rates of a certain country for Government employees.

TAXABLE INCOME	TAX RATES %
1 – 100,000	5
100,001 – 200,000	13
200,0001 – 300,000	20
300,001 – 400,000	30
400,001 – 500,000	40
500,001 and above.	45

An employee has a gross monthly income of Shs 753,500. She is entitled to the following monthly allowances:
- Marriage and child allowance of shs 115,500.
- Housing and transport allowance of 10% of the gross income.
- Medical care of Shs81,600.

Insurance premium of Shs 25,500.
Calculate the
(a) taxable income
(b) income tax
(c) net income

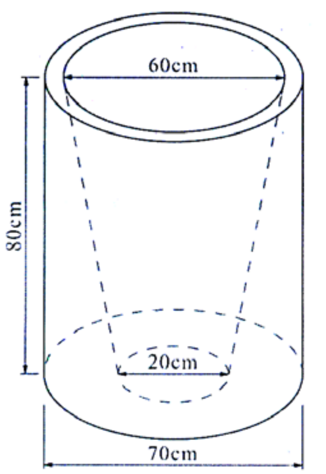
15..In a certain trading centre, thirty nine people kept either a dog, a cat or hens. 24 kept a dog (D), 16 kept hens (H) and 17 kept a cat (C). Those who kept both a dog and a cat were more than those who kept both a cat and hens by one person. 9 kept both a dog and hens. 2 kept all the three.
(a) Represent the information on a Venn diagram.
(b) Find how many people kept both a cat and hens.
(c)If a person is picked at random from the trading centre, what is the probability that the person did not keep a dog ?

16..(a) Given that f(x) = ax + b, f(4) =4 and f (-1) = -6, find the values of a and b.

(b) The function $h(x) = \dfrac{4}{5x+1}$.

Find
(i) $h^{-1}(x)$,
(ii) $h^{-1}(2)$.

17.. The diagram below shows a flower shows a flower vase. The outer part is cylindrical with diameter of 70 cm and height of 80 cm. The inner is a section of a cone with diameters 60 cm and 20 cm.



Find the volume of the:
(a) Soil which can fill the vase.
(b) material which was used to make the vase.

Paper 1: UNEB 2013
SECTION A:

1. Factorize $a^2 - b^2$ completely.
Hence evaluate $3.14^2 - 0.14^2$.

2. Solve for x in the equation
$2(x^2 + 4x + 4) = 5 + x$

3. Given that $\cos\theta = \dfrac{-12}{13}$ and $0^0 \le \theta \le 180^0$,
find $\tan\theta$

4. The following marks were obtained by 30 students in a mathematics test.

45	41	41	52	48
58	39	38	26	59
70	61	46	39	65
29	49	63	69	60
40	42	64	41	46
41	32	49	56	49

(a) Construct a frequency distribution table starting with the class 21 – 30.
(b) State the modal class.

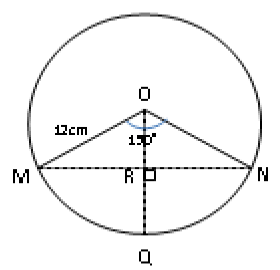
5. Simplify: $3^{2x+y} \times 3^{x-y} \times 9^{-x}$ ***(04 mrks)***

6. Solve: $\dfrac{n-1}{2} - \dfrac{n-3}{4} = \dfrac{1}{2}$

7. If $\mathbf{A} = \begin{pmatrix} 2 & 3 \\ 4 & 2 \end{pmatrix}$ and $\mathbf{B} = \begin{pmatrix} 6 & ^-2 \\ 7 & 3 \end{pmatrix}$,
calculate $2\mathbf{A} - \mathbf{B}$.

8. A translation $\begin{pmatrix} 2 \\ 3 \end{pmatrix}$ followed by a translation $\begin{pmatrix} x \\ y \end{pmatrix}$ gives the translation $\begin{pmatrix} 5 \\ ^-2 \end{pmatrix}$ Find the values of x and y. ***(04 mrks)***

9. In the diagram below, O is the centre of the circle. R is the mid-point of MN and the angle MON = 150^0



Find the length of RQ. (04 mrks)

10. A number is chosen at random from the integers 1 to 8. Find the probability that the number chosen is either a multiple of 4 or a prime number.

SECTION B

11. (a) (i) Make y the subject of $\dfrac{1}{y} + B = \dfrac{x}{2n}$
(ii) Find the value of y when n = 10, x = 65, and B = 3.
(b) Betty is 9 years younger than David. John is three times as old as Betty. The sum of all their ages is 49 years. Find:
(i) John's age,
(ii) David's age.

12. (a) By shading the unwanted regions, show on a graph the region satisfying the inequalities below:
$x \ge 0$
$y \ge 0$,
$x - y \le 5$,
$x + 3y \le 9$, ***(08 mrks)***

(b) Use your graph to find the values of x and y which give the maximum values for both x + y and x + 3y.

13. A ship leaves a port and sails for 120 km a bearing of 062^0. It then changes direction to a bearing of 1600 and sails for 20^0 km an island. Using a scale drawing with representing 20 km, find;
(a) The distance of the island from the
(b) The bearing of the port from the island.
(c)How long it would take the ship to directly back to the port at a speed 20 km /h

14. The tables below shows the marks scored by 75 students in a test.

Marks	10-14	15-19	20-24	25-29	30-34	35-39	40-44
Number of Students							

a) Represent the given data on a histogram.
b) Use your histogram to estimate the modal
c) Calcalate the mean mark using a working mean of 27.

15. (a) Draw a graph of y = (x – 2)(x – 3) for the domain $0 \leq x \leq 5$. (06 mrks)
Use 2 cm to represent I unit on both axes. (06 mrks)
(b) From your graph, find the values of x for which $x^2 - 5x$ _+ 6 = 0. (02 mrks)
(c) By drawing an appropriate line on the graph, find values of x for which $x^2 - 5x + 2 = 0$ (04 mrks)

16. (a) Given that matrix P = $\begin{pmatrix} 317 \\ ^{-}132 \end{pmatrix}$

Q = $\begin{pmatrix} 1 & ^{-}1 \\ 0 & 3 \\ 3 & 2 \end{pmatrix}$ and R = PQ;

i) Determine the order of R.
ii) Find the matrix R.
(b) solve the following simultaneous equations using the matrix method:
5x + 3y = 7
2x - 4y = 3 (06 mrks)

17. Triangle ABC with vertices A (1, 1) and C(3,1) is enlarged with a of -4 about (2,2) to triangle A angle A′B′C′ is then rotated through a positive quarter tun about (0, -4) to triangle A̋B̋C̋.
a) Draw on the same axes the triangles
ABC, A”B”C” and A”B”C”. (10 mrks)
b) Write the coordinates of
(i) A′, B′ and C′
A′, B′ and C′ mrks)

Paper 2: UNEB 2013
SECTION A:

1. Without using mathematical tables or a calculator, simplify:

$$\frac{(0.25)^2 \text{x} \left(\frac{1}{64}\right)^2}{(128)^{-2}}$$ ***(04 marks)***

2. Given that M = {the first five multiples of 3} and S = {the first five square numbers}, find:
a) $M \cap S$,
b) $n(M \cap S)$,

3. The position vectors of P and Q are $\begin{pmatrix} -6 \\ 15 \end{pmatrix}$ and $\begin{pmatrix} 4 \\ 5 \end{pmatrix}$ respectively. Find the magnitude of PQ.
(04 mks)

4. A line whose gradient is 3, passes through the point (2, 1). Find the :
a) equation of the line
b) y-intercept ***(04 mks)***

5. Simplify $\frac{2.4\text{x}10^2}{6.0\text{x}10^{-3}}$ Give your answer in standard form. ***(04 mks)***

6. Given that f(x) = 3x + 5 and g(x) = $\frac{2}{x-5}$, find:
a) gf(x)
b) gf$\left(\frac{1}{2}\right)$

7. Find the distance between the points (5, 9) and -7, 2). Give your answer to one decimal place (04 mks)

8. A traveller had £800. She exchanged it to Uganda shillings (UGX) at a rate of £1 for UGX 3,200. She used UGX 720,000 in a hotel. How much money in UGX did she remain with? (04 Mks)

9. Two similar plastic containers have capacities of 2 litres and 54 litres. If the height of the big container is 87cm, find the height of the small container.
(04 mks)

10. A scale on a map is 1:500,000. What distance in kilometers does 1 centimeter on the map represent?
(04 Mks)

SECTION B
Answer any five queations from this section. All questions carry equal marks.

11. If h(x = px + 3 and that h(4) = 23
a) find the value of:

i) p
ii) h(0)
iii) h(-5)

b) Determine
i) $h^{-1}(x)$
ii) $h^{-1}(13)$

12. A quantity p is partly constant and partly varies as the square of q. when q = 2, p = 0. When q = 3, p = 65
a) Form an equation relating p and q (08 mks)
b) Determine the values of q when p = 100 (04 mks)

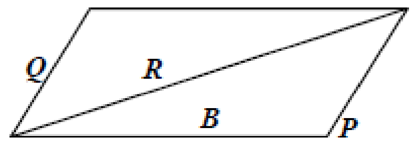
13. a) Peter deposited UGX 2,500,000 in a bank which offers a compound interest of 15% per annum. How much money did he have in the bank at the end of two years? (05 mks)
b) The cash price of a radio is UGX 720,000. It can be bought on hire purchase terms by making a deposit of 30% of the cash price and then paying 8 monthly installments of UGX 85,000 each
i) Find the cost of the radio on hire purchase terms
ii) How much more doe one pay on hire purchase rather than on cash terms? (07 mks)

14. In a class of 40 students, 18 play Hockey (H), 15 play Tennis (T) and 22 play Football. 7 play hockey and tennis. 9 play tennis and football. 8 play hockey and football. 4 play all the three games.
a) Represent the given information on a Venn diagram. (06 mks)
b) Find the number of students who do not play any of the three games. (02 mks)
c) Find the probability that a student choses at random plays only;
i) One game
ii) Two games ***(04 mks)***

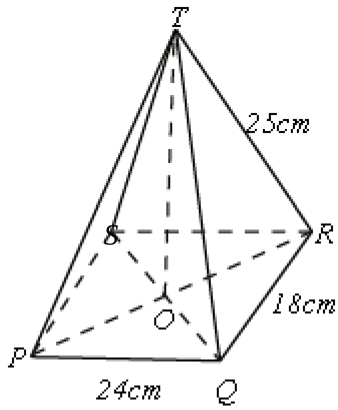
15. A cyclist sets off from town A at 4:00am at a speed of $20kmh^{-1}$ to go to town B, 100km away. A motorist also sets off from town A at 7:30am at a speed of $100kmh^{-1}$ to go to town B. Find the:-
(a) distance from town A when the motorist overtakes the cyclist. (06 marks)
(b) time when the motorist overtakes the cyclist. (03 marks)
(c) time the cyclist reached town B (03 marks)

16. A Quadrilateral OABC has points P, Q and OA, OB and OC respectively. OA = 3OP, OB = 5OQ and OC = 2OR. OP = and OQ = q and OR = r
(a) Express the following vectors in terms of p, q and r:
(i) PQ, (ii) AB, (iii) BC, (iv) CA. (09 marks)
(ii) Given that OABC is a parallelogram, show that 3p -5q +2r = 0 (03 marks)

17. In the figure below, PQRST is a right pyramid with a rectangular base.



PQ = 24cm. QR = 18cm. The slanting edges are 25cm each.



Calculate the:
(a) height of the pyramid.
(b) angle between the slanting face QRT and the base.
(c) volume of the pyramid.

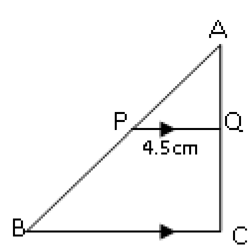
Paper 1: UNEB 2014
SECTION A:

1. Solve for x in the inequality $\frac{x+3}{4}$

$$\frac{x+3}{4} < 2$$

2. Given that $2^{2y} = \frac{1}{8}$, find the value of y.

3.In the figure below, PQ is parallel to BC. AP : PB = 3:4 and PQ = 4.5cm



Calculate the length of BC.

4. The average of 8 numbers is 30 while that of a different set of 7 numbers is 15. Find the average of all the numbers.

5. Simplify: $(4x^2 - 9) \div (2x + 3)$ ***(04 marks)***

6. If A = $\begin{pmatrix} x & -7 \\ 4 & 6y \end{pmatrix}$ and $\begin{pmatrix} 17 & -y & -21 \\ 4 & 6y & 36 \end{pmatrix}$

Find the values of y given that 3A = B.

7. Factories the expression $3x^2 - 10x + 3$
Hence find the values of x when
$3x^2 - 10x + 3 = 0$

8. Given that sin A = $\frac{3}{5}$ and A is obtuse, find: without using mathematical tables or a calculator, the value of tan A.

9. An object P whose area is $4cm^2$ is Transformed by matrix $\begin{pmatrix} 1 & -2 \\ 1 & 1 \end{pmatrix}$ to its image P^1.

Find the area of P^1.

10. A number is chosen from the numbers 1to 9 . Find the probability that the number chosen is a triangle number.

SECTION B

11. The table below shows ages of 60 university students, to the nearest years.

Age (years)	17 - 19	20-22	23-28	26-28	29-31
Number of students	3	7	13	28	12

a) Calculate the student's mean age.
b) (i) Draw a cumulative frequency curve (Ogive) for the data.
c) Use the Ogive to find the median age.

12. A group of members had to raise Shs 3,600,000 to buy a plot of land. Each member was to contribute the same amount of money, 10 member's dropped out before raising the money.
(a) Write down expressions for each member's contribution before and after the 10 member dropped out.
(b) After the 10 members dropped out, each member had to pay Shs 60,000 more.
Find
(i) The original number of members in the group
(ii) how much each member contributed.

13 (a) Copy and complete the following table for the curve $y = 2x^2 - 3x - 5$ for values of x from -3 to 4

x	-3	-2	-1	0	1	2	3	4
$2x^2$						8		
-3x						-6		
-5	-5	-5	-5	-5	-5	-5	-5	-5
y						-3		

(b) Using a scale of 2 cm for 1 unit on the x-axis and 2 cm for 5 units on the y-axis, draw the graph of y = $2x^2 - 3x - 5 = 0$ for $-3 \le x \le 4$.
(c) Using your graph solve the equation
$2x^2 - 3x - 5 = 0$.

Solution:
(a)

x	-3	-2	-1	0	1	2	3	4
$2x^2$						8		
-3x						-6		
-5	-5	-5	-5	-5	-5	-5	-5	-5
						-3		

(b) Using a scale of 2 cm for I unit on the x-axis and 2 cm for 5 units on the y –axis, draw the graph of $y = 2x^2 - 3x - 5$ for $-3 \le x \le 4$.
a) Using your graph, solve the equation
$2x^2 - 3x - 5 = 0$.

14.a) The matrix A = $\begin{pmatrix} a & 14 \\ 1 & b \end{pmatrix}$ and its invers

$A^{-1} = \begin{pmatrix} 1 & -7 \\ -\frac{1}{2} & 4 \end{pmatrix}$ $AA^{-1}=1$

b) A housewife buys the following items in three weeks. Week one she buys 2 packets of tea, 2 tins of margarine, 2 kg of sugar and 3 packets of biscuits.
Week two she buys 2 tins of margarine, 3 kg of sugar and 4 packets of biscuits. Week three she buys I packet of tea, 2 kg of sugar and 2 packets of biscuits.
(i) Write this information in a 3 x 4
(ii) A packet of tea costs Shs 1,000, a tin of margarine costs shs 1,500, a kilogramme of sugar costs Shs 2,800
(iii) and a packet of biscuits costs shs 500.
(iv) Write a column matrix for the cost of the items.
(v) Find her expenditure in the three weeks

15. A triangle with vertices A(-1, 1), B(-1,3) and C(-2,3) is mapped onto triangle $A''B''C''$

a) Plot the points A, B and C on a graph paper. Join the points to form triangle ABC.

(02 marks)

b) Find the coordinates of:

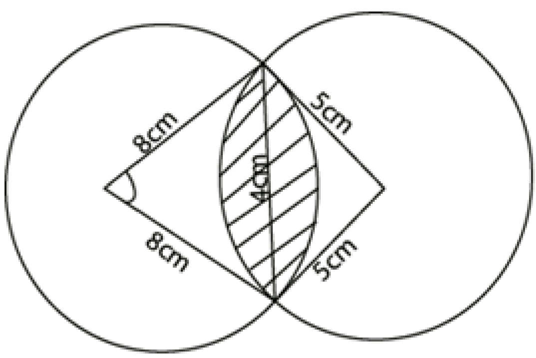
(i) A', B' and C'

(ii) A'' B'' and C'' ***(06 marks)***

c) Find the centre and angle of the rotation which maps A'' B'' C'' back onto ABC.

(04 marks)

16. The diagram below shows two intersecting circles of radii 5 cm and 8 cm with a common chord of 4 cm.



Find the area of the shaded part (12 marks)

17. An export company is to transport 300 tonnes of pineapples. Two cargo planes are available. A Boeing which can carry 30 tonnes of pineapples per flight and an Airbus which can carry 20 tonnes of pineapples per flight. The Airbus has to make more flights than the Boeing. The Boeing has to make at least 3 flights. The company has 150,000 US dollars for transport costs . The cost per flight is 12,000 dollars for Boeing and 9,000 dollars for Airbus.
If x is the number of flights made by the Boeing and y is the number of flights made by the Airbus;
a) Write down four inequalities satisfying the given conditions
b) Plot graphs of the inequalities you have formed on the same axes and shade the unwanted regions.
c) Find the number of fights each place should make if the cost of transport is to be minimum

Paper 2: UNEB 2014
SECTION A:

1. Express 2.6363 …… as a fraction in its simplest form ***(04 marks)***

2. The function $g(x) = ac^2 + 3$. If $g(2) = 11$, find the value of a. ***(04 marks)***

3. Find the co-ordinates of the point of intersection of the lines $y = 2x$ and $y = 3 - x$. ***(04 marks)***

4. Two similar jugs have heights of 21cm and 14cm. the smaller jug has a capacity of 1.2litres. Determine the capacity of the larger jug. ***(04 marks)***

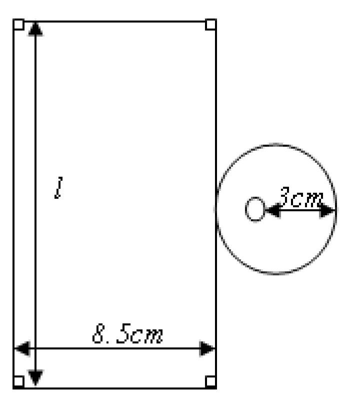
5. Two sets M and N are such that $n(M) = 8$, $n(N) = 11$, $n(M \cap N) = 5$ and $n(M \cup N)^1 = 3$. Find n(€), where € is the universal set.
(04 marks)

6. The scale on a map is 1 : 2000. A building is represented on the map by an area of 3cm^2. Find the actual area in cm^2 occupied by the building.
(04 marks)

7. Find the equation of the line which passes through the point (-3, 5) and is parallel to the line $2y + 3x + 7 = 0$ ***(04 marks)***

8. Abdul's salary is Shs. 400,000 per month. He pays an income tax of 30% per month. How much is Abdul's net income per month?
(04 marks)

9. The diagram below shows a net of a cylinder. O is the centre of the circles.



Calculate the
(a) length marked l.
(b) area of the curved surface of the cylinder.
[Use $\pi = 3.14$] ***(04 marks)***

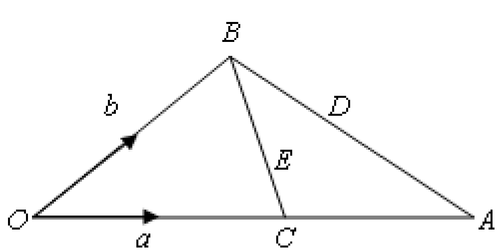
10. Given that Q(4, 1) and R(1, 5) are two points in a plane. Determine:
(a) the Vector RQ (02 marks)
(b) |RQ|
SECTION B:

11. Fifty six soccer fans supported premier league matches of three teams;
Arsenal (A), Chelsea (C) and Livcrpool (L), 32 fans watched team A playing, 18 watched C playing and 30 watched L playing. 20 fans watched both A and L playing. 12 watched both A and C playing. 8 fans watched both C and L playing. The number of fans that watched all the three teams playing is equal to the number of those that did not watch any of the teams playing.
Use a Venn diagram;
(a) find the number of fans who watched all the three teams playing. ***(10 marks)***
(b) determine how many fans watched at least two of the teams playing. ***(02 marks)***

12. (a) Use logarithm tables to evaluate;
$\sqrt{\frac{33.7 \times 0.429}{76.1}}$
(b) If log10 x = 0.3979 and log10 y = 0.4771, find the value of log10 x 3 y. ***(04 marks)***

13. A lorry set off at 7:00 am from station A to station B, 360 km away. It travelled at a constant speed of 50kmh-1 for 2 hours. The lorry then stopped for 1 hour. It then proceeded at a steady speed for 4 hours to station B.
A mini-bus left station B at 8:00 am for station A and moved non-stop for $4\frac{1}{2}$ hours.
(a) Using a scale of 2cm to represent 40km on the vertical axis and 2cm to represent 1 hour on the horizontal axis, draw on the same axes, distance-time graphs for the lorry and the minibus. ***(06 marks)***
(b) Use your graphs to find the;
(i) time when the two vehicles met;
(ii) distance from B when the vehicles met.
(iii) average speed from the minibus ***(06 marks)***

14. In the figure below, OA = a and OB = b. C and D are the mid-points of OA and AB respectively. E is a point on BC such that
BE = $\frac{2}{3}BC$



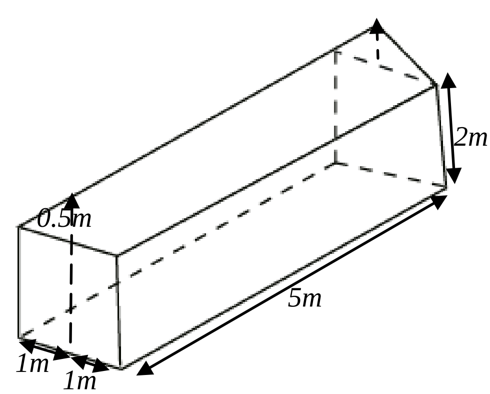
(a) Express in terms of a and b the vectors:
(i) BE.
(ii) OE.
(iii) BD ***(07 marks)***
(b) Show that O, E and D lie on a straight line

(05 marks)

15. (a) Given that f(x) = $x^2 - 4x + 3$ and g(x) = $\frac{1}{x}$, find;
(i) gf(x)
(ii) gf(-2). ***(05 marks)***
(b) If h(x) = 5x + 7, find;
(i) $h^{-1}(x)$
(ii) $h^{-1}(8)$
(iii) the value of x for which $h^{-1}(x) = 0$
(07 marks)

16. (a) Nankya deposited Shs. 750,000 in a savings and credit organization. The organisation gives simple interest of 12% per annum. Calculate the;
(i) interest she got at the end of two years
(ii) total amount she had in the organisation at the end of the two years. (05 marks)
(b) Opio bought a radio at Shs. 60,000. He wanted to sell it at a profit of 20% but found no buyer. When he reduced his new price by 10% he found a buyer. Determine the;
(i) price at which he sold the radio
(ii) percentage profit he made ***(07 marks)***

17. The figure below shows a store whose dimensions are in metres. The roof is covered with iron sheets.



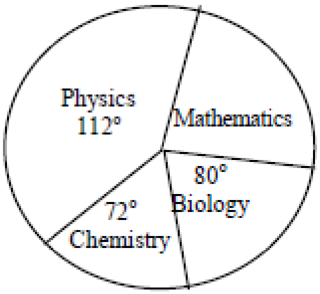
(a) What is the volume of the enclosed space?
(b) Calculate the total surface area of the roof.
(c) The area of each iron sheet which was used is $0.56m^2$. how many iron sheets were used?
(d) The cost of an iron sheet is Shs. 18,500. How much money was spent on buying the iron sheets?

Paper 1: UNEB 2015
SECTION A:

1.Given that a* b = $a\sqrt{b}$ find the value of (2*4) * 16 ***(04 marks)***

2. Two towns A and B are such that the bearing of B from A is 085^0 Find the bearing of A from B. (04 marks)

3. The pie chart below represents the subjects taught by 45 science teachers.



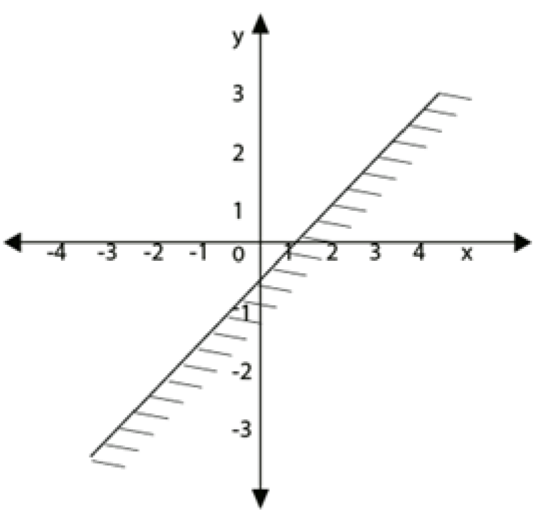
Determine the number the number of teachers who teach Mathematics. ***(04 marks)***

4. Make b the subject of the equation

$t = 20 + \sqrt{a - b^2}$ ***(04 marks)***

5. Given that $A = \begin{pmatrix} 2 & -2 \\ -3 & 4 \end{pmatrix}$, determine A^{-1}

6. Determine an equation which is represented by the unshaped region on the graph below.



7. Combining these two situations we get the inequality represented by the unshaped region as $y > x - 1$.

a) Plot the point A(4,2) on a graph. (2)marks)

b)Find the coordinates of the image of the point A after a rotation of + 90^o about (1, -1).

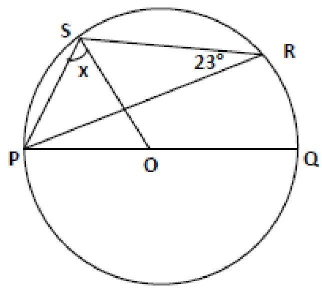
(b) From the graph, the co-ordinates of the image of the points A are A^1(-2, 2)

NB: To locate A' we draw a line joining A(4, 2) to the centre of rotation, C(1, -1). Then from Point C, we draw an angle of 90^0 in the anticlockwise direction (i.e. + 90^0) A long this angle, we locate point A' such that is then the image of A under a rotation of + 90^0 about C(1, -1).

8. Solve the equation:

$\frac{3}{4}(2a + 1) = \frac{5}{6}(a + 5)$ ***(04 marks)***

9, In the figure below, PQ is a diameter and O is the centre of the circle. Angle PRS = 23^o.



Calculate the value of the angle marked x

10 . A coin and a regular tetrahedron with face numbered from 1 to 4 are tossed.

a) Construct a table showing all possible outcomes. (02 mark)

b) What is the probability of getting a tail and a number greater than 1? (02 marks)

2.2 SECTION B:

11. (a) Copy and complete the following table for the curve = $-2x^2 + x + 1$.

x	-3	-2	-1	0	1	2	3
$-2x^2$	-18		-2			-8	
x	-3		-1			2	
1	1		1			1	
y	-20		-2			-5	

(04 marks)

(b) Using the values in your completed table, draw the graph of $y = -2x^2 + x + 1$.

(c) Use your graph to solve the equation

$6 - x - 2x^2 = 0$ ***(05 marks)***

12. A motor cyclist travelled 8 km up a hill at a speed of x km/h . On the return journey down the hill, his speed was (x + 4) km /h. The difference in time between the uphill and downhill journeys was 10 minutes.

a) Write down an expression for the time taken for the

(i) Uphill journey

(ii) Downhill journey ***(02 marks)***

b) (i) Using expressions in (a), form a Quadratic equation for the difference in time for the two journeys.

(ii) solve the quadratic equation

c) what was his average speed for the uphill and downhill journeys.

13. (a) Matrix S= $\begin{pmatrix} x+7 & x \\ 3 & 0 \end{pmatrix}$ and B = $\begin{pmatrix} x-1 & 0 \\ 2 & 2 \end{pmatrix}$

If C = A + B, find the value of x for which the determinant of matrix C is 2. ***(05 marks)***

(b) Solve the following simultaneous equations using the matrix method.

3x + 2y = 8

3y + 4x = 11 ***(07 marks)***

14. The table below shows the ages of 50 people treated for tuberculosis (TB) at a health centre.

86	85	56	59	67	62	63	50	91	62
56	27	50	54	80	61	52	52	16	28
66	46	55	58	56	77	26	40	42	51
35	45	68	51	49	40	93	84	79	63
53	25	93	27	71	66	52	30	12	

a) Construct a frequency table starting with the class 10 – 19. ***(03 marks)***

b) Use the frequency table to calculate the;

(i) Mean age of the people treated for TB.

(06 marks)

(ii) Median age of the people treated for TB.

(03 marks)

15. A school hired a bus and a minibus to transport students to a study tour. Each trip of the bus cost Sh 40,000 and that of the minibus cost 25,000. The bus has a capacity of 42 students and the minibus 14 students. All the 126 student contributed a total of Sh 200,000 and to go for the tour. The minibus had to make more trips than the bus. If X and Y respectively;

a) Write down five inequalities representing the given informat ***(05 marks)***

b) (i) Plot the inequalities on the same axes.

(ii) By the shading the unwanted region, show the region satisfying all the inequalities. ***(04 marks)***

a) Use the graph to find the number of trips each vehicle should make so as to spend the least amount of money. (04marks)

16. Triangle ABC with vertices A(1,2), B(2, 6) and C(4,2) is mapped onto triangle A' B' C' by a reflection in the line x + y = 0.

Triangle A' B' C' is then mapped onto triangle A' B' C' is then mapped onto triangle A' B' C' by a transformation whose matrix is

$\begin{pmatrix} 2 & 5 \\ -4 & -5 \end{pmatrix}$

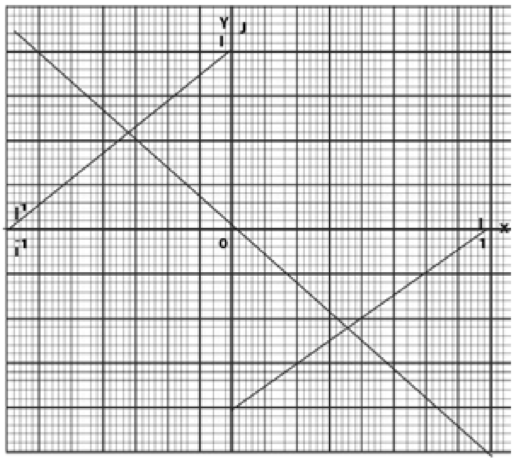
a) Use I (1, 0) and J(0, 1) to find the matrix of reflection in the line y + x = 0.

b) Find he coordinates of:

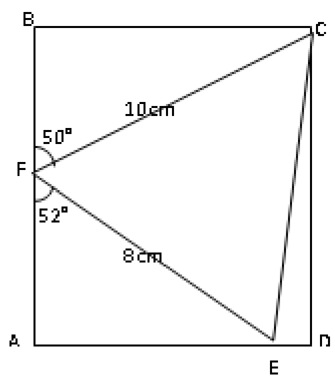
(i) A' B' and C'

(ii) A'' B'' and C'' ***(06 marks)***

(c) Determine a matrix for the single transformation which maps A'' B'' C'' back onto ABC.



17. In the diagram below, ABCD is a rectangle with CF = 10cm, EF = 8 cm, angle BFC = 50^0 and angle EFA = 52^0.



Calculate

a) The length

(i) BC ***(02 marks)***

(ii) AB ***(05 marks)***

b) The area of triangle CEF. ***(05 marks)***

Paper 2: UNEB 2015
SECTION A:

1.Simplify $\left(\frac{8}{27}\right)^{\frac{-2}{3}}$ ***(04 marks)***

2. Find the equation of the line through the point R(5,9) and parallel to the line joining the point S(15, -2) to the point T(-3, 4).

3. Amina bought a television set (TV) at a discount of 5%. The market price of the TV was Sh. 320,000. How much did she buy the TV?

(04 marks)

4. Given that P(2,3) and Q(5,8) are two points in a plane, determine the;
 (a) Vector PQ
(b) magnitude of PQ ***(04 marks)***

5. Solve: $\log_{10}(7x + 2) - \log_{10}(x - 1) = 1$
(04 marks)

6. The function $h(x) = bx^2 + 4x$. If $h(-1) = 3$, find the value of b.

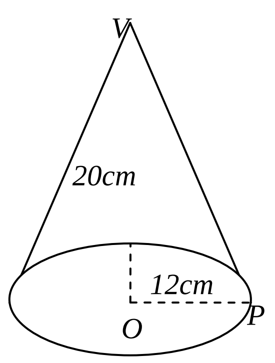
7. In a class of 15 students, 7 like M athematics, 9 like English and 2 like neither Mathematics nor English. Find the number of students who like both Mathematics and English. ***(04 marks)***

Hence the number of students who like both Mathematics and English is 3.

8. The capacity of a cylindrical tin is 2 litres. Its radius is 8cm. Find its height. ***(04 marks)***

9. A line has gradient $\frac{1}{2}$ and passes through the point (-4,7). Find the coordinates of the point at which the line cuts the y-axis. ***(04 marks)***

10. The figure below shows a cone whose base radius is 12cm and perpendicular height OV is 20cm.



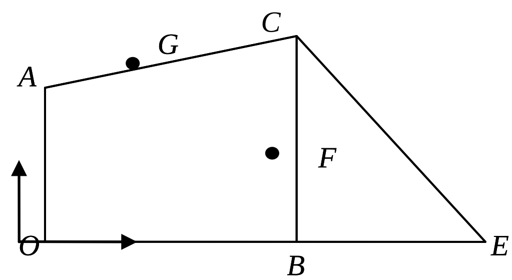
Determine the:-
(i) slant height PV
(ii) area of curved surface of the cone ***(04 marks)***

SECTION B:

11. (a) A map has a scale of 1:250,000. The area of the swamp on the map is $12cm^2$. What is the actual area of the swamp in km^2? ***(05 marks)***
(b) In a business John gets a fixed pay of sh. 80,000 and Daniel gets Sh. 60,000 per month. The remainder is shared among John, Daniel and Tom in the ratio 2:3:5 respectively. At the end of a certain month the business made Sh. 480,000. Determine the amount each got from the business.
(07 marks)

12. (a) A mapping is defined by $f(x) = x^2 - x + 3$. Determine the range of the mapping whose domain is {-3, 0, 1, 2}.
(b) Given that $h(x) = 3x - 5$ and $g(x) = x^2$. Find hg(-2).
(c) If $f(x) = 2x + 5$, find the value of $f^{-1}(11)$.
(04 marks)

13. In the diagram below, OA = a, OB = b
BC = 2OA and 3OB = 2OE. F is a mid-point of $\overline{BC}$. G divides $\overline{AC}$ in the ratio 2:1



(a) Express in terms of a and b the vectors:
 (i) CB
 (ii) AC
 (iii) BE ***(06 marks)***

(b) Show that G, F and E and collinear. (06 marks)

14. Two towns A and B are 200km apart. A Tata lorry left town A at noon and travelled at a speed of 50km/hr for one hour.
It stopped for 30 minutes then continued to B at a speed of 60km/hr. an Isuzu lorry left town B at 12:30p.m. and travelled for one hour at a speed of 40km/hr.
It then changed and travelled at a speed of V km/hr and arrived at town A at 4:30p.m.

(a) Using scales 2cm to represent 20km and 4cm to represent one hour, draw distance-time graphs showing the journeys for the two lorries on the same axes. ***(07 marks)***

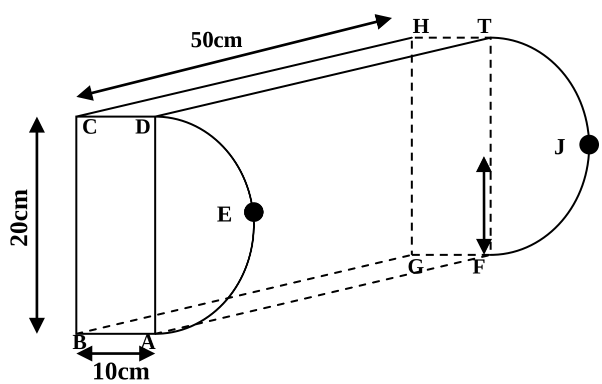
(b) Use the graphs to estimate the;
 (i) distance from A to the point where the two vehicles met.
 (ii) time at which the two vehicles met.
 (iii) time of arrival for the Tata lorry at town B
 (iv) speed (V) of the Isuzu lorry ***(05 marks)***

15. (a A worker's gross salary is Sh. 200,000 per month. If Sh. 130,000 is tax-free and the rest is taxed at 10%, what is the worker's net pay per month?
(04 marks)
 (b) Mr. Odoi and Mrs. Kaiso are money lenders. Mr. Odoi lends money at a simple interest rate of 15% per annum. Mrs. Kaiso lends money at a compound interest rate of 15% per annum. A trader

wants to borrow Sh. 500,000 for 2 years. Which of the two lenders would be cheaper and by how much? ***(08 marks)***

16. A restaurant supplies food to 129 factory workers. It found out that 72 workers like matooke (M), 50 like potatoes (P) and 32 like rice (R). 15 like matooke and rice. 18 like matooke and potatoes. 7 like potatoes and rice. 44 like matooke only. 10 dislike all the three types of food.
(a) Represent the given information on a Venn diagram. ***(06 marks)***
(b) Find the number of workers who like all the three types of food ***(03 marks)***
(c) Find the probability that a worker chosen at random from the factory likes at most two types of food. ***(03 marks)***

17. The diagram below shows a piece of wood of uniform cross-section ABCDE in which ABCD is a rectangle and ADE is a semi-circle of diameter $\overline{AD}$.
$\overline{BC} = 20\text{cm}$, $\overline{AB} = 10\text{cm}$ and $\overline{CH} = 50\text{cm}$



Calculate the:
(a) area of the cross-section ABCDE ***(04 marks)***
(b) volume of the wood ***(02 marks)***
(c) total surface area of the piece of wood ***(06 marks)***

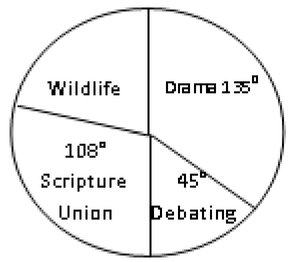
(Take $\pi = 3.14$

2016 PAPER ONE
SECTION A

1. Make a the subject of the expression

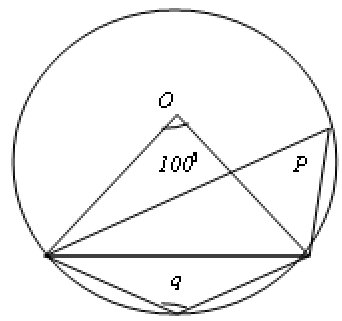
$$c = \frac{a^2}{(a-b)(a+b)}$$ ***(4 marks)***

2. The pie chart below shows the various clubs that 40 students belong to



Determine the number of students in the wildlife club ***(4 marks)***

3. Given that a b = a + b + ab
a) evaluate 3 x 5
b) find the value of n, when 7 + n = 23
4. The circle below has its centre at o.



Calculate angles p and q***(4 marks)***

5. An object at (0,0) undergoes a translation

$A = \begin{pmatrix} 5 \\ -12 \end{pmatrix}$ then followed by translation

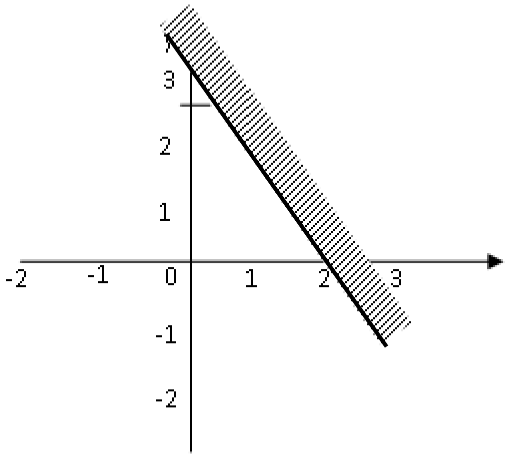
$B = \begin{pmatrix} 3 \\ 4 \end{pmatrix}$

a) Find a single translation equivalent to the two translations A and B
b) How far is the object from (0,0)?

6. Solve the equation; $\frac{5x+2}{3} - \frac{7x+2}{5} = 2$
(4 marks)

7. Two fair coins are tossed
a) Coins tract table showing all the possible outcomes
b) what is the probability of getting at least a tail?

8. Find the inverse of the matrix $A = \begin{pmatrix} 5 & 7 \\ -3 & -2 \end{pmatrix}$***(4 marks)***
9. Determine the inequality which is represented by the unshaded region on the graph below.



(4 marks)

10. A pilot in a plane at altitude of 500m above the horizontal ground sees a camp at an angle of depression of 15^0. Find the horizontal distance the pilot would have to fly so that the plane is directly above the camp. ***(4 marks)***

SECTION B: (60 MARKS)
Answer any five questions from this section. All questions carry equal marks,

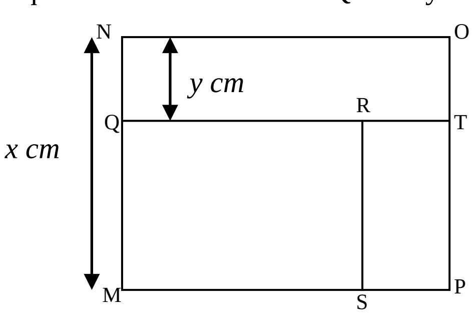
11. A manager of a restaurant spent UGX 29,000 to purchase 4kgs of rice and 7kgs of Irish potatoes. Later he increased each of the above quantities by 1kg thus increasing his expenditure by UGX 5,000.
a) Write down two equations that represent the manager's purchases.
b) Use your equations to find the cost of rice and Irish potatoes per kilogram
c) How much would the manager pay for 10kgs of rice and 15kgs of Irish potatoes?

12. a) Solve the equation

$$3\begin{pmatrix}1+x\\ y\end{pmatrix} - \begin{pmatrix}x\\ 1-2y\end{pmatrix} = \begin{matrix}5\\ 9\end{matrix}$$

b) Given that M = $\begin{pmatrix}0 & 1\\ 3 & 0\end{pmatrix}$ and N = $\begin{pmatrix}2 & 1\\ 3 & 2\end{pmatrix}$
i) Calculate N^2 and MN
ii) Find the value of the scalar k if $N^2 + kN = M$

13. In the figure below, MNOP and MQRS are squares. MN = x cm and QN = y cm.



a) If the area of the rectangle QNOT is $1cm^2$ less than area of MQRS show that $y^2 - 3xy + x^2 = 1$
b) Given that y = 3cm, find the appropriate value of x.
c) Calculate the area of the rectangle PTRS.

14. The following table shows the marks scored by 36 students in a Mathematics test.

Maths	Frequency
30-39	4
40-49	6
50-59	3
60-69	12
70-79	2
80-89	5
90-99	4

a) Calculate to 2 decimal places the
i) mean mark
ii) medium mark.
b) Find the probability that a student picked at random scored below 50

15. a) Copy and complete the table below for
y = (3x + 1)(2x - 5)

x	-1	0	1	2	3	4
3x+ 1	-2		4		10	
2x-5	-7		-3		1	
y	14		- 12		10	

b) Use your completed table to draw a graph of y = (3x + 1)(2x - 5) with a scale of 2cm for 1 unit on the x - axis.
c) Draw on the same axis the line of y = 5
d) Use the two graphs in (b) and (c) to solve the equation $6x^2 - 13x - 10 = 0$

16. a) The image of P(6,3) after a reflection is P(3,6)
i) Plot the points P and P1 on the graph paper.
ii) Construct the line of reflection. Hence find the equation of the line of reflection.

c) The image of ABCD under a matrix of transformation $\begin{pmatrix}1 & 0\\ -2 & 1\end{pmatrix}$ is A, B, C and D, the coordinates of the image are $A^1(1, 0)$, b1(4, -6), C(4, -4), D(1,2). Determine the coordinates of A, B, C and D.

17. The manager of the cinema hall wishes to divide the seats available into two classes executive and ordinary. There are not more than 120 seats available. There must be at least twice as many ordinary seats as there are executive seats. Executive seats are priced at UGX 15,000 each. Ordinary seats are priced at UGX 10,000 each. At least UGX

1,000,000 should be collected at each show to meet the expenses.

a) Taking x as the number os executive seats and y as the number of ordinary seats, write down five inequalities from the given information.

b) Represent the inequalities on a graph

c) From your graph, find the number of seats of each kind which must be sold to give the maximum profit.

2016 PAPER TWO
SECTION A

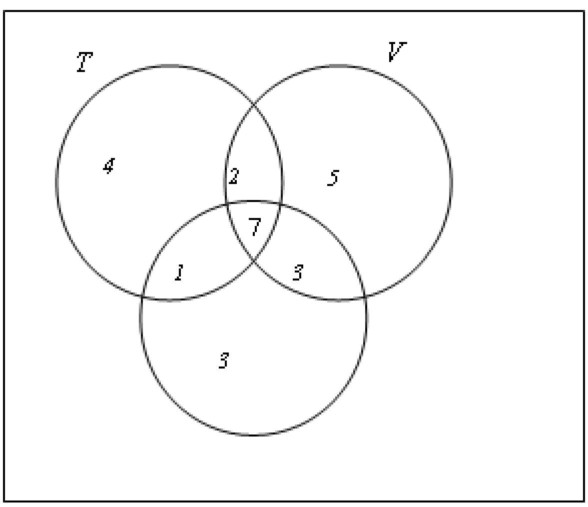
1. Given that h(x) = 3x - 2, find the value of

i) h (-2)

ii) x when h(x) = 7 ***(4 marks)***

2. Josephine obtained 95% in a test which was marked out of 80marks. How many marks did she score out of 80 ? ***(4 marks)***

3. The Venn diagram below shows the number of students who play tennis (T), volley (V) and football (F)



Find

a) The number of students who play only one game.

b) $n(V \cup F \cap T)$

4). A straight line passes through the points (-2, 5) and (2, -3). Determine the equation of the line.

5. The volume of the sphere is 2000cm^3 . Calculate the volume of a similar sphere whose radius is half of that of the given sphere.

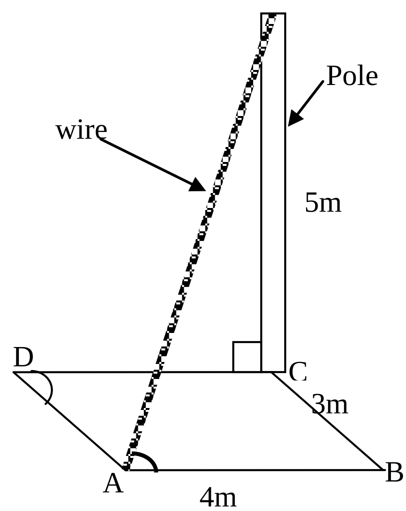
6. Given that $\frac{a + b\sqrt{2}}{c} = \frac{4+\sqrt{2}}{4-\sqrt{2}c}$, find the values of a, b and c

7. The coordinates of points A and B are (-2, -5)and (x, y) respectively, the coordinates of the midpoint of $\overline{AB}$ are (-3, 1). Determine the values of x and y.

8. The position vectors of A and B are a and b respectively. A point x, is on $\overline{AB}$ such that $\overline{4AX} = \overline{3AB}$. Find the position vector of x, in terms of a and b.

9. An examination body pays its setters UGX 100,000 as basic fee and UGX 8,000 for each question set. A withdrawing tax of 6% is deducted from a setter's gross pay. Okot set ten questions. How much was his net pay.

10. The figure below shows a vertical pole, CP of height 5m standing on a rectangular horizontal slab ABCD. $\overline{AB}$ = 4m and $\overline{BC}$ = 3m. PA is a wire that supports the pole.



Calculate the angle between the wire PA and the slab ABCD.

SECTION B: (60 MARKS)

Answer any five questions from this section. All questions carry equal marks.

11. A group of 84 tourist were asked whether they had ever visited Gulu, Mbarara or Soroti, the number of tourists who visited Gulu was equal to the number of tourists who had visited Mbarara .54 had visited Soroti . 14 had visited Soroti and Gulu only .12 had visited Soroti and Mbarara only . 16 had visited Gulu and Mbarara only. 13 had visited all the three towns . 8 had not visited any of the towns.

a) Represent the given information of the Venn diagram.

b) How many tourists had

(i) Visited Mbarara?

(ii) Not visited Gulu?

c) Given that a tourist is selected at random, what is the probability that the tourist had visited two towns only?

12. Towns p and Q are 100km apart. A pick-up starts from town p at 5:00am at a steady speed of 30km/h for 1 hour. It increases its speed to 100km/h until it reaches town Q towards P at a steady speed of 60km/h until it breaks down 1 ½ hours later.
a) On the same axes, draw distance – time graphs for the pick-up and the taxi. (use scale 2cm : 30 minutes on the horizontal axis and 2cm : 10km on the vertical axis)
b) Use your graph to find
(i) the time the taxi and the pick-up passed each other and how far they were from p.
(ii) how far the taxi was from town Q when it broke down
(iii) the time the pick-up reached town Q.

13. (a) Evaluate $\dfrac{2\frac{1}{2}+\left(\frac{3}{5}x1\frac{1}{4}\right)}{1\frac{1}{8}-\frac{3}{4}}$

(b) A lake occupies an area of 43.75 km^2. What would be its area in cm^2, on a map whose scale is 1:250,000?

14. (a) Given that T = {2, 5, 6, 8, 9, 10, 12, 13}, illustrate on papygrams the relations:
(i) "Greater than by 3"
(ii) "Factor of."
(b) If f(x) = x + 13 and g(x) = $\log_{10}$ (x + 2) Find
(i) The value of x when f(x) = 0
(ii) gf(85).

15. (a) A bank in a certain country buys and sells foreign currency as follows

Currency	Buying (UGX)	Buying (UGX)
1 US. Dollar ($)	2,900	3,000
1 pound Sterling (£)	4,650	4,700

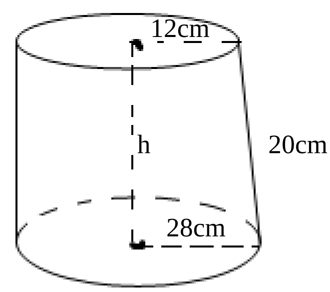
A tourist arrived in that country with $4,500 . UGX converted all the dollars to shillings at the bank. During her stay she spent UGX 9,900,000 and then converted the remaining shillings to pound sterling. Calculate the amount she received in pound sterling.
(b) A generator is being sold in cash or on hire purchase. Its cash value is UGX 894,000. On hire purchase, a deposit of 50% of the cash value is made and followed by equal monthly installment of UGX. 65,000 for 8 months. Calculate the money saved when one buys the generator in cash rather than on hire purchase.

16. Given that

OP = $\begin{pmatrix}3\\4\end{pmatrix}$, PQ = $\begin{pmatrix}4\\-8\end{pmatrix}$, OR = $\frac{1}{2}$ OQ and

S is a point on $\overline{PQ}$ such that $\overline{PS}:\overline{SQ}$ = 1:3, find:
a) OR
b) (i) PR
(ii) $|PR|$
c) OS

17. The diagram below shows a lampshade made out of a lower part of a cone, the base radius is 28 cm, the top radius is 12cm and the slant height is 20cm.



Calculate the;
a) Height h, of the lamp shade.
b) Surface area of the lampshade. (Use π = 3.14)

2017 PAPER ONE
SECTION A

1. Factorize: (x + 4)^2 - (x - 3)^2 ***(04 mks)***

2. Solve the simultaneous equations: ***(04 mks)***
2x - 3y = 7
x + 4y = -2

3. The table below shows marks obtained by 34 students in a Chemistry set.

Marks	Number of students
20 – 29	3
30 – 39	5
40 – 49	8
50 – 59	8
60 – 69	10

Calculate the mean mark. ***(04 mks)***

4.Given that s*t = $2s^2$ - 3t, evaluate 6 *(5* 2).

5. An interior angle of a regular polygon is 162^0. Find the sum of its interior angles ***(04 mks)***

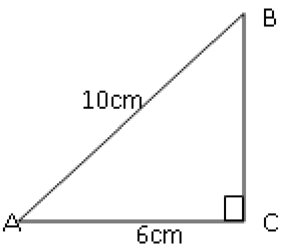
6. Find the values of x and y in

$$= 3\begin{pmatrix} x & 0 \\ 0 & y \end{pmatrix} -2\begin{pmatrix} 3 & 0 \\ 0 & 4 \end{pmatrix} = \begin{pmatrix} 3 & 0 \\ 0 & 4 \end{pmatrix}$$ ***(04 mks)***

7. Solve for x in the inequality ***(04 mks)***

$$\frac{1}{2} - \frac{2}{3}x < \frac{1}{6}x - \frac{1}{4}$$

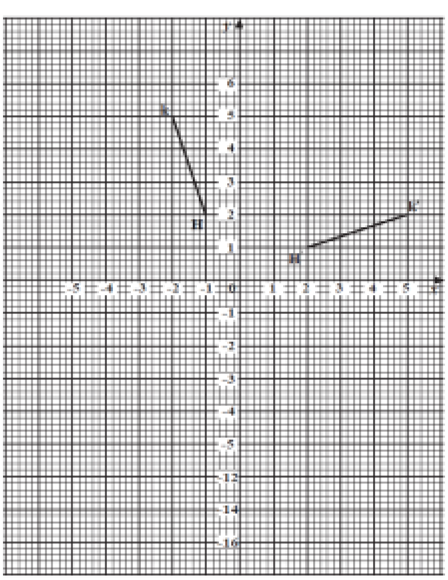
8. In the right angled triangle ABC below, AB = 10cm and AC = 6cm



a) length of BC ***(02 mks)***
b) area of triangle ABC ***(02 mks)***

9. A number which is divisible by 3 is chosen at random from a set of even numbers between 1 and 20. What is the probability of choosing the number? ***(04 mks)***

10. The graph below shows the line HK and its image HK1 after a rotation in the clockwise direction ,



use the graph to determine the;

a) coordinates of the centre of rotation ***(02 mks)***
b) angle of rotation ***(02 mks)***

SECTION B (60 MARKS)

Answer any five questions from this section. All questions carry equal marks

11. a) Copy and complete the table of values below for $y = x^2 + 2x - 15$ ***(03 mks)***
b) Use your completed table to draw the graph of $y = x^2 + 2x - 15$
Use a scale of; 1cm to represent 1 unit on the x-axis, 1cm to represent 2 units on the y-axis. ***(04 mks)***
c) Draw on the same graph the line y = 2x - 14
Hence solve the equation $x^2 - 1 = 0$ (05 mks)

12. Four schools participated in a football tournament which was played in two rounds. The results were as given below;
1st Round

- Bakulu S.S. won one, drew three and lost two matches.
- Dodo S.S won two, drew two and lost two matches
- Kawunga S.S won three, drew two and lost one match
- Oronga S.S. won none, drew two and lost four matches

2nd Round

- Bakulu S.S. won one, drew two and lost three matches.
- Dodo S.S won two, drew one and lost three matches
- Kawunga S.S won two, drew three and lost one match
- Oronga S.S. won one, drew four and lost one matches

a) Write down a 4 x 3 matrix which shows the performance of the schools in
(i) each of the two rounds ***(04 mks)***
(ii) both rounds. ***(03 mks)***
b) Three points are awarded for a win, one point for a draw and no point for a loss.
(i) write down a 3 x 1 matrix to represent the award of points ***(01 mk)***
ii) using matrix multiplication, determine which school won the tournament . ***(04 mks)***

13. a) Make D the subject of the expression

$$L = \sqrt{\frac{3B}{T - D}}$$

Hence, find the value of 0 when B = 540, L = 18 and T = 17 ***(06 mks)***
b) Auma bought 5 Sackets of washing powder

and 2 tubes of toothpaste at UGX 1,700 in January. In February she bought 15 Sackets of washing powder and 2 tubes of toothpaste at UGS. 4,400. What was the price of each item during the two months? ***(06 mks)***

14. Using a ruler, a pencil and a pair of compasses only.
a) construct a triangle ABC, where angle ABC = 70^0 , $\overline{AB}$ = 9.3cm, $\overline{BC}$ = 8.7cm (05 mks)
b) Measure the length of AC and angle ACB. ***(02 mks)***
c) (i) Draw an inscribed circle in the triangle ABC
(ii) Find the radius of the circle ***(05 mks)***

15. A cupboard has 5 white cups and 3 black cups. Two cups are picked from the cupboard one after the other without replacement.
a) Draw a tree diagram to represent the given information
b) Calculate the probability of picking:
(i) one white cup and one black cup
(ii) two cups of the same colour
(iii) at least one white cup ***(07 mks)***

16. A triangle whose vertices are P, Q and R is mapped on a triangle whose vertices are P'(0,'), Q'(5,7) and R' (0, 2) by a matrix of transformation $\begin{pmatrix} 3 & -1 \\ 4 & -1 \end{pmatrix}$. The triangle P'Q'R' is then mapped onto triangle P"O"R" by a matrix of transformation $\begin{pmatrix} 2 & 0 \\ 0 & 2 \end{pmatrix}$

Find the:
a) coordinates of P" , Q" and R" ***(03 mks)***
b) single matrix of transformation which would map P", Q" and R" back onto PQR ***(04 mks)***
c) Coordinates of P, Q and R ***(05 mks)***

17. An investor wants to buy 2 types of generations A and B. Generation A needs $2m^2$ of space and B needs $3m^2$. The available space is only 60m2. The cost of A is \$2,000 and that of B is \$10,000. The investor has \$80,000 to be spent. If x and y represent number of generators of type A and B respectively.
a) write down four inequalities from the information given (04 mks)
b) represent the four inequalities on the same axes.
c) find the greatest number of generators of both types A and B that the investor can buy using the minimum amount of money/. ***(02 mks)***

2017 PAPER TWO
SECTION A

1. An increase of 15% in salaries makes the monthly expenditure on salaries for a factory to be UGX 22,425,000. Find the expenditure before the increase. ***(04 mks)***

2. The sets M and P are such that n(M) = 50, n(P) = 25 and n(M∪P) = 60. Calculate n(P∩M). (04 mks)

3. Find the equation of the line joining the points (3,5) and -2,10) ***(04 mks)***

4. A metallic cylindrical pipe of uniform cross-sectional area has an outer radius of 14cm and an inner radius of 6.5cm. It has a length of 4.2 metres. Calculate the volume in cm3, of the metal used to make the pipe. ***(04 mks)***

5. Express $\frac{3}{1-\sqrt{2}}$ in the form a + b$\sqrt{2}$ ***(04 mks)***

6. Given that f(x) = $\frac{3x+16}{4}$, find the value of $f^1(1)$ ***(04 mks)***

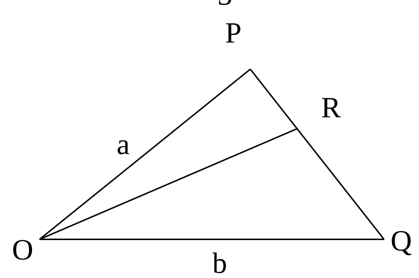
7. The coordinates of the mid-point of a line PQ are (8,-1). The coordinates of P are (5,-5. Determine the coordinates of Q. ***(04 mks)***

8. Two water tanks are of the same shape. The larger tank is 80cm high with a capacity of 500 litres. What is the capacity of the smaller tank whose height is 48cm? ***(04 mks)***

9. Fauza bought one dozen of shirts at UGX 40,000 per shirt. She sold them at a profit of 20%. How much money did she earn as profit from the shirt sales?

10. In the figure below,

OP = a, Oq = b and PR = $\frac{1}{3}$ PQ.



Express OR in terms of a and b ***(04 mks)***

SECTION B: (60 MARKS)

Answer any five questions from this section. All questions carry equal marks.

11. a) Simplify $\dfrac{\left(3\frac{5}{6}\div 2\frac{2}{15}\right)x\frac{3}{23}}{5\frac{1}{3}-2\frac{7}{12}}$ ***(06 mks)***

b) A forest reserve covering an area of 807.5km^2 is represented on a map by a green area of 32.3mc2. determine the scale of the map. ***(06 mks)***

12. In a survey carried out in the department of languages at a certain University, the following data was collected: 20 students spoke German. 10 spoke French and German. 9 spoke French and Kiswahili. 7 spoke Kiswahili and German only. 2 could not speak any of the three languages. 22 could speak at least two of the languages. 12 could speak only one language. 11 could either speak Kiswahili or German but not French. ***(06 mks)***

a) Use a Venn diagram to represent the given information. ***(03 mks)***

b) Find the number of students that could speak;

i) all the three languages

ii) Kiswahili only.

(iii) French only.

c) What is the probability that a student picked at random from the group could speak either Kiswahili nor German? ***(04 mks)***

13. A cyclist covered a journey of 48km from station A to station B in $5^1/_2$ hrs. The cyclist rode at 12km/hr for the first 2 ½ hrs and changed speed for the remaining part of the journey.

a) (i) Determine the speed fo the cyclist for the remaining part of the journey. (06 mks)

(ii) Represent the cyclist journey on a distance – time graph. ***(04 mks)***

b) Calculate the average speed of the cyclist from statin A to B.

14. (a) Given the set {2, 4,6} draw a papygram to show the relation"

''is the smallest prime factor of''. ***(03 mks)***

(b) For the mapping $x \rightarrow 4x+5$, find the domain when the range is {1,13} ***(04 mks)***

(c)The function f(x) = 2x^2 and g(x) = 5x - 3. Find the value of x such that f(x) = g(x)

15. a) If $a = \begin{pmatrix}-2\\4\end{pmatrix}$, $b = \begin{pmatrix}-5\\1\end{pmatrix}$, $c = \begin{pmatrix}-1\\3\end{pmatrix}$ and 2a + m + b = c, find

(i) m (ii) $|m|$

b) Using vectors, show that the points P(-4, 1), Q(0,2) and R(8,4) lie on a straight line. ***(06 mks)***

16. The table below shows fares for some flights at an airport.

Destination	One way ticket (US dollars)	Return ticket (US dollars)
A	300	565
B	705	1295
C	380	714
D	186	302

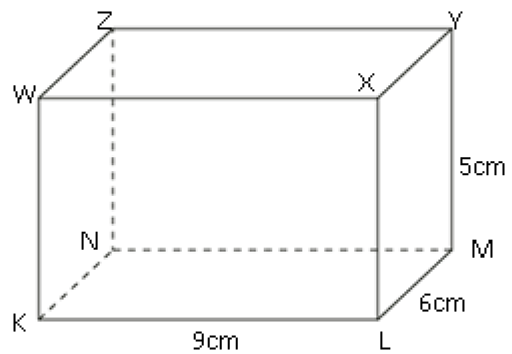
- One way ticket means from airport to destination
- Return ticket means from airport to a destination and back to airport

a) Calculate the amount in UGX for a one way ticket to B if the exchange rate is US$ 1 to UGX 2,500/= ***(02mks)***

b) A family bought four return tickets from destination A at UGX 5,737,000. Determine the exchange rate. ***(05 mks)***

c) A tourist bought a one way ticket to C at a rate of US $ to UGX 2,400. Another tourist bought a one way ticket to C at a rate of US $ 1 to UGX 2,420, a week later. How much more in UGX dis the second tourist pay? ***(05 mks)***

17. The diagram below shows a cuboid KLMNWXYZ in which KL = 9cm, LM = 6cm and MY = 5cm.



a) Calculate the length

(i) KM

(ii) KY.

b) Determine the angle between;

(i) line KY and the base KLMN

(ii) plane KZYL and plan WXY.

456/1 MATHEMATICS
Paper 1: UNEB 2018
SECTION A:

1. Given that m* w = $\frac{3m-n}{2}$, evaluate 6* (3*1) * 1). ***(04 marks)***

2. Find the integral values of y in the inequality $2y + 3 < 27$ if $y > 9$. ***(04 marks)***

3. Determine the inverse (P^{-1}) of $P = \begin{pmatrix} 4 & 6 \\ -4 & -5 \end{pmatrix}$

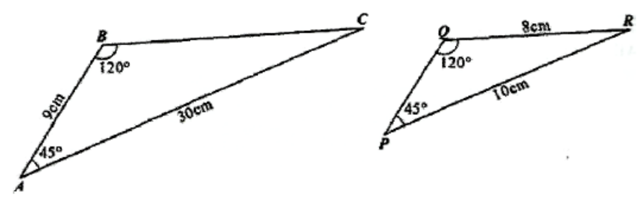
(04 marks)

4. The ages in years of six girls are as follows: 17, 8, 15, 12, 15, 13.
What would be the age of the seventh girl that would make the mean age of all the girls to be 13 years?
(04 marks)

5. Factorise $3x - 48y$ completely. ***(04 marks)***

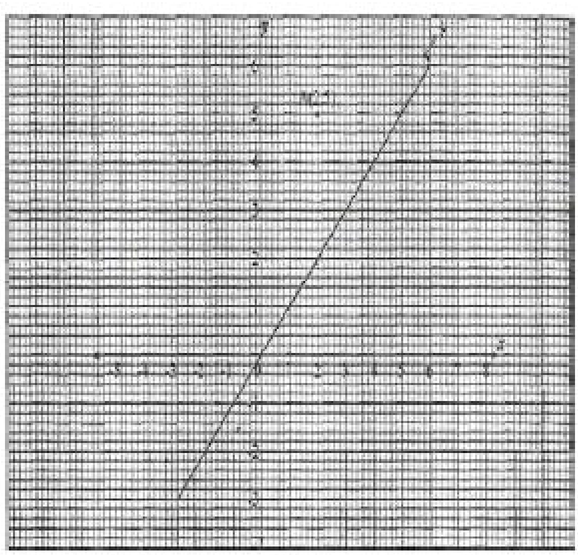
6. Form a quadratic equation in x whose roots are -3 and $\frac{1}{4}$ ***(04 marks)***

7. The triangles ABC and PQR shown below are similar.



Find the lengths of
(a) *PQ.*
(b) *EC.* ***(04 marks)***

8. A point $A(2,5)$ is reflected in the line $y = x$ which is shown on the graph



(a) Use the graph to show the image of *A.*
(b) State the coordinates of *A* .

NB: *Cut along this line and attach to your answer booklet. Remember to write your name and personal number on this sheet*

9. The table below shows the sum of two numbers

+	1	2	3
3	-	5	6
5	6	_	8
7	8	-	-

(a) Copy and complete the table. *(02 marks')*
(b) What is the probability that the sum is both odd and prime? *(02 marks)*

10. Find the two possible values of x if $10\sin x = 6$ and $0° \leq x \leq 180°$ (04 marks)

SECTION B : (60 MARKS)

Answer any five ***questions from this section. All questions carry equal marks.***

11. A bag contains 3 black balls, 4 green balls and 5 yellow balls.
(a) If two balls are picked at random without replacement, find the probability that both balls are of the same colour. ***(09 marks)***
(b) How many black balls must be added to the bag so that the probability of drawing a black ball is $\frac{1}{2}$?
(03 marks)

12. (a) Make *N* the subject of the expression
$V = MN^2P.$
Hence, find the value of N when $M = 9$, $P = 3$ and $V = 243$. ***(05 marks)***
(b) Amooti bought three books and five pens at Shs9,700. If he had bought two books and eight pens, he would have spent Shs900 less. Calculate the cost of a
(i) book,
(ii) pen. ***(07 marks)***

13. The vertices R(0,1), *S* (0,3) and 7(3,1) of a triangle are mapped onto *R*', *S' and T' by*
a transformation matrix $P = \begin{pmatrix} 1 & 0 \\ 2 & 4 \end{pmatrix}$
(a) Find the coordinates of the vertices of the image triangle *R'S' T'* ***(06 marks)***
(b) Use the determinant of *P* to find the ratio of the area of triangle *RST to the area* of triangle *R 'S'T'.* ***(03 marks)**)*
(c) Determine the matrix of transformation which maps *R 'S'* T' back onto *RST.*
(03 marks)

14. Using a ruler, a pencil and a pair of compasses only,
(a) construct a triangle *ABC,* in which angle *BAG* = 30°, angle *ABC* is 120 d $\overline{AB} = 8cm$ ***(05 marks)***
(b) Measure and record the lengths *AC* and BC. ***(02 marks)***
(c) (i) Draw an inscribed circle in the triangle *ABC.*
(ii) Measure and record the radius of the circle. (05marks)

15. (a) Copy and complete the table below for values of $10 - x^2$.

X	-4	-3	-2	-1	0	1	2	3	4
$10 - x^2$	-6		6	9	10	9		1	-6

(i) Using 2cm for 1 unit on the x-axis and 1cm for 1 unit on the y-axis, draw the graph of $y = 10 - x^2$

(ii) Use your graph to solve the equation $10 - x^2 = 0$

(07 marks)

(b) (i) On the same axes, draw the graph of the equation $y = 2x + 3$.

(ii) Use your graphs to solve the equation $x^2 + 2x - 7 = 0$ ***(05 marks)***

16. (a) Using matrix method, solve the following simultaneous equations:

$3x - 4y - 1 = 0$

$6x - 6y = 5$ ***(06marks)***

(b) (b) Three girls went shopping and bought loaves of bread, cakes and packets of biscuits. Ann bought 2 loaves, 3 cakes and 6 packets of biscuits. Betty bought 3 loaves, 4 cakes and 5 packets of biscuits. Caroline bought 3 loaves, 6 cakes and 3 packets of biscuits,

(i) Represent this information in matrix form,

(ii) One loaf cost Shs3,500, one cake costs shs500 and a packet of biscuits costs Shs2,000. Using matrix multiplication obtain the money spent by each girl. Hence, determine the total amount of money spent by the three girls. ***(06 marks)***

17. A wholesaler wishes to transport at least 240 bags of sugar from the factory to his shop. He has a lorry that can carry 90 bags per trip and a pick-up that can carry 20 bags per trip. The cost of each trip is Shs 50,000 for the lorry and Shs 15,000 for a pick-up. He has Shs 180,000 available to transport the sugar. The pick-up makes more trips than the lorry. If x is the number of trips to be made by the lorry and y the number of trips to be made by the pick-up;

(a) Write down five inequalities to represent the given information. ***(04 marks)***

(b) Represent the inequalities on a graph. ***(04 marks)***

(c)Use the graph to find the possible number of trips to be made by the lorry and the pick-up. Hence find the minimum cost of transporting the bags of sugar. ***(04 marks)***

456/2 MATHEMATICS
Paper 2: UNEB 2018
SECTION A:

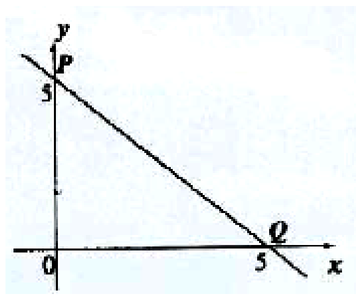
1. Express the recurring decimal 1.633 . . in the form $\frac{a}{b}$ where a and b are integers. ***(04 marks)***

2. A line passes through points (3, k) and (2, 7). It is parallel to another line whose gradient is 12. Find the value of k. ***04 marks)***

3. Calculate the volume of a hemisphere whose radius is 4.9 cm. ***(04 marks)***

4. Given that A={2, 3, 5,7, 11,13, 17} and B= {1,2,3,5,6,10,15,30}, find $n(A \cap B)$. ***04 marks)***

5. The diagram below shows a line which cuts the y-axis at P and the x-axis at Q



Determine the equation of the line. (04 marks)

6. If $\log_x y = 2$ and $xy = 27$, find the values of x and y. ***(04 marks)***

7. Jane bought a television set at Shs 450,000. She sold it at Shs 550,000. Calculate her percentage profit. ***(04 marks)***

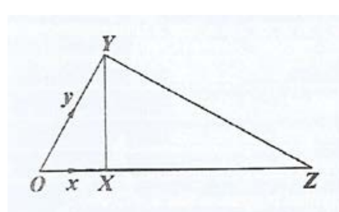
8. Mugisha, Kate, Okello and Zziwa like the following types of foods:- matooke, rice, meat and matooke respectively.

(a) List the elements of the domain and range of the relation "likes" ***(02 marks)***

(b) Draw an arrow diagram to illustrate the relation. ***(02 marks)***

9. The length of each side of a cube is 2x cm. The surface area of the cube is 216 cm". Find the length of each side. ***(04 marks)***

10. In the diagram below, OX = x, OY=y and OZ=3OX.



Express 2OY + ZY in terms of x and y. ***(04 marks)***

11. Two functions f and h are defined as $f(x) = x^2 - 1$ and $h(x) = x + 3$.
Find
(a) $f^{-1}(3)$. ***(05marks)***
(b) the value of x if $hf(x) = fh(x)$. ***(07marks)***

12. At a workshop of 150 teachers, it was found that 58 drank juice (J) , 66 drank water (W) and 57 drank soda (S) . 10 drank water and juice, 11 drank juice and soda and 13 drank water and soda. Some of the teachers drank all the three types of drinks. All the teachers drank at least one of the drinks.
(a) Show this information on a Venn diagram. ***(07 marks)***
(b) Find the number of teachers who drank all the three types of drinks. ***(02 marks)***
(c) What is the probability that a teacher chosen at random did not drink water? ***(03 marks)***

13. (a) A car driver covered a distance of 60 km at 100 km/h. A lorry driver covered the same distance but took half an hour more.
Calculate the,
(i) time taken by the lorry driver.
(ii) average speed of the lorry driver.
(05 marks)
(b) A traffic police patrol car travelling at 120 km/h is chasing a taxi 0.5 km away and travelling at 100 km/h. How far must the police patrol car travel in order to catch up with the taxi? ***(07 marks)***

14. The table below shows the tax structure on taxable income of public servants working in a certain country.

Income per annum (Shs)	Tax rate %
0 – 1,200,000	12.5
1,200,001 – 2,400,000	30.0
2,400,001 – 3,600,000	36.5
3,600,001 and above	45.0

A man's gross annual income is Shs 6,460,000. His allowances are;

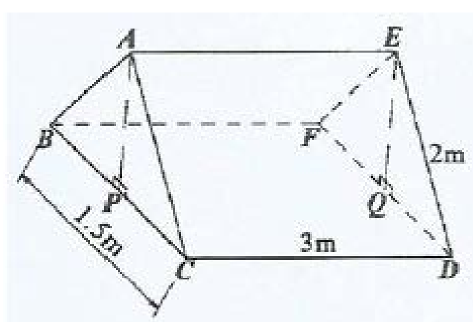
Housing - Shs 125,000 per month.
Marriage - $\frac{1}{10}$ of his gross annual income.
Medical - Shs 354,000 per annum.
Transport - Shs 60,000 per month.

Family allowances per annum for only 3 children are as follows:
Shs 25,000 for each child between 10 and 18 years.
Shs 32,000 for each child below 9 years.
He has to pay an insurance premium of Shs 48,900 per annum.
He has four children with two of them below eight years, one is 16 years and the oldest is 20 years. Calculate,
(a) his taxable income. ***(07 marks)***
(b) income tax paid annually. ***(05 marks)***

15. The cost C, of operating a day school for one day is partly constant and partly varies as the number of students, n. It costs Shs 40,000 to run the school when there are 500 students and Shs 64,000 when there are 900 students.
(a) Form an equation for the cost C and the number of students, n. (08 marks)
(b) What would be the cost of running the school when there are 700 students? ***(02 marks)***
(c) If the cost of running the school is Shs 82,000 per day, how many students are in the school? ***(02 marks)***

16. The position vectors of points P, Q and R are $OP = \begin{pmatrix} -3 \\ -5 \end{pmatrix}$, $OQ = \begin{pmatrix} -7 \\ -1 \end{pmatrix}$ and $OR = \begin{pmatrix} -1 \\ 9 \end{pmatrix}$. M is a point such that $OM = _x\ OQ$ and $OM = OP + _y\ PR$.
Determine the:
(a) vector PR. ***(03 marks)***
(b) values of x and y. ***(07 marks)***
(c) position vector OM. ***(02 marks)***

17. The figure below represents a tent in the form of a triangular prism ABCDEF. $\overline{BC} = 1.5$ m, $\overline{CD} = 3$ m and the slanting edges are 2 m long.



Calculate the:
(a) height of the tent, AP. *(02 marks)*
(b) angle between the lines BC and AC. *(02 marks)*
(c) angle between the planes ABFE and ACDE. (03 marks)
(d) angle between the line CE and the base BCDF. *(05 marks)*

456/1 MATHEMATICS
Paper 1: UNEB 2019

SECTION A:

1. Solve the quadratic equation:
$P^2 - 7p + 12 = 0$ (04 marks)

2. The lengths of 8 trousers in centimeters are 90, 115, 98, 103, 108, 105, 101 and 98.

Find the;
Modal length.
Median length. (04 marks)

3. Given that $\tan \Theta = \frac{-5}{12}$ and $270^o \leq 360^o$, determine the value of $\cos \Theta$ (04 marks)

4. Factorise completely the following expressions:

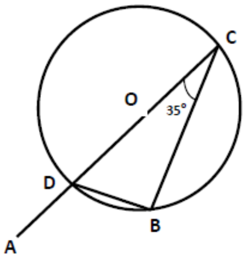
(a) $(a + 1)^2 - 3(a + 1)$. *(02 marks)*

(b) $49 - (x - 4)^2$. *(02 marks)*

5. A square of area $36cm^2$ is transformed to an image using the matrix $\begin{pmatrix} 3 & 1 \\ 2 & 5 \end{pmatrix}$. Determine the area of the image (04 marks)

6. Matovu is twice as old as Nankya. After four years, the sum of their ages will be 26 years. Find Nankya's age. (04 marks)

7. The figure below shows a circle with centre O and angle BCD = 35^o.



Calculate;
(a) angle CDB.
(b) angle ADB. *(04 marks)*

8. Solve the simultaneous equations:
$2y - 3x = 13$
$3y + x = 3$ (10 marks)

9. The table below shows the ages in years of 40 teachers in a school.

Age (years)	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69
Number of	2	4	8	10	7	5	3	1

Draw a cumulative frequency curve (ogive) for the data. *(04 marks)*

10. Given that $\begin{pmatrix} x & 3 \\ 2 & y \end{pmatrix}\begin{pmatrix} 2 \\ 5 \end{pmatrix} = \begin{pmatrix} -1 \\ 18 \end{pmatrix}$, find the values of x and y (04 marks)

SECTION B : (60 MARKS)

Answer any five *questions from this section. All questions carry equal marks.*

11. Mukisa stays 6km away from the factory where he works. One day, he started on his journey at 6:42am and arrived at 7:30am. He walked part of the journey at 5km/h. Realizing he would be late, he ran the rest of the journey at 10km/h.
(a) What distance did he have to run? *(07 marks)*
(b) The factory closes its gate to its workers at 7:45am. Determine the number of minutes by which Mukisa would have been late had he not run part of the journey. *(05 marks)*

12. (a) Given the matrices

$B = \begin{pmatrix} 2 & 8 \\ 16 & -4 \end{pmatrix}$ *and* $C = \begin{pmatrix} 6 & -4 \\ -12 & 8 \end{pmatrix}$

Find the inverse of the matrix (B + C). *(05 marks)*

(b) Mayo sells shirts of sizes Small (S), Medium (M) and extra Large (XL). The table below shows his sales for 3 days.

SIZE	Day		
	Mon	Tues	Wed
S	2	2	1
M	7	4	1
XL	3	5	3

He sells each shirt at Shs. 40,000 for S, Shs. 40,000 for M and Shs. 60,000 for XL
(i) Write down a:
- 3 x 3 matrix for the sales
- 1 x 3 matrix for the prices of the shirts
(ii) Use the matrices to calculate his total income from the shirts. *(07 marks)*

13. On a farm, there are four houses P, Q, R and S. P is 800m on a bearing of 020^o from Q. R is 500m on a bearing of 160^o from Q. S is 1200m on a bearing of 045^o from R
(a) Use a scale of 1cm to represent 100m to construct a scale drawing showing the positions of the four houses
(09 marks)
(b) Find the distance and bearing of s from P.
(03 marks)

14. (a) A bag contains red balls and white balls. The probability of picking a white ball is $\frac{1}{8}$. If there are 24 balls in the bag, find the number of red balls.
(04 marks)
(b) A basket contains 30 bananas. Ten of them are ripe and the rest are unripe. Two bananas are selected at random from the basket with replacement. Find the probability that;

(i) both are ripe.
(ii) one is ripe and one is unripe. (08marks)

15. The height y metres of a wave on a certain day is given by y = 5 + cos (30x)o where x is the number of hours after midnight. .

(a) Use x at intervals of one hour from 0 to 6 hours to find the corresponding values of y. Put the values of x and y in a table . (04 marks)

(b Use the table to draw a graph of y against x.

(06 marks)

(c) From your graph, find the;

(i) height of the wave at 3:30am
(ii) time when the height of the wave is 5.2m

(02 marks)

16. A triangle ABC with vertices A(-4, 2), B(-5, 5) and C(-1, 4) is mapped onto triangle A'B'C' by a transformation matrix

$$T = \begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}.$$

The triangle A'B'C' is mapped onto triangle A"B"C" by another transformation matrix

$$M = \begin{pmatrix} -2 & 0 \\ 0 & -2 \end{pmatrix}.$$

(a) Determine the coordinates of the vertices
(i) A', B' and C'.
(ii) A", B" and C" ***(04 marks)***
(b) On the same axes draw the triangles ABC, A'B'C' and A"B"C" (04 marks)
(c) Determine fully the transformation represented by
(i) T.
(ii) M (04 marks)

17. A school has organized a Geography study tour for 90 students. Two types of vehicles are needed; taxis and costa buses. The maximum capacity of the taxi is 15 passengers while that of the costa bus is 30 passengers. The number of taxis will be greater than the number of costa buses. The number of taxis will be less than five. The cost of hiring a taxi is Shs. 60,000 while that of the costa is Shs. 100,000. There is only Shs. 600,000 available.

(a) If x represents the number of taxis and y the number of costa buses; write six inequalities for the given information.

(05 marks)

(b) Represent the inequalities on graph paper by shading the unwanted regions. (Use the scale of 2cm to 1 unit on both axes)

(04 marks)

(c) Find from your graph the number of taxis and costa buses which are full to capacity that must be ordered so that all students are transported. ***(03 marks)***

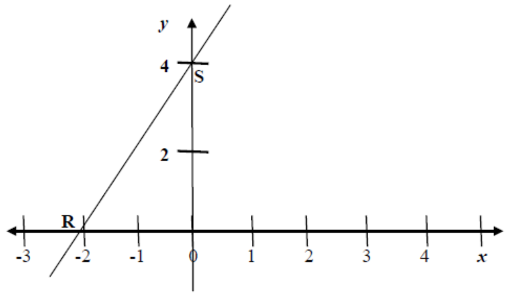
456/2 MATHEMATICS

Paper 2: UNEB 2019
SECTION A:

1. If 7y = 24, find the value of y, correct to 2 decimal places. *(04 marks)*

2. Two sets A and B in the universal set ε, are such that $n(A \cap B) = 3$, n(B) = 5 and n(A") = 7. Use a Venn diagram to find $n(A \cup B)'$. (04 marks)

3. In the diagram below, the line RS cuts the x-axis at R and the y-axis at S.



Determine the equation of the line RS.

(04 marks)

4. Express 0.84545… as a fraction in its simplest form ***(04 marks)***

5. The coordinates of points A and B are (-5, -3) and (1, 9) respectively.
Find the;
(a) Mid-point of AB ***(02 marks)***
(b) length of AB ***(02 marks)***

6. The function f is defined as $f: x \rightarrow 3^x - 2x$. Determine the range if the domain is {0, 1, 2, 3} ***(04 marks)***

7. An open cylinder has a height of 15cm and a radius of 7cm. Calculate the surface area of the cylinder. ***(04 marks)***

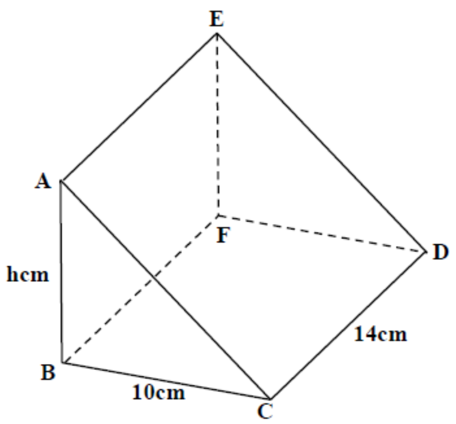
8. Given that $a = \begin{pmatrix} 4 \\ -5 \end{pmatrix}$ and b = 3a.

find $|a+b|$.

9. Apili has Shs. 20,000,000 on her fixed deposit account in a bank. The bank gives a compound interest at a rate of 4% per annum. Calculate the amount Apili will receive after 2 years.

(04 marks)

10. The volume of the prism below is 1190cm^3, AB = h cm, BC = 10cm and CD = 14cm.



Find the value of h. (04 marks)

SECTION B:

Answer any five questions from this section. All questions carry equal marks.

11. (a) Show that points A(-3, -2), B(3, 1) and C (5, 2) lie on a straight line. (06 marks)

(b) Two points M and N have position vectors $\begin{pmatrix} 3 \\ -1 \end{pmatrix}$ and $\begin{pmatrix} -2 \\ 5 \end{pmatrix}$ respectively.

If P is a point such that 3MN = MP, find the coordinates of P. (06 marks)

12.The cost C (Shs) of a roll of cloth is partly constant and partly varied as the square of length / (metres) of the cloth. The cost of a roll of 50 m is Shs.50,000. The cost of a roll of length 80 m is Shs.96,800.

(a) Form an equation relating the cost, C and the length, l. ***(08 marks)***

(b) Calculate the;
(i) cost of a roll of length 20 m.
(ii) length of a roll which costs Shs.34,700.
(04 marks)

13. In a class of 68 students, 2 of them do not eat any of the three foods of beef (B), chicken (C) and fish (F). 25 students eat beef and chiceken, 19 eat beef and fish while 23 eat chicken and fish. 38 students eat fish. Some students eat all the three foods. The numbers of students in the class who eat only one of the foods are equal.

(a) Represent the given information on a Venn diagram. *(05 marks)*
(b) Determine the number of students in the class who eat;
(i) all the three foods
(ii)beef.
(iii)fish. ***(05 marks)***

(c) If a student is selected at random from the class, find the probability that the student eats only two of the three foods. ***(02 marks)***

14. A car travelling at 12m/s accelerates uniformly and in 3 seconds its velocity is 30m/s. It then continues at this velocity for another 4 seconds and finally decelerates uniformly to rest in 6 seconds.
(a) Draw a velocity – time graph for the motion of the car. ***(05 marks)***
(b) Using your graph, determine the acceleration of the car. ***(02 marks)***
(c) Calculate the distance travelled by the car in the 13 seconds. ***(05 marks)***

15. (a) The functions $f(y)$ and g (y) are defined as
$f(y) = y + 2$
and $g(y) = \frac{y-4}{5}$
Find;
(i) $fg(y)$
(ii) $fg(9)$ ***(05 marks)***
(b) If the function
$h(x) = \frac{x-4}{x-2}$,
determine;
(i) $h^{-1}(x)$ (y)
(ii) $h^{-1}(3)$ ***(07 marks)***

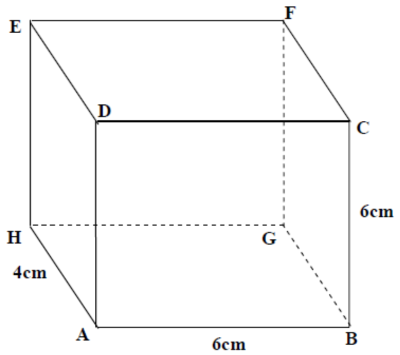
16. The table below shows the income tax rates of government employees.

Taxable monthly income (Shs)	**Tax rate**
100,000 and less than 200,000	10%
200,000 and less than 300,000	20%
300,000 and less than 400,000	30%
400,000 and less than 500,000	40%
500,000 and over	55%

An employee has a gross monthly income of Shs.703,900 including non-taxable monthly allowances as given below.
- Marriage allowance: Shs.126,500 per month
- Housing and transport: 15% of gross monthly income
- Medical care: Shs.48,000 per month.

Find his;
(a)taxable income. ***(04 marks)***
(b) net income. ***(08 marks)***

17. In the figure below ABCD is a square, AB = BC = 6cm and BG = 4cm.



Calculate the;

(a) (i) length of AF

(ii) angle between the line AF and plane ABGH. (08 marks)

(b) angle between planes ABFE and ABGH (04 marks)

END