My MATHEMATICS

Practice WORK BOOK

Make learning mathematics fun!

Over 500 questions to keep you up dated in mathematics

New generation edition 2022-23

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PREFECE

This book has been developed basing on the curriculum whose aim is to enable learners to make informed decisions as mathematicians, give others the skills that they need to think critically and study efficiently.

This book has been designed while taking care of special learning needs. It has been developed to ensure that majority of the learners leave school with a worthwhile relevant qualification in mathematics that they will eventually use in everyday life and at workplaces.

The major aim of the content in this book is to develop mathematical understanding, logical reasoning, thinking, problem solving skills, and analytical thought, with the intent to help learners to solve familiar and unfamiliar problems. The content is purposed to build the confidence of the learners with the mathematics that s/he uses in his/her daily life and the community at large.

This work book is an invaluable reference resource of mathematical questions that vividly captures the entire UCE mathematics syllabus prescribed by the NCDC. It is written by experienced mathematics teachers, making its coverage of the questions adequate and comprehensive. It is a realistic attempt to condense the entire UCE syllabus probable mathematics questions.

The core aim of this work book is give learners a practical touch in mathematics and give hope to learners to excel in mathematics. For simplicity issues, the spaces provided for calculations may not be sufficient enough, you are required to provide extra space in your exercise book where necessary and calculate.

We are hopeful that you will find this work book handy and very useful in your endeavours.

BEST WISHES FROM US THE AUTHORS

ACKNOWLEDGEMENTS

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NUMERICAL CONCEPTS.

Numerical concept concerns types of numbers, operation on numbers, factors, prime factors, LCM, HCF, fractions, decimals, number bases, scales and representative fractions.

<u>QUESTIONS</u>

1. Find the LCM of 96, 54 and 128.

2. Two indicators flash at intervals of 60 second and 96 seconds. If they start flashing at the same time, after how long will they flash again together?

3. Express 1764 as a product of its prime hence find the square root of 1764

4. When the numbers 53, 77 and 113are each divided by another number n, each leaves a remainder of 5. Find the greatest value of n.

5. Squares as large as possible and of equal size are to be cut from a rectangular sheet of paper of dimensions 36cm by 60cm. find;
   i.   the size of each square.
   ii.   the number of squares which are cut out.

6. Simplify and evaluate the following
   i. $\frac{2}{3} of \frac{3}{5} + \frac{3}{5}$

   ii. $1\frac{2}{7} + 1\frac{1}{4} \div 2\frac{1}{7} + \frac{1}{2}$

iii. $\dfrac{3\frac{4}{5}\,of\,\frac{6}{7}+2\frac{1}{3}}{\left(4\frac{1}{4}-2\frac{1}{2}\right)+\frac{3}{7}\div\frac{15}{14}}$

7. Mr Kalema's monthly salary is shs. 1450000. He spends $\frac{2}{5}$ of his salary on food, $\frac{1}{4}$ on rent, $\frac{1}{5}$ of the remainder on transport and the rest is saved. How much money does he save?

8. Maina, Nambi and Abiti are to share 175 mangoes in the ratio 10:8:7. How many mangoes will each get?

9. If p:q=4:3 and q:r=2:5, find the ratio p:q:r

10. When the number x is decreased in the ratio 4:7, it becomes 160. Find the number x

11.   Given that x:y =4:5 and x+y = 20, find the value of
         3x-y

12.   Find the value of $\frac{3x-y}{x+y}$ if x:y = 5:7

13.   On the map of scale 1:60000, the length of the road is
         3.5cm. Find the actual length of the road in km.

14.   On a map of scale 1:200000, a game reserve has an area of 20cm^2. Find the actual area in km^2

15.   A road reserve stretches an area of 100km by 20m. if on a map, it measures 2cm^2, find the scale of the map

16.   According to Hooke's law, the extension of an elastic material is directly proportional to the force applied. When a force of 20N is applied on a wire, the wire extends by 7cm. what force must be applied to the same wire so that it extends by 10cm?

17.   At Kawanda ss, 100kg of beans can feed 350 students per day. How many kg of beans are required if 200 more students join the school?

18.   It would take 15 men to cultivate a piece of land in 6 days. How long will 10 men take to cultivate the same piece of land working at the same rate?

19.   10 men take 4 days to dig a trench of length 10km. How long will 3 men take to dig the same trench if they work at the same pace?

20.   It would take 15 men 8 days to dig a trench of 240m long. Find how many days it would take 18 men to dig a trench of 60m length if working at the same rate.

21.   The quantity V varies directly as h and inversely as the square of r. given that when r =50, h = 100 and V = 80. Find r when h =320 and V=100.

22.   A quantity M partly constant and partly proportional to N and that when N = 6, M = 130 and when N = 15, M = 220.

    i.   Write down an expression connecting M and N

    ii.   Find the value of M when N = 25

23. Atom science centre is a holiday coaching centre for students. The cost of running atom science centre is partly constant and partly varies directly with the number of students available per holiday. It costs shs.350000 when 50 students attend the holiday program and shs.600000 when 100 students attend. If C is the cost and n is the number of attendants,

  i. Find the cost of running atom science centre when 250 students attend the holiday program.

  ii. If during a certain holiday, shs.750000 was spent, determine the number of students who attended that holiday program.

24. Solve for n in the equation: $243_n = 201_{seven}$

25. Given that: $143_x + 15_{x+1} = 113_{eight}$ find the value of x

ALGEBRA

Algebra which is the relationship between alphabetical letters and mathematical operations, concerns expansion and factorisations of expressions with brackets, different approaches for example difference of two squares, quadratic factorisation, algebraic operations, change of subject of a formula, linear and simultaneous equations, quadratic equations and graphs, mapping and relations, evaluating functions, logarithms, indices and surds,

QUESTIONS

1. Factorise the following
    i. $5x + 5y$

ii. $4x + 8y - 6z$

iii. $6a^2b - 18ab^2$

iv. $ax + ay - by - bx$

    v. $4ax - 12a - 9x + 27$

    vi. $x^4 - 16$

    vii. $25(x + y)^2 - 1$

    viii. $x^2 + 8x + 15$

ix. $2x^2 + 5x - 3$

x. $5y^2 - 37y + 14$

2. Without using a calculator or mathematical tables, evaluate the following
   i. $25(383^2 - 17^2)$

ii. $7.06^2 - 2.04^2$

iii. $\dfrac{269^2 - 137^2}{3 \times 7 \times 8}$

3. Given that $x * y = \dfrac{2}{3}x^2 - 4y^2 + xy$. Evaluate,
   i. $6 * 3$
   ii. $9 * (6 * 3)$

4. The operation is defined by $x * y = x(4 + y)$.
   Solve the equation $3 * a = 4 * 5$

5. Make the following letters in brackets the subject of the formulae
   i. $A = \pi r^2 h$ (h)

   ii. $V = \frac{4}{3}\pi r^3$ (r)

iii. $T = \sqrt{\dfrac{pbh}{4+a^2}}$ (a)

6. Given that $r = \dfrac{d^2}{4\pi^2}\left(\dfrac{f-hm}{n}\right)$. Make m the subject.

7. Solve the following linear equations
   i. $3x - 4(x - 2) = 5x + 7$

   ii. $\frac{(2x+4)}{5} - 6 = 2(4 - 3x)$

   iii. $\frac{m+2}{2} + 3 = \frac{4m-4}{11}$

8. Think of a number which when added to 3 and the result doubled gives the answer 28.

9. Janat is twice as old as Masturah. In four years' time, the sum of their ages will be 65. Find their present ages.

10. The length of a rectangle is 7cm more than its width. Given that its perimeter is 38cm. find;
   i. the dimensions of the rectangle
   ii. area of the rectangle

11. Joyce is 7 years younger than her husband and 5 years older than her brother. The sum of the ages of her husband and brother is 58. Determine the age of Joyce's brother

12.   A bus left Gulu for Kampala a distance of 320km at an average speed of 60km/h. At the same time, a minibus left Kampala for Gulu at an average speed of 70km/h. both vehicles use the same route. After how long will the two vehicles meet each other?

13.   The coordinates of points P and Q are (-4, -5) and (m, n) respectively. The coordinates of the midpoints of PQ are (-3, 1). Determine the values of m and n

14.   Use elimination method to solve the pairs of simultaneous equations below

    i.   x+3y = 22

        4x-5y =-31

    ii.   2x+3y-14=0

        3x+2y+5=0

15. Use substitution method to solve the following pair of simultaneous equations

i. 4x+y = 5

3x – 2y =12

ii. 3m - 4n = 10

5m + 2n = 8

iii. 2a - b - 4 = 0
      3a = 6 + 2b

16.   The sum of two numbers is 55 and their difference is 21. Find the numbers.

17.   In a super market, Nankya bought 3kg of sugar and 2 tins of kimbo at shs. 25200, Kizito also bought 1kg of sugar and 4 tins of kimbo at shs.32400. Find the cost of a kg pf sugar and a tin of kimbo.

18.   Thrice a number minus twice the second number is 13. Five times the same number add the second number is 39. Find the two numbers.

19.   Solve the following quadratic equations by factorisation

i. $4x^2 - 16x + 16 = 0$

ii. $4a^2 - 50a + 84 = 0$

iii. $x^2 - 4x = 0$

20.   Solve the following quadratic equations by completing squares

i. $x^2 + 3x - 6 = 0$

ii. $5x^2 + 13x + 6 = 0$

iii. $4y^2 = 12 - 7y$

21.   By using the quadratic formula, solve the following quadratic equations

i. $4x^2 - 16x + 16 = 0$

ii. $4a^2 - 50a + 84 = 0$

iii. $x^2 - 4x = 0$

22.   Form a quadratic equation whose roots are 5 and -7

23.   The product of two consecutive numbers is 42. Find the two numbers.

24.   The height of a right angled triangle is 3cm more than its base. Given that the area of the triangle is 44cm^2 , find its height and the length of its base

25.   Draw the graph of $y = 2x^2 - 3x - 5$ for $-3 \leq x \leq 4$
Use your graph to solve the following equations
i. $2x^2 - 3x - 5 = 0$
ii. $2x^2 - 3x - 2 = 0$
iii.   Find also the turning point of the curve and the minimum value of the curve

26.   (a). Draw the graph of $y = 3x - 2x^2 + 5$ for $-3 \leq x \leq 4$

(b). Use your graph to solve the equations

(i). $3x - 2x^2 + 5 = 0$

(ii). $-2x^2 + x + 4 = 0$

(c). Determine the equation of line of symmetry of the curve.

27.	(a). Copy and complete the table below

x	-4	-3	-2	-1	0	1	2
x^2		9			0		
$3x$		-9			0		
-2		-2			-2		
y		-2			-2		

(b). Use the table above to draw the graph of $y = x^2 + 3x - 2$

(c). Use your graph to solve the equation $x^2 + 3x - 2 = 0$

(d). On the same axes draw the graph of the line $y = 3x + 5$. Hence determine the coordinates of the points of intersection of the curve and the line.

28. Draw a papygram for the relation "greater than" of a set M = {-3. -2, 0, 1, 2, 3}

29. Find the range B for the mapping $x \to 3x + 2$ given the domain A = {-3, -2, 0, 1, 2, 3}

30.   Draw a papygram to show the relation defined on the given set.

i.   Set A = {2, 3, 4, 5, 7}, relation "is less than"

ii.   Set P = {-4, -3, -2, 0, 4, 9, 16}, relation is "is a square root of"

31.   Given that $h(x) = \frac{1}{2}x^2 - t$ and $h(4) = 5$. Find;

    i.   The value of t

    ii.   h(-2)

32.   Given that $f(x) = \frac{ax+2}{x-1}$ and f(3) = 4 determine the;

    i.   Value of a

    ii.   The value of x for which f(x) is meaningless

33.   (a) Given that $g(x) = 2\sqrt{x} + 6$. Find the value of x for which f(x) = 16

(b) If $f(x) = 5x + 8$ and $g(x) = 3x + 5$. Find:

i. $[fg](x)$

ii. $[gf](x)$

34.   Given that $f(x) = 4x + 5,\ g(x) = 2x - 3,$ and $h(x) = 3x + 1$, Find:

i. $ff(x)$
ii. $gg(3)$
iii. $fgh(x)$
iv. $gfh(-2)$

35.   Given that $f(x) = 3x + 7$ and $fg(x) = 6x - 8$, Find
  i. $g(x)$
  ii. $g^{-1}(x)$

36.   Given that $p(x) = \frac{3x+4}{x-5}$ Find:
   i. $p^{-1}(x)$
   ii. $p^{-1}(-3)$

37.   Given that $h^{-1}(x) = \frac{1+3x}{4x-3}$ Find:
   i. $h(x)$
   ii. $h^{-1}(2)$

38.   The function $g(x) = \dfrac{3x^2-27}{3x^2+10x-8}$. Determine the values of x for which;

i. $g(x) = 0$
ii. $g(x)$ is meaningless

39.   Simplify the following

i. $\dfrac{4^{-2} \times 2^3 \times 16^{\frac{1}{2}}}{8^{-3}}$

ii. $\dfrac{(125)^{\frac{1}{3}} \times 3^{-1}}{(81)^{\frac{-1}{4}} \times (25)^{\frac{1}{2}}}$

iii. $\dfrac{2^{x+3}+2^x}{2^{x+2}-2^x}$

40.   Solve the following equations

i. $16^{(2x+2)} = 8^{(x+3)}$

ii. $\dfrac{3^t \times 3^{2t}}{3^{4t}} = 3^5$

iii. $27^{(m-1)} \times 9^m = 81^m$

41.   Solve for x and y in the equation $3^{(2x+1)} \times 2^{(x+2)} = 3888$

42.   Simply the following.
   i. $\frac{2}{4}\left(3\frac{3}{8}\right)^{\frac{-2}{3}}$

ii. $\left(\dfrac{8}{125}\right)^{\frac{-2}{3}} \times \left(\dfrac{8}{8^{\frac{1}{2}}}\right)^{-2}$

iii. $\dfrac{18^{\frac{1}{2}} \times 6^{\frac{2}{3}} \times 3^{\frac{1}{6}}}{54^{\frac{1}{2}} \times 12^{\frac{1}{3}}}$

43.   Solve the following equations

i. $8^y + 2^{3y} + 3 = 131$

ii. $2^{2m} + 0.8125 = 0.875$

44.   Convert the following to logarithmic notation
   i. $13^2 = 169$

   ii. $27^{\frac{1}{3}} = 3$

45.   Convert the following to index notation
   i. $\log_5 625 = 4$

   ii. $\log_{49} 7 = \frac{1}{2}$

46. Evaluate the following

   i. $\log_5 125$

   ii. $\log_6 \frac{1}{36}$

47. Simplify the following:

   i. $\log p + 2\log q - 3\log r$

    ii. $\frac{1}{3}\log m - \frac{1}{3}\log n$

    iii. $2\log 7 + \log 4$

48.   Without using tables or a calculator, evaluate the following

    i. $\log_{10} 200 + \log_{10} 50$

ii. $\log_2 \frac{4}{7} + \log_2 \frac{3}{2} - \log_2 \frac{3}{14}$

iii. $\dfrac{\log_{10} 27 + \log_{10} 125}{\log_{10} 15}$

49. Solve the following for x or y
   i. $\log_3 x + \log_3 4 = \log_3 28$

ii. $\log_4 y - \log_4 5 = \frac{5}{2}$

iii. $\log_2 x + \log_2 x^2 + \log_2 x^3 + \log_2 x^4 = 5$

iv. $\quad \log_2(3x + 8) - \log_2(x + 1) = 2$

v. $\quad \log(3y - 1) - \log(2y + 1) = \log 4$

50. Given that $\log_{10} m = 1.4230$ and $\log_{10} n = \bar{1}.3122$, evaluate the following

i. $\quad \log_{10}\left[\dfrac{m^3}{n}\right]$

ii. $\log_{10} \sqrt{mn}$

51. Given that $\log_{10} x = 0.2410, \log_{10} y = 1.4321$ and $\log_{10} z = \overline{2}. 1732$, evaluate the following,

i. $\log_{10} \dfrac{x^2 y}{z}$

ii. $\log_{10} \dfrac{\sqrt[3]{y}}{x^2}$

52.   Given that $\log_{10} 2 = 0.3010, \log_{10} 3 = 0.477 \; and \; \log_{10} 5 = 0.699$, evaluate the following.

i. $\log_{10} 30$

ii. $\log_{10} 1080$

iii. $\log_{10} \left[\dfrac{45}{32}\right]$

53. Use mathematical tables to evaluate the following:

i. $\dfrac{423 \times 0.684}{0.243}$

ii. $\dfrac{892 \div 3.04}{0.0752}$

iii. $(0.38)^2 \times \dfrac{1}{0.06821}$

iv. $\left(\dfrac{18.9^2 \times 19.2}{73.9}\right)^{\frac{1}{3}}$

v. $\quad \sqrt[4]{\left(\dfrac{14.9 \times 18.2}{0.029}\right)}$

54.   Express the following surds in the form $a\sqrt{b}$

    i. $\sqrt{50}$

    ii. $\sqrt{243}$

iii. $\sqrt{500}$

55. Simplify the following
 i. $3\sqrt{5} + \sqrt{80} - 4\sqrt{45}$

 ii. $\sqrt{192} + 2\sqrt{75} + \sqrt{300} - 7\sqrt{48}$

iii. $\left(3 + \sqrt{7}\right)\left(4 + 3\sqrt{7}\right)$

56. Express $\frac{(\sqrt{6}-\sqrt{3})}{(\sqrt{6}+\sqrt{3})}$ in the form $a + b\sqrt{c}$.

Hence find the value of a, b and c.

57. Rationalise the following

i. $\frac{1}{3\sqrt{7}}$

ii. $\dfrac{1}{\sqrt{7}+\sqrt{6}}$

iii. $\dfrac{1}{2\sqrt{3}+3\sqrt{2}}$

58. Simplify the following

i. $\dfrac{3\sqrt{18}+\sqrt{72}}{2\sqrt{27}+4\sqrt{12}}$

ii. $\dfrac{4\sqrt{500}-2\sqrt{45}}{3\sqrt{80}+\sqrt{125}}$

iii. $\dfrac{2}{\sqrt{2}+\sqrt{5}} - \dfrac{1}{\sqrt{2}-\sqrt{5}}$

MATRICES

This concerns representation of quantified information in rectangular array, order of matrices, mathematical operations on matrices, solving simultaneous equations, real life word problems that are solved using knowledge of matrices

QUESTIONS

1. Given that $A = \begin{pmatrix} 7 & 2 \\ 2 & 1 \end{pmatrix}$, $B = \begin{pmatrix} 6 & 3 \\ 0 & 9 \end{pmatrix}$ and $C = \begin{pmatrix} 3 & -2 \\ 1 & 4 \end{pmatrix}$, find the matrix P such that

$$P = 2A - \frac{1}{3}B + C^2$$

2. Given that $\begin{pmatrix} 5 & x \\ 3 & x \end{pmatrix} \begin{pmatrix} y \\ 2 \end{pmatrix} = \begin{pmatrix} 25 \\ 4 \end{pmatrix}$. Find the values of x and y

3. If $A = \begin{pmatrix} 4 & 3 \\ 2 & 5 \end{pmatrix}$ and $B = \begin{pmatrix} 2 & 3 \\ 1 & 4 \end{pmatrix}$, Find;

    i.   DetA^2

    ii.   Det (A+2B)

    iii.   Show that det(AB) = detA X detB

4. Given that $P = \begin{pmatrix} 3x + 1 & 2x - 3 \\ 4 & 5 \end{pmatrix}$ and $DetP = 59$. Determine the possible values of x

5. Find the inverse of $T = \begin{pmatrix} 5 & 3 \\ 4 & 3 \end{pmatrix}$

6. Given that $P = \begin{pmatrix} x & 12 \\ 9 & 3x \end{pmatrix}$ find the values of x for which P has no inverse

7. Given that $T = \begin{pmatrix} 2x^2 + 1 & 9 \\ 2x & 4 \end{pmatrix}$ is a singular matrix, find the value of x.

8. Given that $A = \begin{pmatrix} 8 & 5 \\ 3 & 2 \end{pmatrix}$ and $B = \begin{pmatrix} -2 & 5 \\ 3 & -8 \end{pmatrix}$
   i.   Find BA
   ii.   Describe the matrix BA
   iii.   What do you say about A and B?

9. Find the values of x and y such that $\begin{pmatrix} x^2 & 1 \\ 1 & 3 \end{pmatrix} + \begin{pmatrix} 2x & 3 \\ 1 & 4 \end{pmatrix} = \begin{pmatrix} 3 & y \\ 2 & 7 \end{pmatrix}$

10. Given that $A = \begin{pmatrix} -4 & 3 \\ 0 & -2 \end{pmatrix}$, $B = \begin{pmatrix} 1 & 0 \\ 3 & -2 \end{pmatrix}$ and $C = \begin{pmatrix} -1 & 6 \\ 6 & 0 \end{pmatrix}$. Find the matrix AB+C, hence describe it.

11.   Use matrix method to solve the simultaneous equations:

3x + 4y = 19

5x = 23 + 2y

12.   4 pens and 5 books cost shs. 4400, while the cost of 2 pens and 7 books is shs. 4900.
   i.   Form a pair of equations
   ii.   Use matrix method to calculate the cost of each item.

13.   A competition involved finding out hidden discs. The discs were in 4 colours of white, green, red and orange. Three teams x, y and z participated. Team x found out 6 white, 9 green, 4 red and 2 orange discs. Team y found out 4 white, 6 green, 9 red and 4 orange discs while team z found out 3 white, 4 green, 10 red and 3 orange discs.

The points for each colour of the discs found out were as follows

12 points for each white disc

6 points for each green disc

5 points for each red disc

7 points for each orange disc

i.   Write down a 3 X 4 matrix for the disc and call it P

ii.   Write down a column matrix for the points.

iii.   By matrix multiplication, calculate the total number of points earned by each team.

14.   Jane bought 2 kilograms of sugar, 3 loaves of bread and 2 litres of milk. Sarah bought 5 kilograms of sugar, 2 loaves of bread, 3 litres of milk and 4 kilograms of rice. The prices of the commodities were as follows

Sugar – shs.4800 per kg
Bread – shs.3200 per loaf
Milk – shs.1200 per litre
Rice – shs.2800 per kg

(a) From the above information, write down;

i.   a 2 X 4 matrix for the purchases
ii.   a column matrix for the prices

(b) Use the matrices in (a) (i) and (ii) to calculate the total expenditure of each person.

GEOMETRIC CONSTRUCTION AND BEARING

This concerns construction of straight lines, special angles, bisecting lines and angles, construction of triangles, circumscribing and inscribing triangles, bearing of one point from another, application of bearing

QUESTIONS

1. Using a ruler a pair of compasses only,
   (a). Construct a triangle PQR in which PQ = 11.5cm, < PQR = 60^0 and QR = 8.4 cm.
   (b) Construct the bisector of the angles PRQ and QPR. Let them meet at point S.
   (c) From S draw a line perpendicular to PQ meeting PQ at T.
   (d) Draw a circle with centre S and radius equal to ST.
   (e) Measure the length ST correct to nearest millimetre and state how far is the point S from PR and QR.

2. (a) Using a ruler and a pair of compasses only construct a triangle ABC in which lengths AB = 7 cm, BC = 5 cm and angle ABC = 60^0.

(b) Construct a circumscribed circle to the triangle ABC.

(c) Construct a perpendicular from C to AB to cut AB at Y. measure length CY.

3. Using a ruler, a pencil and a pair of compasses only,
   (a) Construct a triangle PQR, where QR = 8.6cm, and PR = 6.8cm and angle PQR=75⁰. Measure PQ and angle PRQ.
   (b) Draw a circle with centre O, inscribing triangle PQR and find the area of the circle. (use $\pi = 3.14$)

4. (a) Using a ruler, a pair of compasses only, construct a quadrilateral OPQR in which <ROP = 105^0, OP =7.3cm, OR = 6.9 cm, RQ = 7.8cm and PQ = 8.5 cm. (b) Join O to Q and construct a circumcircle to the triangle OPQ. Find the area of the circle.

5. (a) Using a ruler and a pair of compasses only, construct a quadrilateral ABCD where AB=5cm, BC = 8cm, < ABC = 150^0 and <BAD = 90^0.

(b) Drop a perpendicular from D to C to meet AC at point E. measure the length DC.

(c) Draw an inscribed circle of triangle DEC. measure the diameter of the circle.

6. A plane flies 540 km from airport A to airport B on a bearing of 060^0. From B it travels 46 km to airport C on a bearing of 150^0. From C it heads for airport D, 360 km away on a bearing of 265^0.

(a) Draw to scale a diagram showing the route of the plane (use a scale of 1 cm: 50 km)

(b) From your diagram determine the distance and bearing of airport A from airport D.

(c) If the plane is to leave airport A to airport C at an average speed of 125kmh^{-1}, how long will it take?

7. A ship leaves port M and sails for 180 km on a bearing of 120^0 and sails for 300 km to island P. using a scale of 1 cm to 30 km, find
   (a) The distance of island P from port M.
   (b) The distance of the port M from island P
   (c) How long it takes the ship to sail directly back to the port?

8. Four planes P, Q, R and S leave an airport at the same time. P flies on bearing of 240^0 at 900 kmh^{-1} ,Q flies due East at 750 kmh^{-1}, R flies due North West at 900kmh^{-1} and S flies due North East at 660kmh^{-1},

(a)Using a scale of 1 cm to represent 100km, make a scale drawing to show the position of the planes after 40 minutes.

(b) Using your diagram, find the distance between

(i) P and Q

(ii) Q and S

(c) Determine the bearing of

(i) P and S

(ii) S and R

9. Mitala's house is 400km from the storm ranch in the direction 300^0 (N 60^0 W).   Lumu's house is in the direction 030^0 from the storm ranch.
   (a) By scale drawing (1 cm: 50 km), how far apart their houses are?
   (b) Determine the bearing of
   (i) The storm ranch from Lumu's house
   (ii) Mitala's house from Lumu's house

STATISTICS

This is concerned of finding the mean, median, mode, deciles, quartiles and percentiles of grouped and ungrouped data using the calculation methods and graphical approach.

QUESTIONS

1. The data below shows the marks scored by 12 students in a test, which was marked out of 40:
   17, 22, 15, 33, 36, 39, 24, 19, 18, 16, 22, 30.
   i.   Find the modal mark and the range
   ii.   Calculate the mean mark and the median mark

2. The data below shows the weights in kg of 8 students arranged in ascending order: 26, 33, 2x, (x + y), 50, 58, 62, (2x + y).
   Given that the median is 48 and the range is 42,
   i.   Determine the values of x and y.
   ii.   Find the mean weight of the students.

3. The table below shows the weights in kg of some students:

weight (kg)	No. of students
35	4
40	x
45	x + 2
50	5
55	3
60	6
65	3

Given that the average weight of the students is 52.6, find the value of x

4. The following are scores out of 50 obtained by a class of 50 students in a mathematics test.

10	12	23	14	12	14	17	21	14	12
10	10	6	6	22	14	8	15	14	22
13	8	6	24	15	10	12	14	15	14
14	18	27	14	8	10	25	14	16	9
12	14	8	25	14	5	14	20	19	6

(a) Make a frequency distribution table with class intervals of 5, starting with 5 – 9
(b) Draw a histogram and use it to estimate the modal mark.
(c) Calculate the median mark

5. 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.

(b) Calculate the mean mark using an assumed mean of 47.

(c) Represent the information on an ogive and use it to estimate the median mark

6. The table below shows the marks scored by 70 students in a mathematics examination with their corresponding cumulative frequencies:

marks (x)	cf
1 – 10	2
11 – 20	8
21 – 30	15
31 – 40	24
41 – 50	45
51 – 60	55
61 – 70	62
71 – 80	67
81 – 90	69
91 - 100	70

Use the table to:
(a) Calculate
  (i)   The mean mark
  (ii)   The modal mark
(b) Draw a cumulative frequency curve and use it to estimate:
  (i)   The interquartile range
  (ii)   The 80th percentile.

7. The table below shows the marks scored by students in a physics exam at Atom science centre.

marks	f	x	d = x -A	fd	cf
10 – 19			-30		3
20 – 29					8
30 – 39					17
40 – 49					23
50 – 59					27
60 – 69					30
70 – 79					34

f = frequency, d = deviation, x = class mark

(a) Copy and complete the above table
(b) Using your table calculate:
   (i)   The mean mark
   (ii)   The median mark
(c) What is the probability that a student picked at random scored 39% and below?

SET AND PROBABILITY THEORY

This is concerned with basic concept of a set, subsets, compliment of a set, representation of set using a Venn diagram and solving real life problems using set, find probability from a set, probability theory, types of events, probability tree diagrams

1. A bag contains blue pens, red pens, and green pens. The probability of picking a blue pen is $\frac{3}{10}$ while the probability of picking a red pen is $\frac{1}{4}$. Find the probability of picking a green pen.

2. (a) A basket contains 12 oranges and some apples. The probability of picking an apple from the basket is $\frac{2}{3}$. Calculate the number of apples in the basket. (b) A bag contains a number of black and a number of white beans. If a bean is chosen at random, the probability that it is black is 0.75. There are 35 black beans in the bag. Calculate the number of white beans.

3. A bag contains 40 mangoes, some of which are ripe and the rest are unripe. The probability of picking a ripe mango at random is $\frac{2}{5}$. Find the number of unripe mangoes in the bag.

4. A box contains blue, red and white balls. The probabilities of picking a blue and a red ball at random are $\frac{1}{5}$ and $\frac{7}{15}$ respectively. Given that there are 10 white balls in the box, determine the number of blue and red balls.

5. *A* fair die is tossed once. Calculate the probability of getting.
     (i)   an even number
     (ii)   A prime or an odd number.
     (iii)   A composite number.

6. A number is chosen at random from the integers 1 to 9. Find the probability that the number is either a multiple of 4 or a prime number.

7. A coin and a die are tossed simultaneously at once.
   (a) Draw a table of outcomes
   (b) Find the probability that a head and an even number appear.

8. An experiment consists of tossing together 2 dice simultaneously.
   - (a) Construct a possibility space.
   - (b) Find the probability that the sum of the numbers appearing on top is;
     - i. a multiple of 2
     - ii. a factor of 6
     - iii. a triangular number.

9. Events M and N are mutually exclusive. Given that P(M) = 0.4 and P(N) = 0.3. Find P(M U N).

10. Two independent events P and Q are such that P(P) = $\frac{1}{7}$ and P(Q) = $\frac{2}{3}$ Find, (i)P(P∩Q)

(ii)P(P∪Q)

11. Five similar cards labeled 1 to 5 placed in a bucket and 2 cards were picked randomly in turns.
    (a) make a possibility space
    (b) Use the probability space in (a) to calculate the probability that each card had a triangular number.

12. An octahedron and a tetrahedron labeled 1 to 8 and 1 to 4 respectively are tossed together at once.
(a) Draw a table of outcomes.
(b) Use the table of outcomes to determine the probability that both show;   even numbers   composite numbers   multiples of 3
A box contains 4 black balls and 3 red balls. Two balls are randomly selected one after the other without replacement. Find the probability that both balls are red.

13. Four coins were tossed once together.
    (a) make a possibility space
    (b) Use the possibility space to calculate the probability of getting at least 3 heads.

14. A bag contains 6 red balls, 4 white balls, and 5 blue balls. What is the probability of randomly picking a white ball, a blue ball, and a white ball in that order, if the balls are picked without replacement?

15.   A 3-digit number is formed out of the digits 2, 3, and 4. Find,

(a) the possible numbers to be formed

(b) the probability that the numbers formed are even

(c) the probability that the numbers formed are greater than 340.

16.   A bag contains 3 red and 4 blue beads. 2 beads are taken out of it. What is the probability that the first is red and the second is blue if,
   (i)   the first bead is put back?
   (ii)   the first bead is not replaced?

17. A Bag contains 4 red and 7 blue marbles. 2 marbles are picked at random from the bag. What is the probability that they are both of the same colour, given that,
(i)   The first marble is put back?
(ii)   The first marble is not put back

18. In a group of 30 boys, 20 play Cricket. 23 play Hockey, and 2 play neither of the two games. Use a Venn diagram to find the number of students who play both games.

19. In a class of 50 students, 20 like Soda (S), 6 like Passion fruit juice (P) but not Soda and the number of students who like none of the two drinks is twice those who like both drinks.
Using a Venn diagram, find the number of students who like
(i) both drinks
(ii) only one drink
(iii) only soda.

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20.　A class of 38 students had to choose between Fine Art (F) and Computer (C) in their combinations. 15 chose Fine Art while 19 chose Computer. The number of students who chose both subjects is half of those who don't like any of the two subjects. Find the number of students who like;
(a) both subject
(b) at least one subject.

21.   All 100 tourists who came to Uganda in June 2022 visited the source of the Nile, 10 of them visited Kidepo and Murchison Game Park, 55 of them visited Kidepo, and 50 of them visited Murchison game Park. How many of them visited neither Kidepo nor Murchison Game Park?

22.   Of the 35 candidates in Senior 4, 13 registered for Geography (G), 20 for History (H), and 17 for Fine Art (A). 9 registered for both Geography and Fine Art, $n(G \cap H) = 3, n(G \cap H \cap A) = 2, and\ n(H \cap A \cap B') = 8$.

Represent this information on a Venn diagram and use it to find:

(i)   The number of candidates who registered for History only.

(ii)   The number of candidates who did not register for Geography

(iii)   The probability that a candidate picked at random registered for at least 2 subjects.

23.   A group of students was asked what games they play. It was found out that 20 play Rugby (R), 30 play soccer(S) and 15 play basketball(B),6 play both Rugby and soccer, 4play both soccer and basketball and 5play both Rugby and basketball. The number of students who play soccer only is equal to twice the number of students who play Rugby only. All the students play at least one of the games.

(a) Represent the above information on a Venn diagram.

(b) Find:

(i) the number of students who play all the three games

(ii) The number of students in the group.

(d) If the students is chosen at random from the group, Find the probability that the student plays at least two games.

24. In a certain trading center, thirty nine people kept either a dog a cat or hens, 24 kept a dog (D) 16 kept a hen (H) or 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 a hen. 2 kept all the three.
  (a) Represent the information on a Venn diagram.
  (b) Find how many people kept both a cat and hen.
  (c) If a person is picked at random from the trading center, what is the probability that the person did not keep a dog?

25. In a class of 168 students, 87 like Matooke (M), 62 like Posho (P), while 94 like Rice (R). Of these students. 28 like both Matooke and Posho, 39 like both Matooke and Rice, while 27 like both Posho and Rice. Only 4 of the students do not like any of the foods.

(a) Represent the above information on a Venn diagram.

(b) Determine the number of students who like;

(i) all the three foods

(ii) at most two foods

(c) If a student is chosen at random from the class, determine the probability that the student likes only one of the foods.

26.   In Senior 4, there are 112 students. 45 of the students take Geography (G), 32   take Physics (P), and 28 take Literature (L). 19 take both G and P, 10 take both P and L, 22 take both G and L, and 8 students take all the three subjects.
Draw a Venn diagram and use it to find;
(i) the total number of students who take only one subject.
(ii) the number of students who take none of the subjects.
(iii) the number of students who take at least two subjects.
(iv)   the probability that a student chosen at random from the class takes only two subjects

27. Of the 35 tourists who visited Uganda, 13 went to Queen Elizabeth National Park (Q), 20 went to Bwindi Impenetrable Forest (B), while 7 went to Kidepo (K). If 19 tourists Q and K, n(Q∩ B) = 3, n(Q ∩ B∩ K) = 2 and n(B ∩ K ∩ Q') = 8,

(a) Represent the above information on a Venn diagram.

(b) Use the Venn diagram to find:

(i) the number of tourists went to Bwindi only.

(ii) the number of tourists went to at most 2 parks.

(iv) the site that could not be visited alone.

28.   A group of fans of a certain radio station were asked the kind music they like. It was found out that 32 like Kadongo-Kamu (K), 40 like gospel music (G), while 28 like Lingala (L) 17 fans like both Kadongo-Kamu Gospel music, 12 like both Kadongo Kamu and Lingala, and 18 like Gospel music and Lingala, while 5 like none of the three music types. It was also found out that the number of fans who like both Gospel and Lingala is twice those who like both Kadongo Kamu and Gospel.

(a) Draw a Venn diagram to portray the above information.

(b) Use the Venn diagram in (a) find the number of fans who like

    (i)   all the music types

    (ii)   only one music type

(c) Calculate the total number of fans in the group.

(d) Calculate the percentage of fans who like at most two music types.

TRIGONOMETRY

This is a branch of mathematics that deals with the study of the relationship between the sides of a triangle and its interior angles. With also applications of elevation, depressions and graphs

QUESTIONS

1. Without using mathematical tables and a calculator, evaluate the following:

i. $\dfrac{6sin60^0+2tan60^0}{4cos30^0-2sin60^0}$

ii. $\dfrac{2tan30^0\times4sin60^0}{4sin30^0+3tan45^0}$

2. (a) Given that $sin\alpha = -\frac{8}{17}$ for $0° < \alpha < 270°$, find the value of $16tan\alpha - 34cos\alpha$.

(c) If $tan\theta = 0.75$ for $0° < \theta < 90°$. Find the value of $sin^2 \theta + 2cos\theta$.

3. a) Given that $cosx = \frac{3}{5}$ for $0° < x < 360°$,

   Find the two possible values of 2sinx — 3tanx.

4. Find the two possible values of 0 in the following equations:

   (a) $cos\theta = -0.623$

(b) $\sin\theta = 0.74$

(c) $tan\theta = -1.3$

(d) $2sin\theta - 3cos\theta = 0$

(e) $\cos(\theta + 20^0) = -0.5$

5. A ladder is leaning against a tree making an angle of 36° with a horizontal ground. If the distance from the tree to the foot of the ladder is 8 metres, calculate the length of the ladder. Find the length of the shadow formed by the tree of height 15 metres if the angle of inclination of the sun is 50°.

6. Cgire, who is 1.7 metres tall is standing 50 metres away from a vertical building. He observes the top of the building at an angle of elevation of 45°. Find the height of the building.

7. The angle of elevation of the top of a tree from point P on the horizontal ground is 24.5°. From another point Q, 5 metres nearer to the base of the tree, the angle of elevation of the top of the tree is 32.2°. Calculate (to 1 decimal point), the height of the tree.

8. In the figure given, are two poles CD and AB perpendicular to the level ground. They are d metres apart. The angle of elevation of B from C is 50° and the angle of elevation of B from D is 35° and the height of CD is 10 metres.
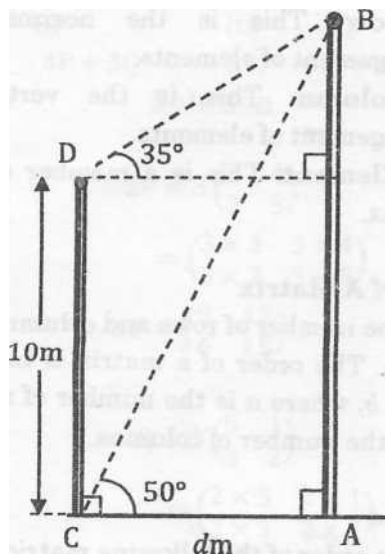
Calculate:
(a) the distance between the poles
(b) the distance from D to B.
(c) the height of pole AB.

9. A boy of height 1.2 metres is looking at the top of the tree of height 20 metres at an angle of elevation of 30°. When the boy moves a distance of x metres towards the tree, the angle of elevation changes to 42°. Find:

(i) the distance from the tree to the new position of the boy.

(ii) the distance from the tree to the original position of the boy.

(iii) the value of x

COORDINATE GEOMETRY AND LINEAR INEQUALITIES
This concerns coordinate geometry of a straight line, gradient of a straight line, equation of a straight line, parallel lines and perpendicular lines, solving linear equations and representation on a number line, representing inequalities on a graph and linear programming

QUESTIONS

1. Find the length of the line joining the points A(5, 5) and (2, 1). (b) The mid-point of the line joining the points A(a, 4b) and B (*2a, b*) is M (9.5, 5). Find the value of a and b.

2. (a) Determine the equation of the line passing through the point P(-3,-2) and   meets the line through points A(2, 3) and B(-1, 5) at90^0.

3. Find the equation of the line passing through the points A(-4, 2) and perpendicular to another line $5y - 3x + 7 = 0$. 3.

4. Find the equation of the line perpendicular bisector of the line passing through the points A(3, 4) and B(1, 8).

5. A straight line passing through the points A(a, 4) and B(3,2a) is perpendicular to another line $y = -3x + 5$. Find the value of a.

6. find the coordinate of the point of intersection of the line $7y - 3x = 6$ with the line $5y + 2x = 25$.

7. find the equation of the line passing through the points A(6, -2) and B(3,7), hence find the point of intersection of the line with the line $5x + 3y - 4 = 0$.

8. A straight line passing through the point (6,1) and (4,2) is parallel to another line $4ax - 3y = 7$. find the value of a.

9. Determine the equation of a straight line which makes 30^0 with the positive $x - axis$ and passes through the point $(5,1)$.

10. Determine the equation of a straight line passing through the points $(-4,5)$ and $(1,7)$.

11. A straight line passing through the points A (n,3) and B(4,2n) has a gradient of 3. Find
    i.   the value of n

    ii.   the equation of the line.

12. Determine the points of intersection of the lines $2y + x = 8$ and $2x + 3y = 13$.

13. The straight lines $2ax + by = -4 \ and \ bx + 3ay = 1$ intersection at the point (1,2).find the values of a and b.

14. Find the equation of the line passing through the point (7,4) and perpendicular to another line whose gradient is $\frac{2}{3}$.

15. Find the equation of the line passing through the points A(-2,3) and perpendicular to another $4x - 3y + 6 = 0$.

16. A straight line passing through the points A(-3,1) and B(-7,n) is perpendicular to another line whose gradient is $\frac{2}{3}$. Find the value of n.

17. A straight line passing through the points A(p,4) and B(2,6) is perpendicular to the line $4y + x = 8$.find : (i) the value of p. (ii)the equation of the line AB.

18. (a) A straight line through the points P(4,3) and Q (5,7) is perpendicular to another line $3ax - 4y + 7 = 0$. Determine the value of a.

19. Find the equation of the line through the points of intersection of the lines $x + 3y = 11$ and $5x - 4y = -2$ and perpendicular to the line $4x + 2y + 9 = 0$.

20. Find the equation of the line which is a perpendicular bisector of A(3,4) and B(1,10).

21. Given that the points P(-2,4), Q(4,12) and R (10,2x) are collinear, find the value of x.

22. A straight line joining the points P(a,b) and Q($2b$,$3a$) and its mid point is   M(6.5,12). Determine the value of a and b . hence find the equation of the line PQ.

23. Find the coordinates of the point R which divides internally the line joining the points P(3,7) and Q(8,-3) in the ratio 3:2.

24. Solve the following inequalities and represent the solution set on a number line .
    (a) $5x + 5 < x - 9$

    (b) $\frac{2}{3} y - 4 \leq y + 7$

    (c) $3\left(\frac{1}{2}m -\right) \leq 4(m + 2)$

(d) $\frac{2}{3}(15x - 3) \geq 8x + 2$

(e) $\frac{4}{5}x - 2(x + 3) > \frac{1}{2}(x + 4)$

(f) $\dfrac{m}{5} - \dfrac{m-3}{4} \le \dfrac{1}{4}$

25. Find the range of the following inequalities and represent them on the number line

(a) $6 \le 3x(x-2) \le 9$

(b) $8 < 4x - 4 < 20$

26. Find the integral values of the following inequalities.
   (a) $-7 \leq -6 - x \leq 2$

(b) $5x - 13 < 42 < 5x + 7$

27. Solve the following inequalities.
    (a) $(3x + 5)(x - 2) \leq 0$

    (b) $2x^2 - 3x + 1 \leq 0$

    (c) $y(y - 1) < 3(y - 1)$

(d) $m^2 - 12y + 35 > 0$

(e) $x^2 - 2x - 15 \geq 0$

You may be required to use a graph paper to answer the following questions

28. (a) By shading the unwanted regions, show the region that satisfies the following inequalities:
$$x + y \leq 3$$
$$y \geq x - 4$$
$$y \geq -3x$$

(c) Find the area of the wanted region.

29. (a) By shading the unwanted regions show the feasible region R which satisfies the inequalities,

$$y + 4 \geq x$$
$$y + 3x \geq 0$$
$$y \leq 3 - x$$

(b) Find the area of the feasible region R.

(c) Given that $z = 5x + 4y$, find the two possible integral values of z in the feasible region R.

30. The cost of manufacturing the blue band in a factory is determined by the components milk x and flavours y . if the constraints for the production are $2x + 3y \leq 15,\ 2x - 3y \leq 6, x \geq 1\ and\ y \geq 0$.
    (a) Represent the following on a square paper.
    (b) Given that the cost function $,c = 50x + 30y$ find
       (i)   Minimum cost
       (ii)   Maximum cost

31. In a hotel , 100 employees are transported to work every day . The hotel has 5 minibus and 6 fuso trucks . There are 7 skilled senior drivers . Each minibus can carry a maximum of 16 workers and each fuso truck can carry not more than 20 workers . The minibus cost shs . 2,500/= and the fuso truck costs shs.3,200/= to run each week . If x is the number of minibus used and y is the number of fuso trucks used,
    (a) Write down four inequalities representing the above information apart from $\geq 0 \ and \ y \geq 0$.
    (b) Plot on the same graph the above inequalities.
    (c) Find the number of minibus and fuso trucks which will minimize the cost of truck and oil.

32. 90 supporters of football were to be transported to go and cheer their team when playing. They were to use a coaster and a taxi. The capacity of a coaster and a taxi was 25 and 15 respectively. The cost of each trip a coaster is shs.120,000/= and that of a taxi is shs. 64,000/= and they expected to spend at least shs.240,000. Each of these vehicles had to make at least a trip. Given that the coaster made x trips and the taxi made y trips.
   a) Write down the four inequalities representing the given information.
   b) Graph the inequalities by shading off the un wanted regions.
   c) Determine the number of trips made by each vehicle so as to have as many supporters for the match. Hence find the total cost of that option

BUSINESS ARITHMETIC

This concerns finding profit and loss, percentage profit and loss, discount, commission, hire purchase, compound interest, appreciation and depreciation, taxation

1. Musa bought an article at shs.7,200 and and sold it at a percentage profit of 50%. How much did he sell the article?

2. A trader bought 15 shirts each at shs.4,500, he then sold them to peter making a total loss of 20%.how much did he sell the shirt?

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3. After being allowed a discount of 27% the money paid for the T.V was shs.365,000.what the market price of the T.V?

4. The market price of a radio is shs.430,000.after being allowed a discount, the customer paid shs.380,000.calculate the percentage discount.

5. A sales agent is offered a commission of 20% on the first shs.100,000of sales and 15% on the remaining sales . if an agent makes sales of shs.350,000 how much commission will he earn?

6. A sales man earns a commission of 12% on the first shs.200,000 of the sale, 7% on the next shs.120,000 and 5% of the remaining sales. If he earned a total commission of shs.44,400, how much sale did he make?

7. A man works as an agent of a certain company. He earns a salary of shs.320,000 per month. In addition he earns a commission of 12% on the first shs.150,000 of the sales, 10% on the next shs.100,000 of the sales and 8% on the remaining sales. If he makes the sale worth shs.450,000,calculate his monthly income.

8. Calculate the simple interest on shs.990,000 for 8 months at a rate of $5\frac{1}{2}$ % per annum.

9. A man deposited shs. 680,000 in a bank which offers a 15% simple interest per year . calculate the amount of money that will be on the man's account after 2 years and 3 months.

10.   John borrowed a certain amount of money from the bank which charges a simple interest of 13% per annum. If he paid the interest of shs 202,800 after 3 years, how much did he borrow?

11.   After how long can the simple interest of shs.237,600 be earned on the deposit of shs.480,000 at a simple interest rate of 11% per annum.

12. Bemba deposited a certain amount of money in a bank at a simple interest rate of 12% per annum. After $3\frac{1}{2}$ years his money accumulated to shs. 525, 400 . how much did he deposit in the bank?

13. Mitala borrowed shs.720,000 at a compound interest rate of 12% per annum. Calculate the amount of money he will pay back after 3 years.

14.   Find after how long will shs.1,123,200 if invested at a compound interest rate of 20% per annum.

15.   After how long can a certain amount of money deposited in a bank be left to multiply itself 4 times if the bank offers a compound interest rate of 10% per annum?

16.   Find a sum of money which will amount to shs.9,036,675 if invested at a compound interest rate of 18.5% per annum for 3 years.

17.   Wasswa invested shs.200,000 in a saving society which offers a 15% a compound interest per year. If the interest is compounded quarterly, find the amount of money he will have after 3 years.

18.   The market price of a radio is shs.620,000. A customer can buy it either on cash basis or on hire purchase.on a cash basis a customer is offered a cash discount of 10% of the market price. On hire purchase a customer pays a deposit of 30% of the market price an pays the balance in 12 monthly installments, each of shs.50,000. Calculate the savings a customer would make if he pays the radio on cash basis rather than on monthly hire purchase.

19.   A freezer can either be bought on cash basis or on hire purchase a customer makes a down payment of 22% of the cash price and the balance is 8 weekly installments of shs.75,000 each. If the total cost of the freezer on hire purchase is shs.754,000, calculate the cash price of the freezer , hence find the saving which a customer makes when he buys the freezer on cash basis rather than on weekly hire purchase.

20.   The cash price of an article is shs.270,000. When a customer buys the article on hire purchase he first deposits a certain amount of money and then pays on weekly installments each shs.38,000 for 7 weeks. If the cost of the article on hire purchase is shs. 331,000, calculate the percentage of the cash price paid as a deposit.

21.   The following is an advertisement for a freezer.

Freezer   Freezer   Freezer

....

Available

Price: shs.600,000

          >>>>>>Terms<<<<<<

Cash   8% discount

Hire purchase :Deposit of 40% of the market price and pay shs.55,000 per month for 9 months, or 60,000 per week for 7 weeks.

Calculate :

(a) The saving a customer would make by buying the freezer on cash terms rather than on weekly hire purchase.

(b) The percentage profit the seller makes on monthly hire purchase if the cost price was 3% less than on cash terms.

22.

The text texture of taxable income of citizens in a working class of a certain country is as follow:

Taxable income (Shs)	Tax rate (%)
0 – 230,000	Free
230,0001 – 330,000	12.5
330,0001 – 500,000	20.0
500,001 – 660,000	30.0
660,001 and above	40.0

A man's gross monthly income is Shs.960,000. The monthly allowances including insurance accrued to him
Were:
Transport Shs. 612,000 p.a
Housing   Shs.150,000
Medical $\frac{1}{2}$ th of gross monthly income.
He has to pay insurance premium of Shs.15,000 per month.
Calculate the man's;
(a)taxable income
(b) income tax
(c)net income

23.

Sarah who is not married earns Shs.9,120,000 per year . she has personal allowance of Shs.120,000 and earned income of 15% of her remaining income . the income tax is charged at 25% on the first Shs.200,000, 30% o the next Shs.400,000 and 40% on her remaining income. Calculate the amount of income tax due.

24.

The income tax of a certain country are shown in the table below:

Taxable income (Shs)	Rate (%)
01 – 200,000	6
200,001 – 500,000	13
500,001 – 900,000	20
900,000 and above	30

(a) Calculate the income tax an employee pays if the employee's taxable income is Shs.1,170,000.
(b) Given that the employee's untaxed allowance is Shs.140,750, find the employee's net income.

25.

In a certain country income tax is computed after deducting the following allowances:

Allowance	Amount(Shs)
Marriage	10,000
Single	4,000
Each child above 10 but below 20 yrs	3,000
Each child under 10yrs	2,000

Bitama is married with children of which two are below 10 years. The other child is 12 years old . Bontwe is single but has 2 dependents aged 11 and 15 years. Each month Bitama and Bontwe earns Shs.150,000 and Shs.140,000 respectively. The income tax is calculated as follow:

Taxable income	% tax
1 st:01 – 10,000	20
Next:10,001 – 50,000	15
Rest: 50,00 and above	10

Calculate:

(i)   The taxable income for Bitama and Bontwe.
(ii)   The income tax for Bitama and Bontwe.
(iii)   Express the total tax for each man as a percentage of their respective income.

SIMILARITY AND TRANSFORMATIONS

Similarity is concerned with figures of the same shape but different sizes, ratios of related dimensions on particular similar shapes, linear scale factor, area scale factor and volume scale factors, transformation of shapes i.e., translation, reflection, enlargement and rotation using cartesian plane and matrices.

1. ABC and XYZ are similar triangles with right angles at B and Y.
   AC = 13cm, BC = 5cm and YZ = 12.5cm.
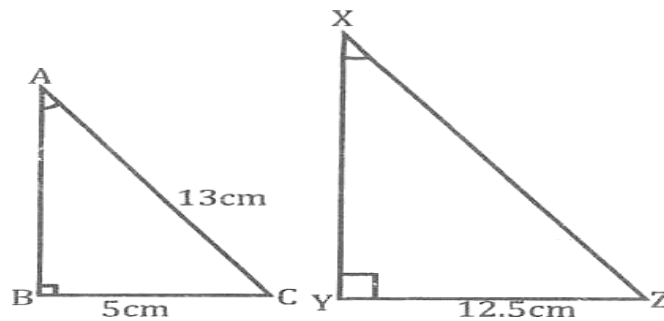
Calculate the length of YZ

2. Triangles ADE and ABC are similar DE is parallel to BC. AD = 4cm DE = 6cm and BC = 9cm.
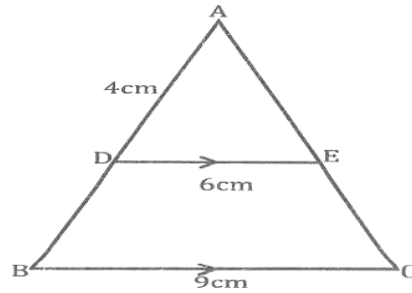
Calculate the length of BD.

3. Two perfume bottles are similar in shape. The smaller one is 6cm high and holds 30ml of perfume. The larger one is 9cm high. What volume of the perfume can the larger one hold?

4. A liquid is filled into two similar shaped tubes. The smaller one contains $25cm^3$ and the larger one contains $200cm^3$. If the smaller test tube is 4cm long, how long is the larger one?

5. The ratio of height of two similar figures A and B is 2:5. What is the ratio of their areas? If the area and the volume of the similar figure is 440cm² and 640cm³ respectively. Calculate the area and volume of the larger figure.

6. Two similar cylindrical tins T_1 and T_2 have surface area of 268cm² and 1,104cm² respectively. If the radius of T_2 is 13cm, find the radius of T_2

7. The ratio of the radius of two circles is 5:3. Find the ratio of their areas.

8. The ratio of the corresponding sides of two similar triangles is $\frac{5}{3}$. if the area of the larger triangle is l3cm², Find the area of the smaller one.

9. Two similar triangles have areas of 16cm² and 36cm² respectively if the base of the larger triangle is 9cm, find the base of the smaller one.

10. A water tank is in the shape of a cylinder of radius 4m and 7m. A similar tank has a radius of 2.5m. Calculate the height of the tank?

11. The length of the corresponding sides of similar triangles are 5cm and 8cm. given that the area of the small triangle is 15cm2, find the area of the bigger triangle.

12. In the triangle below PQ is parallel to ST, PQ=14cm, PS=4cm and TR=6cm.
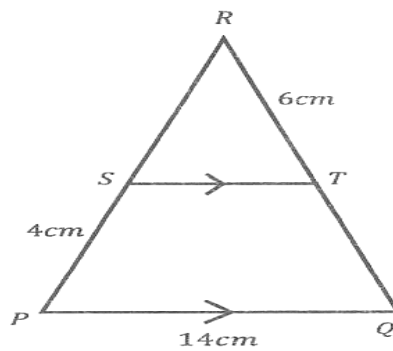
Find the length SR and QT.

13. The height of cone A is 7cm and the height of another similar cone B is 15cm. Find the surface area of B if the surface area of A is 204cm².

14. Two similar saucepans A and B hold 2000cm³ and 54,000cm³of water respectively. Given that the height of B is 25cm, Find the height of A.

15. The cone has a volume of 12,700cm³ and surface area of 420cm². Find the volume of a similar cone which has a surface area of 3,780cm².

16. Two similar cylindrical containers A and B have cross-sectional area in the ratio 4:9
(a) Find the radius of container A if that of container B is 15cm
(b) Find the volume of container B if that of A is 72cm³.

17. The height of two similar buckets A and B are 30cm and 45cm respectively. The capacity of bucket A is 20 litres.
Find the capacity of B in cm^3.

18. The lengths of two similar pipes are in the ratio 3:5. The surface area of the bigger, longer pipe is 420m^2. Find the surface area of the shorter pipe.

19. A cylindrical tank of diameter 3.8cm and height of 8cm has the volume of 5.08cm³. Find the radius and height of a similar tank of volume 40.64cm³.

20. Four buckets of water of bucket A can completely fill a similar bucket B. If the height of bucket A is 38cm, find the height of bucket B,

21. The cross-sectional area of a right circular cone P is thrice the cross- sectional area of a similar right circular cone Q. if the volume of P is 40.72cm², find the volume of cone Q.

22. A translation T =($\frac{3}{5}$) maps the point *(a, b) onto* (-5, b). Find *a* and *b*

23. The transformation M = $\begin{pmatrix} 3 & 0 \\ 4 & 1 \end{pmatrix}$ maps the points A and B onto A'(6,9) and B'(12,18) respectively. Determine the coordinates of A and B.

24.   A triangle ABC with vertices A(3,0), B(4,4)and C(2,l)is mapped onto triangle A'B'C' with vertices A'(15,3), B'(32,12) and C'(13,4) respectively by the transformation T. Determine the matrix of transformation T.

25. A triangle PQR with vertices P(3,1),Q(-2,4) and R(6,0) is mapped onto its image P'Q'R' by the matrix of transformation T = $\begin{pmatrix} 4 & 3 \\ 1 & 2 \end{pmatrix}$. P'Q'R' is then mapped onto triangle P"Q"R" with vertices P" (70,10), Q" (28,12) and R" (108,12) by the transformation, M Find: the vertices of P', Q', and R'   the matrix transformation M A single matrix of transformation which maps PQR and directly onto P" Q" R".

26. Triangle PQR has its vertices at P(0,3) Q(0,6)and R(5,5). The triangle is given a positive quarter turn about (0,0) to produce P'Q'R' the image of PQR, followed by a reflection in the line x = -y to produce A"B"C". Determine the coordinate of A'B'C' on a piece of squared paper.

Describe fully a single transformation which maps ABC onto A"B"C".

27. An enlargement with centre (0,0) maps the point A(2,3) onto A'(—18,—12). Determine the matrix of enlargement.

28.   A trapezium ABCD has vertices A(2,l) B(3,1)C(3,2) and (2,3)
(a) Determine and draw the image of the trapezium under each of the following transformation.

a reflection in the Y — axis, label it A',B',C',D'.

an enlargement with centre of enlargement $(2,\frac{1}{2})$ scale factor 2 , label it A" ,B",C",D".

A rotation of 270° anticlockwise about the point (0,1), label it A", B",C", D".

Describe the single transformation that will map A"B"C'D" back onto

KINEMATICS

This deals with motion of bodies or objects. It involves finding speed, distance and time, it also involves drawing distance-time and velocity-time graphs.

QUESTIONS

1. Soroti and Jinja are about 229km apart. A minibus heading for soroti leaves jinja at 8:55am with a steady speed of 156km/hr. At 9:40am a saloon car travelling 80 km/hr leaves soroti and travels steadly towards Jinja. Using a scale of 2cm:20km and 2cm:1hr.
   i. Draw on the same axis the distance time graph showing the journey of the minibus and the car. Hence or after wise determine when and what distance from jinja the two meet.
   ii. Given that the minibus increases its speed by 14km/hr. Calculate the time when the minibus arrive in soroti and the difference in the time of arrival.

2. The distance from town A to town B is 360km. An express bus leaves town A at 6:30am and travels at steady speed of 80km/km towards town B. At the same time, a taxi leaves town B travelling nonstop towards town A at asteady speed of 100km/hr.

      i.   Determine when and what distance from A the two vehicles met

      ii.   Find the difference in times of arrival of the two vehicles

3. Peter and David live in 2 different towns 18km apart. One day peter leaves his place at 9:12am and walks at a steady speed of 7kmh^{-1} towards David's home. David also leaves his home at 9:40am and cycles towards peters home. He travels the first 20 minutes at a steady speed of 21kmh^{-1} till his bicycle develops a mechanical fault which causes him to reduce his speed thus arriving at peters place at 11:44am. Using a scale of 6cm:1hr, on the horizontal axis and 2cm:1km on the vertical axis, draw graphs to represent the two journeys. Use your graph to find:
   i.   Peters time of arrival
   ii.   Davids average speed for the slower part of the journey

VECTORS

This chapter is concerned with position vectors, displacement vectors, addition and subtraction of vectors, magnitude of a vector and collinear points.

QUESTIONS

1. Given that AB = $\begin{pmatrix} 3 \\ 3 \end{pmatrix}$ and CB = $\begin{pmatrix} -4 \\ 3 \end{pmatrix}$, find:
   (i)   AC
   (ii)   the magnitude of AC

2. Given that OB = $\begin{pmatrix} 2 \\ 3 \end{pmatrix}$ and OA = $\begin{pmatrix} 8 \\ -3 \end{pmatrix}$ Find:

   (i)   Vector AB
   (ii) |AB|

3. Given that A(2,3)and B(8,l) and that OK = 3OA — | AB. Find the coordinates of K.

4. A point T has a position vector $\begin{pmatrix} 2 \\ 3 \end{pmatrix}$. Find the coordinates of the point P if the column vector PT $=\begin{pmatrix} 9 \\ -1 \end{pmatrix}$

5. Given that vectors $a = \begin{pmatrix} 4 \\ 2 \end{pmatrix}, b = \begin{pmatrix} -3 \\ 1 \end{pmatrix}$ and $c = \begin{pmatrix} 4 \\ 5 \end{pmatrix}$. Find the scalars s and t such that $sa + tb = c$.

6. Three points O, P and Q in the same plane have position vectors $\begin{pmatrix} 1 \\ 1 \end{pmatrix}$, $\begin{pmatrix} 4 \\ 5 \end{pmatrix}$ and $\begin{pmatrix} 7 \\ 2 \end{pmatrix}$ respectively. Find the coordinates of *R,* the midpoint of PQ and the distance of R from O.

7. Show that the points A(—2,2), B(-5,8) and C(—9,16) are collinear.

8. In the figure below, OP = p, OQ = q, 4PM = 3MQ. R is a point on OP such that 30R = 20P.
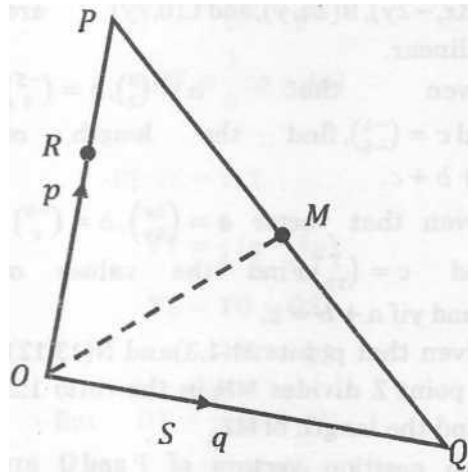
Express the following vectors in terms of p and q:

    (i)   PQ
    (ii)   PM
    (iii)   OM
    (iv)   RM

9.   In the figure below, ST = 2TQ, PQ = a, SP = b, and SR = 2PQ.
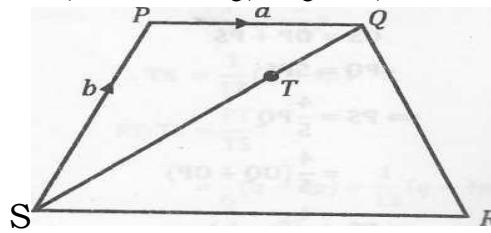
(a) Find the following vectors in terms of a and b.

(1) SQ   (ii) TR

(111) QR   (iv) PT

(v) TQ

(b) Show that the points P, T, and R are on a straight line. Hence state the ratio PT: PR.

10. Given that P(6,l) and Q(-5,5) find |OR| if OR = OP + - OQ and 0 is the origin.

11. Show that the points A(3x, —2y), B(2x,y),and C(0,7y) are collinear.

12. Given that $a = \begin{pmatrix} 5 \\ 2 \end{pmatrix}$, $b = \begin{pmatrix} 7 \\ 6 \end{pmatrix}$ and $c = \begin{pmatrix} 0 \\ -3 \end{pmatrix}$, find the length of a + b + c.

13. Given that points M(1,3)and N(13,12). A point Z divides MN in the ratio 1:2. Find the length of MZ.

CIRCLE PROPERTIES AND MENSURATION

Mensuration involves finding the areas and volumes of shapes and objects for example, rectangles, triangles, trapezium, cylinder, cone, sphere, frustrum's, pyramids and then circle properties of cyclic quadrilateral, tangents and cosecant lines.

1. Find the area of a regular pentagon with side 10cm.

2. A rectangle has a perimeter of 28cm and an area of 48cm^2. Calculate it's dimensions.

3. In a parallelogram $PQRS$, PQ = 12cm, QR = 5cm and $<QPR$ = 60°. Find its area.

4. Find the area *of* a rhombus *ABCD* 'whose diagonals are 18cm and 15cm.

5. A floor of 1.4m by 0.8m is to be filled by square tiles of sides 4cm.
          (a) Find the number of square tiles needed.
          (b) If each square tile costs Shs.3,000, how much will the tiles cost?

6. Find the volume and surface area of a cylinder with radius 5cm and height 12cm.

7. The length of the slant edge of a right circular cone is 8cm and its base a diameter is 6cm. Find its volume and surface area.

8. A cylindrical tank of diameter 6cm can hold 3200cm^3 of water. Calculate the height of the tank. (Use π = 3.142)

9. A cylindrical pipe is 50cm. Its external diameter is 10cm. If the thickness of the metal is 3cm, find the volume of the material needed to make the pipe. (Use π = 3.142)

10. A lampshade in the form of a frustum has the upper radius of 6cm and base radius of 8cm and a height of 12cm. Calculate the volume of the lampshade   the surface area of the lampshade.

11. The diagram below shows a right circular bucket of base radius 12cm and circular top of radius 20cm. The bucket is 70cm high.
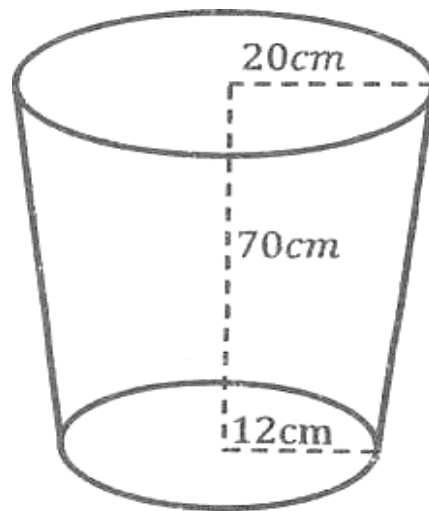
Find:
(i)   the volume of the bucket
(ii)   the surface area of the bucket including the cover.
(Use π = 3.142)

12. The pyramid below has a square base of 10cm and slanting height of 12cm.
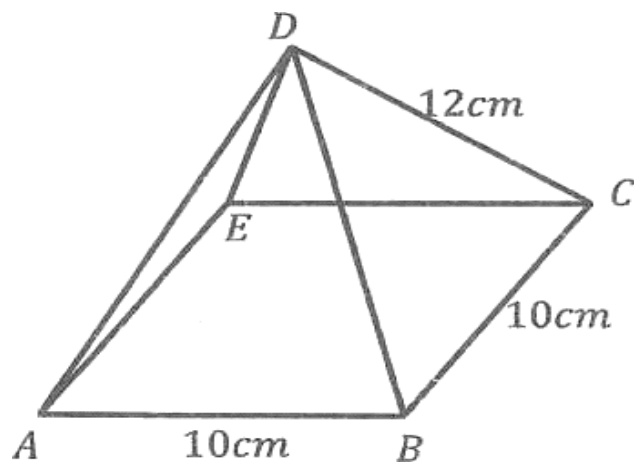
Find:

(i)   its volume
(ii)   its surface area

13. Find the area of the shaded parts in the figures below.

(a)
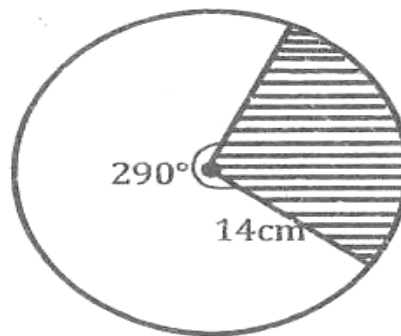
(b)
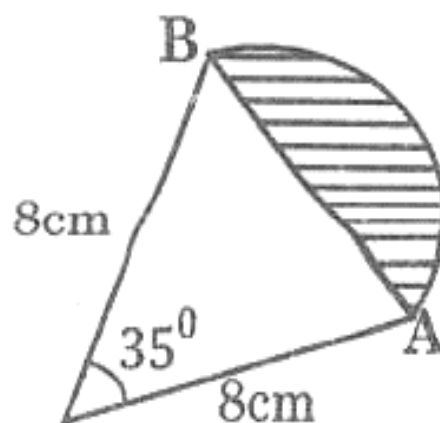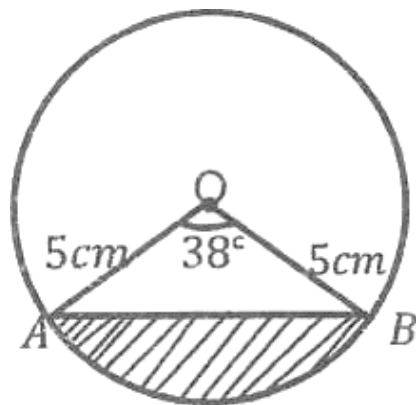
3.The figure below shows a circle with centre O and radius 10cm .two tangents   AB *and BC* are drown from point outside the circle and
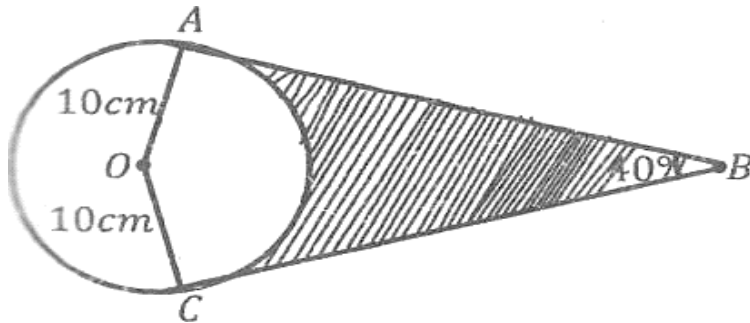
angle *ABC* = 40°

   Find the
   (i)   the length of the tangent *AB*
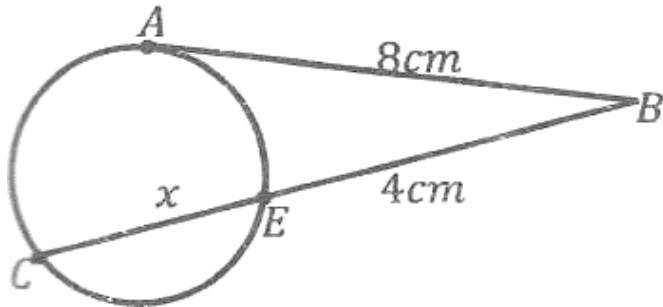   (ii)   the area of the shaded region (π = 3.14)

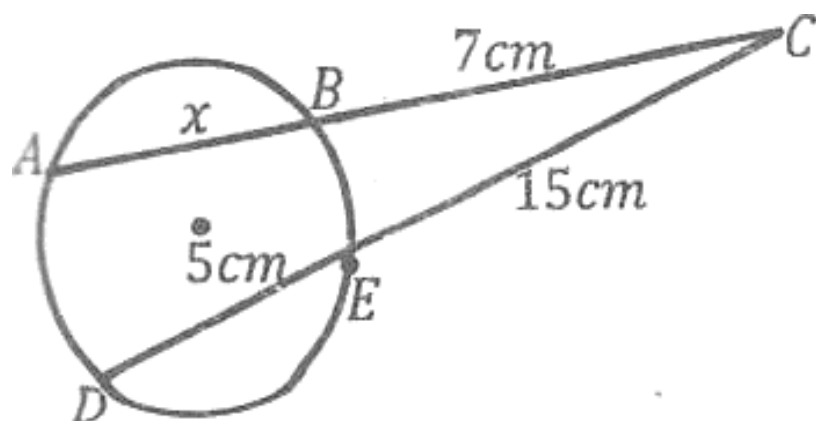4. The figure below shows two intersecting circles of radii 10cm and 7cm with centres M and N respectively
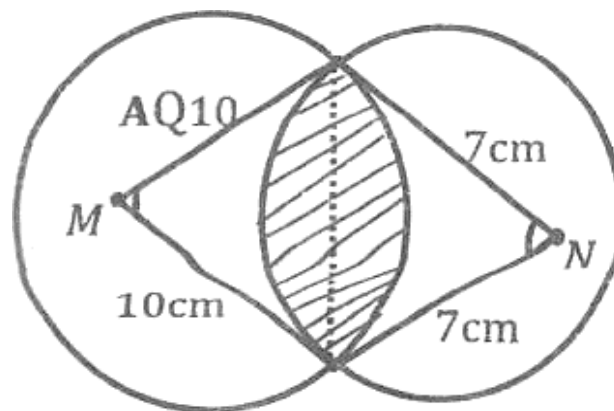
Find the area of the shaded region
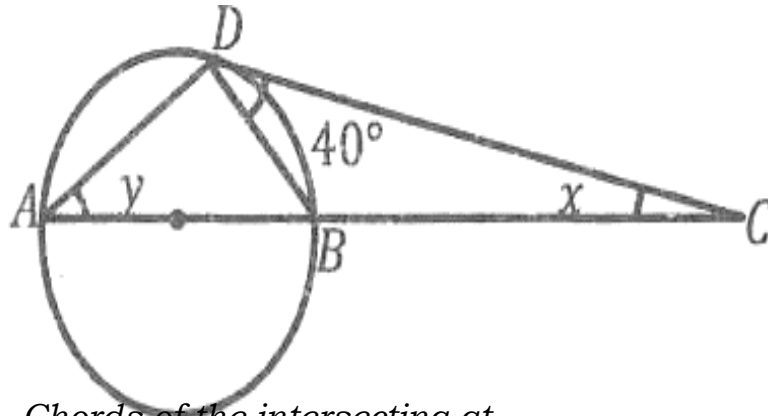
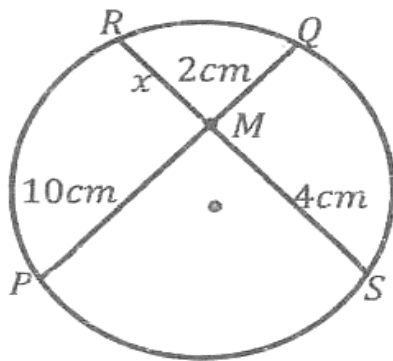5. Find the value of x in the following diagrams

(a)

(b)

2. In the figure below, *AB* is the diameter of the circle. Find the angles marked *x* and *y* if *CD* is a tangent to the circle.

Chords of the intersecting at

7. In the figure below, *PQ* and *RS* are two

point M

find the length of x.

8. Find the unknown angle in the figure below