'O' LEVEL MATHS

Revision guide

STUDY PACK

500 marks

Instructions to candidates

- Answer all questions
- Omission of essential working will result in loss of marks
- Decimal answers which are not exact should be given correct to three significant figures unless stated otherwise.
- Write neatly and legible.
- Electronic calculators can only be used on the topic show that and practice.

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MUSENDO POWER

DECIMALS, SIGNIFICANT FIGURES AND PERCENTAGES

1. Express 1548

(a) One significiant figure **(1)** **(b)** The nearest ten **(1)**

2. Express 0,00349 to

(a) One significant figure **(1)** **(b)** Two significant figure **(1)**

(c) Three decimal places **(1)** **(d)** Four decimal places **(1)**

3. Express 0,016 in standard form **(1)**

4. Express the following as percentages **(1)**

(a) 0,094 **(1)**

(b) $1\frac{1}{3}$ **(1)**

(c) 0,0043 **(1)**

FRACTIONS

1. $3\frac{1}{8} \div 8\frac{1}{3}$ **(2)** **2.** $3\frac{2}{5} \div 1\frac{7}{10} \times \frac{2}{5}$ **(3)** **3.** $\frac{1}{3} \div (\frac{1}{4} + \frac{1}{6})$ **(3)**

4. $\frac{9}{13} - \frac{7}{11}$ **(2)** **5.** $2\frac{2}{11}(4\frac{1}{4} - 3\frac{1}{3})$ **(3)** **6.** $1\frac{3}{4} \div 1\frac{1}{6}$ **(2)**

7. $\frac{1}{3} \div (\frac{1}{4} + \frac{1}{6})$ **(3)** **8.** $(3\frac{1}{8} - 2\frac{1}{3}) \div (4\frac{1}{2} + 1\frac{5}{6})$ **(4)** **9.** $\frac{7}{9}$ Of $(\frac{2}{3} - \frac{5}{12})$ **(3)**

STANDARD FORM

1. Given that $x = 3 \times 10^6$ $y = 4 \times 10^9$

Find the value of:

(a) x^2 **(2)** (b) xy **(2)** (c) $\frac{x}{y}$ **(2)**

2. Given that $x = 8{,}4 \times 10^9$ $y = 9 \times 10^2$ $z = 2 \times 10^{-5}$

Find (a) xy **(2)** (b) yz **(2)** (c) $\frac{xy}{z}$ **(2)**

3. Evaluate $(4 \times 10^2) + (6 \times 10^3) + (1 \times 10^5)$

Giving your answer in standard form. **(2)**

NUMBER BASES

Find the values of

1. $312_5 + 43_5$ **(1)**

2. $214_5 + 132_5$ **(3)**

2. Given that $110_3 = 14_x$ find x **(3)**

4. $120_3 = 13_x + 10_x$ find x **(3)**

5. $4015_7 + 3604_7$ **(3)**

6. $1012_3 - 221_3$ **(1)**

7. $23_x = 21_{10}$ find x **(3)**

8. 503_8-$(226_8 + 167_8)$ = **(3)**

9. $3^4 + 3^3 + 3$ as a number in base 3 **(1)**

10. 2n2 is a number in base 5 and that $2n2_5 = 133_6$ find n **(3)**

EXPAND AND SIMPLIFY

1. $(x-3)^2$ **(2)**

2. $5(4x-7)-6(3x-2)$ **(2)**

3. $4rt^2(3r-t^3)$ **(2)**

4. $3(6x-5)-2(4x-7)$ **(2)**

5. $(3x+2y)(2x-y)$ **(2)**

6. $3(x+2y)-2(x-y)$ **(2)**

7. $3(2y-5)-2(7-2y)$ **(2)**

8. $3(a+2c)-4(2a-c)$ **(2)**

9. $3p-2(2p+3)$ **(2)**

10. $4(2a+b)+2(3a-2b)$ **(2)**

SUBJECT OF THE FORMULA (all questions 3 marks)

1. $S = \pi r^2 + \pi rh$ **(h)**

2. $S = ut + \frac{1}{2}at^2$ **(a)**

3. $m(x+y) = x + 5m - 5$ **(m)**

4. $y = \frac{t-3}{1-t}$ **(t)**

5. $A = \pi r^2$ **(r)**

6. $\frac{x}{a} + \frac{y}{b} = 1$ **(b)**

7. $T = W + Wv^2$ **(W)**

8. $A = \pi r\,(h^2 - r^2)$ **(h)**

9. $V = \pi(R^2 - r_2)$ **(R)**

10. $a(x-1) = b$ **(x)**

SIMPLIFY THE FOLLOWING

1. $\frac{a^2-b^2}{ab+a^2} \div \frac{ab-a^2}{2a^3}$ **(4)**

2. $\frac{x^2-25}{x^2-2x-15}$ **(3)**

3. $\frac{x^2+7x+6}{x^2-36}$ **(3)**

4. $\frac{a^2x^3y-a^2x^3}{a^4x^2y-a^4x^2}$ **(3)**

5. $\frac{25-x^2}{10-2x}$ **(2)**

6. $\frac{n-3}{6} \div \frac{n^2-9}{4}$ **(3)**

7. $\frac{(-m)}{(-m)^2 \times (-m)^2}$ **(2)**

8. $\frac{a^2-2a}{a^2-6a+9} \div \frac{4-2a}{a-3}$ **(4)**

STATISTICS

1. Given the numbers 3;5;4;2;7;3;11
   Find **(i)** the mode **(1)** **(ii)** the median **(1)** **(iii)** mean **(1)**
2. The numbers 4;7;8;k;10;11;14;18 are in ascending order :
   (a) Given that the mode is 8, find the value of **k** **(1)**
   (b) Hence , find the **(i)** median **(1)** **(ii)** mean **(1)**
3. The following entries show the numbers of bicycles sold per day in nine days
   6;10;12;9;14;10;15;10;12
   Find **(a)** the mode **(1)**
   (b) the median **(1)**
   (c) the next entry if the new mean on the tenth day is 12 **(3)**

SOLVE THE FOLLOWING EQUATIONS

1. $\frac{3}{m} - \frac{5}{4m} = 2$ **(2)**

2. $\frac{1}{n} = 2 - \frac{2}{3n}$ **(3)**

3. $x(3x + 2) = 0$ **(3)**

4. $\frac{x+1}{3} + \frac{2x-1}{2} = \frac{7}{6}$ **(4)**

5. $(x - 1)^2 = 9$ **(2)**

6. $\frac{x}{3} = \frac{27}{x}$ **(2)**

7. $3x(x + 4) + 45 = 3(x^2 + 1)$ **(4)**

8. $\frac{3y}{5} - \frac{1}{4} = 0$ **(3)**

GRADIENT

1. $A = (1, -2)\ B = (3,4)$ *find* (**a**)*the gradient of AB* **(2)**

(**b**)*the equation of AB* **(2)**

2. $A = (1,2)\ P = (4, -2)$*lie on line Z*

(**a**)*find the gradient of line Z* **(2)**

(**b**)*find the equation of line Z* **(2)**

A point B $(k, 6)$*lies on line Z*

(**c**)*find the value of k* **(2)**

3.*The equation of a line is* $3x - 7y + 14 = 0$

(**a**)*find the gradient of the line.* **(2)**

(**b**)*find* $y -$ *intercept.* **(2)**

(**c**)*find the coordinates of the*

point where the line crosses the $x -$ *axis* **(2)**

SOLVE THE SIMULTANEOUS EQUATIONS

1. $3x + y = 11\frac{1}{2}$

$x - 2y = 5$ **(3)**

2. $8x + 15y = 11$

$4x - y = 31$ **(3)**

3. $6x + 4y = 3$

$4x + 6y = 5$ **(3)**

4. $2x + 3y = 6$

$6x + 4y = 5$ **(3)**

MATRICES

1. $C = \begin{pmatrix} 2 & -3 \\ 0 & 4 \end{pmatrix} D = \begin{pmatrix} 5 & -2 \\ -7 & 1 \end{pmatrix}$ *find* (**a**)$C - 2D$ **(2)**

(**b**)D^2 **(2)**

2. $A = \begin{pmatrix} -1 & 0 \\ 2 & 3 \end{pmatrix} B = \begin{pmatrix} x & 2 \\ 8 & x \end{pmatrix}$ *find* (**a**)*AB in terms of x* **(2)**

(b) *find x such that Bis singular matrix.* **(2)**

3. $M = \begin{pmatrix} 1 & -1 \\ -1 & 3 \end{pmatrix} N = \begin{pmatrix} 1 & -2 \\ x & 6 \end{pmatrix}$ *find*: (**a**) M^2 **(2)**

(**b**)*x, given that N hasno inverse.* **(2)**

4. *If* $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} N = \begin{pmatrix} 7 & 0 \\ 2 & -1 \end{pmatrix}$ *find N* **(3)**

COLUMN VECTORS

1. $A = (1; -3)$ $AB = \begin{pmatrix} 6 \\ 8 \end{pmatrix}$ $BC = \begin{pmatrix} 2 \\ -2 \end{pmatrix}$

find (**a**) */AB/* **(2)**

(b) */AC/* **(2)**

(c) *The coordinates of B* **(2)**

2. $A = (5; 2)$ $B = (-3; 8)$

find (**a**)*AB as a column vector.* **(1)**

(**b**)*the length of line AB* **(1)**

3. $AB = \begin{pmatrix} 2 \\ 4 \end{pmatrix}$ $BC = \begin{pmatrix} -8 \\ 6 \end{pmatrix}$

find (**a**) *AC* **(1)**

(**b**)*/AC/ living your* answer in surd form. **(2)**

4. $P = (4; 8)$ $R = (-4; -2)$

find (***a***)*PR as a column vector* **(1)**

(***b***)*/PR/ living your answer in surd form* **(2)**

5. $OP = \binom{4}{3}$ $OQ = \binom{6}{-1}$

Calculate (***a***) */OP/* **(2)**

(***b***) *PQ* **(2)**

(***c***) *QP* **(2)**

VARIATION

1. *It is given that* $C = a + KN^2$

Find the two possible value of N given that $C = 102, a = 27$ *and* $K = 3$ **(3)**

2. *y varies directly as v and inversely as* $(x + 2)$

(***i***)*Express y in terms of v, x and a constant k* **(2)**

(***ii***)*Given that when* $y = \frac{3}{2}, x = 8$ *and* $v = 5$, *find the value of k* **(2)**

(***iii***)*Find y when* $x = -11$ *and* $v = 2$ **(2)**

3. *A is partly constant and partly varies as C*

(***a***)*Express A in terms of C and constant h and k* **(1)**

(***b***) *Given that* $A = 1$ *when* $C = 8$ *and that* $A = 3$ *when* $C = 12$, *calculate the value of*:

(***i***)*h* **(2)**

(***ii***)*k* **(2)**

(***c***)*Find the value of A when* $C = 30$ **(2)**

SINGLE FRACTION

Express as single fraction

1. $\frac{3}{x-2}-\frac{2}{x}$ **(3)**

2. $\frac{5m}{8}-\frac{2m+3}{4}$ **(3)**

3. $\frac{3}{x-2}-\frac{2}{x}$ **(3)**

4. $\frac{y}{4y-1}+\frac{3}{5}$ **(3)**

5. $\frac{4}{p}-\frac{3}{1-5p}$ **(3)**

6. $n+\frac{2n}{6n+5}$ **(3)**

7. $\frac{1}{x-1}+\frac{2}{x+1}$ **(3)**

8. $\frac{2a-5}{a-4}-\frac{1}{2}$ **(3)**

9. $\frac{n}{5}+\frac{2n}{6n}+5$ **(3)**

10. $\frac{1}{2x-5}+\frac{2}{3}$ **(3)**

11. $\frac{1}{x}+\frac{1}{2x}$ **(3)**

12. $\frac{x}{2}-\frac{x-1}{2}$ **(3)**

INEQUALITIES

1. *Solve* $y-4<3y+2\leq 6-y$ *and list all the intergral values of y that satisify the inequality.* **(4)**

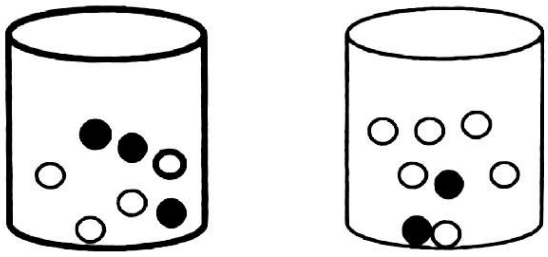
3 (a). *Solve*: $5x-6<2x-3\leq 3x+1$ *giving your answer in the form* $a\leq x<b$ *where a and b are intergers.* **(4)**

(b) *illustrate the solution on a number line.* **(1)**

3. *Solve* : $3n-25<2$ **(2)**

4. *List the interger values of* $6\leq 2x+1\leq 11$ **(3)**

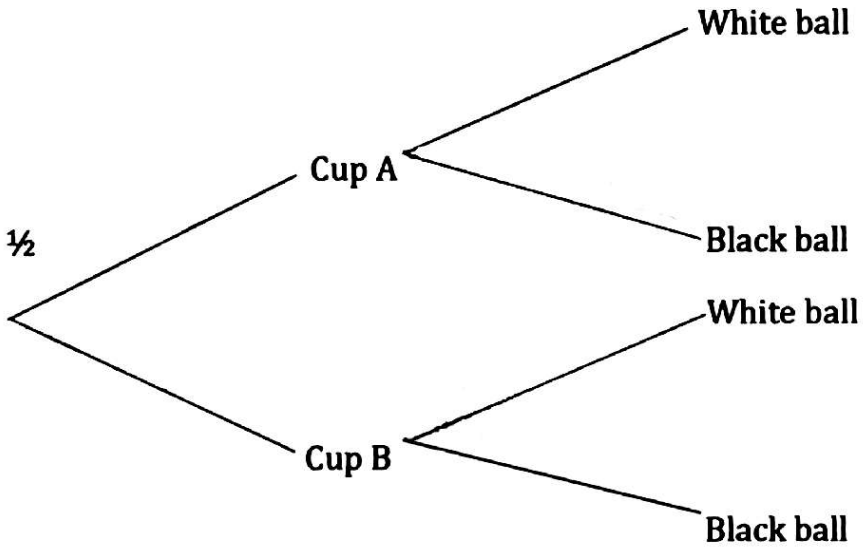
PROBABILITY



Cup A Cup B

Shumi must choose a cup from which he should pick a ball. The probability that he chooses cup A=½

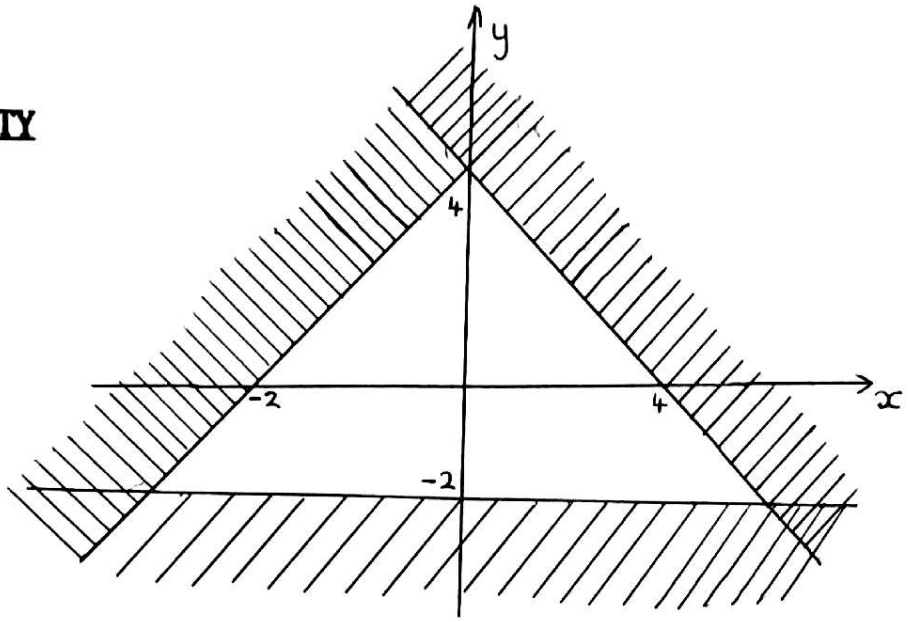
Cup A contains 5 white and 3 black balls. Cup B contains 6 white and 2 black balls. The tree diagram below shows some of this information.ss



a. Complete the probability tree diagram shown above (3)
b. Find the probability that Shumi chooses Cup A and then a white ball (2)
c. Find the probability that Shumi picks a white ball (2)

INEQUALITY

a.



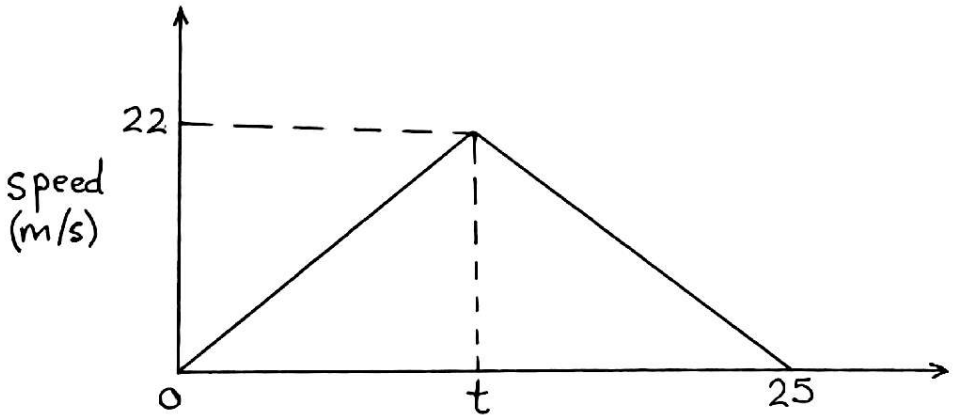
Find the three inequalities which define the unshaded part/region in the diagram above (5)

b. Given that $-5 \leq x \leq 1$ and$6 \leq y \leq 17$, find

i. **The greatest value of x**
ii. **The least value of $x^3 - y$ (3)**

TRAVEL GRAPHS

1.The diagram below shows a speed time graph of a motor cycle.

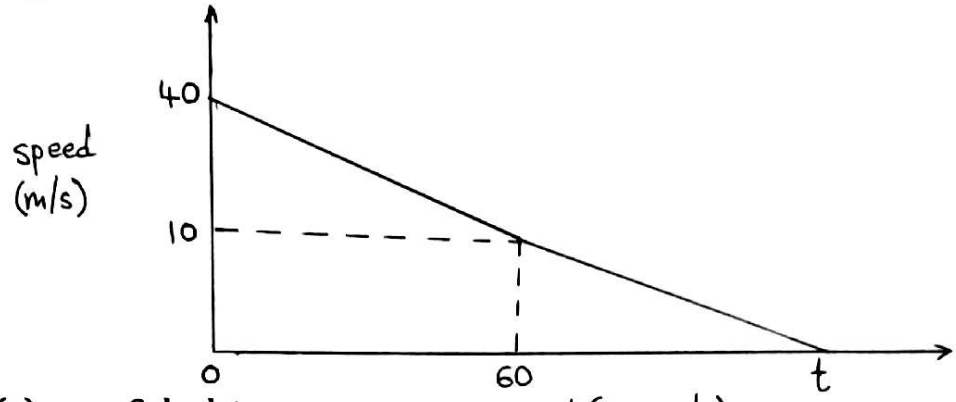


a. **Given that the acceleration during the first t seconds is $2\frac{1}{5}m/s^2$, calculate the value of t (2)**

b. Calculate : 1. The total distance travelled during the 25 seconds **(3)**

2. the average speed for the whole journey **(2)**

2. The diagram shows a velocity time graph of a train which retards in two stages.



(a) Calculate

i. The retardation of the train during the first 60 seconds **(2)**

ii. The distsance that the train covers in the first 60 seconds **(2)**

iii. Given that the train covers a total distance of 3000m during the period of retardation.Calculate the value of t **(3)**

FUNCTIONS

1. $f(x) = 3x^2 - x$

$find\ f\ (-2)$ **(1)**

2. $f(x) = 2k - 3$

$find\ k\ when\ f\ (k) = -21$ **(2)**

3. $f\ (x) = x^2 - 9$

(a) $find\ f\ (7)$ **(1)**

(b) $find\ the\ value\ of\ x$

$for\ which\ f(x) = 16$ **(2)**

4. $Given\ that\ f\ (x) = 27^x$

$find\ (a)\ f\ (\frac{4}{3})$ **(2)**

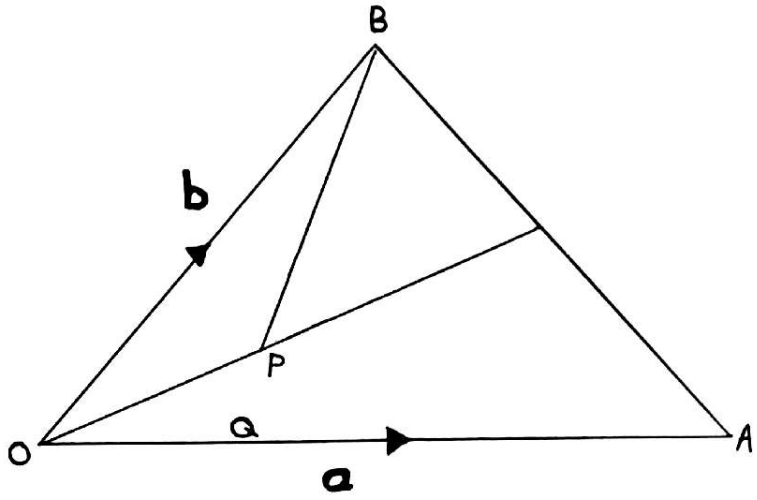
$(b)\ f\ (-\frac{1}{3})$ **(2)**

$(c)\ x\ if\ (x) = 9$ **(2)**

VECTORS

$OA = \boldsymbol{a}$

$OB = \boldsymbol{b}$



M is the midpoint of AB and P is the midpoint of OM

(a) Express the following vectors in the form of **a** and **b**

(i) $\overrightarrow{AB}$ **(1)**

(ii) $\overrightarrow{AM}$ **(1)**

(iii) $\overrightarrow{OM}$ **(2)**

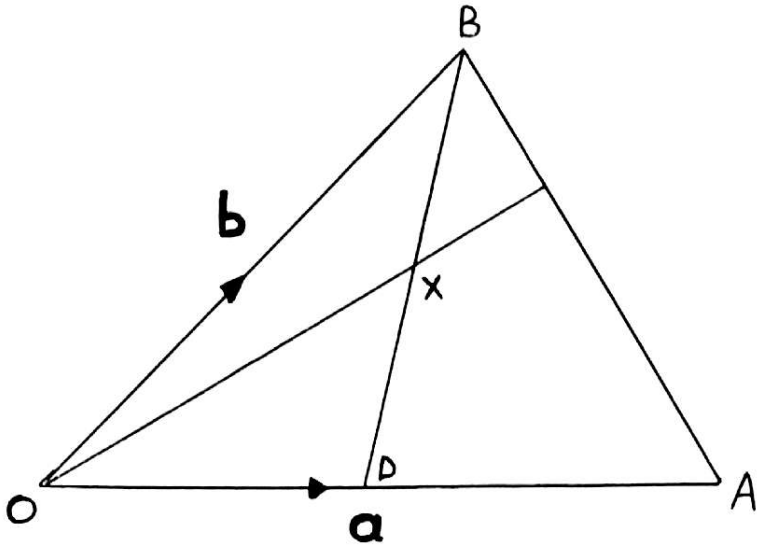
(iv) $\overrightarrow{OP}$ **(2)**

(v) $\overrightarrow{BP}$ **(2)**

(b) Given that Q lies on OA such that OQ: QA =1:2.Express $\overrightarrow{BQ}$ in terms of **a** and **b** **(2)**

(c) Given that BP = k BQ find the value of **k** **(2)**

VECTORS



In the diagram $OA = \boldsymbol{a}$, $OB = \boldsymbol{b}$

The point $\boldsymbol{C}$ *is such that* $\boldsymbol{AC = 3CB}$ *and the point* $\boldsymbol{D}$ *is such that* $\boldsymbol{OD = DA}$

(a) *Express in terms of* $\boldsymbol{a}$ *and /or* $\boldsymbol{b}$ *the vectors*

(i) AB **(1)**

(ii) OD **(1)**

(iii) AC **(1)**

(iv) OC **(1)**

(b) $\boldsymbol{OC}$ *and* $\boldsymbol{BD}$ *meet* $\boldsymbol{X}$. *Given that* $\boldsymbol{BX = kBD}$, *express* $\boldsymbol{BX}$ *in terms of* $\boldsymbol{a}$, $\boldsymbol{b}$ *and* $\boldsymbol{k}$.

Hence show that $\boldsymbol{OX = \frac{1}{2}ka + (1-k)b}$ **(3)**

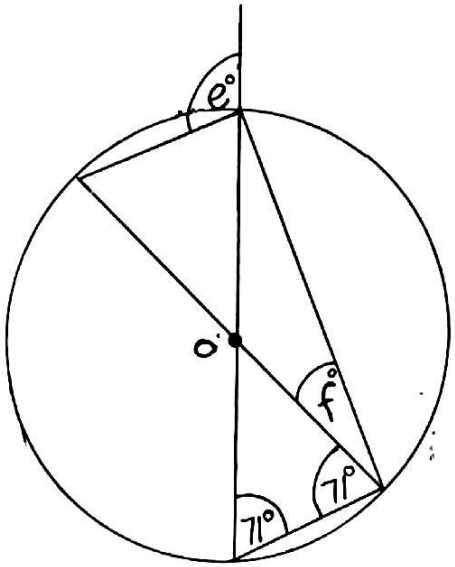
(c) *Given also that* $\boldsymbol{OX = h\,OC}$, *express* OX *tems of* $\boldsymbol{a}$, $\boldsymbol{b}$ *and* $\boldsymbol{h}$ **(1)**

(d) *Using these two expressions for* $\boldsymbol{OX}$, *find the value of* $\boldsymbol{h}$ *and* $\boldsymbol{k}$
(3)

(e) *Find the numerical value of the ratio* $\boldsymbol{BX : XD}$ **(1)**

CIRCLE GEOMETRY

1.

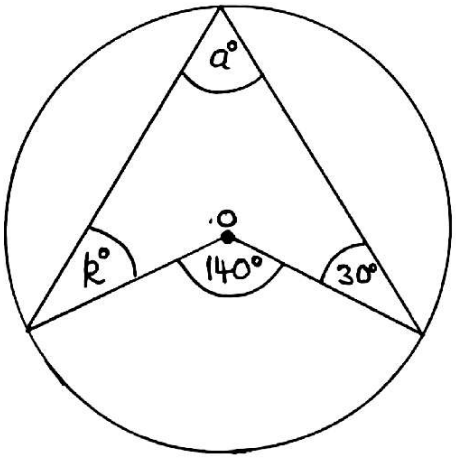


Find all marked angles

e (2)

f (2)

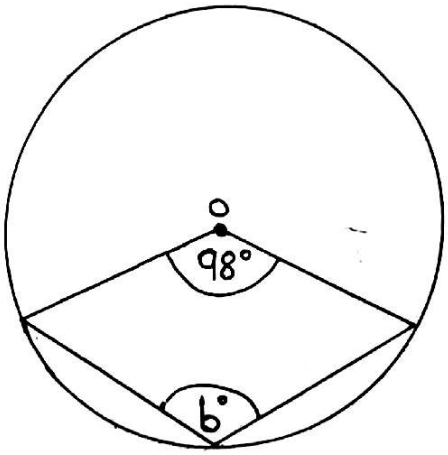
2.



a (2)

k (2)

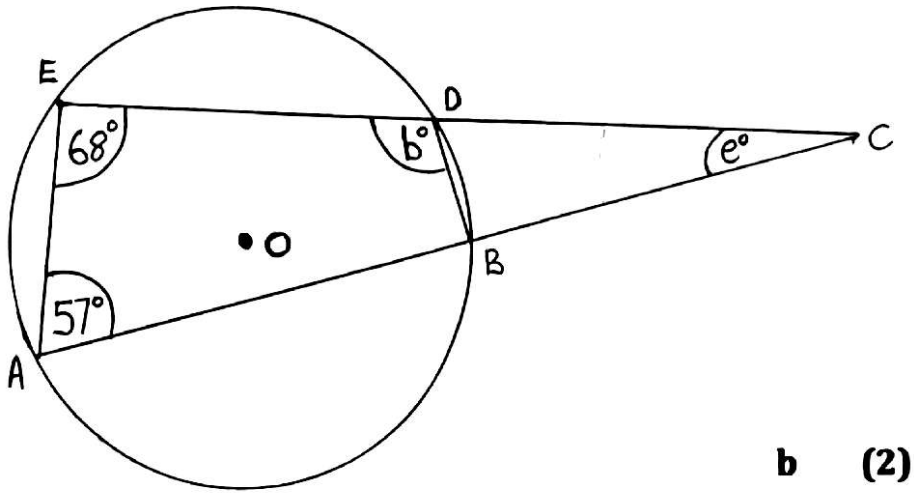
3.



b (2)

CIRCLE GEOMETRY

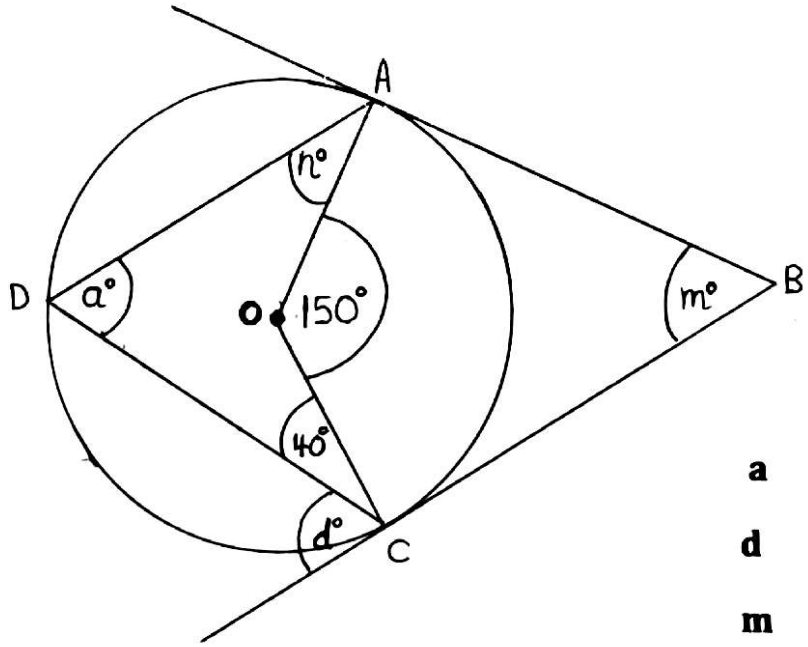
4. **Find all marked angles.**



b (2)

e (2)

5.



a (2)

d (2)

m (2)

n (2)

SHOW THAT ?

1. (a) Given that $2^{2(x^2-3)} \times 2^{3x} = 16$ show that it can be reduced to

$2x^2 + 3x - 10 = 0$ **(3)**

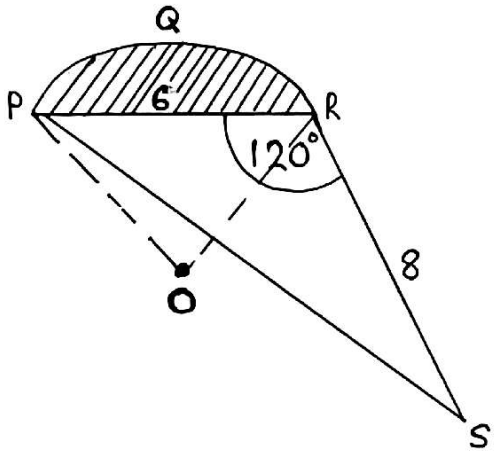
(b) solve $2x^2 + 3x - 10 = 0$ giving your answers correct to 2 decimal places **(5)**

2. (a) Show that the equation

$\frac{1}{2x-5} + \frac{2}{3} = \frac{1}{x+3}$ reduces to $4x^2 - x - 6 = 0$ **(3)**

(b) Solve the equation $4x^2 - x - 6 = 0$ giving your answer correct two decimal places **(5)**

3.



$\pi = 3.142$

In the diagram PQR is a segment of a circle of radius 6cm and centre O.

PR = 6cm ; RS = 8cm ; PS = (3x + 4) cm PRS = 120°.

a) Calculate the area of the triangle. **(4)**
b) Form an equation in x and show that it reduces to $3x^2 + 8x - 44 = 0$. **(3)**
c) Solve the equation $3x^2 + 8x - 44 = 0$, giving your answer correct to 2 decimal places. **(5)**

FURTHER PRACTICE

1. (i) Express $\frac{x}{3} + \frac{x-4}{5}$ as a single fraction in its simplest form.

   (ii) Hence or otherwise solve the equation $\frac{x}{3} + \frac{x-4}{5} = 4$ **(4)**

2. At Power High School, 15% of the total enrolment transferred due to transport costs and 40% of the remainder transferred due to increases in school levies.
   If there were only 612 students left, calculate the enrolment of the school before the students transferred. **(3)**

3. Forty pupils took part in a race and the distances to the nearest metre, that they coverd in a certain time interval, are given in the frequency table below.

Distance (in m)	$10 \leq x < 20$	$20 \leq x < 50$	$50 \leq x < 60$	$60 \leq x < 70$	$70 \leq x < 80$	$80 \leq x < 100$
Frequency (f)	4	6	8	4	13	5
Frequency density	0,4	A	0,8	b	c	0,25

   i. State the modal class **(1)**
   ii. If the information is to be represented on a histogram, find the values of a , b and c. **(3)**
   iii. Calculate the mean distance covered **(3)**
   iv. Two of the pupils are selected at random to make a report on the race.
   Find the probability that both pupils had covered 70m or more in the race. **(2)**

4. Answer the whole of the question on a sheet of graph paper.

Triangle W has vertices at(1 ; 1), (7 ; -1) and (4 ; 4). Using a scale of 2cm to represent 2 units on both axes , draw the x and y-axes for $-10 \leq x \leq 10$ and $-10 \leq y \leq 10$.

a) Draw and label clearly triange W. **(1)**

b) Triangle X is the image of triangle W under a reflection in the line $y = x+2$.
Draw and label clearly,
(i) The line $y = x + 2$
(ii) Triangle X **(3)**

c) (i) Draw and label clearly triangle Y, the image of triangle W under an enlargement of scale factor $-\frac{1}{2}$ with the origin as the centre.

(ii) Write down the matrix which represents this transformation. **(4)**

d) Triangle Z with vertices at (1 ; -3), (1 ;-9) and (6; -6), is the image of triangle W under a certain transformeation.
(i) Draw and label clearly triangle Z.
(ii) Describe **fully** the **single** transformation which maps triangle W onto triangle Z.

(4)

5. Given that $A = \begin{pmatrix} 1 & 2 \\ 0 & 1 \end{pmatrix}$, $B = \begin{pmatrix} 3 & 1 \\ 2 & 0 \end{pmatrix}$, find

(i) $2A + B$

(ii) $B - A$

(iii) B^{-1}

(iv) BA

(v) B^2 **(10)**

6. Mrs Mushowe decides to erect a durawall around her rectangular stand measuring 20m by 11m. Three metres are to be left for a gate.

(a) Find the perimeter of the durawall. **(3)**

She has two options, A or B, to consider for erecting the durawall.

Option A

She could engage a contractor who charges \$12 per metre on a fix and supply basis.

(b) Calculate the total cost of erecting the durawall using option A. **(2)**

Option B

She could buy the following materials as shown in the table below and engage a builder who charges \$100 for the job.

Item	quantity	cost per unit
Bricks	5 000	\$80,00 for 1 000
Cement	10 x 50 kg bag	\$10 per bag
brick force	5 bundles	\$5 per bundle
pit sand	2 loads	\$30 per loads

(c) Calculate the total cost of erecting the durawall using option B. **(3)**

(d) Mrs Mushowe decides to use the cheaper option. Calculate the amount she saves by using that option. **(2)**

7. A school clerk works from 0800 t0 1200 in the mornings and from 1300 to 1630 in the afternoons. If the rate of pay is \$2,40 per hour , calculate

(a) the weekly wage of the clerk **(3)**

(b) the annual pay of the clerk **(2)**

8. Find how much \$343,20 amounts to in 3 years at $12\frac{1}{2}$ %. **(3)**

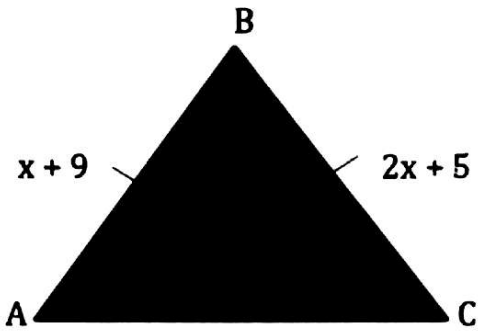
9. A man walked 12 km at 3km/h and cycled 18km at 9km/h. What was his average speed for the whole joursney?

10. It is given that $\sum$ =S {1; 2; 3; ....8; 9; 10} ,with subsets A and B such that A is a set of perfect squares and B is a set of multiples of 3.

i. Draw a venn diagram to represent the sets above.

ii. Find n($A \cup B$) **(4)**

11.



10

In the diagram, ABC is an isosceles triangle with AB = BC.

AB=(x + 9)cm , BC=(2x + 5)cm and the base, AC=10cm.

i. Form an equation in terms of x and solve it . **(3)**

ii. Write down the length of AB. **(1)**

iii. Calculate the area of the triangle ABC. **(2)**

iv. given that all the lengths of the sides of Δ ABC were given to the nearest centimetre, calculate the least possible perimeter of the triangle. **(3)**

12. The trapezium PQRS , in which QR is parallel to PS, is such that PS = 11cm, PQ = 5cm and $Q\hat{P}S = 90°$. If the area of the trapezium is 45 cm^2, Find the length of QR. **(3)**

13. Study the number pattern below:

2; 3; 5; 9; 17; .....

Write down

i. the next two numbers,

ii. the formula that is used to get the next number, (r^{th} term) in terms of r . **(4)**

Answers are available on request