

NameFile Number Class

121/2

MATHEMATICS

Paper 2

2½ Hours

SET 1

FORM 3

Kenya Certificate of Secondary Education (K.C.S.E)

Instructions to candidates

1. Write your name, admission number and class in the spaces provided above.
2. The paper contains two sections: **Section I** and **Section II**.
3. Answer **ALL** the questions in **Section I** and **ANY FIVE** questions from **Section II**.
4. All working and answers must be written on the question paper in the spaces provided below each question.
5. Marks may be awarded for correct working even if the answer is wrong.
6. Negligent and slovenly work will be penalized.
7. Non-programmable silent electronic calculators and mathematical tables are allowed for use.

For Examiner's use only

Section I

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	T o t a l

17	18	19	20	21	22	23	24	Total

Grand Total %

This booklet contains 15 printed pages. Please confirm that all the pages exist and are properly printed before starting the exam.

Section I (50 marks)

Answer all the questions in this section

1. Solve for x in the equation $\sin (4x - 10)^\circ - \cos (x + 60^\circ)^\circ = 0$

(3 marks)

2. (a) Find the greatest common divisor of the term $9x^3y^2$ and $4xy^4$.

(1mark)

(b) Hence factorize completely the expression $9x^3y^2 - 4xy^4$

(2marks)

3 The area of a rhombus is 120 cm^2 . Given that one of its diagonals is 24 cm , calculate the perimeter of the rhombus.

(3 marks)

4. Given that $\overrightarrow{OA} = 2\mathbf{i} + 3\mathbf{j}$ and $\overrightarrow{OB} = 3\mathbf{i} - 2\mathbf{j}$. Find the magnitude of AB to one decimal place. **(3marks)**

5. Given that $\log_{10}7 = 0.8451$ and $\log_{10}6 = 0.7782$. find $\log_{10}25.2$ **(4 marks)**

6. The angle subtended by the major arc at the centre of the circle O is twice the angle subtended by the minor arc at the centre. If the radius of the circle is 3.5cm, find the length of the minor arc.
(Take $\pi = \frac{22}{7}$) **(3 Marks)**

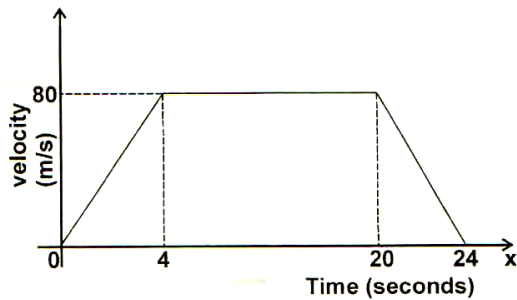
7. Simply and leave answer in surd form.

(4 marks)

$$\frac{-9}{\sqrt{13} + \sqrt{3}} - \frac{5}{\sqrt{3} - \sqrt{13}}$$

8. A line L is perpendicular to $3y - 4x = 7$. Determine the acute angle between L and the x-axis. (3marks)

9. The figure below is a velocity – time graph for a car.



a) Find the total distance travelled by the car.

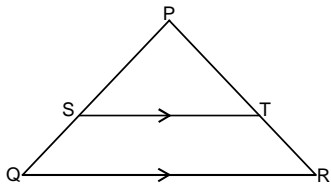
(2marks)

b) Calculate the deceleration of the car.

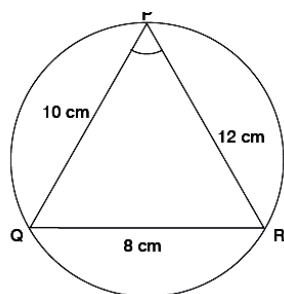
(1marks)

10. The figure below shows triangle PQR in which $PR = 12\text{cm}$. T is a point on PR such that $TR = 4\text{cm}$. Line ST is parallel to QR. If the area of triangle PQR is 336cm^2 , find the area of the quadrilateral STQR.

(3 marks)



11. In the diagram below, P, Q and R are points on the circumference of a circle. $PQ = 10\text{ cm}$, $PR = 12\text{ cm}$ and $QR = 8\text{ cm}$.



Find the radius of the circle to 2 decimal places.

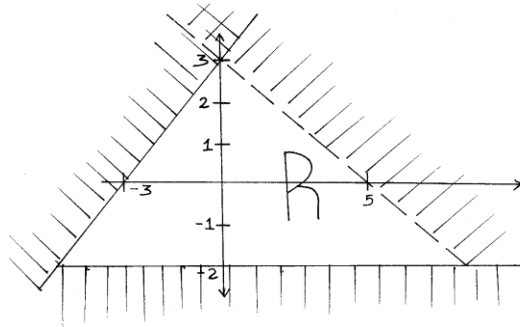
(3 marks)

12. Solve for x in the equation: $2 + \log_7(3x - 4) = \log_7 98$

(3 marks)

13. Form the inequalities represented by region R.

(3 marks)



14. From the roof of a house, a boy can see an avocado tree which is 20m away from the house. He measures the angle of elevation of the top of the tree as 21° and the angle of depression of the bottom of tree as 31° . Find the height of the avocado tree.

(3 marks)

15. Find the percentage error in calculating the volume of the cuboid whose dimensions are 8.2cm by 6.2cm by 5.7cm. (3 marks)

16. A bus moving at a speed of 80km/h is being overtaken by a car moving at 100km/h in a clear section of a road. Given that the bus is 21m long and the car is 4m long. How much time (in seconds) will elapse before the car can completely overtake the bus? (3marks)

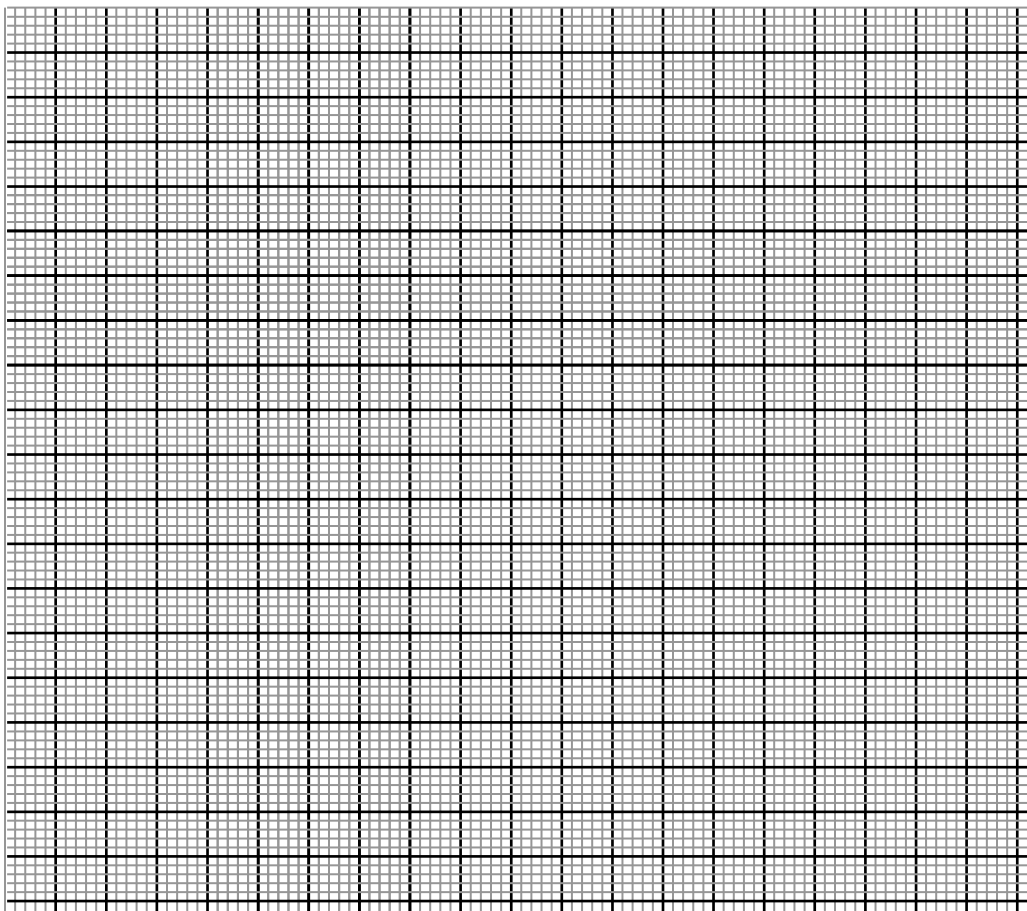
SECTION II: (50 MARKS)
Answer any five questions from this section

17. (a) Complete the table below for the function $y = \sin 2x^\circ$ and $y = 3 \cos x^\circ$ for $-180^\circ \leq x \leq 180^\circ$.

(2 marks)

x°	-180	-150	-120	-90	-60	-30	0	30	60	90	120	150	180
$\sin 2x^\circ$	0			0	-0.87				0.87	0			0
$3 \cos x^\circ$	-3	-2.6		0		2.6						-1.5	

- (b)** On the same axes, draw the graph of $y = \sin 2x^\circ$ and $y = 3 \cos x^\circ$ for $-180^\circ \leq x \leq 180^\circ$. **(5marks)**



(c) Use the graph in (b) above to find:

(i) the value of x such that $3 \cos x^\circ - \sin 2x^\circ = 0$. **(1 mark)**

(ii) the difference in value of y when $x = 45^\circ$. **(1 mark)**

(iii) Range of values of x such that $3 \cos x > 1.5$. **(1mark)**

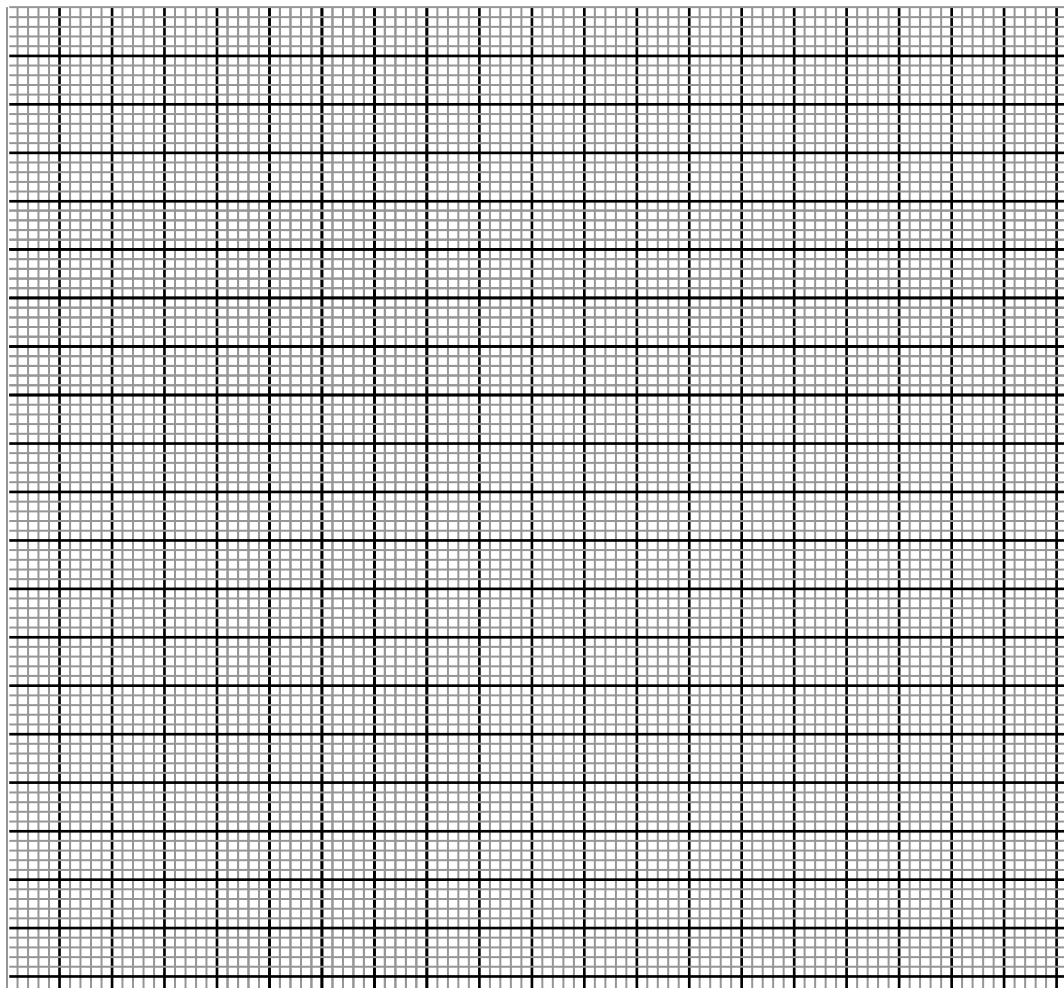
18. (a) Complete the table below for the equation

$$y = x^2 + 3x - 6, \text{ given } -6 \leq x \leq 4.$$

(2marks)

X	-6	-5	-4	-3	-2	-1	0	1	2	3	4
Y	12			-6			-6				22

(b) Using a scale of 1cm to represent 1 unit in the x-axis and 2 units in the y-axis, draw the graph of $y = x^2 + 3x - 6$. (4marks)



(c) Use your graph to solve the quadratic equation.

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

(1mark)

ii) $x^2 + 3x - 2 = 0$

(3marks)

19.a) An enlargement with centre $(-2, 3)$ maps $(1, 0)$ onto $(4, -3)$. What is the image of $(-3, -6)$ with the same centre of enlargement. **(4marks)**

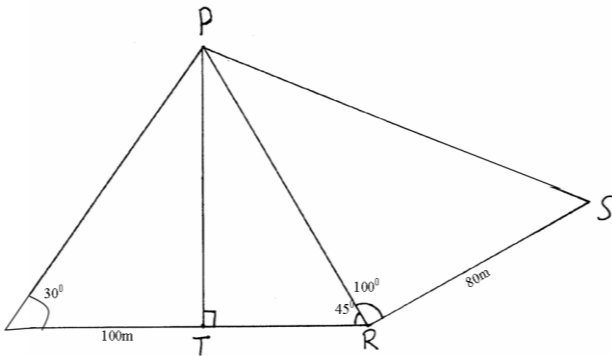
b). If $\frac{9}{98}x^2 - \frac{3}{28}x + \frac{3}{16} + B$ is a perfect square. Find the value of B . **(3 marks)**

c. If $\cos \theta^\circ = \frac{-15}{17}$ and θ is obtuse, find without using tables the values of

i) $\tan \theta^\circ$. **(2marks)**

ii) $\sin (180 - \theta)^\circ$ **(1mark)**

20. The figure below represents a quadrilateral piece of land PQRS divided into three triangular plots. The length QT and RS are 100m and 80m respectively. Angle PQT=30°, angle PRT =45° and angle PRS =100°.



(a) Find to four significant figures

(i) the length of PT.

(2marks)

(ii) The length of PS.

(3marks)

(iii) the perimeter of the piece of land.

(2marks)

(b) The plots are to be fenced with five strands of barbed wire leaving an entrance of 2.8m wide to each plot. The type of marked wire to be used is sold in rolls of length of 480m. Calculate the number of rolls of marked wire that must be bought to complete the fencing of the plot. **(3marks)**

21. Musa obtained a loan in which the rate of interest was charged at 3.5% quarterly. He cleared this loan by paying Ksh: 24,805 at the end of $1\frac{1}{2}$ years.

(a) How much was the loan if the rate was on:

(i) Simple interest. **(4 marks)**

(ii)Compound interest. **(4 marks)**

(b) Calculate the difference between simple and compound interest. **(2 marks)**

- 22.** Two circles, centre A and B, have radii 4cm and 8cm respectively. If the two circles share a common chord 6cm long, (Taking $\pi = 3.142$).
- (a)** Calculate the area of the common region. **(6 marks)**

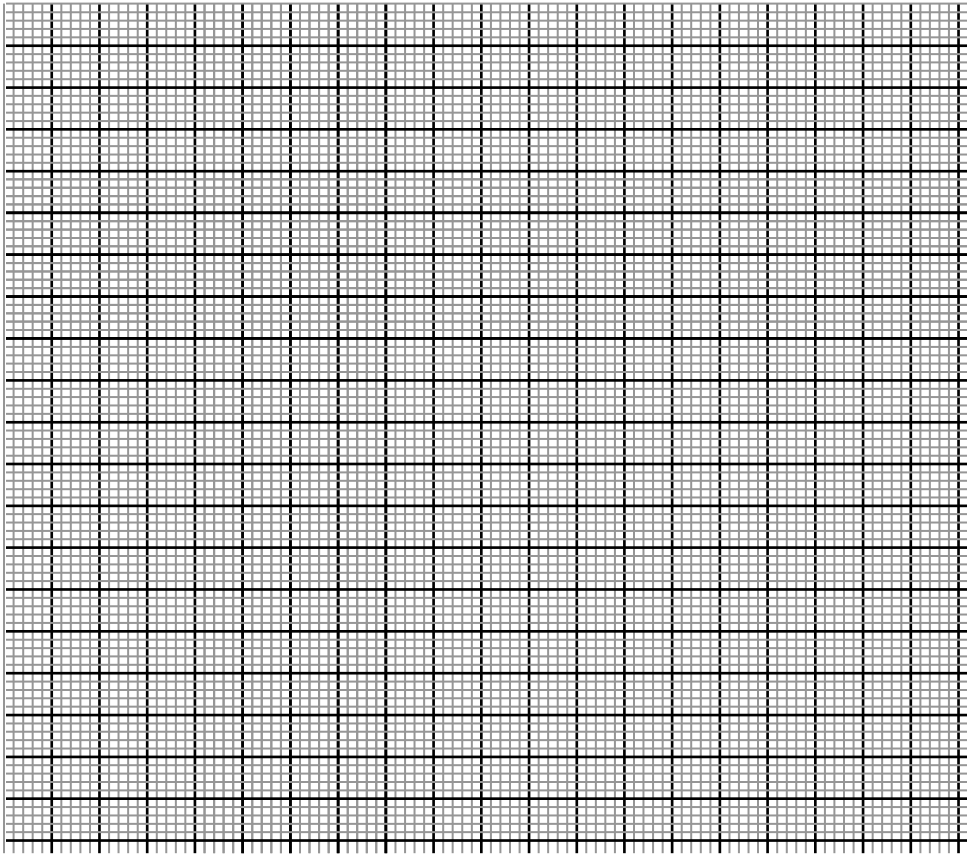
- (b)** After constructing the two circles, each separately on a piece of paper, a student cut out a minor segment on each circle along the chord 6cm and joined the major segments along the chords. Find the perimeter of the figure made. **(4 marks)**

- 23.** The following data was obtained for masses of some pregnant women in a maternity clinic

Mass x (kg)	$1.5 \leq x < 5.5$	$5.5 \leq x < 7.5$	$7.5 \leq x < 13.5$	$13.5 \leq x < 15.5$	$15.5 \leq x < 20.5$
No. Of women	16	20	18	14	15

(a) Represent the information in the table above on a histogram, on the graph paper provided.

(6marks)



(b) Use the information in the table above to estimate:

(i) the mean mass.

(2marks)

(ii) the median mass.

(2marks)

24. a) A room is constructed such that its external length and breadth are 7.5m and 5.3m respectively. The thickness of the wall is 15cm and its height is 3.3 metres. A total space of 5 m^2 is left for doors and windows on the walls.

a) Calculate the volume of:

i) the materials needed to construct the walls with the doors and windows. **(4 marks)**

ii) the materials needed to construct the walls without doors and windows. **(2 marks)**

b) The blocks used in constructing the walls are 450mm by 200mm by 150mm. 0.225 m^3 of cement is used to join the blocks. Calculate the number of blocks. Calculate the number of blocks needed to construct the room. **(4 marks)**

SET 1

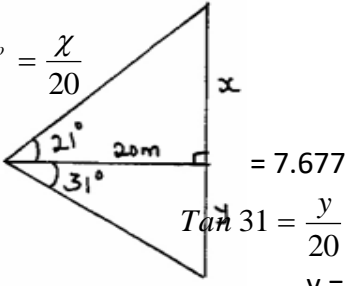
MATHS PAPER 2 MARKING SCHEME.

1	$\sin(4x + 10)^\circ = \sin(90 - (x + 60)^\circ)$ $4x + 10^\circ = 90 - x - 60^\circ$ $4x + x = 20$ $5x = 20$ $x = 4^\circ$	M 1 M 1 A 1							
		3 m k s							
2	<p>a) <i>CD of $9x^3y^2$ and $4xy^4$</i></p> <table style="margin-left: 20px; border-collapse: collapse;"> <tr> <td style="border-right: 1px solid black; padding: 5px;">xy^2</td> <td style="border-right: 1px solid black; padding: 5px;">$9x^3y^2$</td> <td style="padding: 5px;">$4xy^4$</td> </tr> <tr> <td style="border-right: 1px solid black; padding: 5px;">$9x^2$</td> <td style="border-right: 1px solid black; padding: 5px;">$9x^2$</td> <td style="padding: 5px;">$4y^2$</td> </tr> </table> <p><i>GCD = xy^2</i></p> <p>b) $9x^3y^2 - 4xy^4 = xy^2(9x^2 - 4y^2)$ $9x^2 - 4y^2$ $9x^2 - 4y^2 = (3x + 2y)(3x - 2y)$ $= xy^2(3x + 2y)(3x - 2y)$</p>	xy^2	$9x^3y^2$	$4xy^4$	$9x^2$	$9x^2$	$4y^2$	A 1 M 1 A 1	
xy^2	$9x^3y^2$	$4xy^4$							
$9x^2$	$9x^2$	$4y^2$							
		3 m k s							
3	<p>Area of rhombus = $\frac{1}{2}$ product of diagonals</p> $120 = \frac{1}{2} \times 24 \times x$ 2 nd diagonal $x = 10$ $y = \sqrt{5^2 + 12^2} = 13\text{cm}$ Perimeter = 13×4 $= 52\text{cm}^2$	M 1 M 1 A 1							
		3 m k							

		s	
4	$AB = (3i - 2j) - (2i + 3j) = i - 5j$ $|\overline{AB}| = \sqrt{1^2 + (-5)^2} = \sqrt{26} = 5.1 \text{ units}$	M 2 A 1	
		3 m k s	
5	$\log_{10} 7 = 0.8451$ $\log_{10} 6 = 0.7782$ $\log_{10}(25.2) = \log_{10}\left(\frac{6^2 \times 7}{10}\right)$ $= 2\log_{10} 6 + \log_{10} 7 - \log_{10} 10$ $= 2(0.7782) + 0.8451 - 1$ $= 1.5564 + 0.8451 - 1$ $= 1.4015$	M 1 M 1 M 1 A 1	
		4 m k s	
6	$2x + x = 360$ $x = 120^\circ$ $\frac{120}{360} \times \frac{22}{7} \times 2 \times 3.5$ $\frac{1}{3} \times 22 \times 2 \times 0.5 = 7.33 \text{ cm}$	M 1 M 1 A 1	
		3 m k s	

7	$\frac{-9(\sqrt{3}-\sqrt{13})-5(\sqrt{3}+\sqrt{13})}{(\sqrt{3}+\sqrt{13})(\sqrt{3}-\sqrt{13})}$ $= \frac{-9\sqrt{3}+9\sqrt{13}-5\sqrt{3}-5\sqrt{13}}{3-13}$ $= \frac{4\sqrt{13}-14\sqrt{3}}{-10}$ $= \frac{7\sqrt{3}-2\sqrt{13}}{5}$	M 1 M 1 M 1 A 1	
		4 m k s	
8	$3y = 7 + 4x$ $y = \frac{7+4x}{3}$ $\tan \theta = 4/3$ tangent $\theta = 53.13^\circ$	M 1 M 1 A 1	
		3 m k s	
9	(a) $D = \frac{1}{2} (24 + 16)80$ $= 1,600 \text{ m}$ (b) $= \frac{80}{4}$ $= 20 \text{ m/s}^2$ (deceleration)	M 1 A 1 A 1	
		3 m k s	

1	$L.S.f = \frac{12}{8} = \frac{3}{2}$ $A.S.f = \left(\frac{3}{2}\right)^2$ $\frac{336}{A} = \frac{9}{4} \Rightarrow A = 149 \quad \checkmark$ <p>Area of quadrilateral</p> $= 336 - 149 \quad \checkmark$ $= 186 \quad \checkmark \text{ cm}^2$	M 1	
		M 1	
1	$\cos P = \frac{10^2 + 12^2 - 8^2}{2 \times 10 \times 12}$ $P = 41.41^\circ$ $2R = \frac{8}{\sin 41.41^\circ}$ $R = 6.05$	M 1	
		M 1	
1	$2 = \log_7 \left(\frac{98}{3x-4} \right)$ $\frac{98}{3x-4} = 49$ $2 = 3x - 4$ $x = 2$	M 1	
		M 1	
		A 1	
		A 1	
		3 m k s	

1	$y < \frac{-3}{5}x + 3$ $y \leq x + 3$ $y \geq -2$	B 1 B 1 B 1	
		3 m k s	
1	 <p> $\tan 21^\circ = \frac{x}{20}$ $x = 20 \tan 21$ $= 7.677$ $\tan 31^\circ = \frac{y}{20}$ $y = 20 \tan 31$ $= 12.017$ $\therefore \text{Height of tree} = x + y$ $= 7.677 + 12.017$ $= 19.694$ </p>	M 1 M 1 A 1	
		3 m k s	
1	$R.E = \frac{0.05}{8.2} + \frac{0.05}{6.2} + \frac{0.05}{5.7}$ $= 0.02293$ $P.E = 0.02293 \times 100$ $= 2.293$	M 1 M 1 A 1	
		3 m k s	
1	$r.s = 100 - 80 = 20 \text{ km/h}$ $\rightarrow \frac{20 \times 1000}{60 \times 60}$		

$$= \frac{50}{9} \text{ m/s}$$

$$\text{Time} = \frac{\text{total distance}}{v}$$

$$\text{Time} = \frac{(4+21) \times 9}{50}$$

$$\text{Time} = 4.55$$

M
1

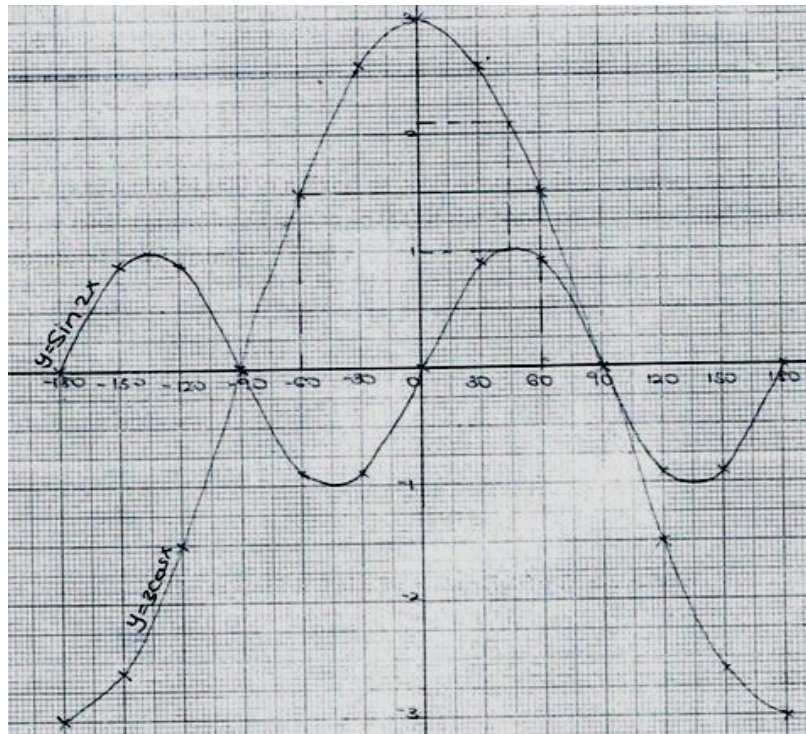
M
1
A
1

3
m
k
s

χ^e	-	-	-	-	-	-	0	3	6	9	1	1	1
	1	1	1	9	6	3	0	0	0	0	2	5	8
	8	5	2	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	-	-	0
Sin	0	0	0	0	-	-	0	0	0	0	-	-	0
χ		8	8		0	0		8	8		0	0	0
		7	7		8	8		7	7		8	8	
					7	7					7	7	
3	-	-	-	0	1	-	3	2	1	0	-	-	-
C	3	2	1	0	1	2	3	2	1	0	-	-	3
o	.	.	.		.	.	.	.	.	.	.	.	.
s	0	6	5	0	5	6	0	6	5	0	5	6	0
	0	0	0		0	0		0	0		0	0	0
χ													

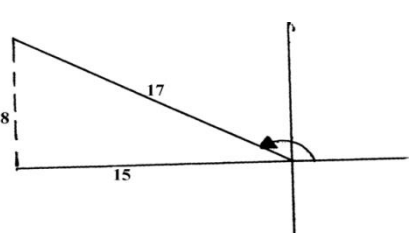
B
1

B
1



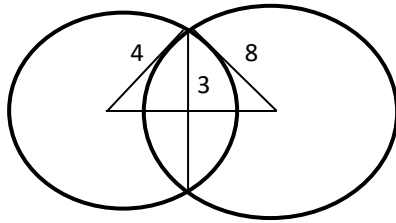
	(i) -90° or 90°	B1		
	(ii) $2.1 \pm 1 = 1.1 \pm 0.1$	B1		
	(iii) $-60^\circ < x < 60^\circ$	B1		

	<table border="1"> <tr> <td>X</td> <td>-6</td> <td>-5</td> <td>-4</td> <td>-3</td> <td>-2</td> <td>-1</td> <td>0</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> </tr> <tr> <td>Y</td> <td>1</td> <td>4</td> <td>-2</td> <td>-6</td> <td>-8</td> <td>-8</td> <td>-6</td> <td>-2</td> <td>4</td> <td>1</td> <td>2</td> </tr> <tr> <td></td> <td>2</td> <td></td> <td>2</td> <td>6</td> <td>8</td> <td>8</td> <td>6</td> <td>2</td> <td></td> <td>2</td> <td>2</td> </tr> </table> <p>b)</p> <p>c) i) From the graph $x = -4.4$ or $x = 1.4 \pm 0.5$. The points (circles) should be clearly on the graph</p> <p>ii) $y = x^2 + 3x - 6$ $0 = x^2 + 3x - 2$ $y = -4$ $x = -3.6$ or $x = 0.6 \pm 0.5$</p>	X	-6	-5	-4	-3	-2	-1	0	1	2	3	4	Y	1	4	-2	-6	-8	-8	-6	-2	4	1	2		2		2	6	8	8	6	2		2	2	T2	
X	-6	-5	-4	-3	-2	-1	0	1	2	3	4																												
Y	1	4	-2	-6	-8	-8	-6	-2	4	1	2																												
	2		2	6	8	8	6	2		2	2																												
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9	a) $k = \frac{4 - -2}{1 - -2} = \frac{6}{3} = 2$ $\frac{x - -2}{-3 - -2} = 2$	M1																																					

	$x + 2 = -2 \quad x = -4$ $\frac{y - 3}{-6 - 3} = 2$ $y - 3 = -18 \quad y = -15$ $\text{Image} = (-4, -15)$ <p>b) $b^2 = 4ac$</p> $\left(\frac{-3}{28}\right)^2 = 4\left(\frac{9}{98}\left(\frac{3}{16} + B\right)\right)$ $\frac{9}{784} = 4\left(\frac{27}{1568} + \frac{9B}{98}\right)$ $\frac{36B}{98} = \frac{9}{784} - \frac{108}{1568}$ $\frac{36}{98}B = \frac{70560}{1229312}$ $B = \frac{5}{32}$  $\sqrt{17^2 - 15^2} = 8$ <p>a) $\tan \theta = -\frac{8}{15}$</p> <p>b) $\sin(180 - \theta) = \sin \theta = \frac{8}{17}$</p>	M1 A1 M1 M1 A1 B1 A1 A1	
		10m k s	
20	<p>(i) $PT = 100 \tan 30$ $= 57.74$</p> <p>(ii) Length $PR = \frac{57.74}{\sin 45}$ $= 81.66$</p> $PS^2 = 81.66^2 + 80^2 - 2 \times 81.66 \times 80 \cos 100$ $PS = 123.8 \text{m}$ <p>(iii) $PT = TR = 57.74 \text{cm}$</p> $PQ = \frac{100}{\cos 30}$ $= 115.5 \text{m}$ $\text{Perimeter} = 115.5 + 100 + 57.74 + 80 + 123.8$ $= 477.04$	M1 A1 M1 M1 A1 M1 A1	

	$=477.0\text{m (4sf)}$ b) Total perimeter $=477.0+57.74+81.66$ $=616.4\text{m}$ Perimeter of open area $=2.8 \times 3$ $=8.4\text{m}$ Fenced perimeter $=616.4-8.4$ $=608$ No of rolls $= \frac{608 \times 5}{480}$ $=6.333$	B1 M1 A1	
		10 m k s	
2 1 .	(a)(i) Interest periods = 6 (for 6 periods) Total interest % $= 6 \times 3.5 = 21\%$ $\frac{121}{100} P = 24805$ $P = \frac{24805 \times 100}{121} = \underline{\text{sh.20500}}$ ii) $A = P \left(1 + \frac{r}{100} \right)^n$ $24805 = P \left(1 + \frac{3.5}{100} \right)^6 = P (1.035)^6$ $P = \frac{24805}{(1.035)^6} = \underline{\text{sh.20190}}$ (b) S.I. $= 24805 - 20500 = 4305$ C.I. $= 24805 - 20190 = 4610$ Difference $= 4610 - 4305 = \underline{\text{sh.305}}$	B1 M1 M1 A1 M1 M1 A1 M1 A1	(both inte rest s)
		A1	

2
2



$$\sin \theta = \frac{3}{5} \Rightarrow \theta = 36.87^\circ$$

$$2\theta = 73.74^\circ$$

$$\sin \theta = \frac{3}{4} \Rightarrow \theta = 48.59^\circ$$

$$2\theta = 97.18^\circ$$

$$\text{area of circle} = \left\{ \left(\frac{73.74}{360} \times 3.142 \times 8 \times 8 \right) - \left(\frac{1}{2} \times 8 \times 8 \sin 73.74 \right) \right\}$$

$$+ \left\{ \left(\frac{97.18}{360} \times 3.142 \times 4 \times 4 \right) - \left(\frac{1}{2} \times 4 \times 4 \sin 97.18 \right) \right\}$$

$$= (24.60 - 22.25) + (13.57 - 7.937)$$

$$= 2.35 + 5.633$$

$$= 7.983 \text{ cm}^2$$

$$b) \text{ arc length} = \frac{262.82}{360} \times 3.142 \times 16 + \frac{315.92}{360} \times 3.142 \times 8$$

$$= 36.70 + 22.06$$

$$\underline{58.76 \text{ cm}}$$

=

B1

✓
angle

B1

M1

✓
angle

M
1

area in
one
circle

M1

A1

are in
the
other
circle

M1

M1

M1

A1

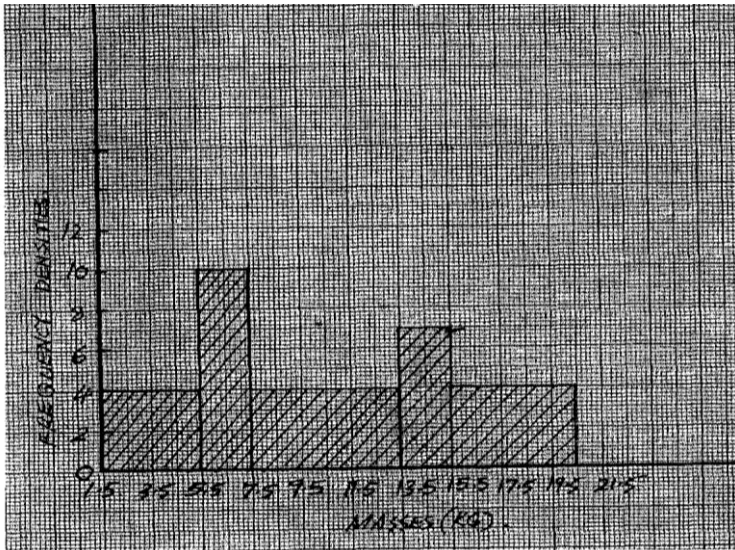
single
values

1st arc
length
2nd arc

length
single
values

10
marks

2
3



Boundaries	X	f	fx	cf	f.dev
1.5 – 5.5	3.5	16	56	16	4
5.5 – 7.5	6.5	20	130	36	10
7.5 – 13.5	10.5	18	189	54	3
13.5 -15.5	14.5	14	203	68	7
15.5 – 20.5	18.0	15	270	83	3

b) (i) mean = $\frac{\sum fx}{\sum f}$
 $= \frac{848}{83}$
 $= 10.2167\text{kg}$

✓B 1
 ✓B 1
 ✓B 1
 ✓B 1
 ✓B 2
 ✓B 1

Axes
f.d
column
c.f
 $\sum fx = 848$
All correct
bars
3 – 4
bars
correctly
plotted

	$(ii) \text{ median} = \frac{7.5 + 42 - 36 \times 6}{18}$ $= 9.5 \text{ kg}$	M1 A1 M1 A1	Substiu tion Answer C.A.O
		10m	
2 4 .	<p>a) $15 \text{ cm} = \frac{15}{100} = 0.15 \text{ m}$</p> <p>i) <i>outer</i> $v = 2(7.5 + 5.3)3.3 \text{ m}^3$ $= 84.48 \text{ m}^3$</p> <p><i>inner</i> $v = 2(7.2 + 5)3.3$ $= 80.52 \text{ m}^3$</p> <p><i>V of material</i> $= 84.48 - 80.52 \text{ m}^3$ $= 3.96 \text{ m}^3$</p> <p>(ii) Volume of the door and windows $= 5 \times 0.15$ $= 0.750 \text{ m}^3$</p> <p>Volume wall $= 3.96 - 0.750$ $= 3.21 \text{ m}^3$</p> <p>b) $1 \text{ m} = 1000 \text{ mm}$ volume of a block $= \frac{450}{1000} \times \frac{200}{1000} \times \frac{150}{1000}$ $= 0.45 \times 0.2 \times 0.15$ $= 0.0135 \text{ m}^3$</p> <p>Number of block $= \frac{3.21 - 0.225 \text{ m}^3}{0.0135}$ $= 221 \frac{1}{9}$</p>	B1 M1 M1 M 1 A1 M1 A1 M1 M1 M1 A1	

