1. Write the following in order of size, smallest first.

$$-\frac{25}{41} \qquad -\sqrt{0.36} \qquad -0.22^{\frac{1}{3}}$$

Answer ....., ..., ... [2]
smallest largest

2. Raja is travelling from Singapore to Sweden.
Raja wants to change 2000 Singapore Dollars into Swedish Krona.
How many more Swedish Krona will he get by changing his money in Sweden? Give your answer to the nearest Swedish Krona.

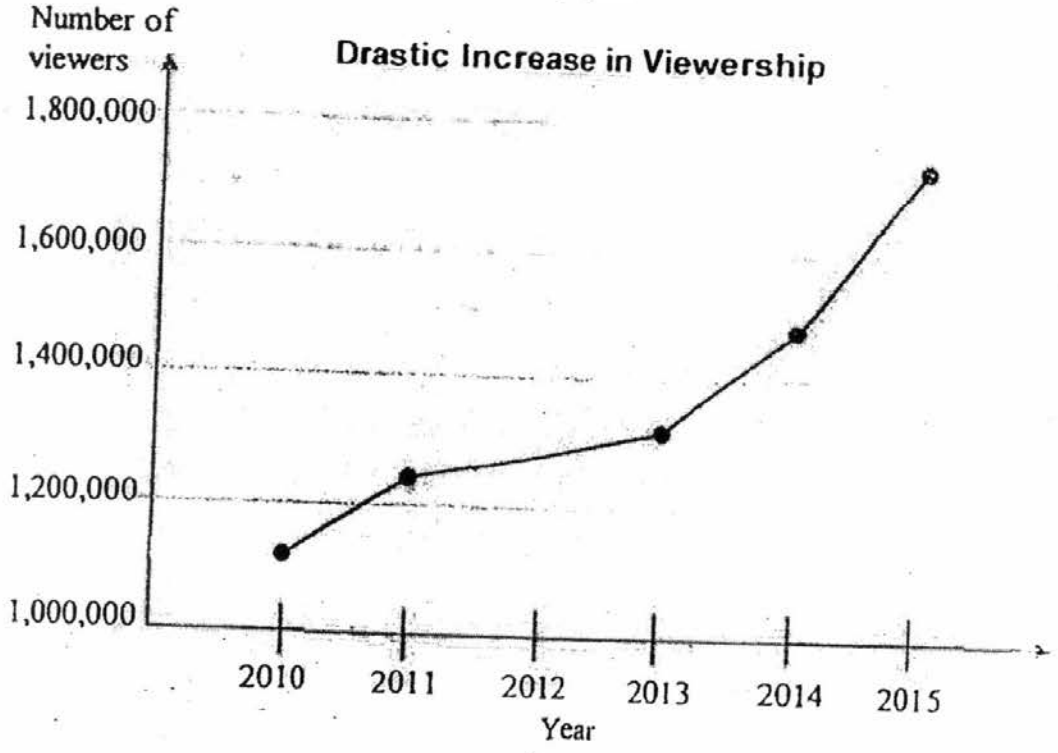
In Singapore	In Sweden
S$1 = 6.373 Swedish Krona	1 Swedish Krona = S$0.1563

Answer ..... Swedish Krona [2]

3. The sine of an angle is 0.1786.
Give two possible values for the angle in degrees, correct to two significant figures.

Answer ..... ° or ..... ° [2]

4. The following chart showing the average number of viewers watching the evening news broadcast was published in a newspaper.



List two ways in which the graph is misleading.

Answer 1 .....

.....

.....

2 .....

.....

.....

---

i. A holiday camp is planned for 30 children and food is bought to last for 12 days. If the number of children increases to 37 children, how many whole days do you expect the food to last?

Answer ..... days

Given that $3 \div 81^{n} = \sqrt{3^{-1}}$, find the value of n.

Answer $n =$ ..... [2]

Two cones, made of the same material, have the same height.
The smaller cone has a mass of 1 kilogram and the larger cone has a mass of 3 kilograms.
Calculate the radius of the smaller cone as a percentage of the larger cone.

Answer ..... % [2]

8. y varies inversely with the square root of x. Describe the change in x when y is halved.

Answer x ..... by .....% [2]

9. The table below shows information about a group of animals in a pet shop.

	Cat	Dog
Long-haired	8	3
Short-haired	5	2

Two animals are selected at random.
Find, as a fraction in its lowest terms, the probability that

(a) they are both cats,

Answer (a) ..... [1]

(b) neither are short-haired dogs.

Answer (b) ..... [1]

Examiner's use

10. A high-speed train travels at an estimated speed of 660 kilometres per hour.

(a) Find the train's speed in m/s.
Express your answer in standard form.

Answer (a) ..... m/s [1]

(b) Calculate the time taken for the train to travel 100 kilometres.
Give your answer in minutes and seconds, to the nearest second.

Answer (b) ..... minutes ..... seconds [1]

11. Each term in this sequence is found by adding a constant to the previous term.

a, 25, b, 37, ...

(a) Find the value of a.

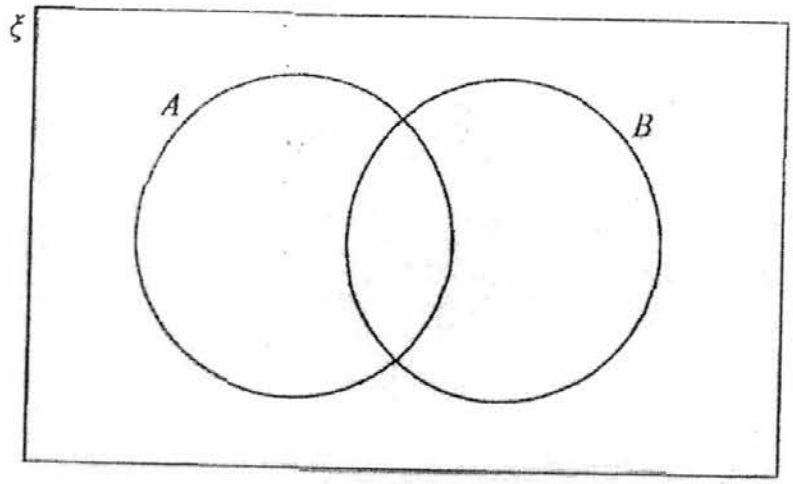
Answer (a) ..... [1]

(b) Find an expression to represent the nth term.

Answer (b) ..... [2]

12. (a) On the Venn Diagram shown in the answer space, shade the set $A' \cap (A \cup B)$.

Answer (a)



(b) 40 students sat for an oral test and Listening Comprehension test. The following table shows the results.

Test	Pass	Fail
Oral	26	14
Listening Comprehension	37	3

Given that two students failed both tests, find the number of students who passed both tests.

Answer (b) ..... students

13. When written as the product of its prime factors,

$$168 = 2^3 \times 3 \times 7$$

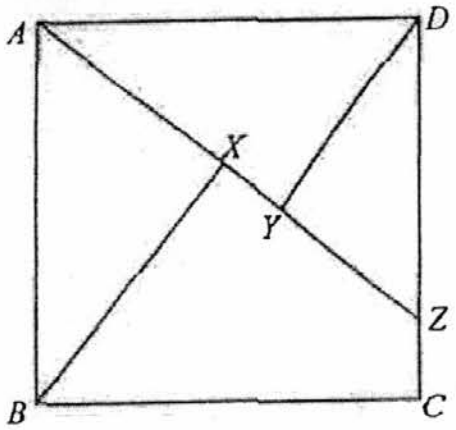
(a) Find the smallest possible integer value of k such that $\frac{168}{k}$ is a perfect square.

Answer (a) k = ...

(b) Find the smallest possible integer value of A, given that the highest common factor and lowest common multiple of 168 and A is 24 and 2520 respectively.

Answer (b) A = ...

4.



A, B, C and D are the vertices of a square. The point Z lies on CD such that A, X, Y and Z are collinear.

Given that $A\hat{X}B = D\hat{Y}A = 90°$, prove that triangles ABX and DAY are congruent.

Answer

[3]

Examiner's use

15. On a particular map, two train stations are shown to be 6 cm apart.

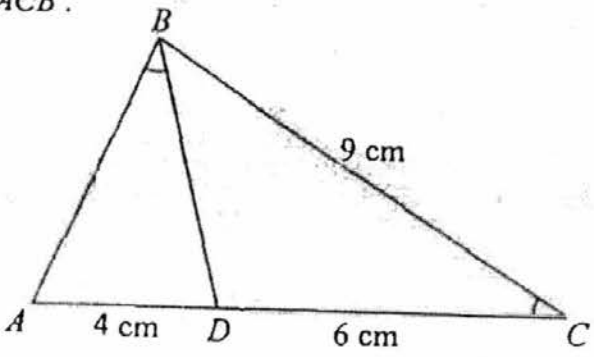
(a) If the actual distance between the stations is 3 km, express the map scale in the form 1 : n.

Answer (a) 1 : ..... [1]

(b) On the same map, a rectangular field occupies an area of 24 cm^2.
Find the actual area of the field in km^2.

Answer (b) ..... km^2 [2]

16. In the triangle ABC, $AD = 4$ cm, $DC = 6$ cm, $BC = 9$ cm and D is a point on AC such that $\angle ABD = \angle ACB$.



Find the length of BD.

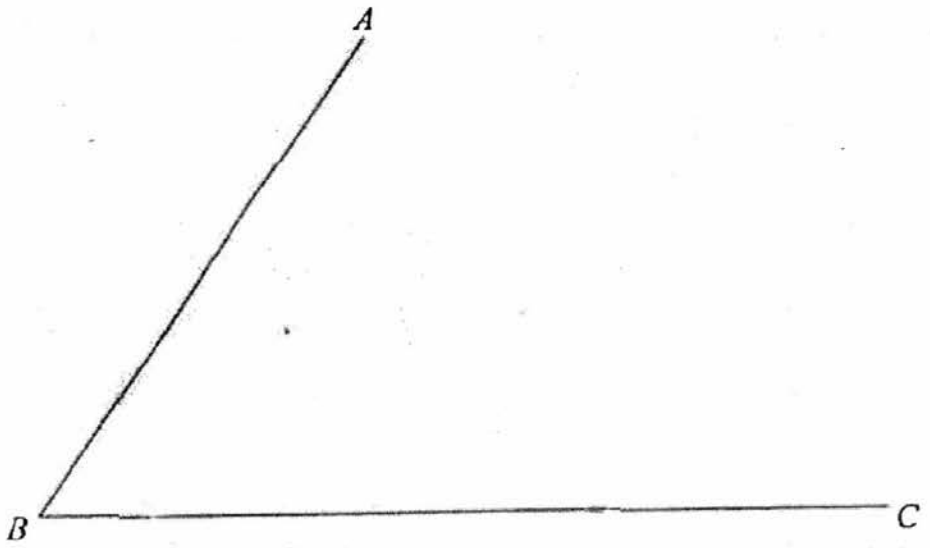
Answer ..... cm [3]

17. The diagram in the answer space below shows three points, A, B and C.

(a) Construct the perpendicular bisector of BC. [1]

(b) Construct the angle bisector of angle ABC. [1]

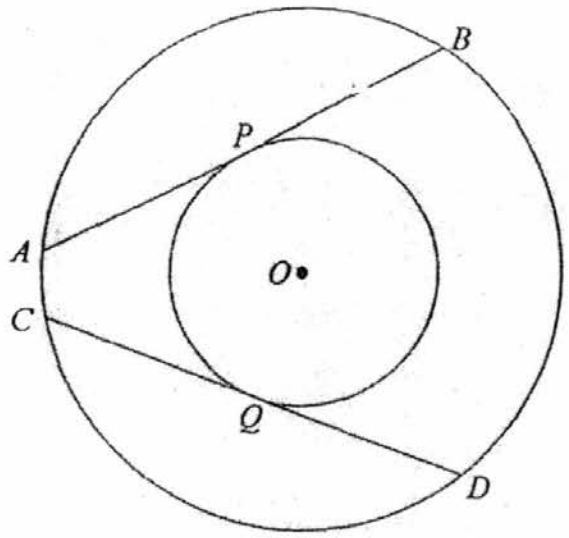
Answer



(c) These two bisectors meet at X.
Complete the statement below.
The point X is equidistant from the lines ..... and .....

and equidistant from the points ..... and ..... . [1]

18. The diagram below shows two concentric circles, with centre O.
A, B, C and D lie on the circumference of the larger circle.
AB and CD are tangents to the smaller circle at points P and Q respectively.



(a) Explain, with reasons, why $AB = CD$.

Answer (a) .....

.....

.....

(b) Given that the radius of the smaller and larger circle are 4 cm and 7 cm respectively, find AB.

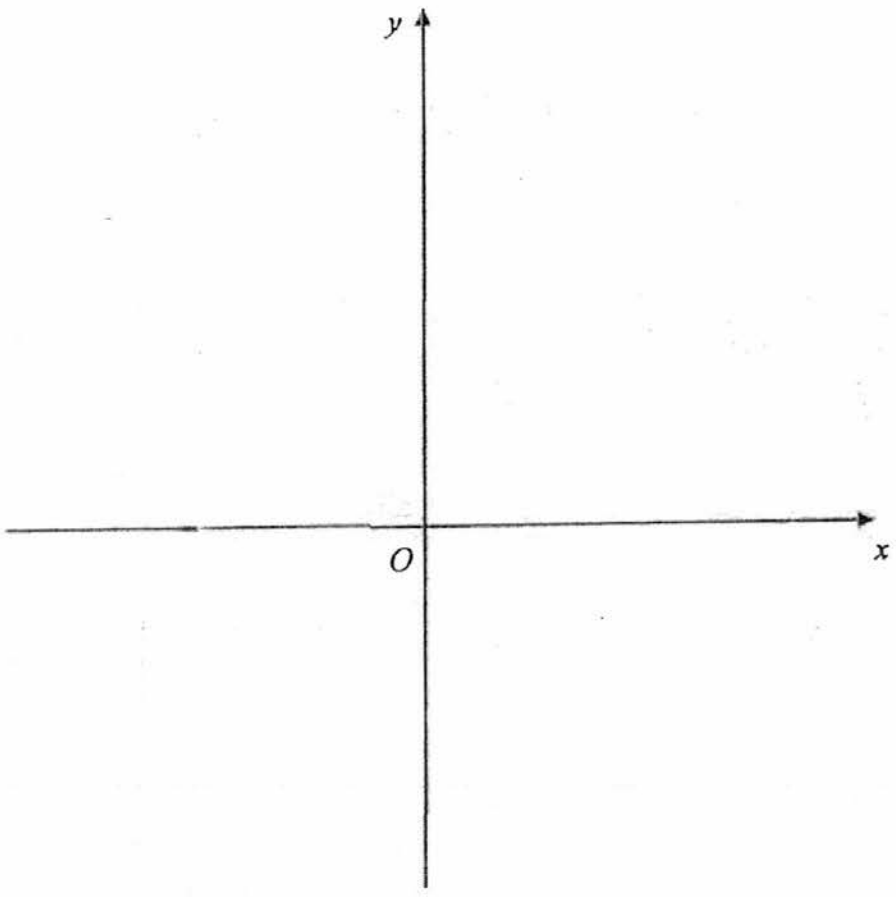
Answer (b) ..... cm

use

9. (a) Express $y = x^2 - 4x + 5$ in the form $y = (x+a)^2 + b$.

Answer (a) ..... [1]

(b) Sketch the graph of $y = x^2 - 4x + 5$ on the axes provided below.



[2]

(c) Using your graph, explain why $x^2 - 4x + 5 = 0$ has no solution.

Answer (c) ..... [1]

20. (a) The cash price of a computer is \$2500.
The hire-purchase price of the computer is \$2775.
The hire-purchase price is a deposit of x% of the cash price plus 12 equal monthly payments of \$200.

Calculate x.

Answer (a) $x =$ ..... [2]

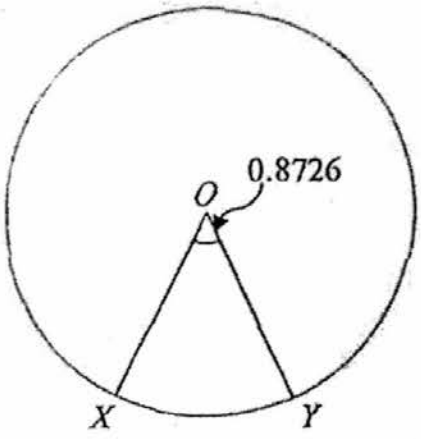
(b) Ali invested some money in a savings account for 5 years.
The rate of compound interest was fixed at 6% per annum and interest was compounded quarterly.
At the end of the 5 years there was \$2693.71.

How much did Ali invest in the account?

Answer (b) \$ ..... [3]

For Examiner's use

21. In the diagram, O is the centre of a wheel of circumference 150 cm.
The points X and Y lie on the circumference of the wheel and $\angle XOY = 0.8726$ radians.



(a) Calculate the number of complete revolutions the wheel would make in travelling a distance of 1 km.

Answer (a) ..... revolutions [1]

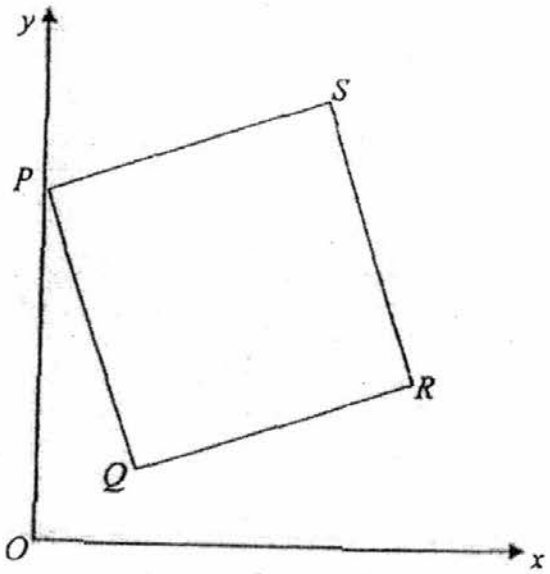
(b) Find the length of the minor arc XY.

Answer (b) ..... cm [2]

(c) Calculate the area of the minor sector XOY.

Answer (c) ..... cm^2 [2]

22. In the diagram, $PQRS$ is a square. P is the point (0, 8), Q is the point (2, 2) and R is the point (8, 4).



(a) Write down the coordinates of S.

Answer (a) (....., ...)

(b) Find the equation of PQ.

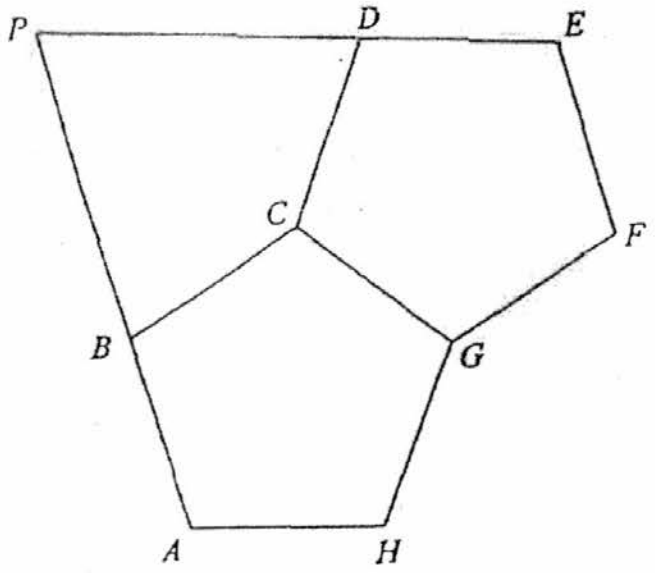
Answer (b) .....

(c) Calculate the area of the square.

Answer (c) ..... units^2

use

4. The diagram shows two regular pentagons $ABCGH$ and $CDEFG$. AB and ED are produced to meet at point P.



(a) Calculate reflex angle BCD.

Answer (a) ..... **[2]**

(b) Explain why BCE is a straight line.

Answer (b) .....

.....

.....

.....

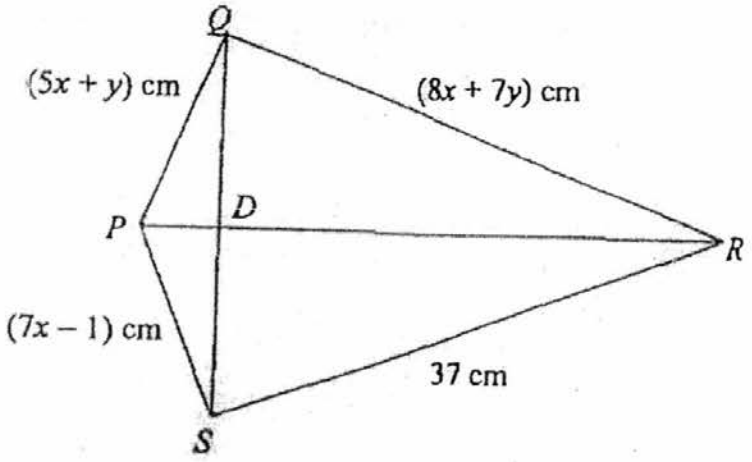
.....

.....

.....

..... **[3]**

24.



A piece of wire is bent into the shape of a kite $PQRS$ as shown.

(a) Find the value of x and y.

Answer (a) $x =$ ....., $y =$ ..... [3]

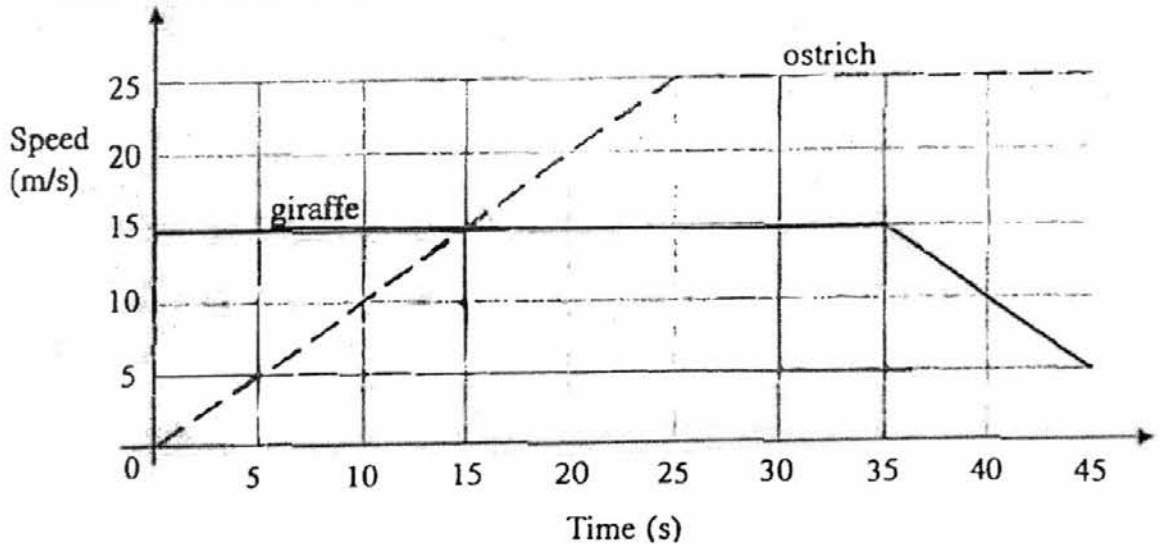
(b) Given that the diagonals intersect at D and that $PD : DR = 1:7$, show that the area of the kite is 480 cm^2.

Answer (b)

[3]

Examiner's use

25. The diagram shows the speed-time graph of a giraffe and an ostrich running for a period of 45 seconds. The giraffe and ostrich travel from the same starting point and in the same direction.



(a) Given that the giraffe decelerates uniformly to a speed of 5 m/s in the last 10 seconds, calculate

(i) its deceleration,

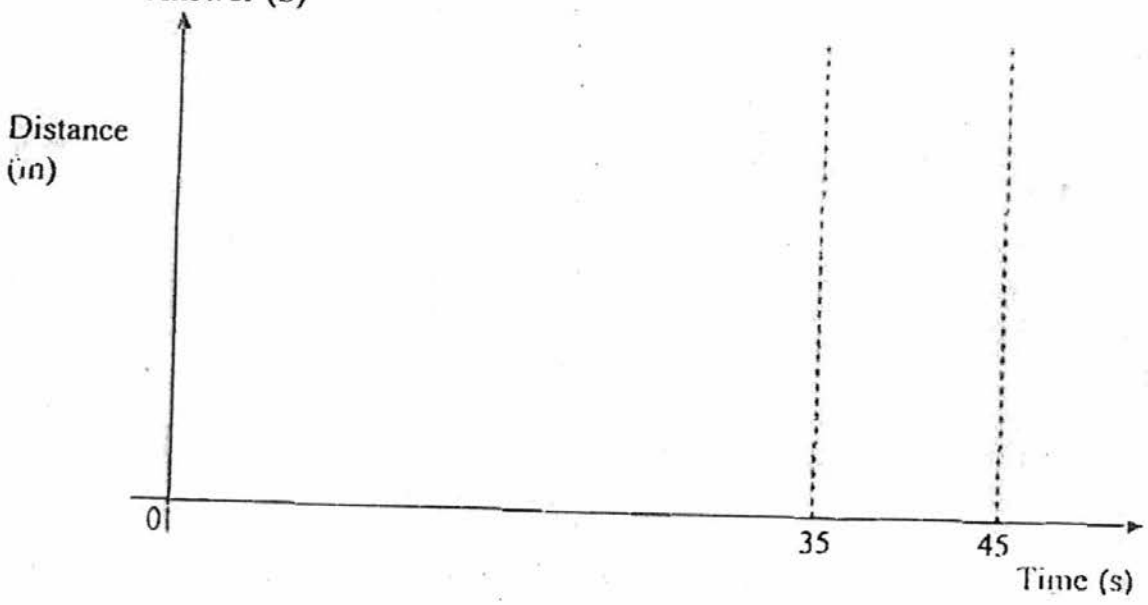
Answer (a)(i) ..... m/s^2 [1]

(ii) its average speed during the 45 seconds.

Answer (a)(ii) ..... m/s [2]

(b) Sketch a distance-time graph for the giraffe.

Answer (b)



(c) Find the time when the giraffe and ostrich meet again.

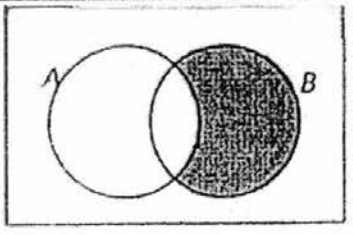
Answer (c) ..... s

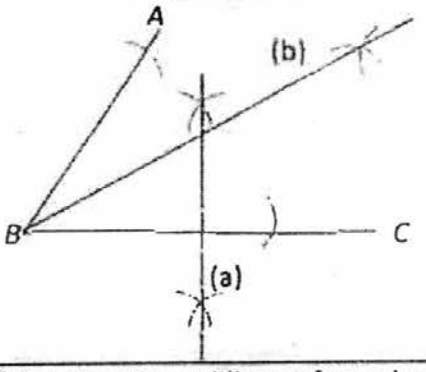
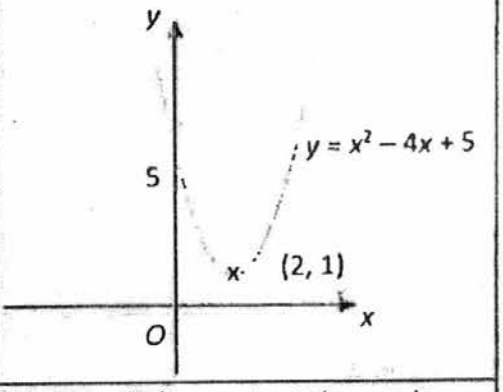
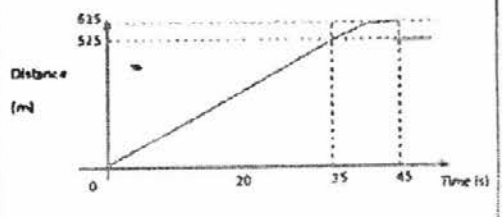
End of Paper

TKGS 2016 Mathematics Prelim Paper 1 Answer Key

	Answer
	$\frac{25}{41}$, $-0.22^{\frac{1}{3}}$, $-\sqrt{0.36}$
	50 Swedish Krona
	10°, 170°

Misleading feature (of graph)	Effect
Vertical axis does not start from zero.	It exaggerates the difference between the number of viewers.
Title is biased	Does not allow readers to make own judgment / Misguides readers who are not discerning
Missing data from 2012	Misrepresents the trend / there could be a drop in viewership from 2012 to 2013

	9 days
	$\frac{3}{8}$
	57.7%
	x increases by 300%
)	$\frac{26}{51}$
)	$\frac{40}{51}$
)	1.83×10^2
)	9 minutes 5 seconds
)	19
)	6n + 13
)	
)	25
)	42
)	360
)	1 : 50 000
)	6 km²
	5.69 cm

Q	Answer
17(a) & (b)	
17(c)	The point *X* is equidistant from the lines AB and BC and equidistant from the points B and C.
18(a)	*OP* = *OQ* (radii of same circle) *AB* = *CD* (equal chords)
18(b)	11.5 cm
19(a)	$y = (x-2)^2 + 1$
19(b)	
19(c)	The graph does not cut the *x*-axis.
20(a)	15
20(b)	$2000.00
21(a)	666
21(b)	20.8 cm
21(c)	249 cm²
22(a)	(6, 10)
22(b)	$y = -3x + 8$
22(c)	40 units²
23(a)	216°
24(a)	$x = 2$, $y = 3$
25(a)(i)	1 m/s²
25(a)(ii)	$13\frac{8}{9}$ m/s
25(b)	
25(c)	31.25 s

Answer all questions on the writing paper provided.

1. (a) (i) Express $\frac{3}{b-a}-\frac{3a-b}{a^2-b^2}$ as a single fraction in its simplest form. [2]

(ii) Given that $T=\frac{1}{4}\sqrt{\frac{h}{h-K}}$, express h in terms of T and K. [3]

(b) (i) Given that $4p^2-12pq+9q^2=0$, find the value of $\frac{3q}{2p}$. [2]

(ii) Solve the inequality $\frac{1}{2}-3x<\frac{3}{4}(2x+1)$. [2]

2. Mr. Tan bought a laptop for \$1000 and a mobile phone for \$800. He sold them to a shop a week later. He sold the laptop at a profit of P% and the mobile phone at a loss of L% on their respective cost prices.

(a) (i) Express the profit for the sale of the laptop in terms of P. [1]

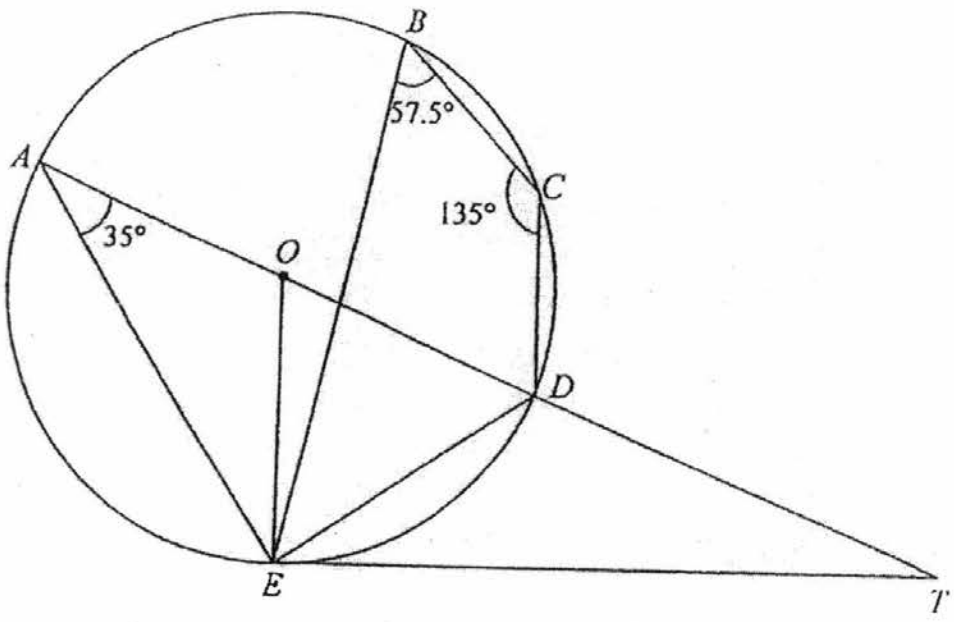
(ii) Express the loss for the sale of the mobile phone in terms of L. [1]

(iii) Hence, calculate and determine if there is an overall profit or loss for the sales made to the shop when the percentage loss of selling the mobile phone is the same as the percentage profit of selling the laptop. [2]

(b) (i) If the overall profit of the sales is exactly 2% of the total cost price, show that $10P=8L+36$. [2]

(ii) Find the values of P and L when the percentage profit from the sale of the laptop is twice that of the percentage loss from the sale of the mobile phone. [2]

3.



The diagram shows a circle, $ABCDE$, centre O.
ET is the tangent to the circle at E and $AODT$ is a straight line.
Angle $EAD = 35°$ and angle $BCD = 135°$.

(a) Find, giving reasons for each answer,

(i) angle EOD,

(ii) angle ADE,

(iii) angle ETA.

(b) Show that BE bisects angle AED.

(c) Given also that angle $EBC = 57.5°$. Determine whether $BC = DC$. Give reasons for your answer.

4. (a) $\xi = \{\text{integers } x\colon 1 \le x \le 9\}$

$A = \{x\colon x \text{ is an odd number and } x^2 \ge 9\}$

$B = \{x\colon x \text{ is not a multiple of } 3\}$

(i) Draw a Venn diagram to illustrate this information. [2]

(ii) Write down $n(A)$. [1]

(iii) List the element(s) contained in the set $(A \cup B)'$. [1]

(b) A factory produces large and small sizes sofas. The following table is used in calculating the cost of producing the sofas.

	Manpower (Hours)	**Raw Material (Boxes)**	**Electricity (Units)**
Large	6	4	0.5
Small	5	2	0.2

(i) Represent the above information in a 2 × 3 matrix **A**. [1]

Manpower costs \$8.50 per hour, the raw material used costs \$2 per box and the electricity costs 70 cents per unit.

(ii) Represent the above information in a 3 × 1 matrix **B**. [1]

(iii) Evaluate the matrix **C** = **AB** and state what the elements of **C** represent. [2]

(iv) If **D** = (10 25), evaluate **DC** and interpret the results. [2]

5. **Answer the whole of this question on a sheet of graph paper.**

The variables x and y are connected by the equation

$$y = x + \frac{4}{x} - 5.2 .$$

Some corresponding values of x and y, correct to 2 decimal places, are given in the table below.

x	0.7	1.0	1.5	2.0	3.0	4.0	5.0	7.0	7.5
y	1.21	−0.20	−1.03	−1.2	p	−0.20	0.60	2.37	2.83

(a) Calculate the value of p. [1]

(b) Using a scale of 2 cm to represent 1 unit, draw a horizontal x-axis for $0 < x \leq 8$.
Using a scale of 4 cm to represent 1 unit, draw a vertical y-axis for $-2 \leq y \leq 3$.

On your axes, plot the points given in the table and join them with a smooth curve. [3]

(c) Use your graph to solve the equation $x^2 - 4x + 4 = 0$. [1]

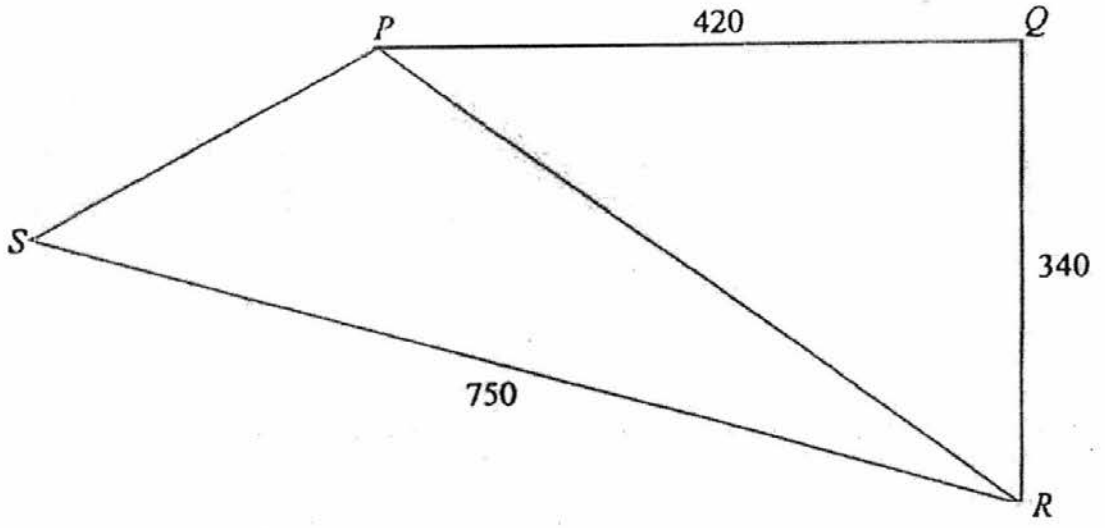
(d) By drawing a tangent, find the value of x where the gradient of the curve is 0.75. [2]

(e) **(i)** On the same axes, draw the line $y = \frac{3}{2}x - 2$ for $0 < x \leq 8$. [1]

(ii) Write down the x-coordinate of the point where this line intersects the curve. [1]

(iii) This value of x is a solution of the equation $x^2 + Ax + B = 0$, Find the value of A and the value of B. [2]

6. The diagram shows four transmission towers, P, Q, R and S of identical height 40 m, on level ground. P is 420 m due west of Q and R is 340 m due south of Q. S is 750 m and on a bearing of 280° from R.



Calculate

(a) the distance PR, [2]

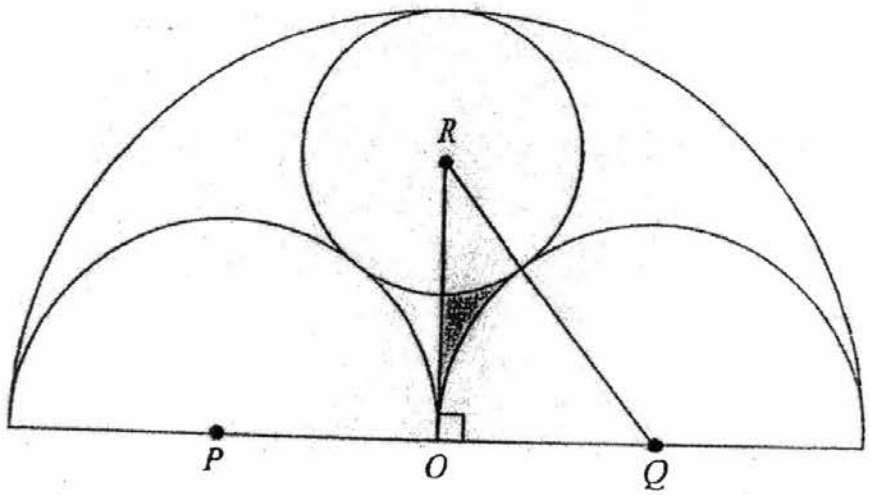
(b) $\angle PRS$, [3]

(c) area of triangle PRS, [2]

(d) the shortest distance of P from RS, [2]

(e) the largest angle of elevation of the top of the transmission tower at P when viewed from a point on RS. [2]

7. In the diagram, O is the centre of the largest semicircle. The circle with centre R has a radius of $(3r + 2)$ cm. Two identical semicircle, with centres P and Q, each has radius of $(6r + 1)$ cm.



(a) Write down an expression, in terms of r, for

(i) QR,

[1]

(ii) OR.

[2]

(b) Form an equation in r and show that it reduces to $18r^2 - 21r - 4 = 0$.

[1]

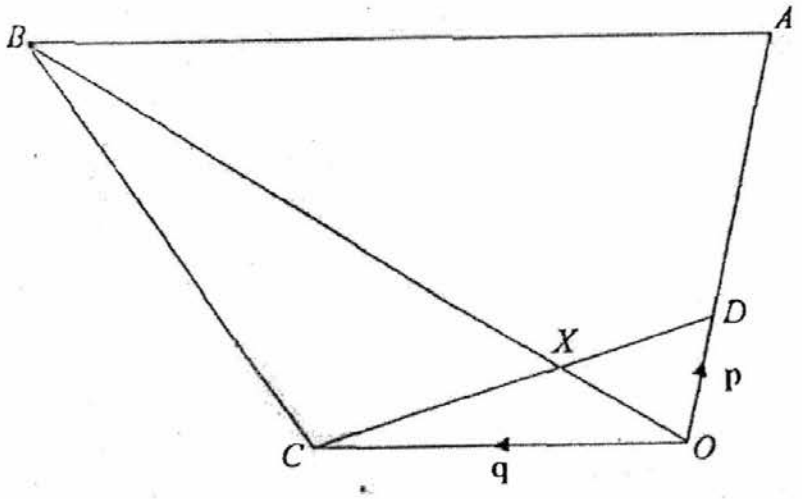
(c) Solve the equation $18r^2 - 21r - 4 = 0$.

[3]

(d) Given that the area of the right-angled triangle OQR is 54 cm^2, find the area of the shaded region.

[3]

8. $OABC$ is a trapezium where $\overrightarrow{OD} = \mathbf{p}$ and $\overrightarrow{OC} = \mathbf{q}$. OB and CD meet at X. $AB = 2OC$ and $OD = \frac{1}{3}OA$.



(a) Express, in terms of $\mathbf{p}$ and $\mathbf{q}$,

(i) $\overrightarrow{CD}$, [1]

(ii) $\overrightarrow{OB}$. [1]

(b) Given that $\overrightarrow{CX} = h\overrightarrow{CD}$, show that $\overrightarrow{OX} = h\mathbf{p} + (1-h)\mathbf{q}$. [2]

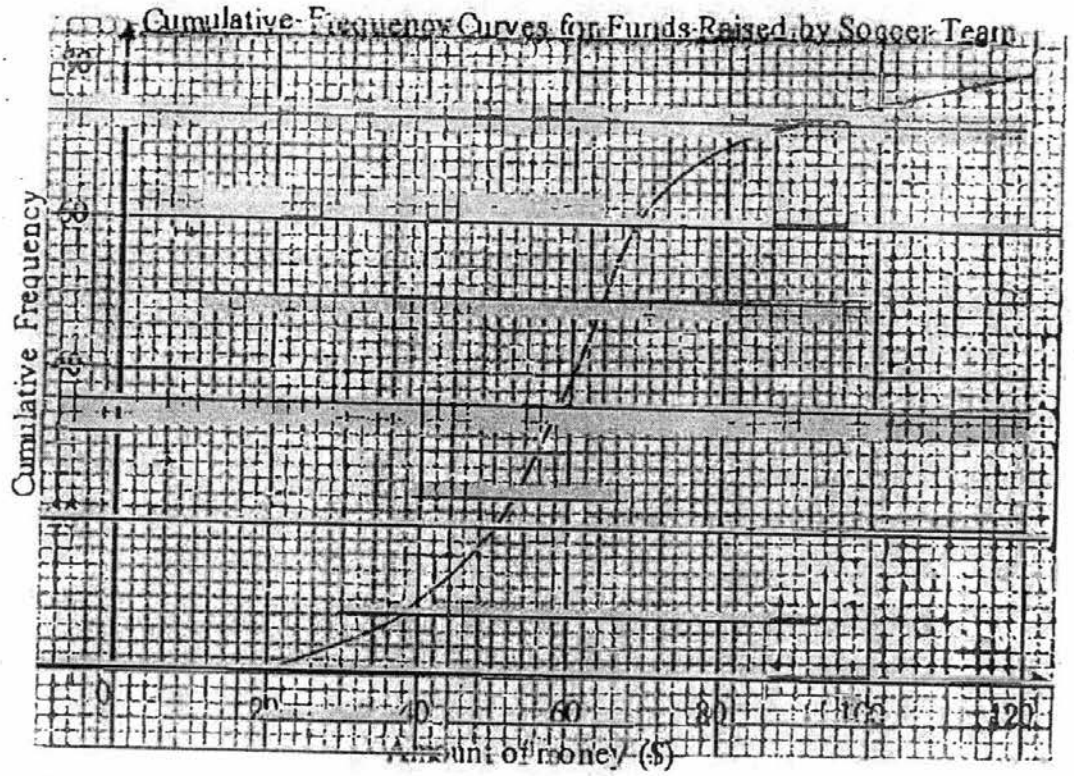
(c) Given further that $\overrightarrow{OX} = k\overrightarrow{OB}$, find the value of h and of k. [3]

(d) Find the numerical value of

(i) $\dfrac{\text{area of } \Delta OBC}{\text{area of } \Delta OXC}$, [1]

(ii) $\dfrac{\text{area of trapezium } OABC}{\text{area of } \Delta OXC}$. [2]

9. The amount collected by 80 members of the school soccer team for a fundraising event is distributed as shown in the cumulative frequency curve below.



(a) Use your curve to estimate

(i) the median amount of money raised, [1]

(ii) the interquartile range. [2]

(b) (i) Copy and complete the grouped frequency table of the amount of money collected by the soccer team.

Amount of money ($)	$20 \le x < 40$	$40 \le x < 60$	$60 \le x < 80$	$80 \le x < 100$	$100 \le x < 120$
Frequency					

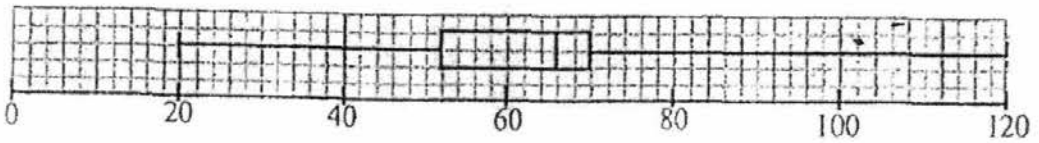
[2]

(ii) Using your grouped frequency table, calculate an estimate of

(a) the mean amount of money collected, [2]

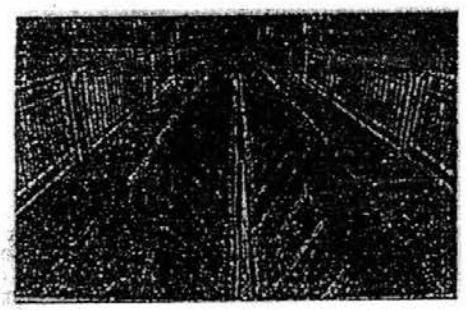
(b) the standard deviation. [2]

(c) 80 members from the school outdoor club also raised funds for the same event. The box-and-whisker plot shows the distribution of the amount collected by them.

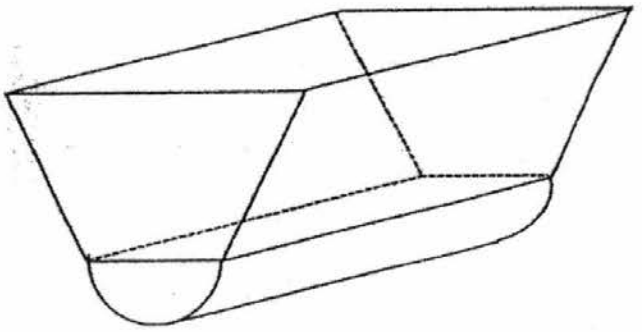


What can you conclude about the amounts collected by the two co-curriculum activity groups? [2]

10. Drains are common in Singapore to regulate water flow to prevent floods from occurring.



In this question, the drain can be modelled as a trapezoid attached to the top of half a cylinder as shown:



The cross section of the drain is made up of a trapezium and a semicircle. The radius of the semicircle is 50 cm and the vertical height measured from the bottom of the semicircle to the top of the trapezium is 200 cm. The length of one of the parallel sides of the trapezium is twice the length of the other.

(a) Find the lengths of the parallel sides and the vertical height of the trapezium. [2]

(b) Calculate the volume of the drain, in cubic metres, which stretches for 10 m. [4]

(c) A drain must be able to channel away 90% of the rain water within 30 seconds, if not preventive measures need to be set up to curb the flood.

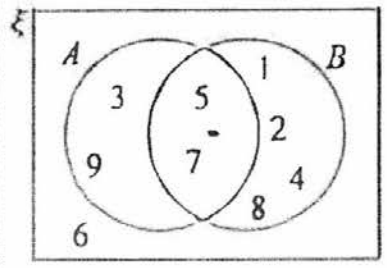
Useful Information

- The rate of flow of water for this drain during a particular rainstorm is 48000 litres per minute
- 1 m^3 is equivalent to 1000 litres

Decide whether preventive measures need to be set up for that particular rainstorm. Show your working and give reasons to justify your answer. [4]

---End of Paper ---

Sec 4 Mathematics Prelim 2016 Paper II Answer Key

S/No.		Answer
(a)	(i)	$\frac{6a+2b}{b^2-a^2}$
	(ii)	$h=\frac{16T^2K}{16T^2-1}$
(b)	(i)	$\frac{3q}{2p}=1$
	(ii)	$x>-\frac{1}{18}$
(a)	(i)	$\$10P$
	(ii)	$\$8L$
	(iii)	$\$2P>0$ $\therefore$ there is an overall profit
(b)	(i)	Show question
	(ii)	$P=6,\ L=3$
(a)	(i)	70°
	(ii)	55°
	(iii)	20°
(b)	Show question	
(c)	Show question	
(a)	(i)	

S/No.			Answer
6.	(a)		PR = 540 m (3.sf)
	(b)		$\angle PRS = 29.0°$ (1 d.p.)
	(c)		Area of ΔPRS = 98200 m^2 (3 s.f.)
	(d)		262 m (3 s.f.)
	(e)		8.7° (1 d.p.)
7	(a)	(i)	$RQ = 9r + 3$
		(ii)	$OR = 9r$
	(b)		Show question
	(c)		$1\frac{1}{3}$ or $-\frac{1}{6}$
	(d)		4.86 cm^2
8	(a)	(i)	p − q
		(ii)	3p + 2q
	(b)		Show question
	(c)		$k=\frac{1}{5}$, $h=\frac{3}{5}$
	(d)	(i)	5
		(ii)	15
9	(a)	(i)	Median = \$60
		(ii)	IQR =\$18
	(b)	(i)	10, 30, 30, 6, 4
		(ii)	(a) Mean = \$61

(ii) $n(A) = 4$

(iii) $(A \cup B)' = \{ 6 \}$

(b) (i) $\begin{pmatrix} 6 & 4 & 0.5 \\ 5 & 2 & 0.2 \end{pmatrix}$

(ii) $\begin{pmatrix} 8.5 \\ 2 \\ 0.7 \end{pmatrix}$

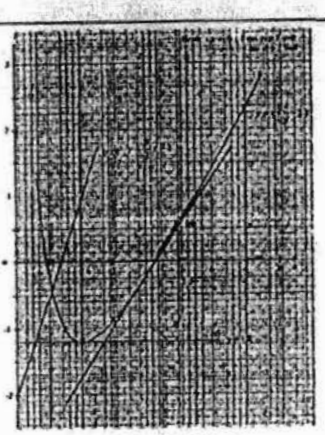
(iii) $C = \begin{pmatrix} 59.35 \\ 46.64 \end{pmatrix}$

The elements represent the cost to produce one large sofa and one small sofa respectively.

(iv) **DC** = (1759.5)

The element represents the total cost to produce 10 large sofa and 25 small sofas.

5 (a) $p = -0.87$

(b) 

(c) $x = 2$

(d) $x = 4$

(e) (i) See graph

(ii) $x = 1.1$

(iii) $\therefore A = 6.4$ and $B = -8$

(ii) (b) S.D = \$19.47 (2 d.p.)

(c) The outdoor club collected more money on average because the median amount of money collected by the outdoor club is \$66 which is higher than the median amount of \$60 collected by the soccer team by \$6.

10 (a) Vertical height = 150 cm or 1.5 m
Length of short side = 100cm or 1m
Length of long side = 200cm or 2m

(b) 26.4 m^3

(c) Since the time taken to channel water is 29.73s which is < 30s, there is <u>no</u> need to set up preventive measures.