

NAME OF CANDIDATE:

CLASS / INDEX NO.



DUNMAN SECONDARY SCHOOL

*Where.....diligence, discernment, discipline, daring, determination
duty become a part of life.*

PRELIMINARY EXAMINATION 2006
SEC 4 EXPRESS/ 5 NORMAL (ACADEMIC)
ELEMENTARY MATHEMATICS 4017 / 1

2 H

28 August 2006

0800 – 1000

Instructions to candidates:

Write your name, index number and class in the spaces at the top of this page.

Answer all the questions.

If working is needed for any question, it must be shown in the spaces below that question.

Omission of essential working will result in loss of marks.

ELECTRONIC CALCULATORS MUST NOT BE USED IN THIS PAPER.

Information for candidates:

The number of marks is given in brackets [] at the end of each question or part question.

The total number of marks for this paper is 80.

You should not spend too much time on any one question.

For π , use 3.14, unless the question requires the answer in terms of π

This question paper consists of 17 printed pages including the cover page

Teo KB

[Turn over

1. Evaluate

(a) $2.65 - 0.73$

(b) 0.218×2.3

(c) $2\frac{4}{5} \times 1\frac{1}{4} - 3\frac{1}{2}$

[1]

Answer (a)

(b)

[1]

[1]

(c)

2. (a) Express $\frac{17}{40}$ as a decimal.

(b) Find the decimal number which is exactly half-way between $\frac{3}{7}$ and $\frac{7}{9}$, giving your answer to 3 decimal places.

Answer (a) [1]

(b) [1]

3. (a) Evaluate $\left(\frac{16}{25}\right)^{-\frac{1}{2}} \times (2^0)^{16} - 3\frac{2}{3}$
- (b) Subtract 465 grams from 2.85 kilograms.
Give your answer in kilograms.

Answer (a)[2]

(b) [1]

4. If it takes 6 men 3 days to dig a well 2 m deep,
- (a) how deep can 12 men dig in 6 days?
- (b) how many days will it take 1 man to dig 1 m?

Answer (a) [1]

(b) [1]

5. Given that $p = 5 \times 10^{-4}$ and $q = 2.4 \times 10^{-5}$, find the value of the following, expressing your answers in standard form.
- (a) $p - q$
- (b) $p \times q$

Answer (a) [1]

(b) [1]

6. The volumes of two similar jugs are in the ratio 16:54.
- (a) Find the ratio of the heights of the jugs.
- (b) Given that the base area of the larger jug is 54 cm^2 , find the base area of the smaller jug.

Answer (a) [1]

(b) [1]

7. Factorise completely

(a) $12a^2 - 75b^2$

(b) $20x^2 + xy - 12y^2$

[2]

Answer (a)

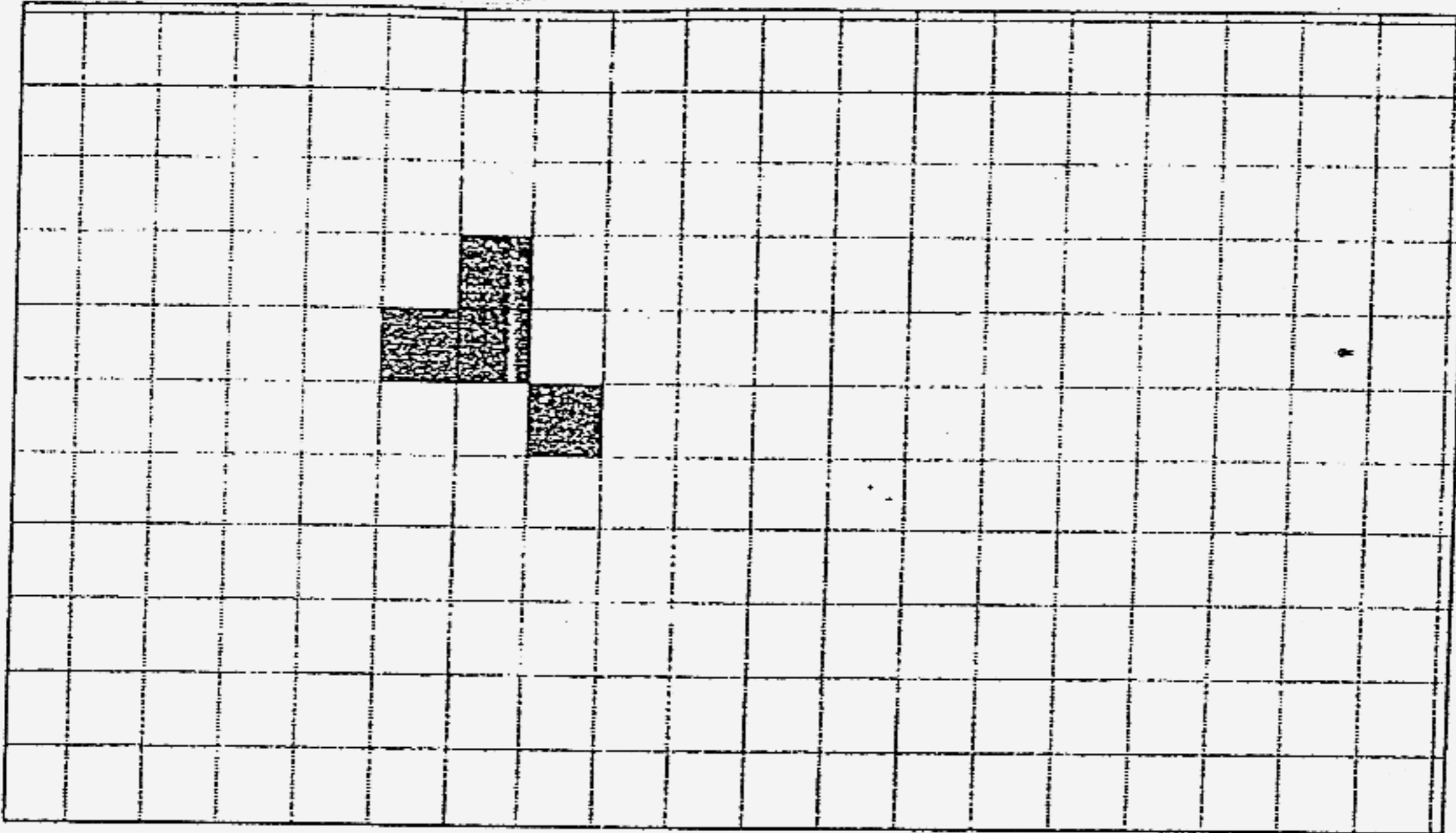
[1]

(b)

8. A man bought a car for \$33 000. He made a first payment of \$12 000 and borrowed the rest from a bank at 10% per annum simple interest. At the end of the first year, he repaid a certain sum to the bank and after that he still owed \$9000. Calculate the sum he repaid.

Answer [3]

9.



On the grid above,

a) Shade 2 squares so that the figure has a rotational symmetry of order 2.

[1]

b) Draw all the lines of symmetry for the figure in part (a).

[1]

10. Given that y varies inversely as $(x + 2)$ and that the sum of the values of y when $x = -1$ and when $x = 2$ is 60, find the value of y when $x = -3$.

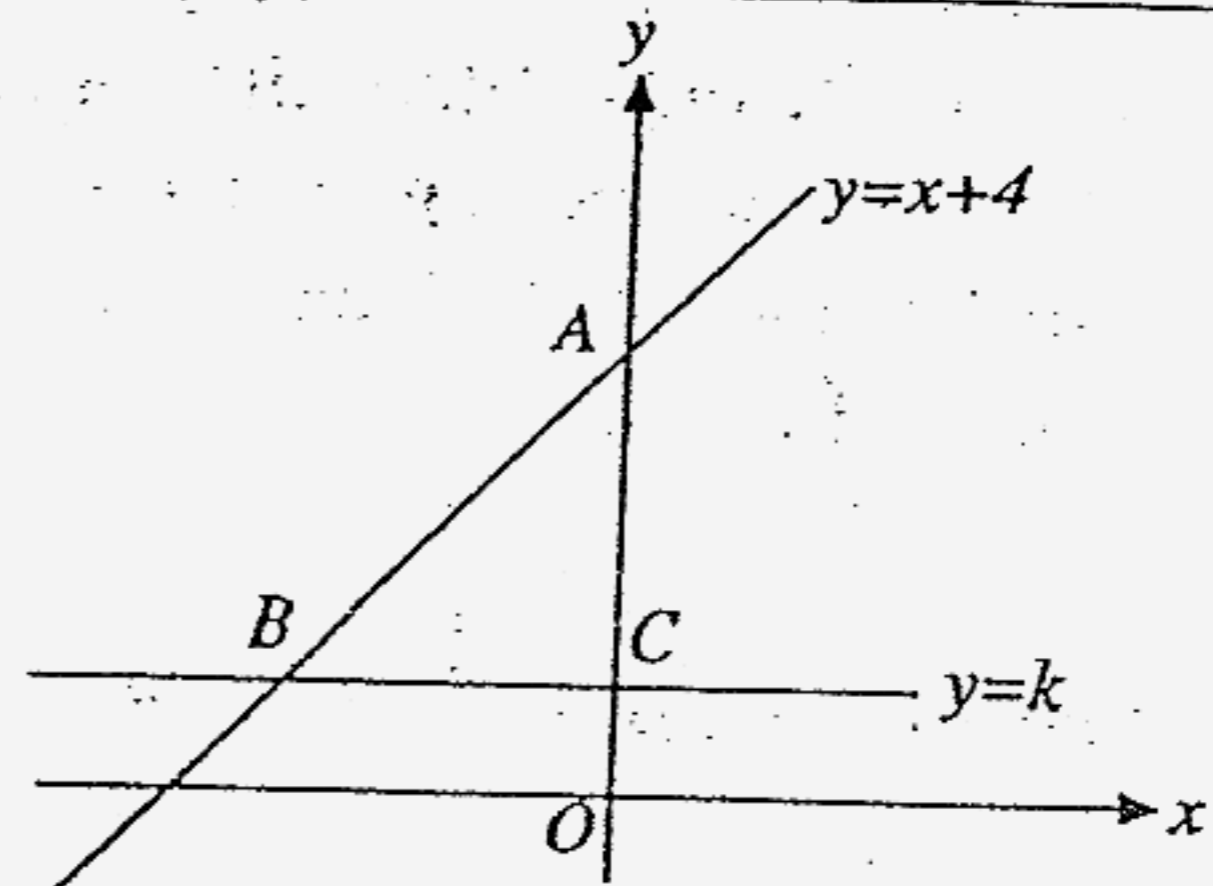
Answer [3]

11.

The line $y = x + 4$ cuts the y -axis at A ,
and the line $y = k$ at B .

k is a constant and $AB = 3\sqrt{2}$.

- State the coordinates of A ,
- Find the value of k ,
- Find the perpendicular distance from C to the line AB , where C is the point of intersection of $y = k$ with the y -axis.



Answer (a) [1]

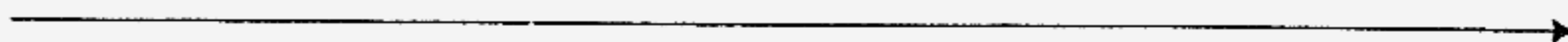
(b) [3]

(c) [2]

12. The ages measured to the nearest year, of 20 mathematics teachers in a school are shown below.

30	52	42	35	50
49	55	60	46	46
58	46	46	42	38
52	58	38	52	49

Draw a labelled dot diagram to represent the data.



[1]

Draw a stem and leaf diagram to represent the ages of the 20 mathematics teachers in the school

Stem	Leaf

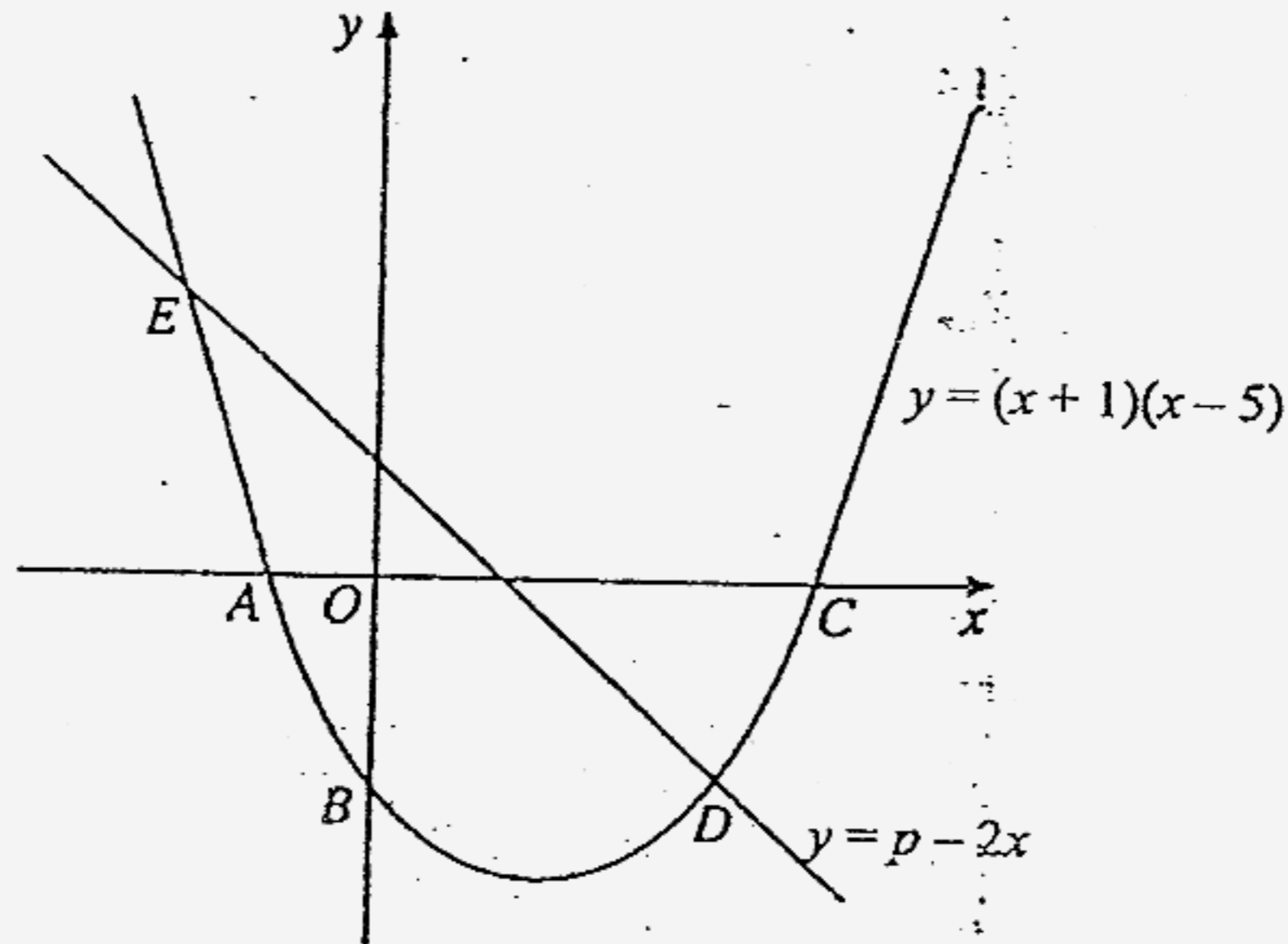
[2]

Find the probability of selecting a teacher who is at least 50 years old.

Answer [1]

13. The diagram shows the graph of $y = (x + 1)(x - 5)$ cutting the x -axis at A and C and the y -axis at B . The straight line $y = p - 2x$ intersects the curve at D and E . The coordinates of D are $(4, d)$.

- (a) Write down the coordinates of A and of B .
- (b) Find the values of d and p .



Answer

(a) $A = \dots\dots\dots$

$B = \dots\dots\dots [2]$

(b) $d = \dots\dots\dots$

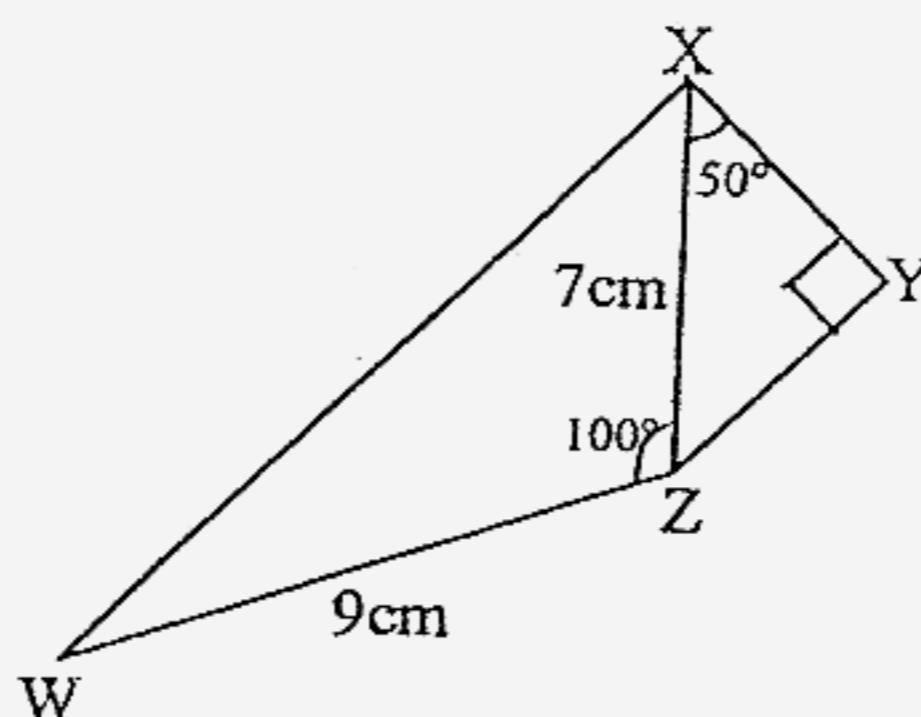
$p = \dots\dots\dots [2]$

14. The diagram shows a quadrilateral $WXYZ$ with $WZ = 9\text{cm}$, $XZ = 7\text{cm}$, $\angle ZXY = 50^\circ$, $\angle WZX = 100^\circ$ and XY is perpendicular to YZ . Find, using as much as information

below as necessary,

- (a) the length YZ ,
 (b) the value of $\tan WZY$,
 (c) the value of XW^2 .

$\sin 40^\circ = 0.6$	$\cos 40^\circ = 0.8$	$\tan 40^\circ = 0.8$
$\sin 80^\circ = 0.9$	$\cos 80^\circ = 0.2$	$\tan 80^\circ = 5.8$



- Answer*
- (a) [1]
- (b) [1]
- (c) [2]

15. In a 6-sided polygon, one of the interior angles is x° and each of the rest of the interior angle is $\frac{4}{5}x^\circ$. Find the value of x .

Answer [3]

16. (a) Express as a single fraction $\frac{1}{m(m-2)} - \frac{3-m}{2-m}$.
- (b) Given that $\frac{2a}{a+b} = \frac{3}{2}$, find the value of $\frac{a}{b}$.

Answer (a) [2]

(b) [2]

17. A map is drawn to a scale of 1:250 000.
- (a) The length of a road is 10 km. Calculate the length of the road on the map in cm.
- (b) A carpark is represented on the map by an area of 0.16 cm^2 . Calculate the actual area of the carpark in km^2 .

Answer (a) cm
[1]

(b) km^2

[2]

18. Solve the simultaneous equations

$$\frac{1}{2}x - y + 1 = 0, 0.25x + 2y = 12.$$

Answer $x = \dots\dots\dots$

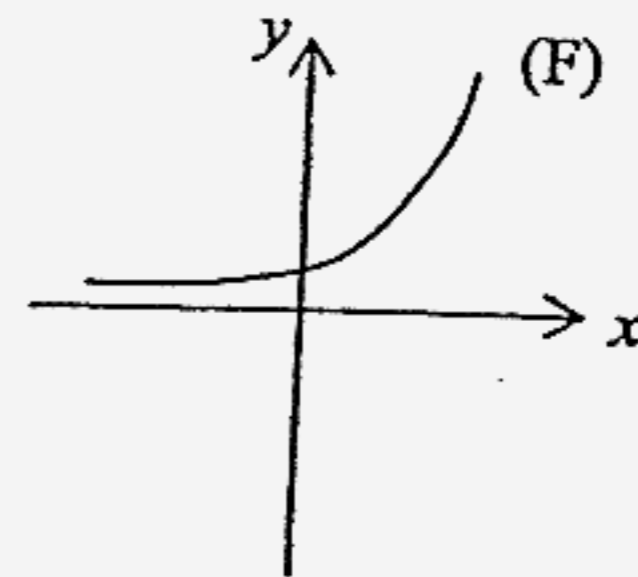
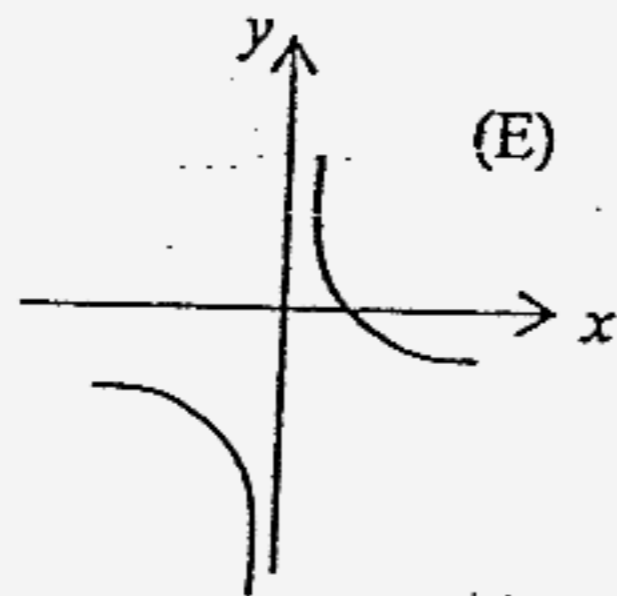
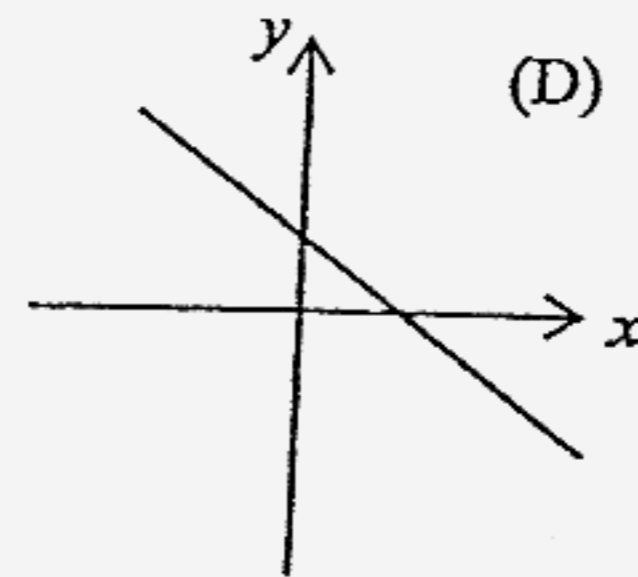
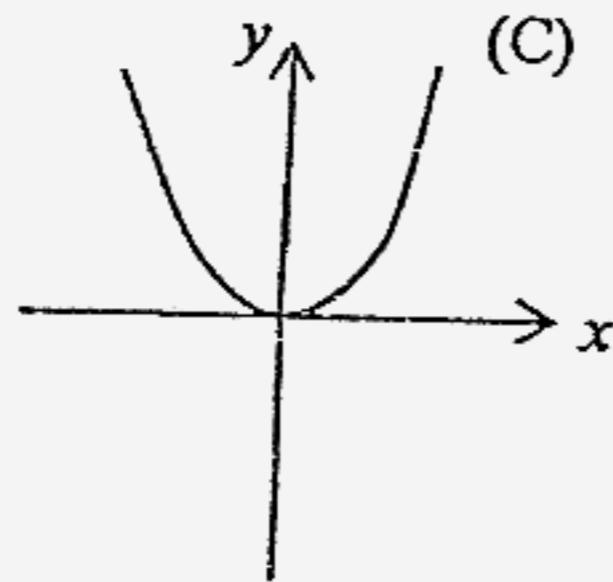
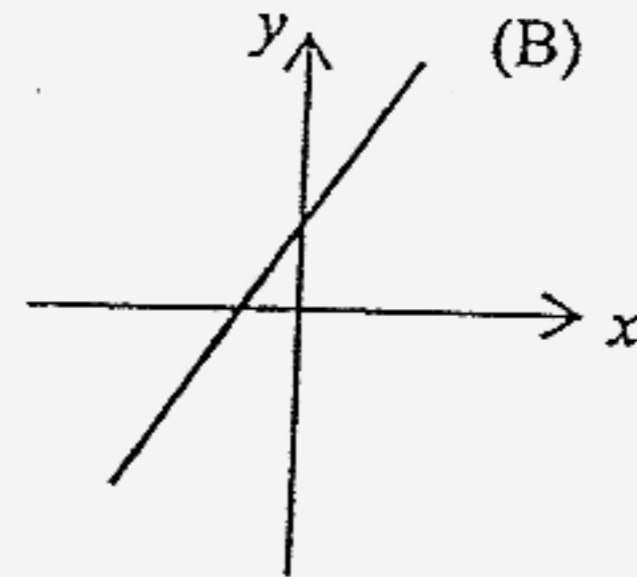
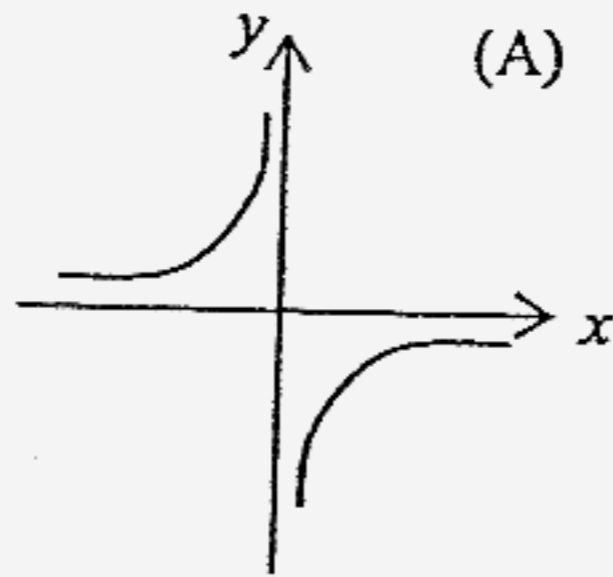
$y = \dots\dots\dots$
[3]

19. (a) Which of the following could be the graph of:

(i) $-2y + 1 = x$

(ii) $y = -\frac{2}{x}$

(iii) $y - x^2 = 0$



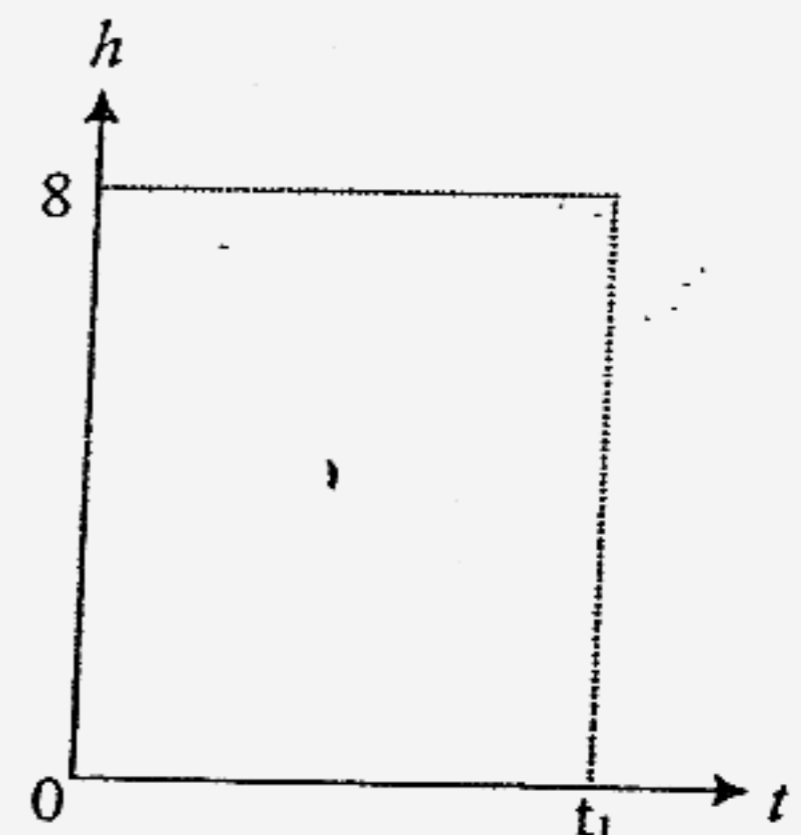
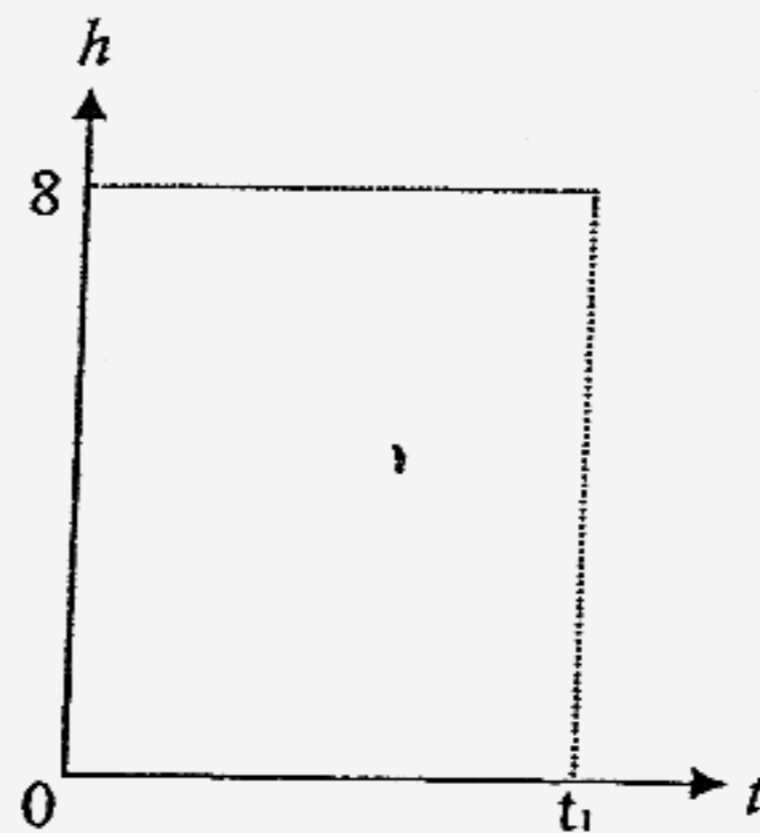
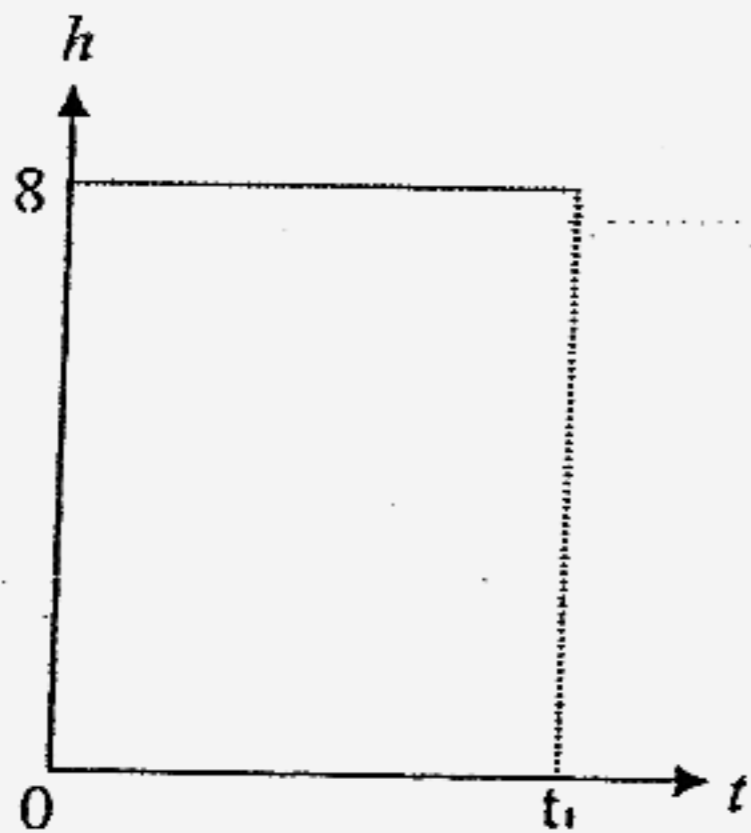
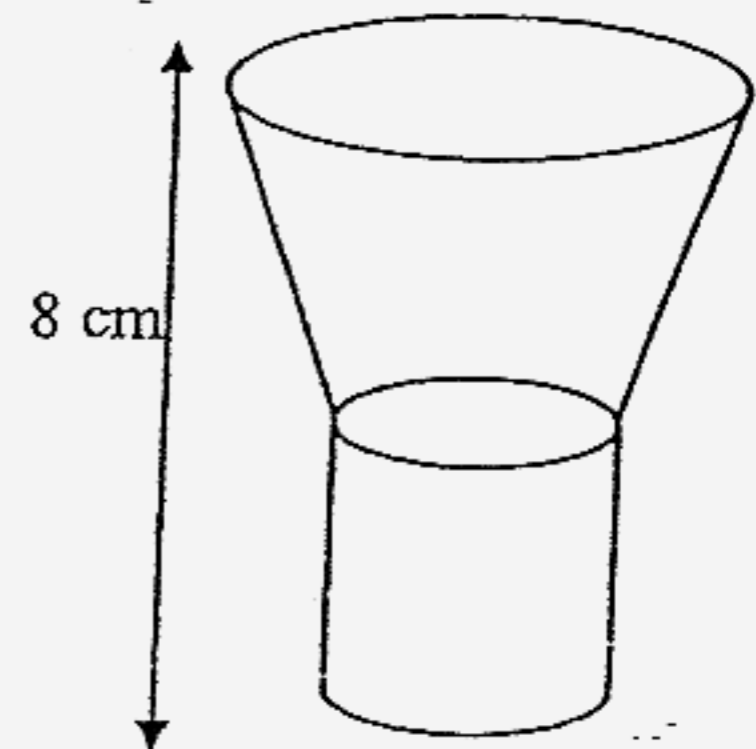
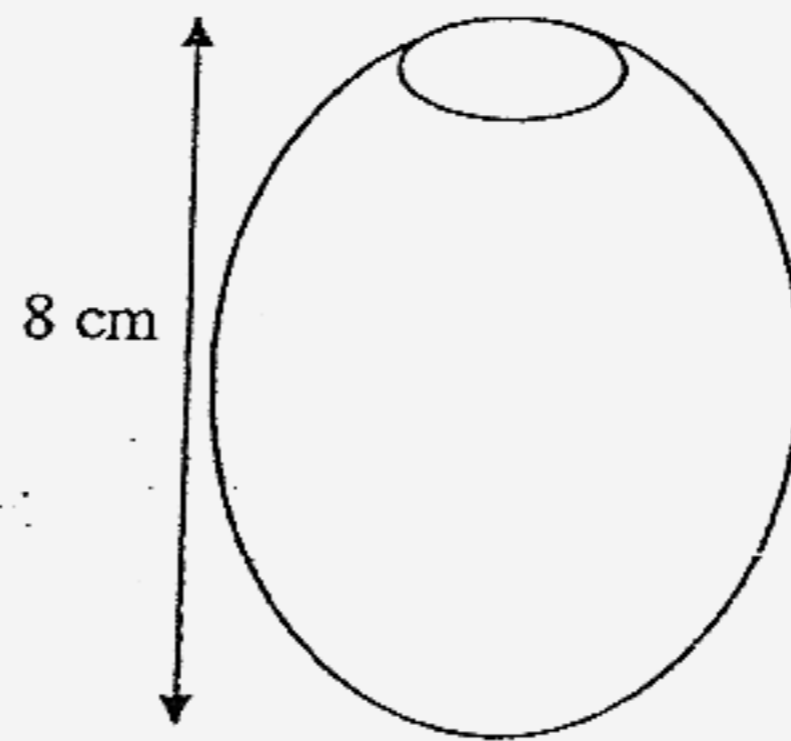
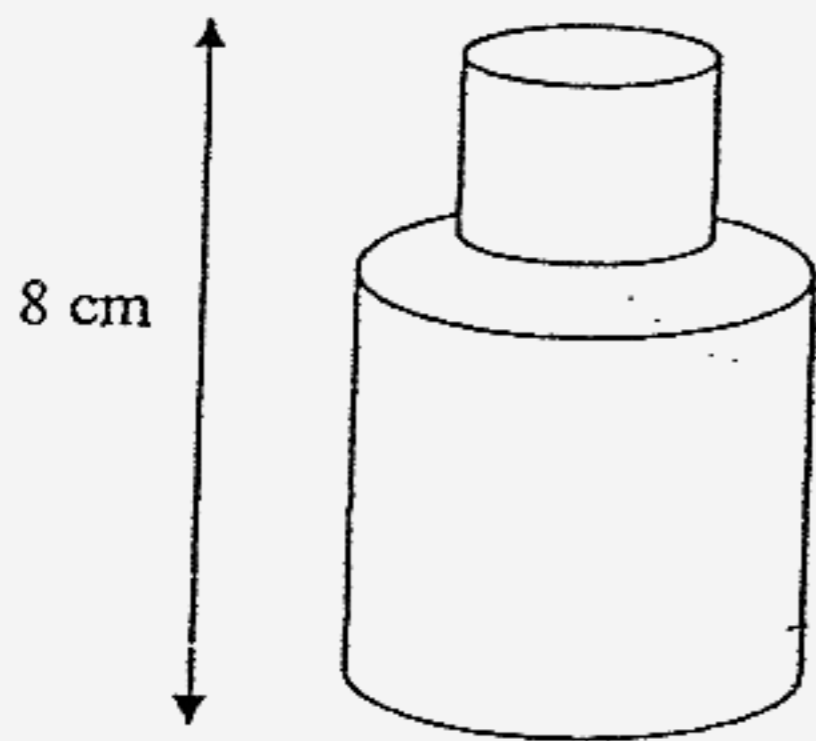
Answer (a) (i) [1]

(ii) [1]

(iii) [1]

19. (b) The containers shown below are being filled with water flowing at a constant rate from a tap. At time t seconds after the tap is turned on, the height of the water in the container is h centimetres. The container is empty initially.

Sketch the graph of t against h for the containers in the axes provided below.



[3]

20. (a) Solve the following equation

$$\frac{2x+15}{3} = 4 - \frac{2x-3}{6}$$

- (b) Given that $\sqrt{\frac{x^2+y^2}{y^2}} = 1-x$, express x in terms of y .

Answer (a) [2]

(b) [2]

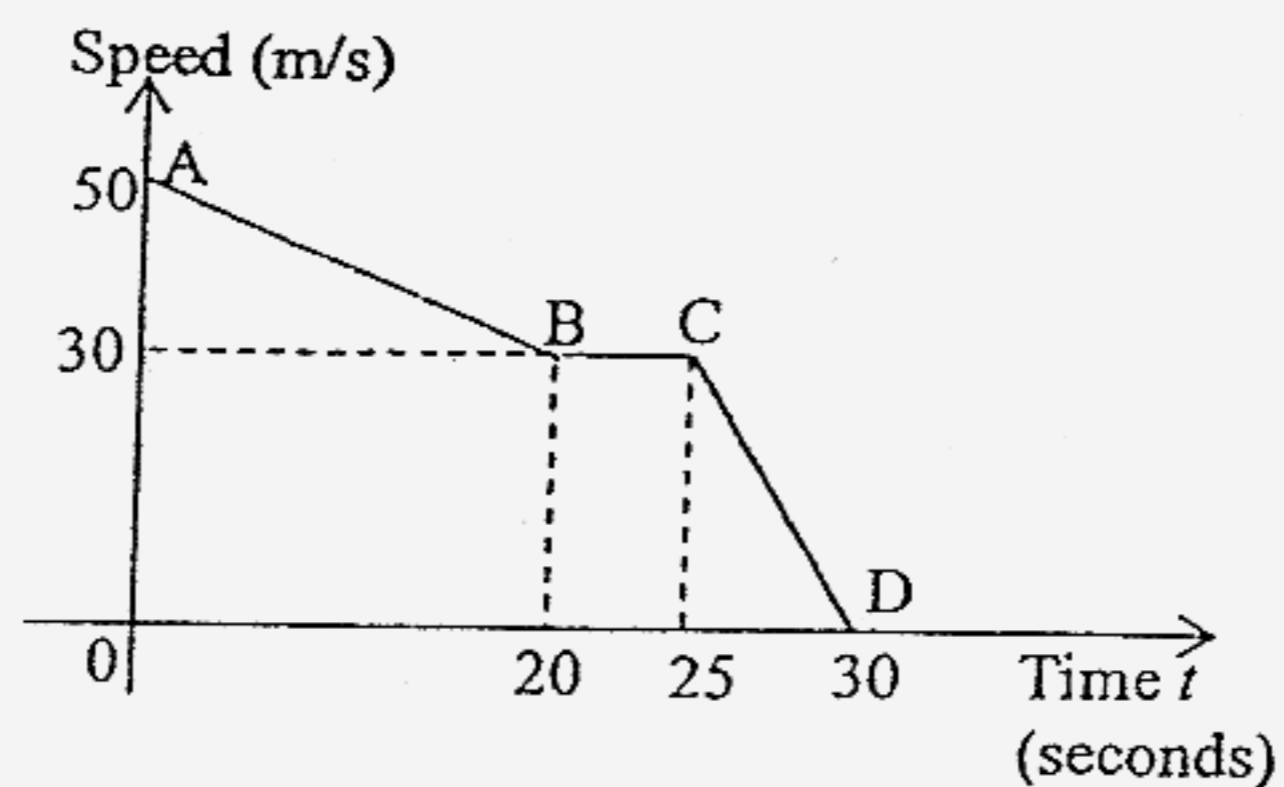
21. (a) Given that $\sqrt{35} = 5.9$, evaluate $\sqrt{560}$.

- (b) Given that $\frac{16.5 \times 0.5}{35.48 \times 15} = 0.0155$, find the value of $\frac{0.165 \times 5}{3.548 \times 0.15}$

Answer (a) [1]

(b) [2]

22. The speed-time graph of a car is shown below:



- Find the greatest retardation of the car.
- Find the average speed from $t = 20$ to $t = 30$.
- Find the speed of the car at $t = 16$ seconds.

Answer: (a)...../s² [1]

(b)m/s [3]

(c) m/s [2]

23. After a football match, the rating given by the press to the players of ManUnited Football Club were as follows:

Farhi	6.5	Ibniputra	9.0
Mohamad Shairul	6.5	Muhamed Shamir	7.5
Muhammad Aidil	7.5	Muhammad Najib	6.0
Muhammad Samir	4.5	Regunath	6.5
Sheikh Muhd	6.0	Harikrishnan	5.0

- (a) Calculate the mean score of the above players.

Answer (a) [2]

- (b) State the median score for the team

Answer (b) [1]

A reserve player was fielded in the last three minutes of the game. His rating is given as below:

Chi Wei x

- (c) If 6.5 is the only modal rating, write down the two values which x cannot take.

Answer (c) [2]

End Of Paper One

Dunman Secondary School
2006 Preliminary Examination
Sec 4Exp/ 5NA Elementary
Mathematics Paper 1 Solution

- 1a) 1.92
b) 0.5014
c) 0
- 2a) 0.425
b) 0.603
- 3a) $-\frac{29}{12}$ or $-2\frac{5}{12}$
b) 2.385
- 4a) 8
b) 9 days
- 5a) 4.76×10^{-4}
b) 1.2×10^{-3}
- 6a) $\frac{2}{3}$
b) 24 cm^2
- 7a) $3(2a - 5b)(2a + 5b)$
b) $(5x + 4y)(4x - 3y)$
- 8) \$14100
- 10) $y = -48$
- 11a) (0, 4)
b) $k = 1$
c) $\frac{3}{\sqrt{2}}$
- 12) $\frac{2}{5}$
- 13a) $A = (-1, 0)$
- b) $B = (0, -5)$
 $d = -5$
 $p = 3$
- 14a) 5.6
b) -0.8
c) 155.2
- 15) 144°
- 16a) $\frac{1+3m-m^2}{m(m-2)}$
b) 3
- 17a) 4
b) 1
- 18) $x = 8$
 $y = 5$
- 19a) (i) D
(ii) A
(iii) C
- 20a) $-\frac{1}{2}$
b) $\frac{2y^2}{y^2-1}$
- 21a) 23.6
b) 1.55
- 22a) 6 m/s^2
b) 22.5 m/s
c) 34 m/s
- 23a) 6.5
b) 6.5
c) 6 and 7.5

Candidate Name:	Class:	Index No:
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PRELIMINARY EXAMINATION 2005
SECONDARY 4 EXPRESS/ 5 NORMAL (ACADEMIC)
MATHEMATICS 4017/2

2h 30min

14 Sep 2005

INSTRUCTIONS TO CANDIDATES:

Write your name, index number and class in the space provided on the separate answer paper.

Section A

Answer all the questions

Section B

Answer only one question

Write your answers and working on the separate answer paper provided.

If working is needed for any question, show it on the same page as the rest of the answer.

Omission of essential working will result in loss of marks.

Hand in your answers for Q1 to Q6 separately from answers for Q7 to Q12.

YOU ARE EXPECTED TO USE AN ELECTRONIC CALCULATOR.

INFORMATION FOR CANDIDATES:

The number of marks is given in brackets [] at the end of each question or part question.

The total marks for this paper is 100.

Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.

For π , use either your calculator value or 3.142, unless the question requires the answer in term of π .

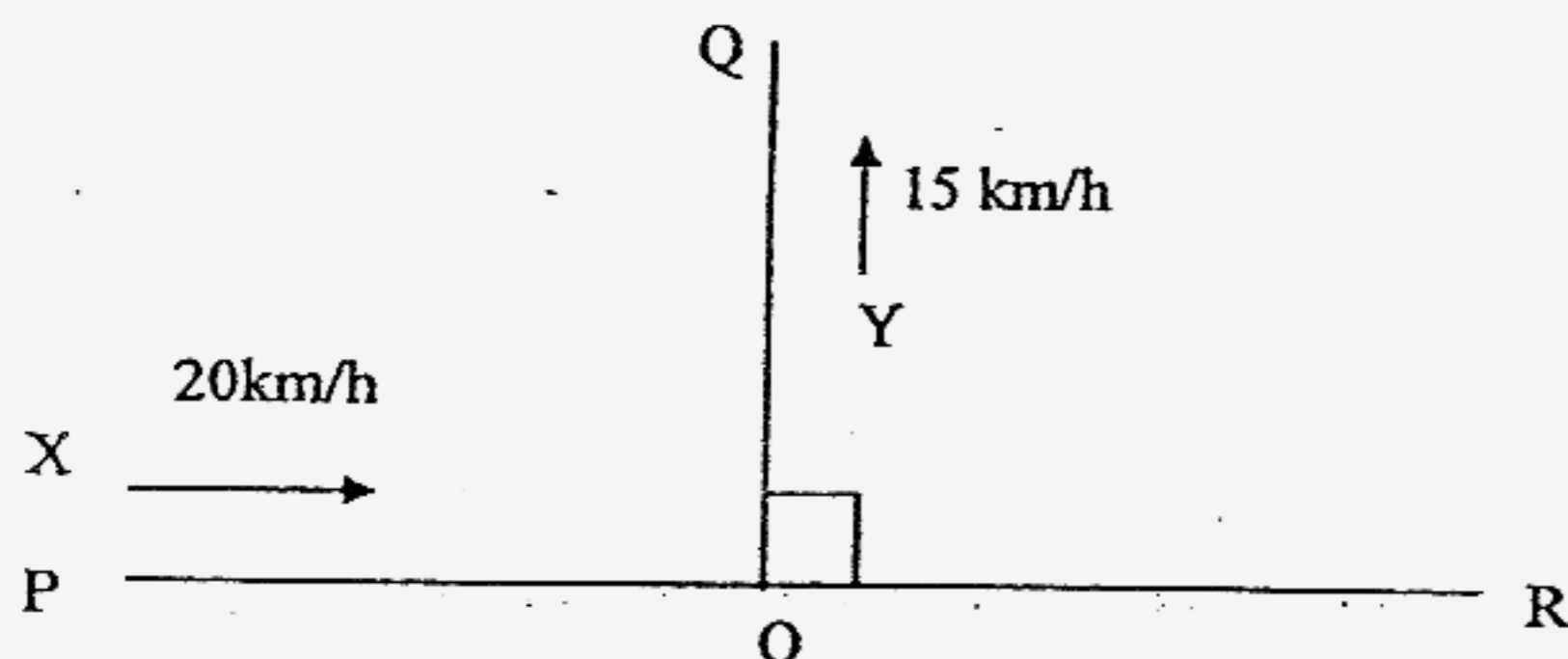
This question paper consists of 9 printed pages including the cover page.

Section A [88 marks]

Answer all the questions in this section.

1. A book publisher produced a book which sold at \$10.20 per copy. The publisher agreed to pay the author:
- 7.5% of the selling price of the first 2000 copies sold,
 - 10% of the selling price of the next 3000 copies sold,
 - 11% of the selling price of the remainder.
- (a) If 5425 copies were sold,
- (i) calculate the amount the author received, [2]
 - (ii) calculate the amount the publisher received. [1]
- (b) If production costs and the author's fees were \$15,400, find, correct to 3 significant figures, the percentage profit made by the publisher. [2]
- (c) From a paperback edition which sold at \$4 per copy, the author received 8% of the selling price of each copy sold.
If he received \$1371.2 from this edition, calculate the number of paperback copies sold. [2]

2.



The diagram shows a road junction at O with PR perpendicular to OQ and that $OP = 40$ km. A cyclist X starting from P travels towards R at a constant speed of 20 km/h. At the same time, another cyclist Y starting from O travels towards Q at a constant speed of 15 km/h.

- (a) Write down, in terms of t ,
- (i) the distance of X from O after t hours. [1]
 - (ii) the distance of Y from O after t hours. [1]
- (b) Given that after t hours the cyclists are d km apart, show that [2]
- $$d^2 = 625t^2 - 1600t + 1600$$
- (c) Hence calculate how long, in hours, it takes for the cyclists to be 60 km apart. [3]

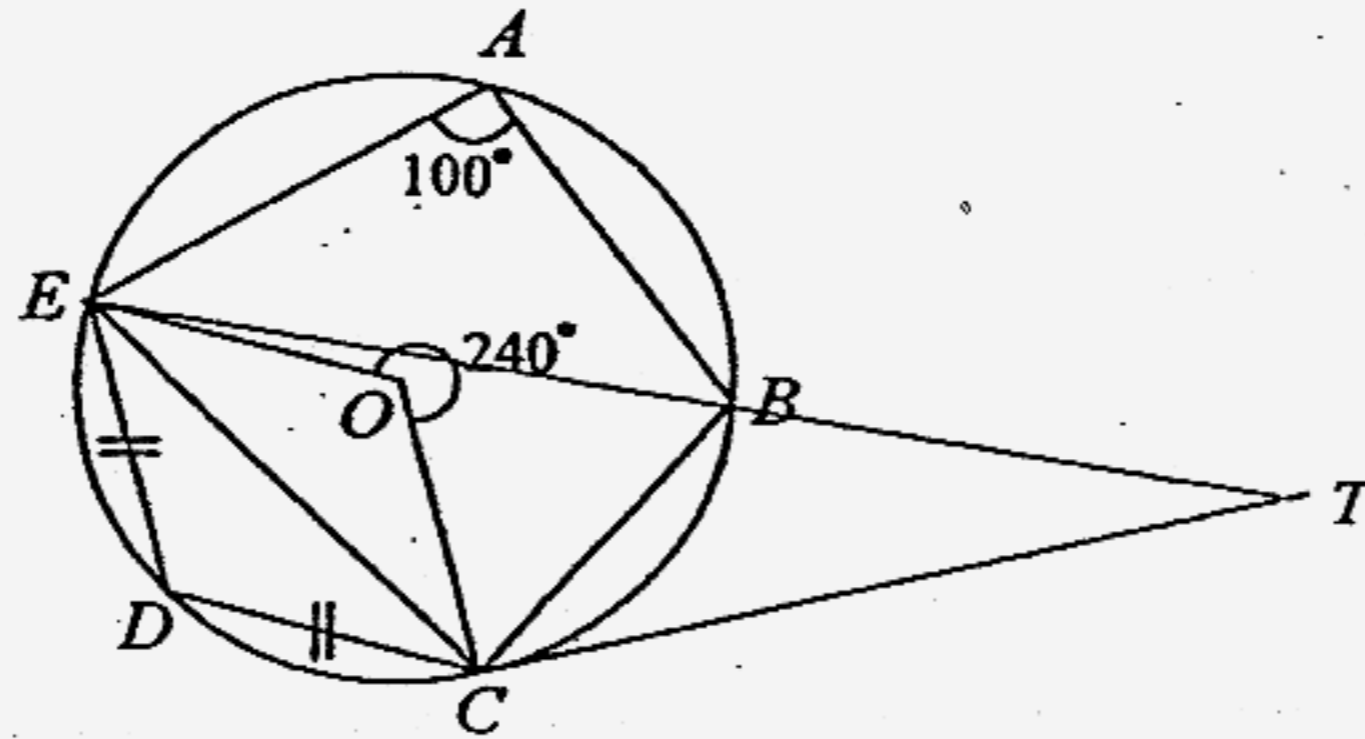
3(a) (i) If $x+2y:3x=2:3$ find the value of $\frac{2x}{3y}$ [2]

(ii) Solve the simultaneous equation [3]

$$5x-2y=24$$

$$x+3y=-2$$

(b) In the circle with centre O , $DE=DC$, reflex $\angle EOC = 240^\circ$ and $\angle EAB = 100^\circ$.
 EBT is a straight line.



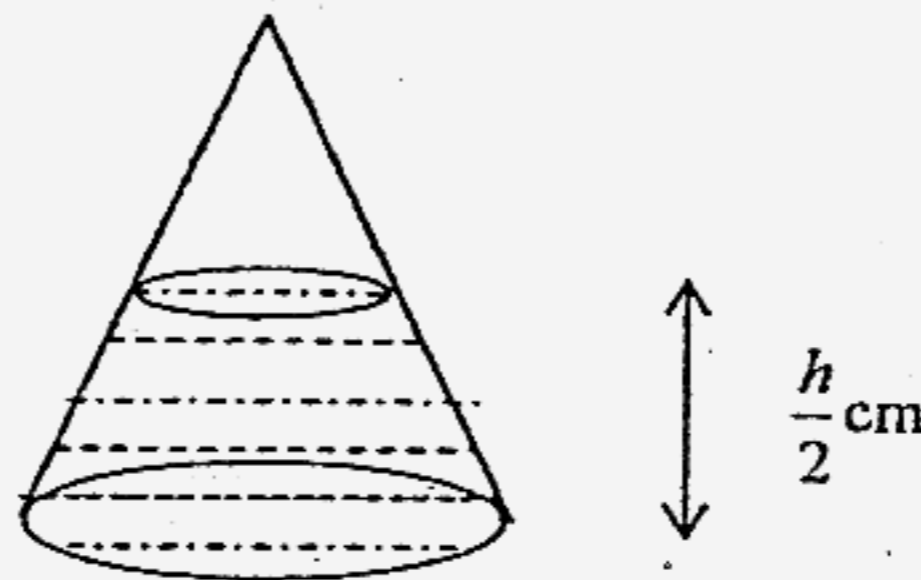
Calculate, stating your reasons clearly,

(i) $\angle DCE$ [2]

(ii) $\angle CEB$ [2]

(iii) Given that $\angle CTE$ is 20° , prove that CT is a tangent to the circle at C . [2]

4. A cone of height h cm is filled with water, covered at the base and inverted to rest on the base as shown in the diagram below. The water reaches a depth of $\frac{h}{2}$ cm. The radius of the base of the cone is 3cm.



(a) Show that the volume of the water in the cone is $\frac{21\pi h}{8} \text{ cm}^3$. [3]

(b) If the volume of water is $10.5\pi \text{ cm}^3$, find

(i) the slant height of the cone [2]

(ii) the curved surface area of the cone not exposed to the water. [2]

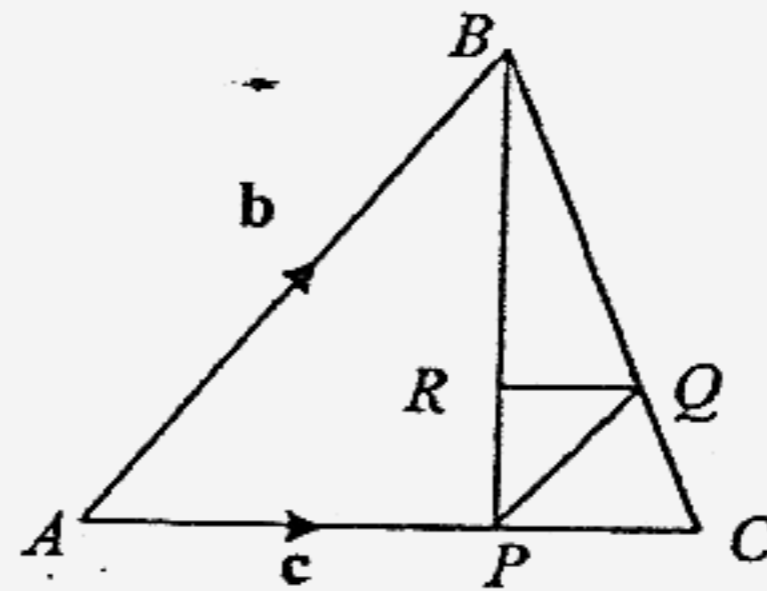
5. In the figure, $\overline{AB} = b$ and $\overline{AC} = c$.
 $AP : AC = 2 : 3$. PQ is parallel to AB and RQ is parallel to AC .

(a) Find in terms of b and c ,

- (i) \overline{PB} , [1]
 (ii) \overline{PQ} , [1]
 (iii) \overline{RQ} , [1]
 (iv) \overline{AR} . [2]

(b) Find the value of

- (i) $\frac{\text{Area of triangle } ABP}{\text{Area of triangle } BPC}$ [1]
 (ii) $\frac{\text{Area of } APQB}{\text{Area of } ABC}$ [2]



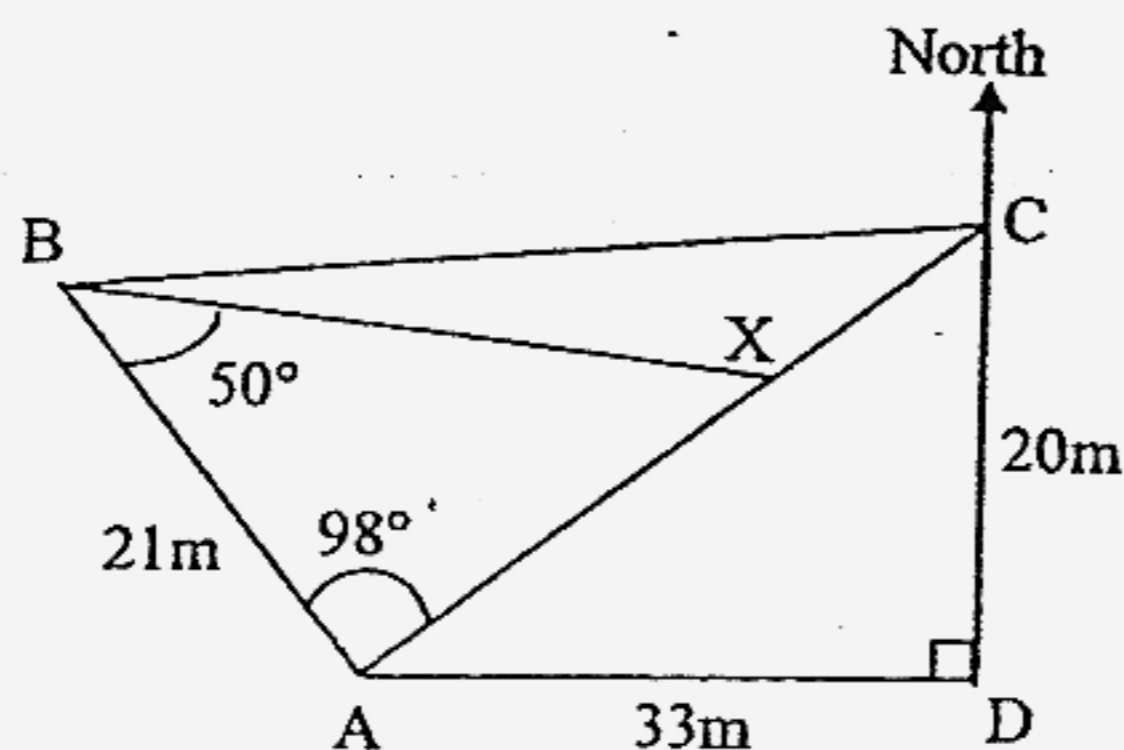
- (c) If triangle BPC has an area of 12cm^2 , find the area of triangle ARP . [2]

6. In the figure, A, B, C and D are four points on level ground. D is due south of C and A is due west of D . $CD = 20\text{m}$, $AD = 33\text{m}$, and $AB = 21\text{m}$. X is a point on AC such that $\angle BAX = 98^\circ$ and $\angle ABX = 50^\circ$,

(a) Calculate

- (i) the bearing of C from A , [2]
 (ii) the length of CX , [3]
 (iii) the area of the quadrilateral $ABCD$. [2]

- (b) An helicopter is hovering at a constant height of 50m directly above A . Casey is walking along the path BX . Calculate the largest angle of depression of Casey when viewed from the helicopter. [3]



Start this question on a fresh piece of paper.

7.

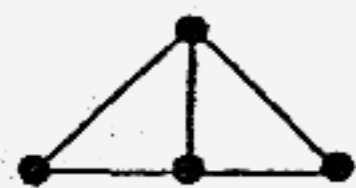


Fig. 1

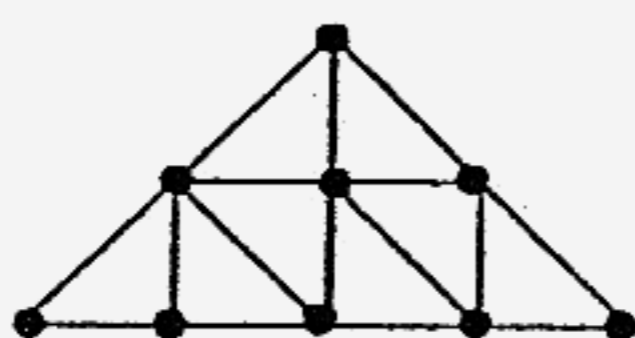


Fig. 2

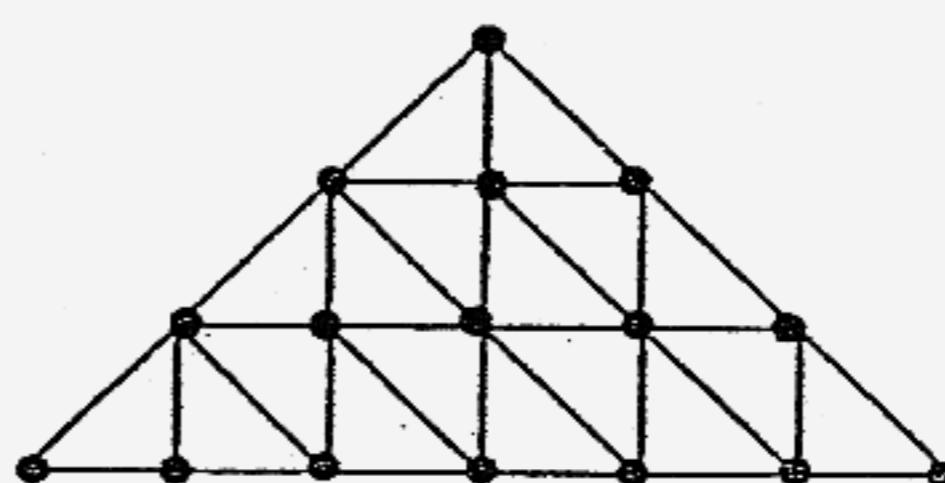


Fig. 3

The total number of dots and the number of small right-angled triangles of each figure is shown in the table below.

Figure	Total number of dots	Number of small right-angled triangles
1	4	2
2	9	8
3	16	18
4	p	q
.	.	.
n	y	z

By considering the diagrams above and the patterns developed in the table, answer the following questions:

- (a) Find the values of p and q . [2]
- (b) Find the total number of dots needed to form figure 10. [1]
- (c) Which figure has 338 small right angled triangles? [2]
- (d) (i) Express y in terms of n . [1]
- (ii) Express z in terms of n . [2]
- (e) Is it possible to have a figure with 250 dots? Explain your answer. [1]

8(a) Each evening, Mr Lee either watches television or reads a book. The probability that he watches television is $\frac{2}{5}$. If he watches television, the probability that he will fall asleep is $\frac{1}{3}$.

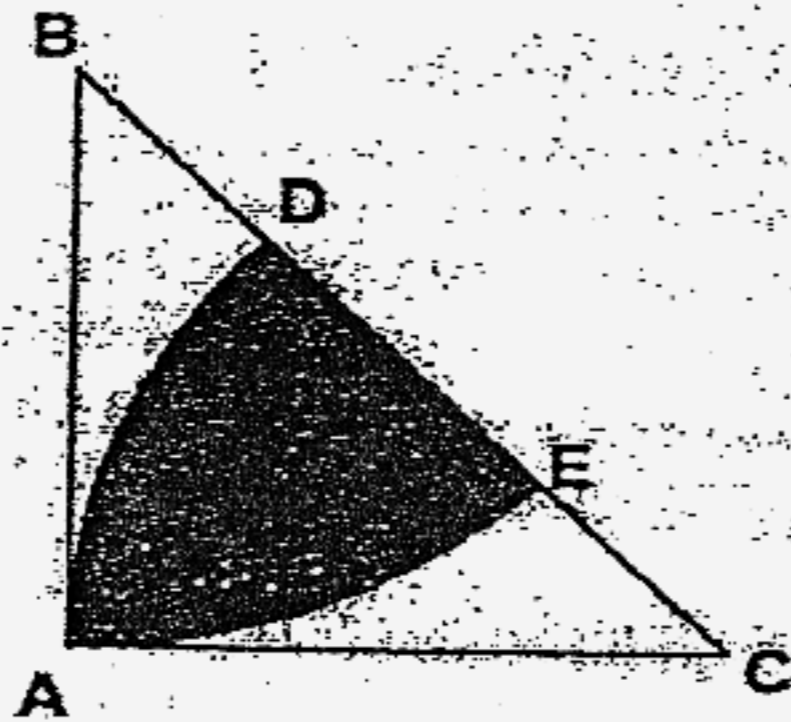
If he reads a book, the probability that he will fall asleep is $\frac{4}{9}$.

- (i) Draw a tree diagram which represents the possible outcomes and their probabilities. [2]
- (ii) Find the probability that Mr Lee will stay awake in the evening. [2]
- (iii) Find the probability that Mr Lee will be able to stay awake for at least one of two evenings. [2]

(b) $\triangle ABC$ is an isosceles right-angled triangle with $AC = AB = 2$ cm. AD is part of a circular arc of radius 2 cm with centre C and AE is part of a circular arc with radius 2 cm and centre B .

Calculate in terms of π ,

- (i) the perimeter of the shaded region. [3]
- (ii) the area of the shaded region ADE . [3]



9. Answer the whole of this question on a piece of graph paper.

The lengths of 80 earthworms found in a garden are given in the following cumulative frequency table.

Length in cm	0	10	20	30	40	50	60	70	80
No of earthworms less than or equal to this length	0	2	5	9	18	34	62	74	80

(a) Copy and complete the following frequency table using the above information. [4]

Length in cm	$0 < x \leq 20$	$20 < x \leq 40$	$40 < x \leq 50$	$50 < x \leq 60$	$60 < x \leq 80$
No of earthworms	5				
Frequency density					

- (b) Using a horizontal scale of 2cm to represent 10cm and a vertical scale of 4cm to represent 1 unit, draw a histogram to represent the information in the table. [2]
- (c) Calculate an estimate of the mean of the distribution. [2]

10. Answer the whole of this question on a piece of plain paper.

Draw a parallelogram $ABCD$ in which $AB = 8$ cm, $AD = 5$ cm and $\angle ADC = 120^\circ$ [2]

- (a) On your diagram, construct and label clearly,
- the locus of point P such that it is equidistant from AB and AD , [1]
 - the locus of point S such that $\angle BSD = 90^\circ$, and [1]
 - the locus of point K , on the same side of AB as D , such that the area of $\triangle AKB$ is 10cm^2 . [1]
- (b) A point R lies within the parallelogram and is such that
- R lies nearer to AD than AB ,
 - $\angle BRD \geq 90^\circ$, and
 - area of $\triangle ARB$ is less than or equal to 10cm^2 .
- On your diagram, shade the region in which R must lie. [2]

Section B [12 marks]

Answer only ONE question in this section.

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

The variables x and y are connected by the equation $y = -x(x^2 - 18)$. Some corresponding values of x and y are given in the following table.

x	-2	-1	0	1	2	3	4	5
y	a	-17	0	17	28	b	8	-35

- (a) Write down the values of a and b . [1]
- (b) Using a scale of 2 cm to represent 1 unit on the x -axis and 2 cm to represent 10 units on the y -axis, draw the graph of $y = -x(x^2 - 18)$ for the values of x in the range $-2 \leq x \leq 5$. [3]
- (c) From your graph, write down the range of values of x for which the gradient of the curve is negative. [2]
- (d) By drawing a suitable straight line on the graph, estimate the solutions of the equation $3x^3 - 54x + 60 = 0$. [2]
- (e) On the same graph, draw the line $y = -2x + 16$ and hence estimate the range of values of x for which $-x(x^2 - 18) \geq -2x + 16$. [2]
- (f) By drawing a suitable tangent to your curve, find the coordinates of the point P on the curve at which the gradient of the tangent is equal to -2 . [2]

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

Using a scale of 2 cm to represent 1 unit on each axis, draw axes for values of x and y in the ranges $-4 \leq x \leq 4$ and $-4 \leq y \leq 6$. [1]

(a) Draw and label the triangle with vertices $A(1, 2)$, $B(3, 2)$ and $C(3, 3)$. [1]

(b) $\triangle ABC$ is mapped onto $\triangle LMN$ by a translation. If L has coordinates $(-3, 3)$

(i) write down the column vector which represents the translation. [1]

(ii) draw and label $\triangle LMN$. [1]

(c) G represents a clockwise rotation of 90° about $(-1, 1)$ and H represents a reflection in the line $y = -x$.

Draw $\triangle PQR$, the image of $\triangle LMN$ under the combined transformation HG . [2]

(d) $\triangle LMN$ can be mapped onto $\triangle PQR$ by a single transformation. Describe fully this transformation. [1]

(e) A shear, with y -axis invariant, maps $\triangle ABC$ onto $\triangle STU$ such that S has coordinates $(1, 0)$,

(i) State the shear factor. [1]

(ii) Draw and label $\triangle STU$. [2]

(f) Describe fully the single transformation that maps $\triangle ABC$ onto $\triangle XYZ$, such that X , Y and Z have coordinates $(1, 3)$, $(3, 3)$ and $(3, 5)$ respectively. [2]

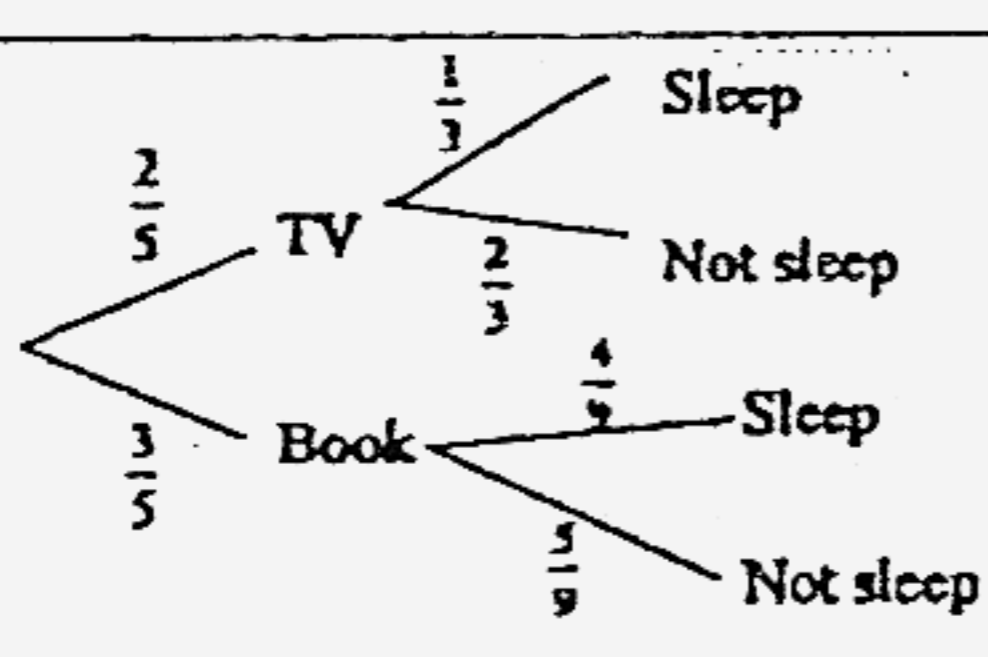


2005 Preliminary Examination
 Mathematics Paper 2
 Sec 4 Express/ 5 Normal Academic
 Marking Scheme

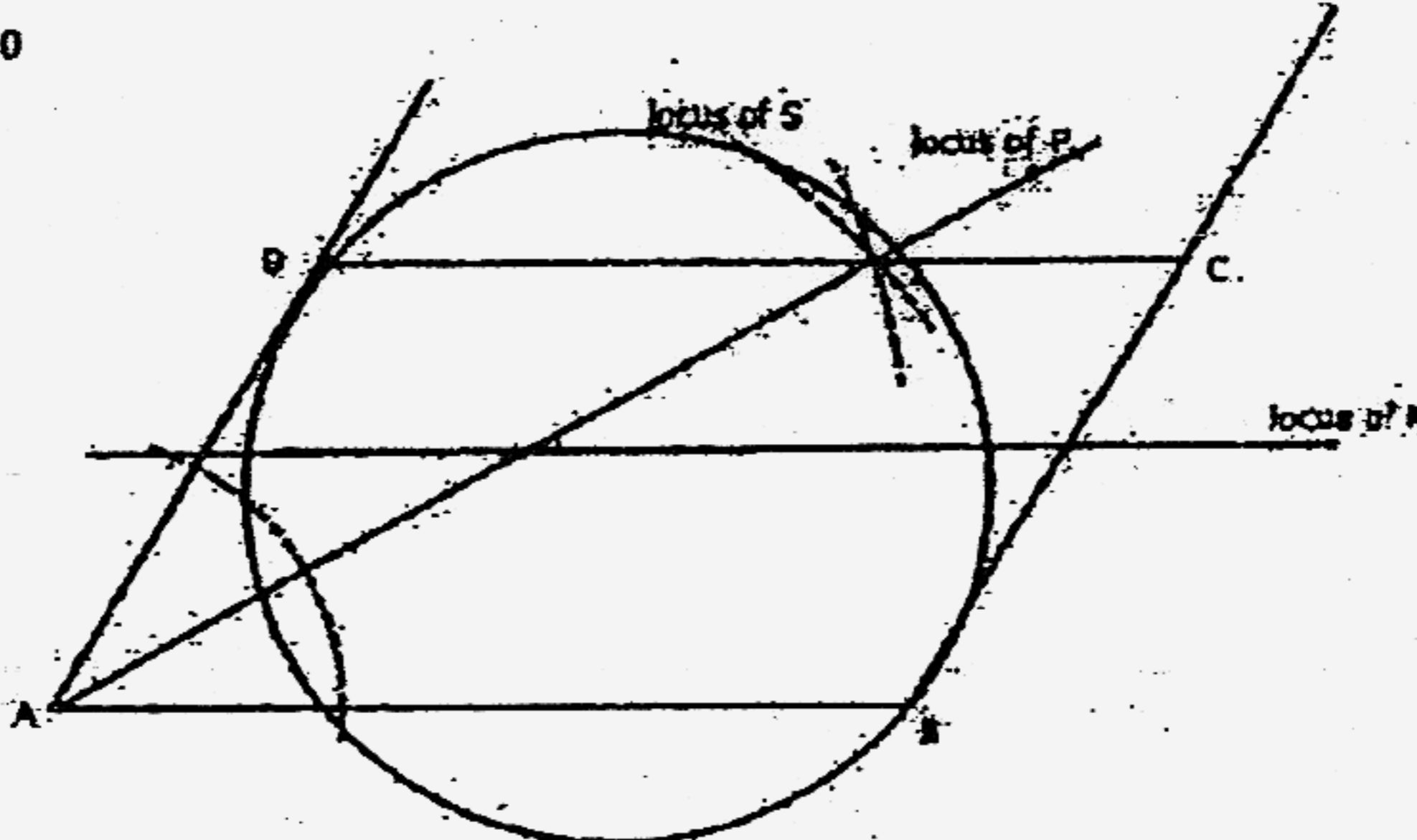
Question	Answers	Remarks
1a(i)	$(0.075 \times 2000 + 0.1 \times 3000 + 0.11 \times 425) 10.20$ $= \$5066.85$	
ii	$10.2 \times 5425 = 55,335$	
(b)	$\frac{55,335 - 15400 - 5066.85}{55,335} \times 100$ $= 63.0\%$	
(c)	$\left(\frac{8}{100} \times 4\right) \times \text{No. of copies} = 1371.2$ No. of copies = 4285	
2a(i)	$40 - 20t$	
(ii)	$15t$	
(b)	$d^2 = (15t)^2 + (40 - 20t)^2$ $d^2 = 625t^2 - 1600t + 1600$	
(c)	$625t^2 - 1600t + 1600 = 3600$ $625t^2 - 1600t - 2000 = 0$ $25t^2 - 64t - 80 = 0$ $t = \frac{64 \pm \sqrt{64^2 - 4(-64)(-80)}}{2(25)}$ $= \frac{64 \pm \sqrt{12096}}{50}$ $= 3.48h \text{ or } -0.919h \text{ (NA)}$	
3a (i)	$\frac{x+2y}{3x} = \frac{2}{3}$ $3x+6y = 6x$ $\frac{x}{y} = 2$ $\frac{2x}{3y} = \frac{2}{3}(2) = \frac{4}{3}$	

Question	Answers	Remarks
3a (ii)	$5x - 2y = 24 \dots (1)$ $x + 3y = -2 \dots (2)$ Substitute $x = -2 - 3y$ into (1) $5(-2 - 3y) - 2y = 24$ $17y = -34$ $y = -2$ $x = 4$	
3b (i)	$\angle DCE = 30^\circ$ (isosceles Δ /angle at centre is twice angle at circumference)	
(ii)	$\angle CBE = 60^\circ$ (\angle at center = $2\angle$ at circumf)	
(iii)	$\angle BCE = 80^\circ$ (opp. angles of cyclic quad.)	
(iii)	$\angle CEB = 40^\circ$	
(iii)	$\angle OCT = 90^\circ$ (radius OC is perpend. To CT)	
(iii)	$\angle OCE = 30^\circ$	
(iii)	$\angle CTE = 20^\circ$	
4a	$V_1 =$ Volume of empty portion $\frac{V_1}{V} = \left(\frac{h}{H}\right)^3 = \frac{1}{8}$ Volume of water in cone = $\frac{7}{8} \times V$ $= \frac{7}{8} \left(\frac{1}{3} \pi \times 3^3 \times h\right)$ $= \frac{21}{8} \pi h$ b $\frac{21\pi h}{8} = 10.5\pi \Rightarrow h = 10.5 \times \frac{8}{21} = 4$ $h = 4$ cm slant height = 5 cm c Radius of cone not exposed to water = $\frac{3}{2} = 1.5$ cm Slant height of cone not exposed to water = 2.5 cm Curved surface area not exposed to water $= \pi \times 1.5 \times 2.5 = 11.8 \text{ cm}^2$	

Question	Answers	Remarks
5a(i)	$\overline{PB} = \overline{PA} + \overline{AB} = b - \frac{2}{3}c$	
(ii)	ΔABC is similar to ΔPQC $\frac{PQ}{AB} = \frac{QC}{BC} = \frac{PC}{AC} = \frac{1}{3}$ $\overline{PQ} = \frac{1}{3}b$	
(iii)	ΔBRQ is similar to ΔBPC $\frac{RQ}{PC} = \frac{BR}{BP} = \frac{BQ}{BC} = \frac{2}{3}$ $\overline{RQ} = \frac{2}{3}\overline{PC} = \frac{2}{3}\left(\frac{1}{3}c\right) = \frac{2}{9}c$	
(iv)	$\overline{AR} = \overline{AP} + \overline{PR}$ $= \frac{2}{3}c + \frac{1}{3}\overline{PB}$ $= \frac{1}{3}b + \frac{4}{9}c$	
b(i)	$\frac{\text{Area of } \Delta MBP}{\text{Area of } \Delta BPC} = 2$	
(ii)	$\frac{\text{Area of } \Delta PQC}{\text{Area of } \Delta ABC} = \left(\frac{1}{3}\right)^2 = \frac{1}{9}$ $\frac{\text{Area of } APQB}{\text{Area of } \Delta ABC} = \frac{8}{9}$	
c)	$\text{Area of } \Delta MBP = 24\text{cm}^2$ $\text{Area of } \Delta MPB = \frac{1}{3}\text{Area of } \Delta MBP = 8\text{cm}^2$	
6a)	$\tan \angle CAD = \frac{20}{33}$ $\angle CAD = 31.2^\circ$ $\text{Bearing of C from A} = 90^\circ - 31.2^\circ = 058.8^\circ$	
b)	$\frac{AX}{\sin 50^\circ} = \frac{21}{\sin 32}$ $AX = 30.36$ $CA = \sqrt{20^2 + 33^2}$ $CX = 8.23\text{m}$	

Question	Answers	Remarks
(iii)	$\text{Area of triangle ABC} = \frac{1}{2} \times 21 \times 38.6 \sin 98 = 401.4 \text{ m}^2$ $\text{Area of ABCD} = 401.4 + \frac{1}{2} \times 33 \times 20 = 73 \text{ m}^2$	
b)	Let AM be shortest distance of A from BX $\sin 50^\circ = \frac{AM}{21}$ $AM = 16.087$ $\tan \theta = \frac{50}{16.087}$ $\text{Ans: } 72.2^\circ$	
7a)	$p = 25, q = 32$	
b)	121	
c)	Figure 13	
d)	i) $y = (n+1)^2$ ii) $z = 2n^2$	
e)	No, 250 is not a perfect square	
8a)(i)	 <pre> graph LR Root(()) --- TV[TV] Root --- Book[Book] TV --- TV_Sleep[Sleep] TV --- TV_NotSleep[Not sleep] Book --- Book_Sleep[Sleep] Book --- Book_NotSleep[Not sleep] TV --- TV_Prob[2/5] Book --- Book_Prob[3/5] TV_Sleep --- TV_Sleep_Prob[1/3] TV_NotSleep --- TV_NotSleep_Prob[2/3] Book_Sleep --- Book_Sleep_Prob[4/9] Book_NotSleep --- Book_NotSleep_Prob[5/9] </pre>	
(ii)	$P(\text{stay awake}) = \frac{2}{5} \times \frac{2}{3} + \frac{3}{5} \times \frac{5}{9}$ $= \frac{4}{15} + \frac{1}{3} = \frac{3}{5}$	
(iii)	$P(\text{awake for at least 1 of 2 evenings})$ $= 1 - P(\text{sleep both evenings})$ $= 1 - \frac{2}{5} \times \frac{2}{5} = \frac{21}{45}$	

Question	Answers	Remarks																		
8b) (i)	$\text{Length AD/AE} = \frac{45}{360} \times 2\pi \times 2 = \frac{\pi}{2}$ $DE = 4 - \sqrt{8} = 1.17$ $\text{Perimeter} = \pi + 1.17$																			
(ii)	$\text{Area of sector BAE/CAD} = \frac{45}{360} \times \pi \times 2^2 = \frac{1}{2}\pi$ $\text{Area of shaded region} = \text{Sum of the 2 sectors} - \text{area of triangle} =$ $2 \times \frac{1}{2} \times \pi - \frac{1}{2} \times 2 \times 2$ $= \pi - 2$																			
9a)	<table border="1"> <thead> <tr> <th>Length in cm</th> <th>$0 < x \leq 20$</th> <th>$20 < x \leq 40$</th> <th>$40 < x \leq 50$</th> <th>$50 < x \leq 60$</th> <th>$60 < x \leq 80$</th> </tr> </thead> <tbody> <tr> <td>No of observations</td> <td>5</td> <td>13</td> <td>16</td> <td>28</td> <td>18</td> </tr> <tr> <td>Frequency Density</td> <td>0.25</td> <td>0.65</td> <td>1.6</td> <td>2.8</td> <td>0.9</td> </tr> </tbody> </table>	Length in cm	$0 < x \leq 20$	$20 < x \leq 40$	$40 < x \leq 50$	$50 < x \leq 60$	$60 < x \leq 80$	No of observations	5	13	16	28	18	Frequency Density	0.25	0.65	1.6	2.8	0.9	
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No of observations	5	13	16	28	18															
Frequency Density	0.25	0.65	1.6	2.8	0.9															
b																				
c	$\text{Mean} = \frac{5 \times 10 + 13 \times 30 + 16 \times 45 + 28 \times 55 + 18 \times 70}{80} = 49.5$																			

Question	Answers	Marks	Remarks
10			<p>B2 - parallelogram constructed correct</p> <p>B1 - locus of P B1 - locus of S B1 - locus of K</p> <p>B2 - region of I marked correct with dotted line along locus of P</p>
11a)	$a = -28, b = 27$	A1	
c)	$x > 2.4$ (Range of 2.3 to 2.5)	B2	
d)	$3x^2 - 54x + 60 = 0 \Rightarrow x^2 - 18x + 20 = 0$ $-x^2 + 18x = 20 \Rightarrow -x(x^2 - 18) = 20$ Draw the line $y = 20$ From graph $x = 1.2$ or 3.5 (Range of 1.1 to 1.3 and 3.4 to 3.6)	A1	
e)	$0.9 \leq x \leq 4$ (Range of 0.8 to 1 and 3.9 to 4.1)	A1	
f)	$x = 2.6$ (Range of 2.4 to 2.8)	A1	<p>M1 - correct scale and axes</p> <p>M1 - correct points plotted</p> <p>M1 - smooth curve</p> <p>M1 - $y = 20$</p> <p>M1 - $y = -2x + 16$</p> <p>M1 - tangent line at $x = 2.6$</p>

Question	Answers	Marks	Remarks
12		<p>M1 - correct scale for axes</p> <p>M1 - $\triangle ABC$</p> <p>M1 - $\triangle LMN$</p> <p>M2 - $\triangle PQR$ (award M1 for correct image under rotation)</p> <p>M2 - $\triangle STU$ (1 mark each for each point.)</p>	
(b)(ii)	$\begin{pmatrix} -4 \\ 1 \end{pmatrix}$	A1	
(d)	Reflection about the line $y = 1$	A1	
(e)(i)	Scale factor = -2	A1	
(f)	Stretch of scale factor 2 from invariant line $y = 1$	B2	