

For
Examiner's
Use**ELECTRONIC CALCULATORS MUST NOT BE USED IN THIS PAPER**For
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Use

- 1 a) The thickness of a paper is 0.0026054 cm. Express 0.0026054 in standard form, correct to 3 significant figures.
- b) Evaluate $(2.56 \times 10^4) \div (2 \times 10^{-3})$ in standard form.

Answer a) [1]

b) [1]

- 2 a) Arrange the following numbers in ascending order.

$$2^{-2}, -3.2 \times 10^{-1}, 2^0, 2.3 \times 10^{-2}$$

- b) Given $\frac{p \times p^3}{\sqrt{p}} = p^n$, find the value of n .

Answer a) [1]

b) $n =$ [1]

- 3 a) Factorise completely $x^2 - 3x + 9y - 3xy$

- b) Given that $A = \sqrt{\frac{2B}{B+3}}$, express B in terms of A .

Answer a) [2]

b) [2]

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- 4 a) Find the largest integer x such that $4x - 15 < 5 - x$
- b) Given that $3 \leq m \leq 5$ and $-1 \leq n \leq 3$, find
- (i) the smallest value of $\frac{1}{m} + \frac{1}{n}$
- (ii) the greatest value of $(m + n)(m - n)$

Answer a) $x = \dots\dots\dots$ [1]

b) $\dots\dots\dots$ [1]

bii) $\dots\dots\dots$ [1]

- 5 The variables x and y are connected by the equation $y = A(x + 1)^2$, where A is a constant. Refer to the table below, calculate

x	3	-1	q
y	32	p	8

- i) A ,
- ii) p ,
- iii) the possible values of q .

Answer i) $A = \dots\dots\dots$ [1]

ii) $p = \dots\dots\dots$ [1]

iii) $q = \dots\dots\dots$ [2]

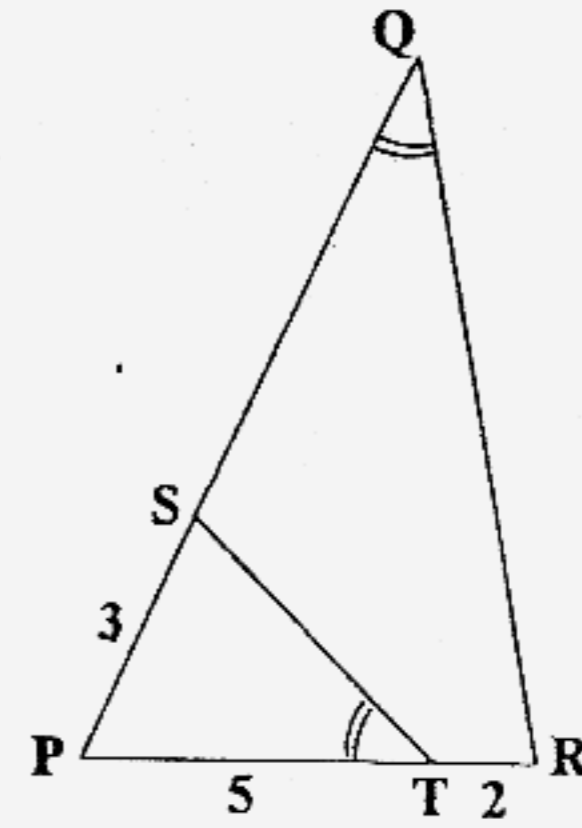
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6

In the diagram, $\hat{PQR} = \hat{PTS}$,

a) Explain why triangles PQR and PTS are similar.



Answer (a)
 [2]

b) Given also that $PS = 3\text{cm}$, $PT = 5\text{cm}$ and $TR = 2\text{cm}$, calculate

(i) QS ,

(ii) $\frac{\text{Area of triangles } PTS}{\text{Area of triangles } PQR}$

Answer bi) $QS = \dots\dots\dots\text{cm}$ [3]

bii) [1]

7 5 men take 7 days to paint a house. The house was painted in x days.

i) Write an expression, in terms of x , for the number of men needed to paint the house.

ii) Hence, or otherwise, find how long it takes for 14 men to paint the same house.

Answer i) [2]

ii)days [1]

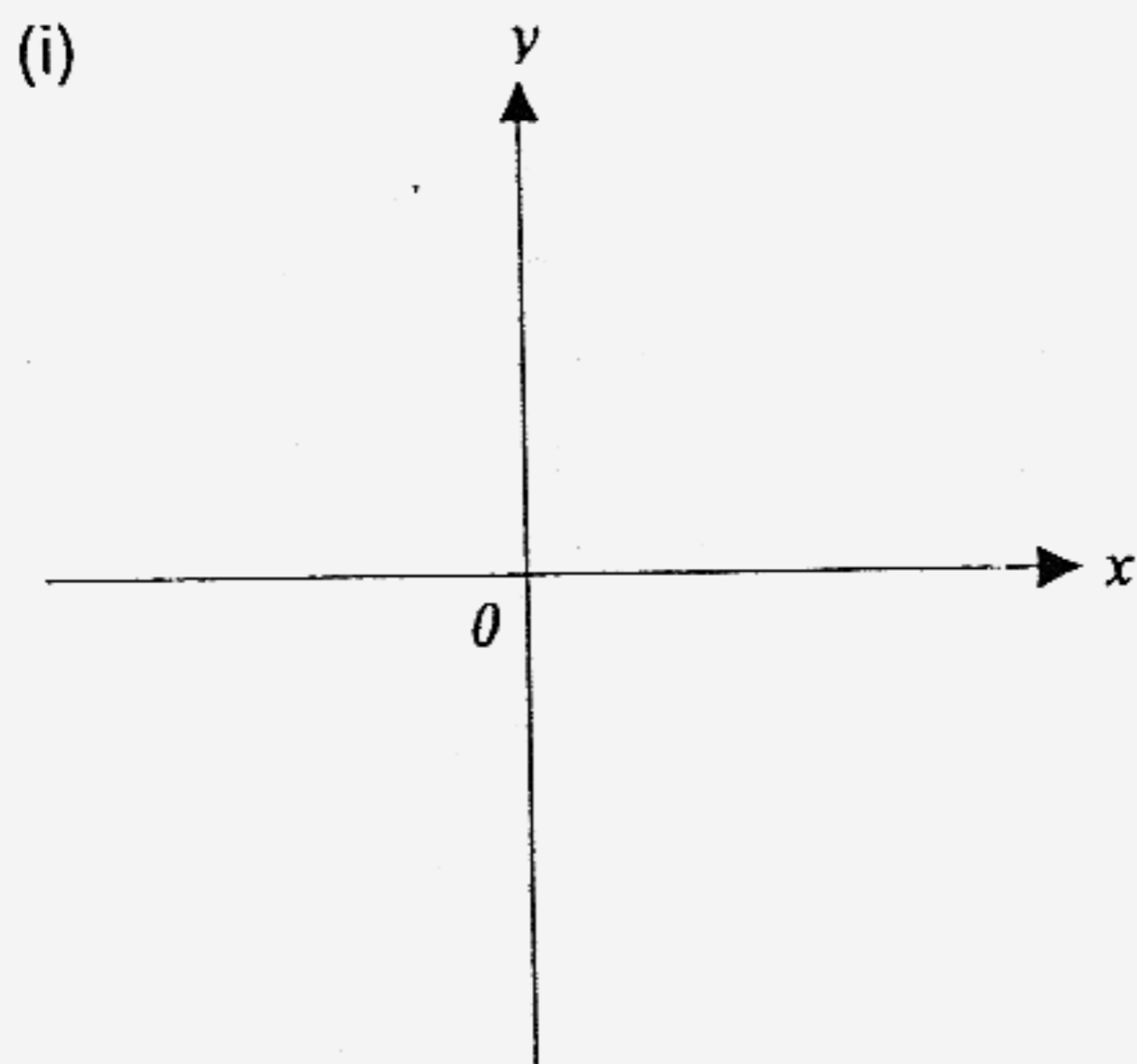
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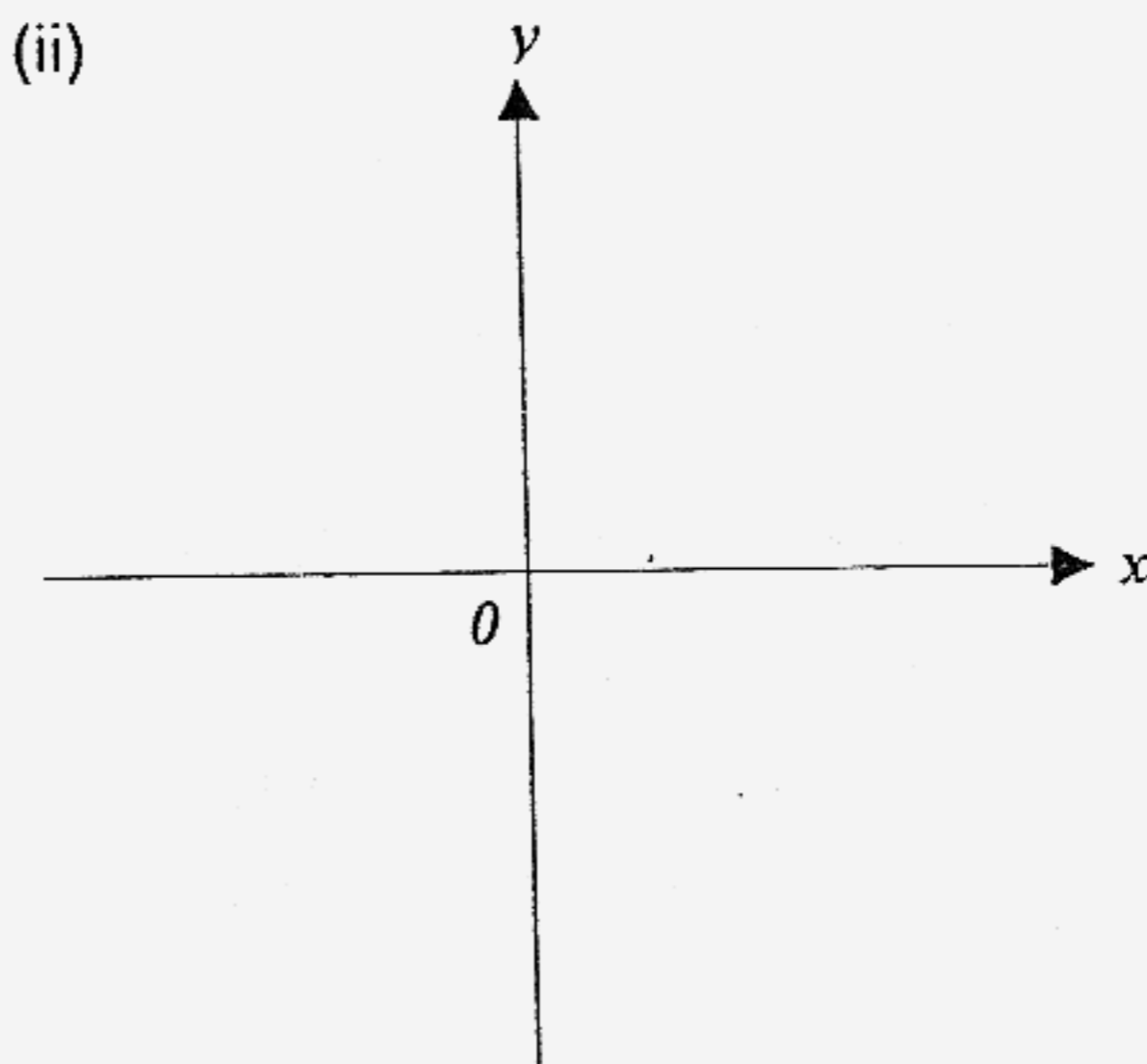
8 a) Given that $y = kx^n$, sketch the graph of y when

(i) $k = 1$ and $n = -2$

(ii) $k = -1$ and $n = 2$

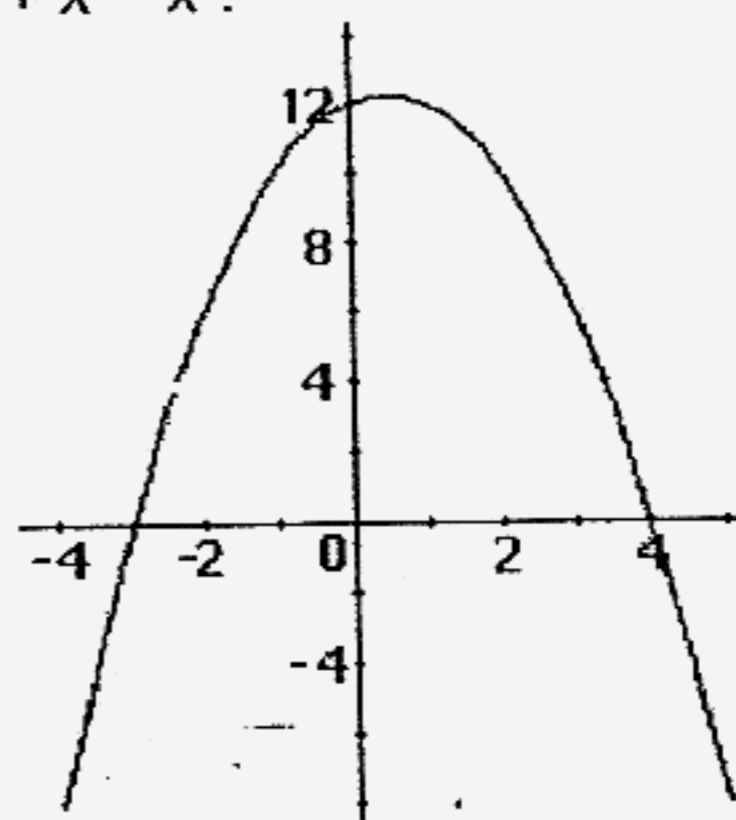


[1]



[1]

b) The diagram shows part of the graph of $y = 12 + x - x^2$.



Find the equation of the straight line that must be drawn on the diagram to solve the following equations graphically.

(i) $x^2 - x - 15 = 0$

(ii) $x^2 - 5 = 0$

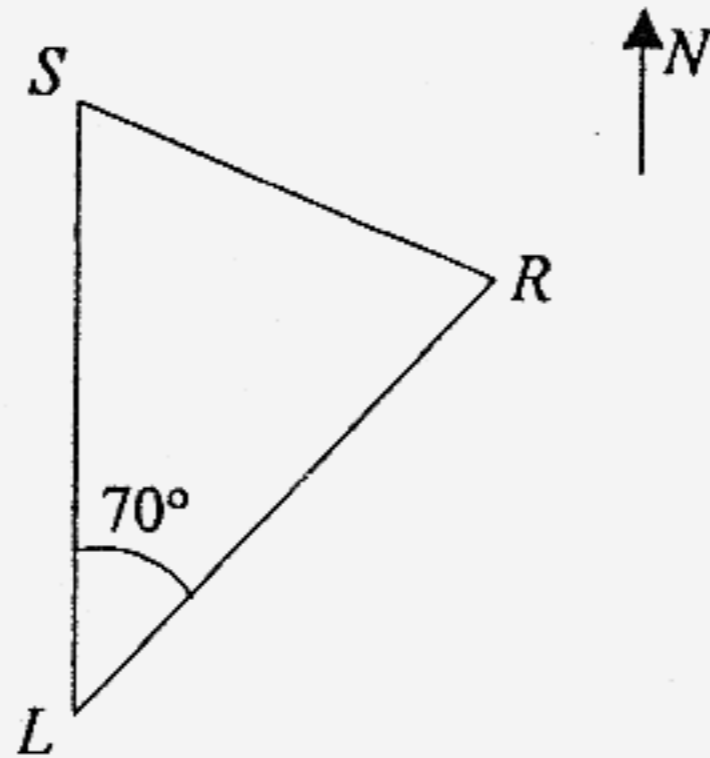
Answer bi) [1]

bii) [1]

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- 9 The diagram shows a school, S and two bus-stops L and R. L is due south of S and $\angle SLR = 70^\circ$. S and R are each 100 m from L. Find

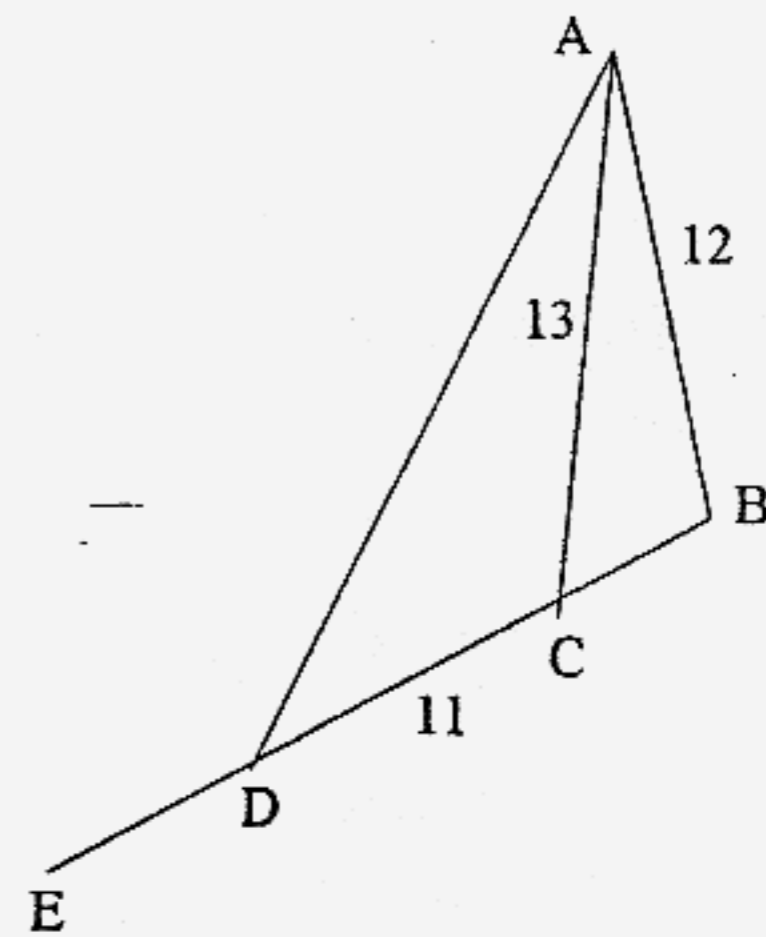


- a) $\angle SRL$,
- b) the bearing of R from S,
- c) the bearing of L from R.

Answer a) [1]
 b) [1]
 c) [1]

- 10 In the diagram, $AB = 12$ cm, $AC = 13$ cm, $CD = 11$ cm, $\angle ABC = 90^\circ$ and BCDE is a straight line.

- a) Calculate the length of AD
- b) Giving each answer as a fraction, find
 - (i) $\tan \angle CAB$
 - (ii) $\sin \angle ACD$
 - (iii) $\cos \angle ADE$



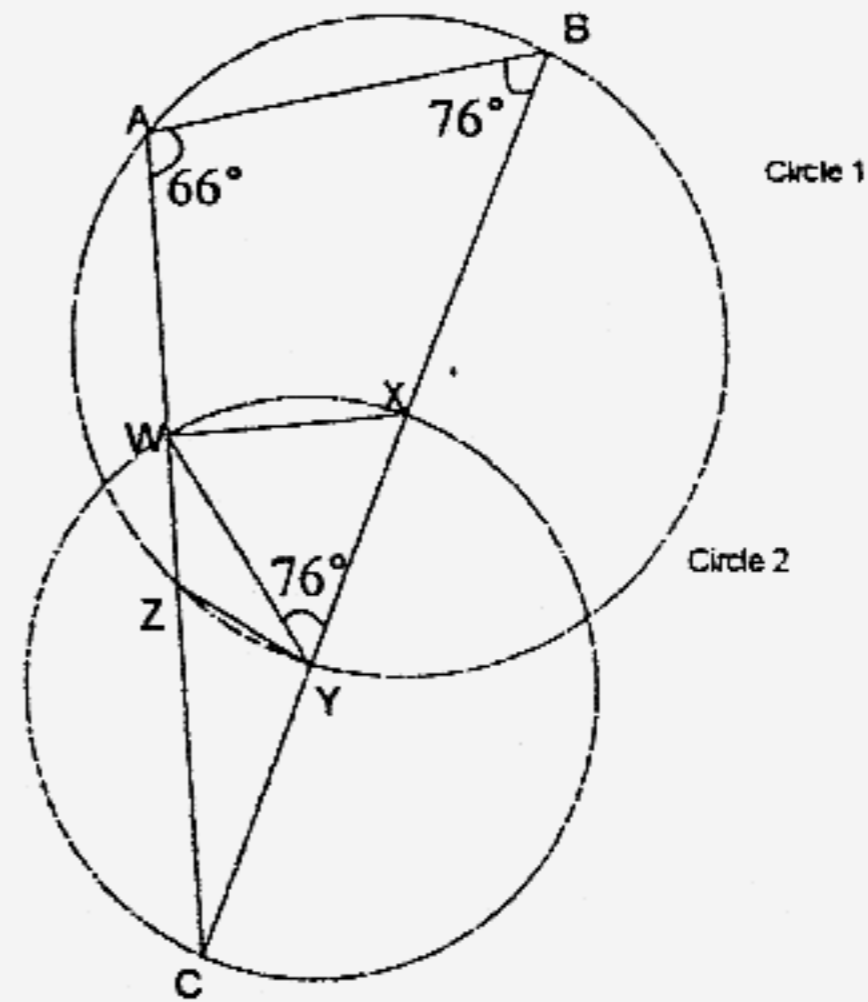
Answer a) $AD = \dots\dots\dots$ cm. [2]
 bi) [1]
 bii) [1]
 biii) [1]

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11 A, B, Z and Y are points that lie on the circumference of Circle 1 and W, X and C on Circle 2. Given that $\hat{CAB} = 66^\circ$ and $\hat{ABC} = \hat{WYX} = 76^\circ$, show that

- a) Y is the centre of Circle 2
- b) $WZ = YZ$



Answer: a) _____ [2]

b) _____ [3]

12. The data below shows the number of children per family in Singapore for Year 2005.

Number of children per family	0	1	2	3
Frequency	7	17	10	x

- i) If the mode is 1, write down the range of values of x.
- ii) Using the largest possible value of x from (i), find the mean and median.

Answer i) [1]

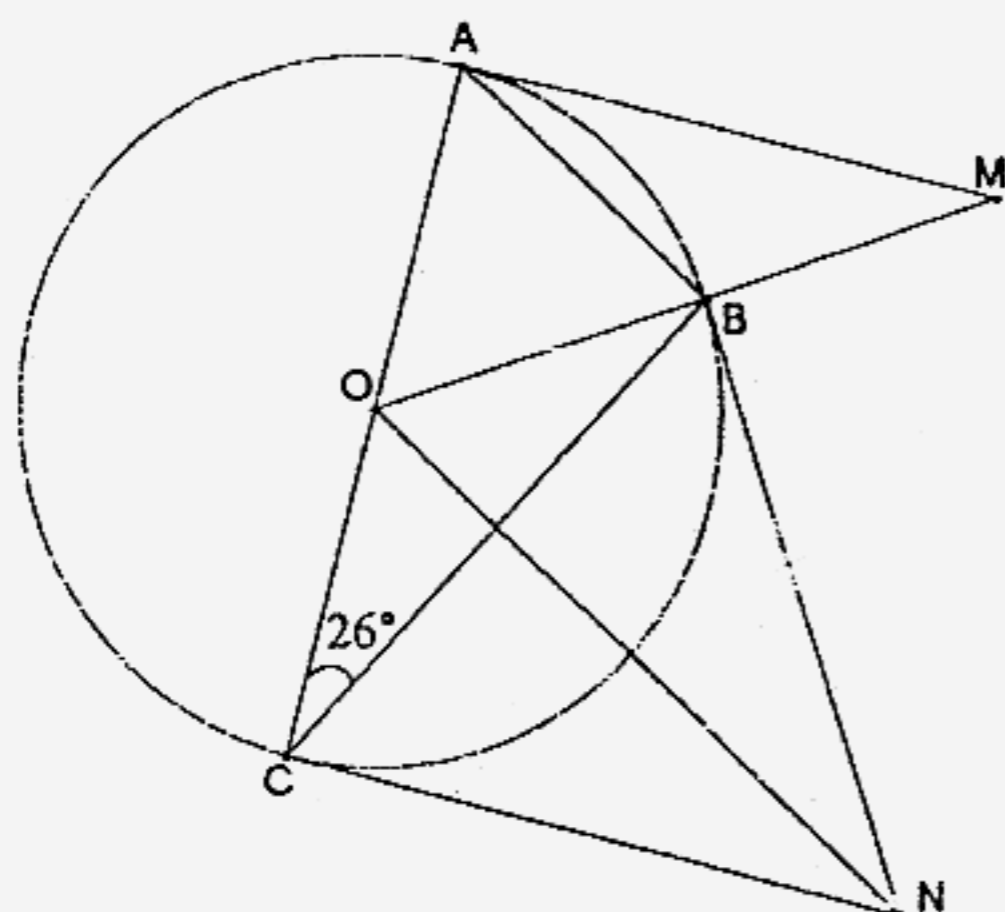
ii) Mean = [1]

Median = [1]

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- 13 O is the centre of the circle and AOC is the diameter. AM, BN and CN are tangents to the circle extended from points A, B and C respectively. X is a point on the circumference of the circle such that ABXC forms a cyclic quadrilateral. Given that $\hat{BCA} = 26^\circ$, find \hat{BXC} .



Answer $\hat{BXC} = \dots\dots\dots$ [2]

- 14 Read the following method to convert a recurring decimal into a fraction.

		<u>Example</u>
Step 1	Given a recurring decimal x .	$x = 0.29292929\dots$
Step 2	Multiply by 100 to get $100x$.	$100x = 29.292929\dots$
Step 3	Subtract x from $100x$ to get $99x$.	$99x = 29$
Step 4	Fraction is $\frac{99x}{99}$	Fraction = $\frac{29}{99}$

- a) Using the above method, convert $0.131313\dots$ into a fraction.
 b) Using a similar method, convert $0.623623623\dots$ into a fraction.

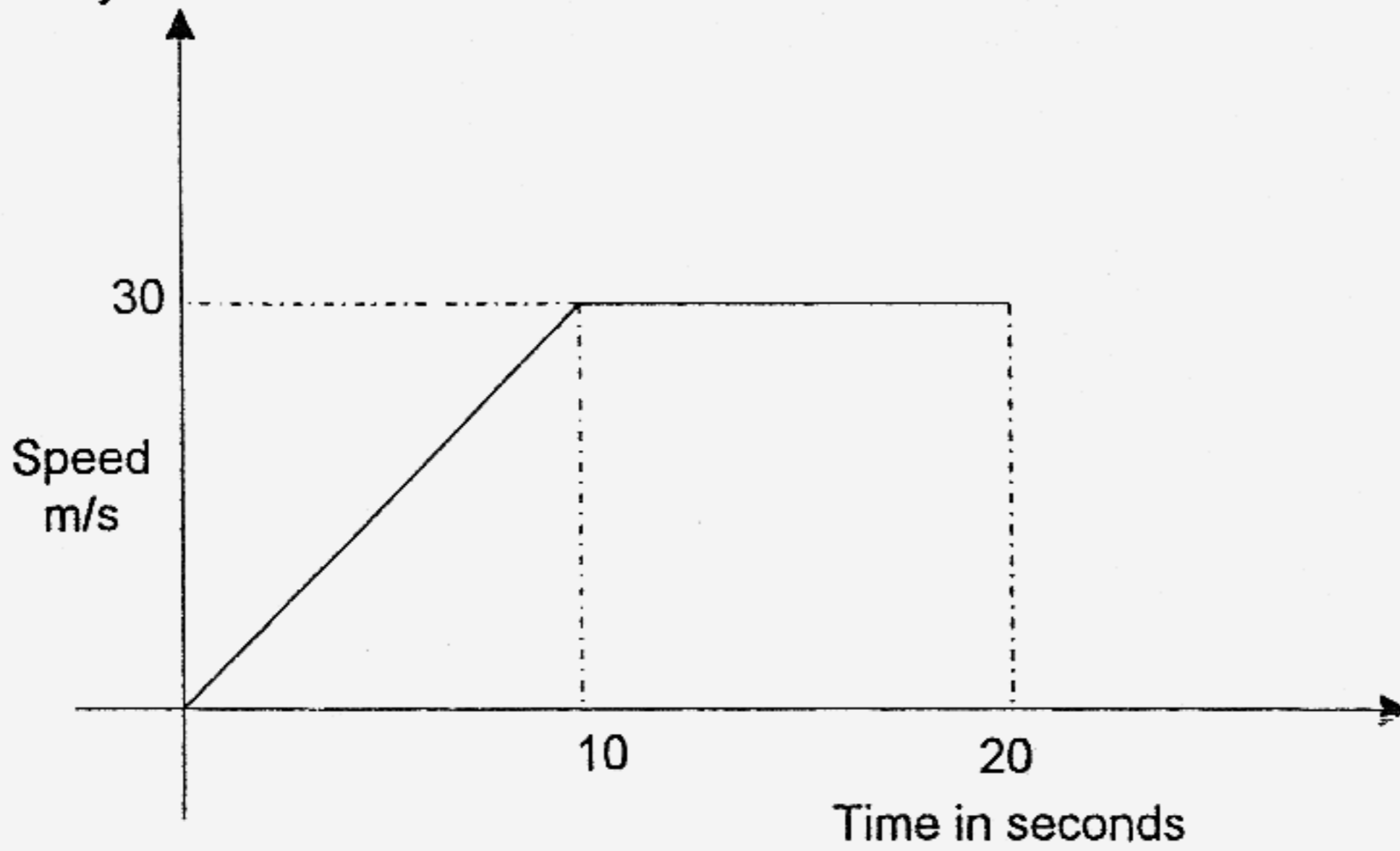
Answer a) $\dots\dots\dots$ [1]

b) $\dots\dots\dots$ [1]

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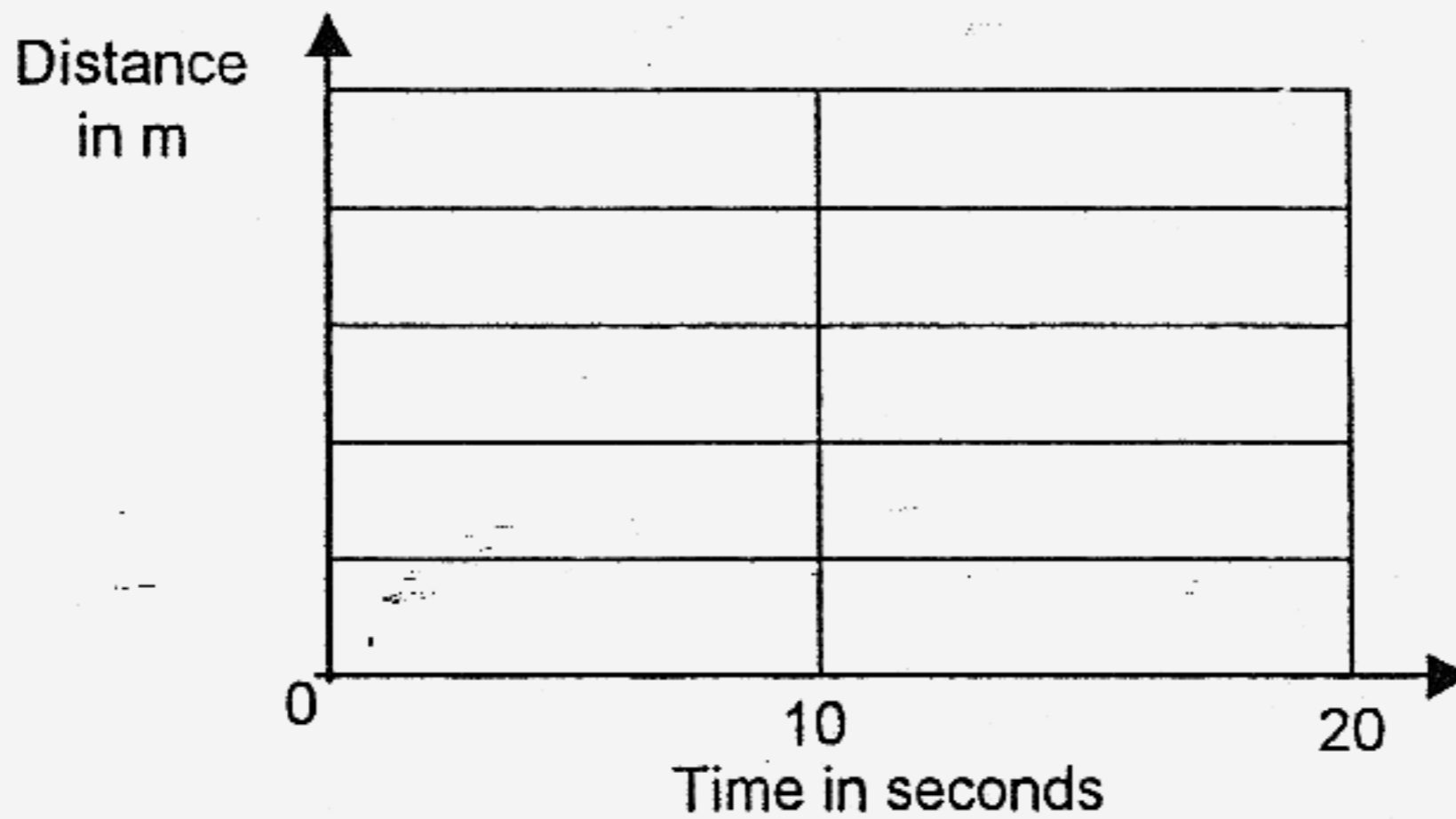
15 The diagram shows the speed-time graph for the first 20 seconds of a cyclist's journey.



- Calculate the distance travelled in the first 15 seconds.
- Calculate the acceleration of the cyclist.
- Calculate the speed of the cyclist at 5th seconds of his journey.
- On the axes in the answer space, draw the distance-time graph for this part of the journey.

Answer: d)

[2]


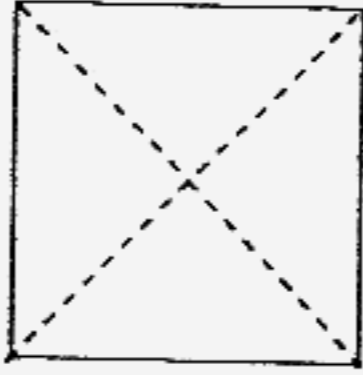
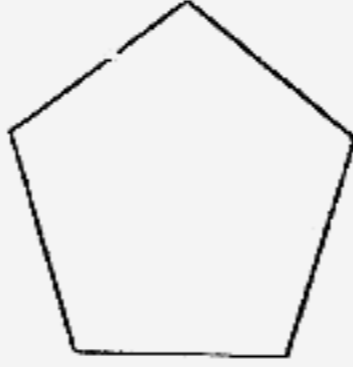
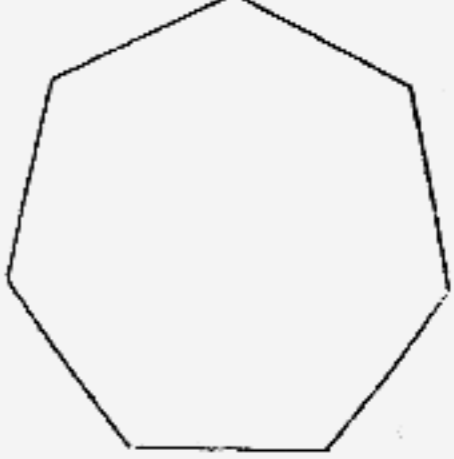


- | | | | |
|--------|----|------------------------|-----|
| Answer | a) |m | [2] |
| | b) | m/s ² | [1] |
| | c) | m/s | [1] |

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16 Diagonals are produced when non-adjacent vertices are joined by straight lines.

Diagram 1	Diagram 2	Diagram 3	Diagram 4	Diagram 5
				
No. of Diagonals=0	No. of Diagonals=2	No. of Diagonals=5	No. of Diagonals=?	No. of Diagonals=14

(i) Draw Diagram 4 on the space provided above. [1]

(ii) Complete the table below. [3]

Diagram	No. of Diagonals	Number Pattern
1	0	0
2	2	1+1
3	5	1+2+2
4	_____	_____
5	14	_____

(iii) How many diagonals are there in the 10th diagram?

(iv) If there are x diagonals in the n^{th} diagram, how many diagonals are there in the $(n+1)^{\text{th}}$ diagram?

Answer iii) [1]

iv) [1]

End of Paper

Name: Register no: Class:



NGEE ANN SECONDARY SCHOOL

Building Character ➔ ➔ ➔ ➔ ➔ *Expanding Minds* ➔ ➔ ➔ ➔ ➔ *Shaping Lives*

End-of-Year Examination 2006

Secondary Three Express / Normal (Academic)

*Ngee Ann Secondary School Ngee Ann Secondary School Ngee Ann Secondary School Ngee Ann Secondary School
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MATHEMATICS PAPER 2

Thursday

5 October 2006

Duration:

1 h 30 min

Additional Materials: 4 foolscap papers, 1 graph paper.

Instructions to Candidates:

1. Write your name, register number and class at the top of this page.
2. Write your answers and working on the separate answer paper provided.
3. Show all your working on the same page as the rest of the answer.
4. Omission of essential working will result in loss of marks.

Section A: Answer **all** questions.

Section B: Answer **one** question.

Information for candidates

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

The total of the marks for this paper is 60.

You are expected to use an electronic calculator for this paper.

If the degree of accuracy is not specified in the question and if the answer is not exact, the answer should be given to three significant figures. Answers in degrees should be given to one decimal place.

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

After checking of answer scripts		
Checked by	Signature	Date
Student		

DO NOT TURN THIS PAGE OVER UNTIL YOU ARE TOLD TO DO SO.

Section A (50 marks)

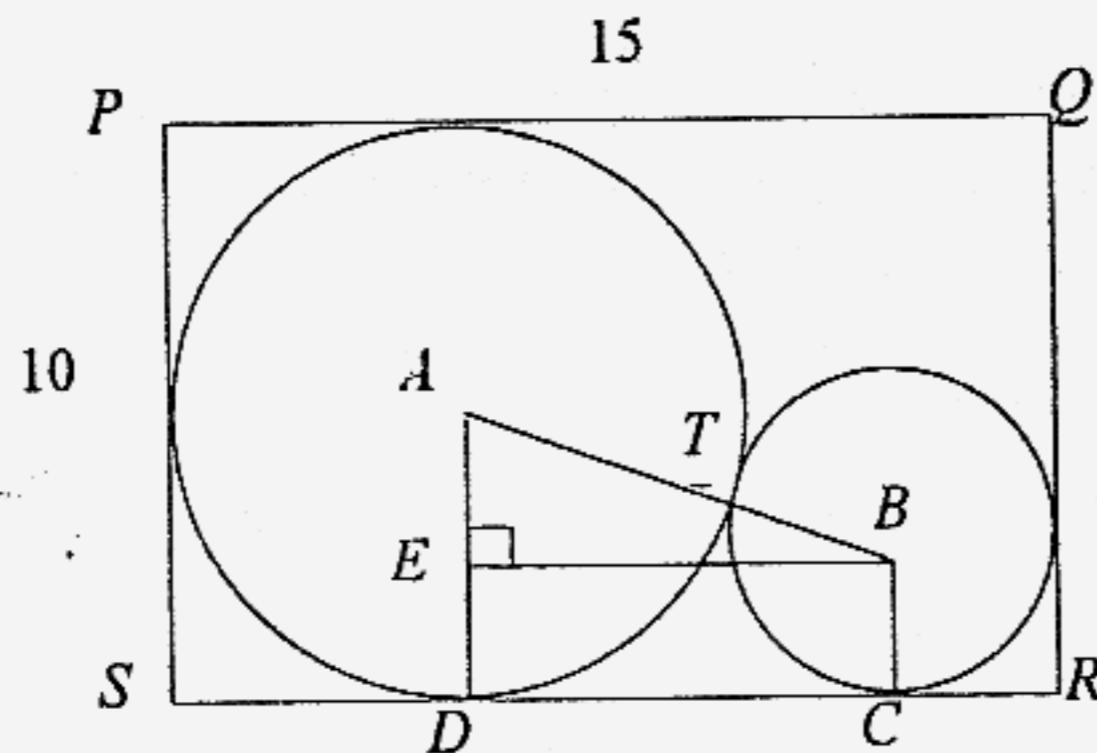
Answer ALL questions in this section.

1 a) Simplify $\frac{9v - 21}{9v^2 - 49}$ [2]

b) Express as a single fraction $\frac{4}{2x-1} - \frac{3}{3x-2}$ [2]

2 The ratio of the surface area of 2 geometrically similar cylinders of the same material is 25 : 81. Both cylinders are filled with water. The mass of water in the larger cylinder is 24 kg. Find the mass of water in the smaller cylinder. [3]

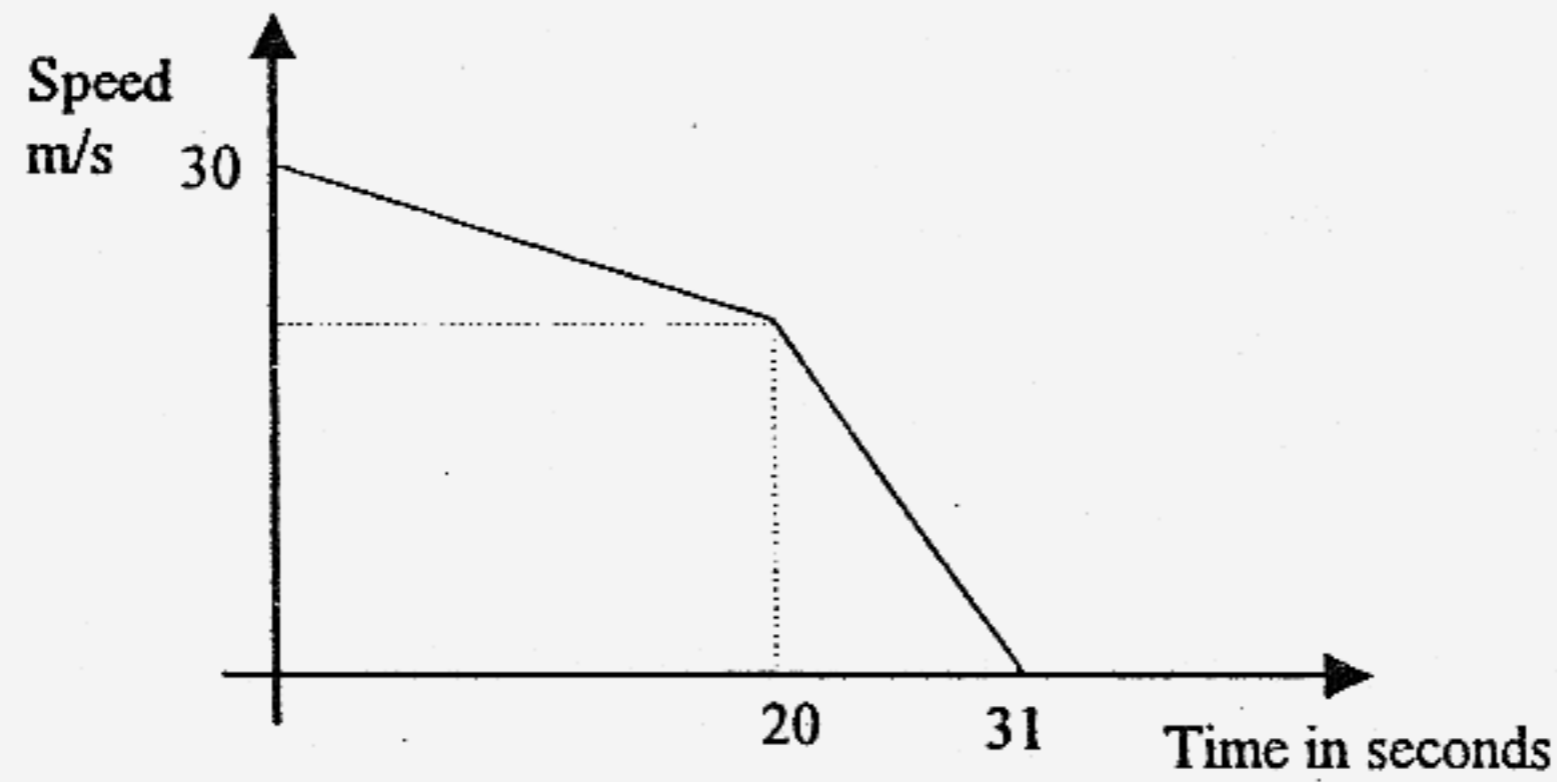
3 The diagram shows a rectangle PQRS, with sides of length 15 cm and 10 cm. The larger circle, centre A touches 3 sides of the rectangle. The smaller circle, centre B, touches 2 sides of the rectangle, and touches the large circle at the point T.



The circle touches the side SR at D and C. The point E is the foot of the perpendicular from B to AD. The radius of the large circle is 5 cm, and the radius of the smaller circle is x cm.

- a) Write down, in terms of x, an expression for the length of
 (i) AB, (ii) CR, (iii) DC, [3]
- b) Explain why $AE = (5 - x)$ cm. [1]
- c) Form an equation in x and show that it reduces to $x^2 - 40x + 100 = 0$. [2]
- d) Solve this equation, giving your answer correct to 3 significant figures. [1]
- e) Hence find the radius of the small circle, correct to the nearest mm. [1]

- 4 The diagram shows the speed-time graph of a car. The car decelerates uniformly from a speed of 30 m/s for 20 seconds at the rate of 0.4 m/s^2 . It is then brought to rest after a further 11 seconds.



Calculate

- a) the speed of the car at $t = 20$ seconds, [2]
- b) the rate of change of speed during the last 5 seconds, [1]
- c) the average speed for the whole journey. [3]

- 5 a) The table below shows the distribution of the weight of the students in a school.

Weight (kg)	Number of Students
$35 < x \leq 40$	7
$40 < x \leq 45$	28
$45 < x \leq 50$	19
$50 < x \leq 55$	22
$55 < x \leq 60$	14

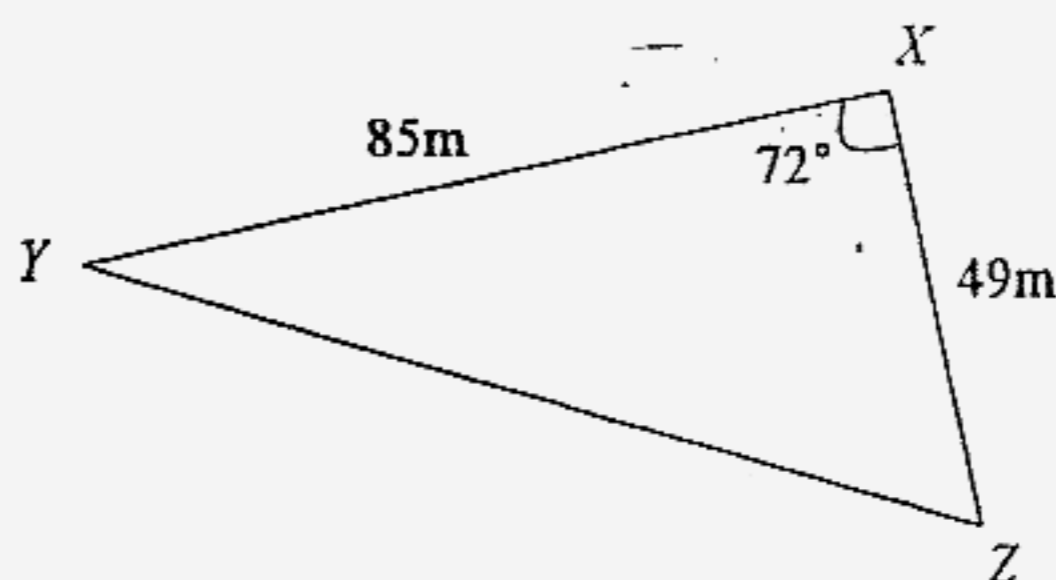
Calculate the mean weight of the students in the school. State the median and modal class of the distribution. [3]

- b) Some students took a class test in September. Below is a stem-and-leaf diagram for the results of the tests of these students.

0	7	9			
1	0	3	8	8	
2	2	5	0	9	4
3	3	6	1	5	7
4	1	5	6	9	

- (i) How many students took the test? [1]
 (ii) If the passing mark for the test is 25, what is the percentage of the students who fail? [2]

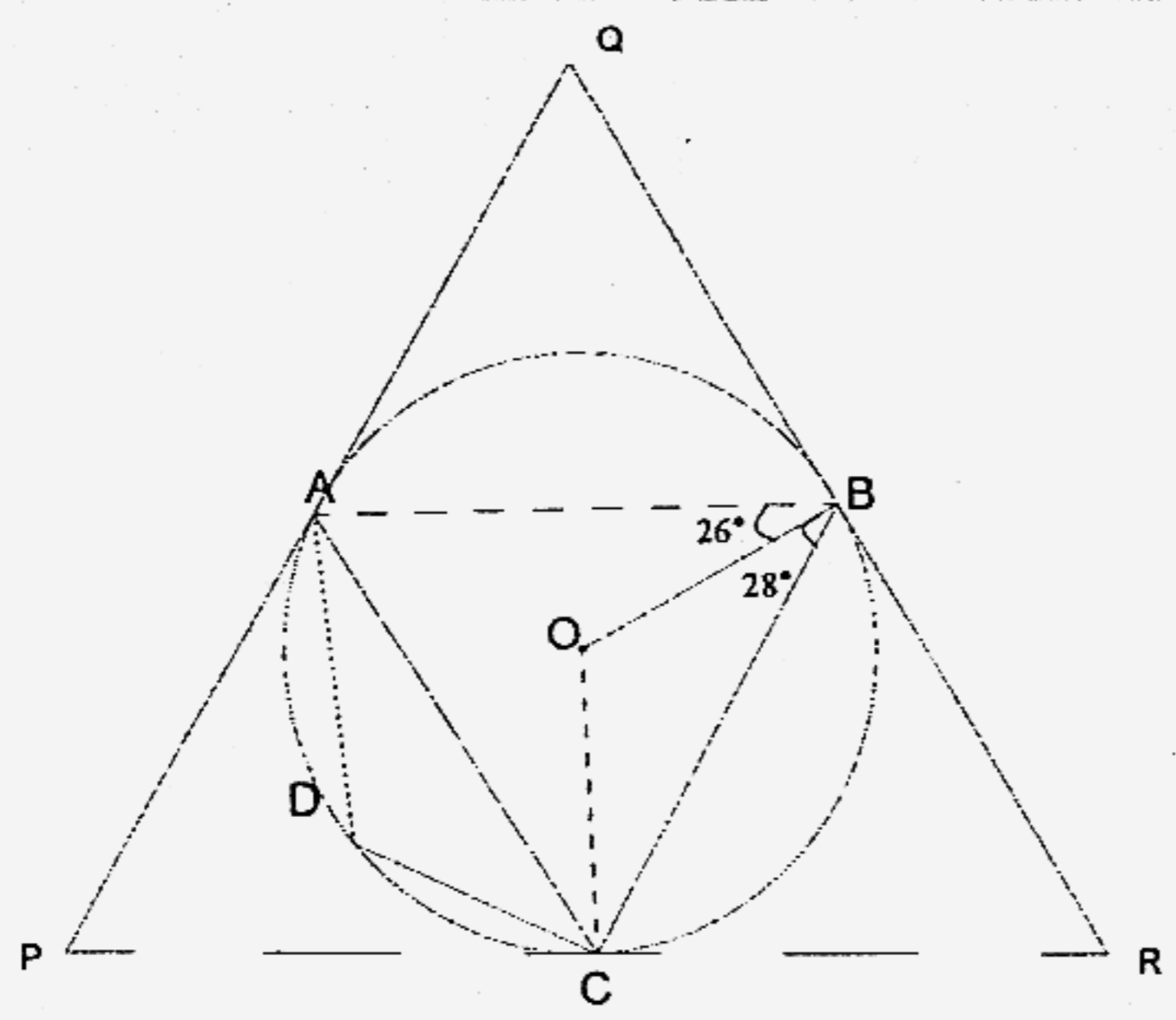
- 6 In the diagram, XYZ represents a horizontal field where $XY = 85\text{m}$, $XZ = 49\text{m}$ and $\hat{YXZ} = 72^\circ$



Calculate

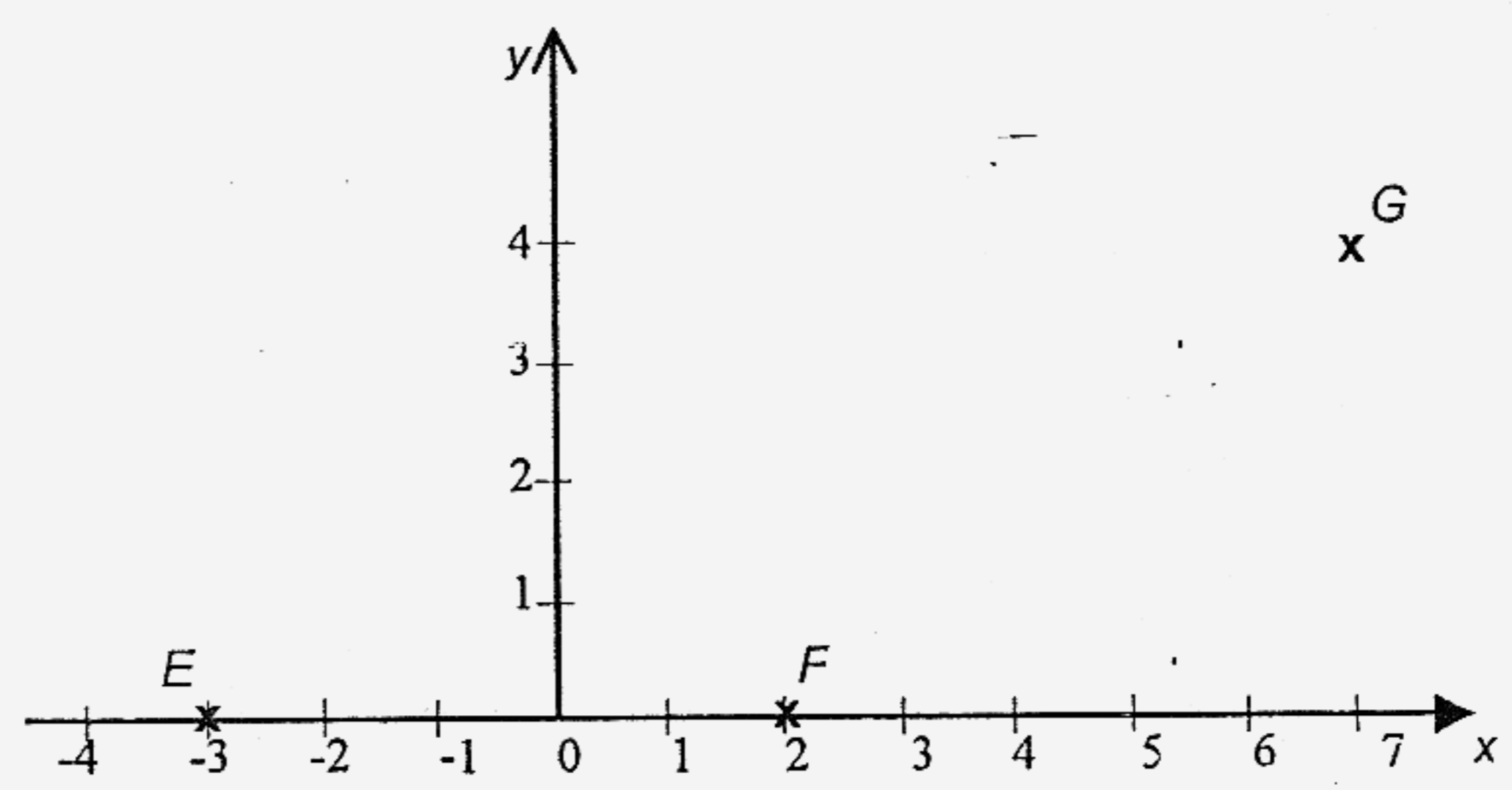
- a) the length of YZ [3]
 b) the area of the field XYZ [2]
 c) If there is a tree of height 10.5m planted at X, calculate the greatest angle of elevation of the top of the tree when viewed from any point on YZ. [3]

7



- O is the centre of the circle ABCD. PQ, QR and PR are the tangents of the circle produced. Given that $\hat{ABO} = 26^\circ$ and $\hat{OBC} = 28^\circ$. Find
- a) \hat{AQB} , [2]
 - b) \hat{ACO} , [2]
 - c) \hat{QPC} , [2]
 - d) \hat{ADC} , [2]
 - e) \hat{CRB} . [2]

8



- $EFGH$ is a parallelogram.
- E is $(-3, 0)$, F is $(2, 0)$, and G is $(7, 4)$. Find
- a) the coordinates of H . [1]
 - b) the coordinates of the midpoint of EG . [1]

c) the equation of the line FG .

[2]

d) the area of parallelogram $EFGH$.

[1]

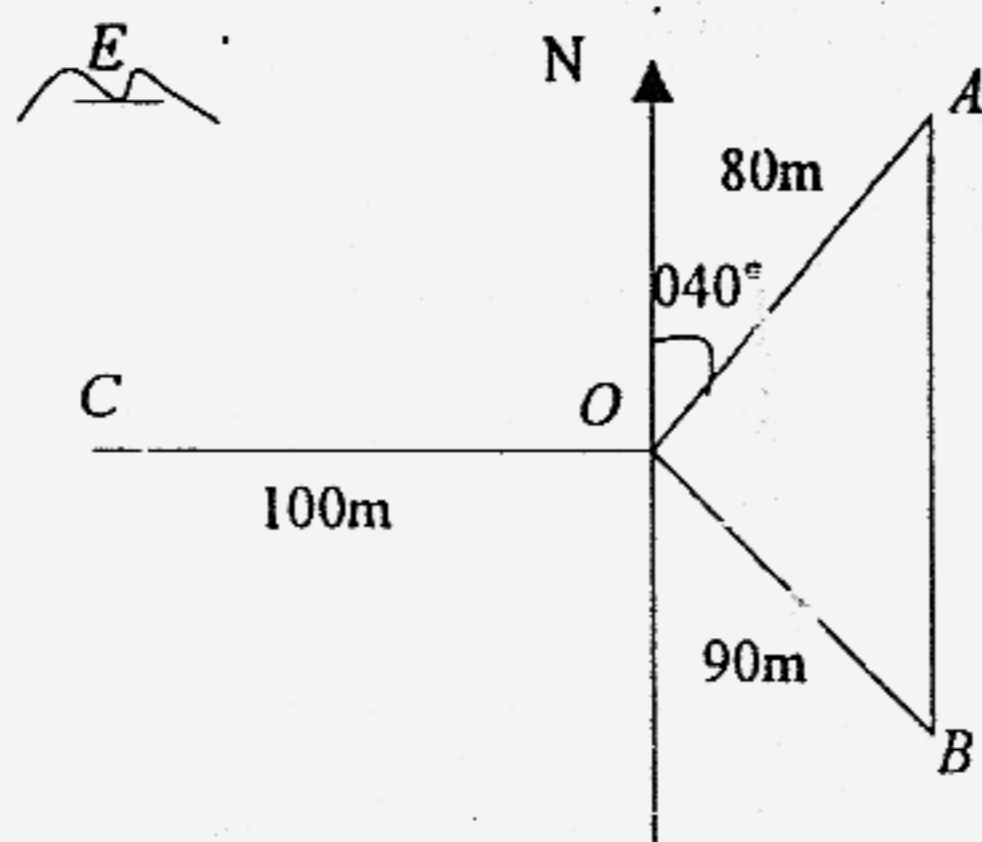
Section B (10 marks)Answer **ONE** question in this section**EITHER****9 Answer the whole of this question on a sheet of graph paper.**The table below gives some values of x and the corresponding values of y , correct totwo decimal places where $y = 8x + \frac{8}{x^2}$

x	0.5	0.75	1	1.5	2	2.5	3	3.5	4
y	36	20.2	16	15.6	18	21.3	24.9	28.7	32.5

- a) Using a scale of 4 cm to represent 1 unit, draw a horizontal x -axis for $0 \leq x \leq 4$. Using a scale of 4 cm to represent 10 units, draw a vertical y -axis for $0 \leq y \leq 40$. On your axes, plot the points given in the table and join them with a smooth curve. [3]
- b) Use your graph to find
- (i) a solution of $8x + \frac{8}{x^2} = 20$, [1]
- (ii) the least value of $8x + \frac{8}{x^2}$. [1]
- c) By drawing a tangent, find the gradient of the curve at the point $x = 0.7$. [2]
- d) On the axes used in part (b), draw the graph of the straight line $y = 30 - 3x$, for values of $x = 0$ to $x = 4$. [2]
- e) Write down the x coordinates of the points at which the two graphs intersect. [1]

OR

10



- a) A surveyor is carrying out a survey on horizontal ground. From a point O , he observes a point A which is 80m from O on a bearing of 040° . The surveyor also observes a point B which is 90m from O and due south of point A . Calculate the angle OBA . [2]
- b) The point C is 100m due west of O . If the surveyor walks directly from C to A , how far does he walk? [3]
- c) A bird is hovering at E , which is vertically above C . The angle of elevation of the bird from A was 25° . Calculate
- the height of the bird above C . [2]
 - the angle of elevation of the bird from point O . [1]
- d) Another bird, hovering at a height of 40m above the triangular ground ABC , saw a prey at an angle of depression of 50° . Calculate the distance the bird must fly to catch its prey. [2]

End of Paper

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End-of-Year Exam 2006

Sec 3 Exp Maths Paper 1

Ngee Ann Sec School

1 (a) 2.61×10^{-3}
(b) 1.28×10^7

2 (a) $-3.2 \times 10^{-1}, 2.3 \times 10^{-2}, 2^{-2}, 2^0$
(b) $n = 3\frac{1}{2}$ or 3.5

3 (a) $(x-3)(x-3y)$
(b) $y = \frac{3A^2}{2-A^2}$

4 (a) $x = 3$
(bi) $-\frac{4}{5}$
(bii) 25

5 (a) $A = 2$
(b) $p = 0$
(c) $q = 1$ or -3

6 (a) Given $\angle PQR = \angle PTS$, $\angle QPR = \angle TPS$ & $\angle QRP = \angle TSP$, triangles are similar (AAA)
(bi) $QS = 8\frac{2}{3}$
(bii) $\frac{9}{49}$

7 (a) $\frac{35}{x}$
(b) $2\frac{1}{2}$ days

8 (a) i) $y = \frac{1}{x^2}$ ii) $y = -x^2$
(bi) $y = -3$
(bii) $y = x + 7$

9 (a) $\angle SRL = 55^\circ$
(b) 125°
(c) 250°

10 (a) $AD = 20$ cm
(bi) $\tan \angle CAB = \frac{5}{12}$
(bii) $\sin \angle ACD = \frac{12}{13}$
(biii) $\cos \angle ADE = -\frac{4}{5}$

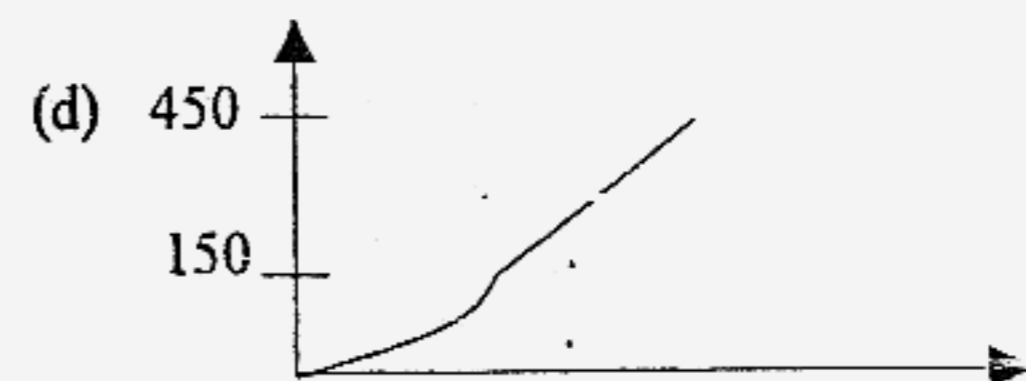
11 (a) Find angles $\angle ACB$, then $\angle WCX$. Since $\angle WYX$ is twice $\angle WCX$, therefore Y is centre of circle 2.
(b) Find angles $\angle WZY$ (cyclic quad), $\angle ZWY$ & $\angle ZYW$. Since $\angle ZWY$ & $\angle ZYW$ are equal, triangle is isosceles. So $WZ = YZ$.

12 (a) $0 \leq x < 17$ or $x < 17, x \leq 16$
(b) Mean = 1.7
(c) Median = 2

13 $\angle BXC = 116^\circ$

14 (a) $\frac{13}{99}$
(b) $\frac{623}{999}$

15 (a) 300 m
(b) 3 m/s^2
(c) 15 m/s



16 (b) no. of diagonals = 9; $1+2+3+3$; $1+2+3+4+4$
(c) $12+3+4+5+6+7+8+9+9 = 54$
(d) $x + n + 1$

ANSWERS

End-of-Year Exam 2006

Sec 3 Exp Maths Paper 2

Ngee Ann Sec School

- 1 (a) $\frac{3}{(2v+7)}$
 (b) $\frac{6x-5}{(2x-1)(3x-2)}$
- 2 4.22 kg
- 3 (a) i) $AB=5+x$ or $\sqrt{20x}$ (use PT)-
 ii) $CR=x$
 iii) $DC=10-x$
 (b) $AE=5-x$
 (d) $x=37.32$ (reject) or 2.68
 (e) Radius= $2.68\text{cm}=27\text{mm}$
- 4 (a) Speed = 22 m/s
 (b) Rate of change = -2 m/s^2
 (c) Average speed= 20.7 m/s
- 5 (a) Mean= 47.9 kg
 Median $45 < x \leq 50$
 Modal class= $40 < x \leq 45$
 (b) i) 20 students
 ii) 45%
- 6 (a) $YZ=84.0\text{ m}$ (3 s.f)
 (b) Area of XYZ = 1980 m^2
 (c) greatest angle of elevation
 = 12.5°
- 7 (a) $AQB=52^\circ$
 (b) $ACO=36^\circ$
 (c) $QPC=72^\circ$
 (d) $ADC=126^\circ$
 (e) $CRB=56^\circ$
- 8 (a) $H=(2,4)$
 (b) midpt of EG = $(2,2)$
 (c) $y=\frac{4}{5}x-\frac{8}{5}$
 (d) 20 units^2
- 9 (b) i) $x=0.75$ or 2.3
 ii) $y=15$
 (c) gradient = -38
 (e) i) $x=0.6$ or 2.6
- 10 (a) $OBA=34.8^\circ$
 (b) $AC=163.4\text{ m}$
 (c) i) 76.2 m
 ii) 37.3°
 (d) 52.2 m

9(a) & (d)

