

Name: _____ ()

Class: _____



MONTFORT SECONDARY SCHOOL

PRELIMINARY EXAMINATION

Secondary 4 Express/ 5 Normal (Academic)

MATHEMATICS

Paper 1

4052/01

26 August 2025 (Tue)

2 hours 15 minutes

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your name, class and register number on all the work you hand in.

Write in dark blue or black pen.

You may use a pencil for any diagrams or graphs.

Do not use staples, paper clips, glue or correction fluid.

Answer **all** questions.

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

If working is needed for any question it must be shown with the answer.

Omission of essential working will result in loss of marks.

The total number of marks for this paper is 90.

The use of an approved scientific calculator is expected, where appropriate.

If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.

For π , use either your calculator value or 3.142.

This document consists of **22** printed pages.

Mathematical Formulae

Compound interest

$$\text{Total amount} = P \left(1 + \frac{r}{100} \right)^n$$

Mensuration

$$\text{Curved surface area of a cone} = \pi r l$$

$$\text{Surface area of a sphere} = 4\pi r^2$$

$$\text{Volume of a cone} = \frac{1}{3} \pi r^2 h$$

$$\text{Volume of a sphere} = \frac{4}{3} \pi r^3$$

$$\text{Area of triangle } ABC = \frac{1}{2} ab \sin C$$

$$\text{Arc length} = r\theta, \text{ where } \theta \text{ is in radians}$$

$$\text{Sector area} = \frac{1}{2} r^2 \theta, \text{ where } \theta \text{ is in radians}$$

Trigonometry

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$

Statistics

$$\text{Mean} = \frac{\sum fx}{\sum f}$$

$$\text{Standard deviation} = \sqrt{\frac{\sum fx^2}{\sum f} - \left(\frac{\sum fx}{\sum f} \right)^2}$$

Answer **all** the questions.

- 1 The number of people in a theatre is given as 2500, correct to the nearest hundred.
Write down the minimum number of people that could be in the theatre at this time.

Answer [1]

- 2 Solve $7 - 8x = 25$.

Answer $x =$ [1]

- 3 Simplify $9a - 5b - 2a + 3b$.

Answer [1]

- 4 (a) $\frac{26.18^3}{\sqrt{4.52 - 0.4^2}}$
Calculate $\frac{26.18^3}{\sqrt{4.52 - 0.4^2}}$.
Write down the first six digits of your answer.

Answer [1]

- (b) Write your answer to part (a) correct to 2 significant figures.

Answer [1]

5

The **sum** of the first n terms of a linear sequence is $\frac{1}{2}n(7n-1)$.

(a) Find the first 3 terms of the sequence.

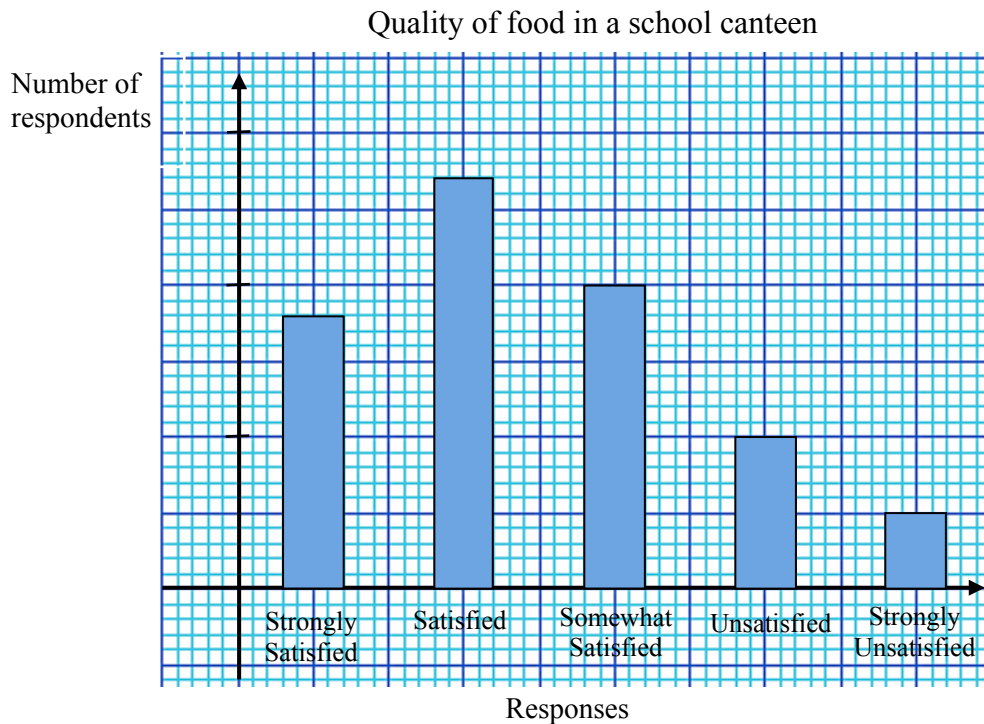
Answer , [2]

(b) Find in terms of n , an expression for the n th term of the sequence.

Answer [1]

6 The bar graph below shows the results of a survey conducted on the quality of food

(e.g. ingredients, portion and taste, etc.) in a school canteen.



- (a) Calculate the number of respondents who answered *Satisfied* as a percentage of the respondents who answered *Unsatisfied*.

Answer% [1]

- (b) Suggest the use of another statistical diagram to represent the results of the survey conducted that shows the relative size of a part in relation to the whole.

Answer [1]

7 $\sin(2x) = 0.8$

Find two possible values of x in the range $0 \leq x \leq \frac{\pi}{2}$ radians.

Answer $x = \dots\dots\dots$ or $x = \dots\dots\dots$ [2]

8 Yue makes 40 medium fruit pies.

The number of small, medium and large pies he makes made each day are in the ratio 5 : 2 : 8 respectively.

(a) How many large fruit pies does he make?

Answer $\dots\dots\dots$ [1]

(b) How many fruit pies does he make altogether?

Answer $\dots\dots\dots$ [1]

9 Express as a single fraction in its simplest form $\frac{3x}{4} - \frac{2(x-1)}{3}$.

Answer $\dots\dots\dots$ [2]

10 The stem-and-leaf diagram shows the heights of 10 students.

Stem	Leaf			
15	0	1	4	8
16	1	2	2	
17	1	2	3	

Key: 15 | 0 represents 150 cm

- (a) Find the mean height.

Answer cm [1]

- (b) Find the standard deviation of the heights.

Answer cm [1]

- (c) It was discovered that all the heights had been recorded wrongly.
The correct height of each student was 2 cm taller.

Without any calculations, explain how the mean and standard deviation will change after the height adjustment.

.....

 [2]

- 11 (a) Express 450 as the product of its prime factors.

[Turn over

Answer [1]

- (b) Find two numbers, both smaller than 100, that have a lowest common multiple of 450 and a highest common factor of 15.

Answer and [2]

- 12 Andrew invests \$15 000 into an account.

The balance, \$ A , of the account after t years is given by the formula $A = 15000 \times 1.032^t$.

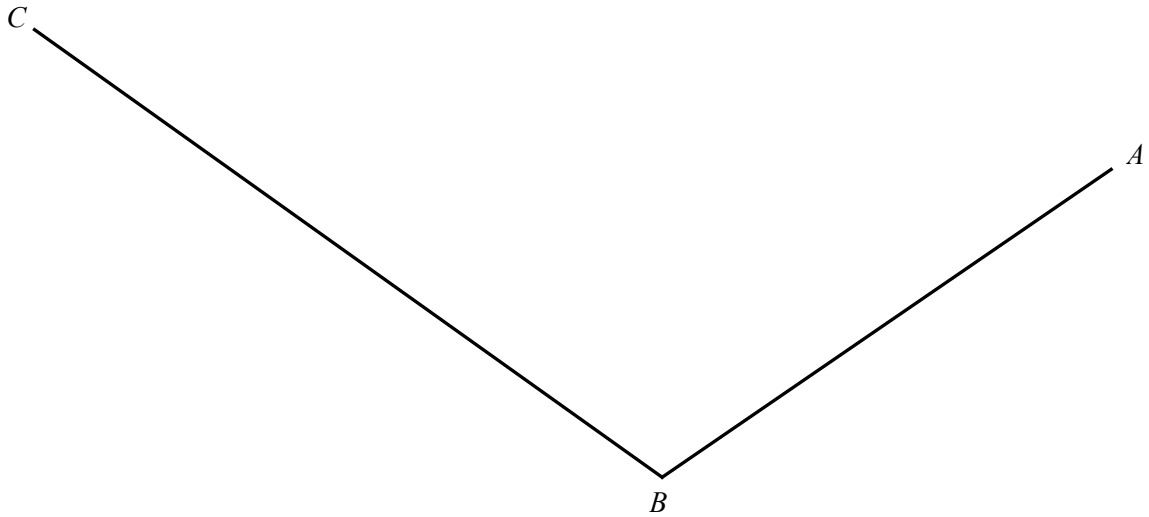
- (a) Calculate A when $t = 3$.

Answer \$ [1]

- (b) Find the percentage increase in the balance after the 3 years.

Answer% [2]

- 13 The drawing in the answer space below shows the positions of the towers A , B and C .



- (a) Construct the perpendicular bisector of BC . [1]
- (b) Construct the bisector of angle ABC . [1]
- (c) A mall is to be built equidistant from AB and BC , and is nearer to C than to B .
Mark clearly a possible position of this mall and label it, M . [1]
-

14 Given that $uv = \sqrt{u^2 - 2t}$, express u in terms of v and t .

[Turn over

Answer [3]

15 Factorise completely.

(a) $8x + 32xy$

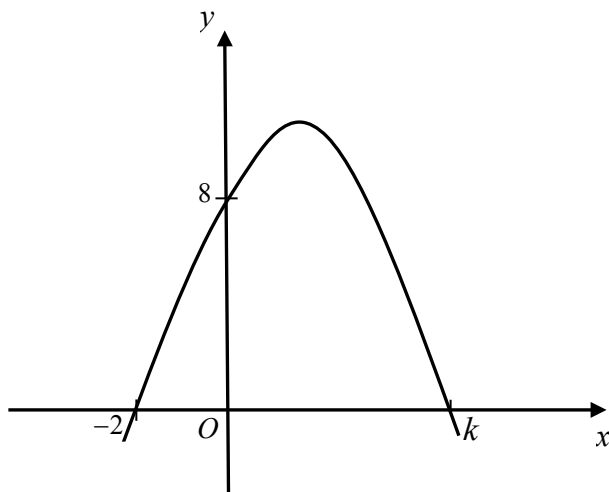
Answer [1]

(b) $6ax - 4ay - 9bx + 6by$

Answer [2]

16 The graph of $y = -(x-1)^2 + q$ is given below.

The y -intercept is 8 and both x -intercepts are -2 and k .

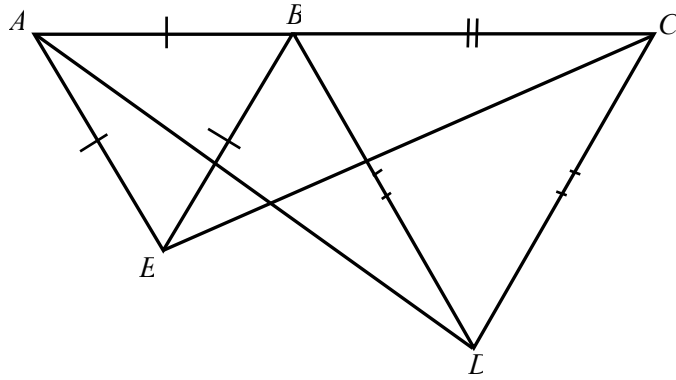


- (a) Find the value of k .

Answer $k = \dots\dots\dots$ [1]

- (b) Find the coordinates of the maximum point.

Answer ($\dots\dots\dots$, $\dots\dots\dots$) [2]



In the diagram, ABC is a straight line, and triangles ABE and BCD are equilateral triangles.

Show that triangle ABD and triangle EBC are congruent.

Give a reason for each statement you make.

Answer

[3]

- 18 (a)** Solve the inequalities $-16 \leq 7 - 2x < 1$.

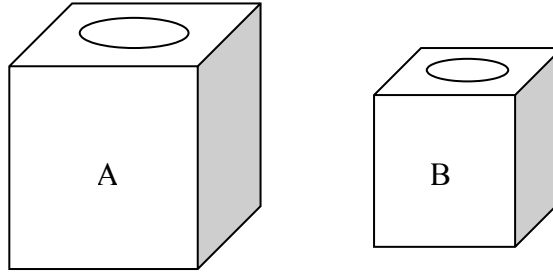
Answer [2]

- (b)** Write down the largest perfect square that satisfies $-16 \leq 7 - 2x < 1$.

Answer [1]

- 19** Two containers shown below are geometrically similar.

The volume of container A is 729 cm^3 and the volume of container B is 343 cm^3 .



- (a) The height of container B is 4 cm shorter than that of container A.
Find the height of container A.

Answer cm [2]

- (b) 98 g of paint is required to coat container B.
Find the amount of paint required to coat container A.

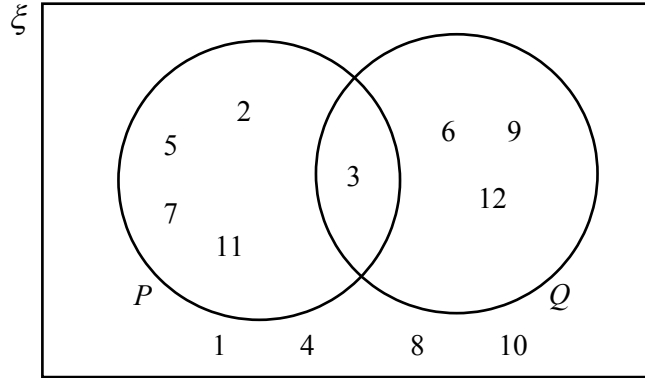
Answer g [2]

$$\xi = \{\text{integers } x : 1 \leq x \leq 12\}$$

$$P = \{2, 3, 5, 7, 11\}$$

$$Q = \{3, 6, 9, 12\}$$

This information is shown on the Venn diagram.



- (i) Describe the elements of set P .

..... [1]

- (ii) Find the value of $n(P \cup Q)$.

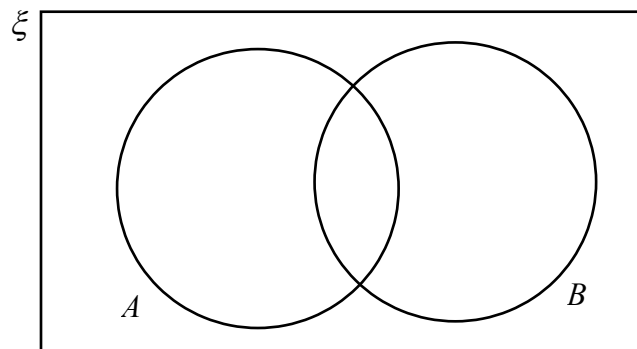
Answer [1]

- (iii) $R = \{x : x \text{ is a multiple of } 6\}$

Use set notation to describe the relationship between Q and R .

Answer [1]

- (b) On the Venn diagram, shade the region which represents the set $A \cap B'$.

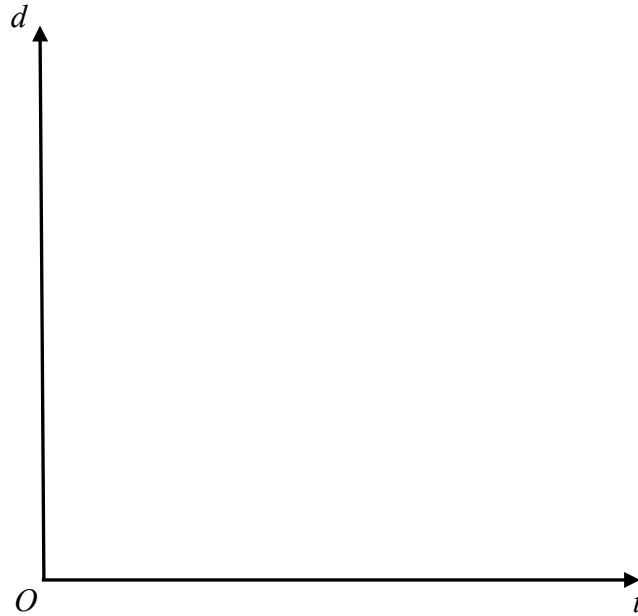


[1]

- 21** An object starts from rest and travels in a straight line.
The distance travelled, d metres, is directly proportional to the square of the travelling time, t seconds.

(a) Sketch a distance-time graph for the object.

Answer



[1]

In the first 4 seconds, the object travels 48 m.

(b) Find the equation for d in terms of t .

Answer $d = \dots\dots\dots$ [2]

(c) Calculate the distance travelled in the first 8 seconds.

Answer $\dots\dots\dots$ metres [1]

- 22** (a) A ship has an average fuel consumption of 0.000 475 kilometres per litre.
Write this consumption in litres per kilometre.

Answer litres/km [1]

(b) A map has a scale of 1 : 2500 000.

(i) The distance between city X and city Y on the map is 12.8 cm.

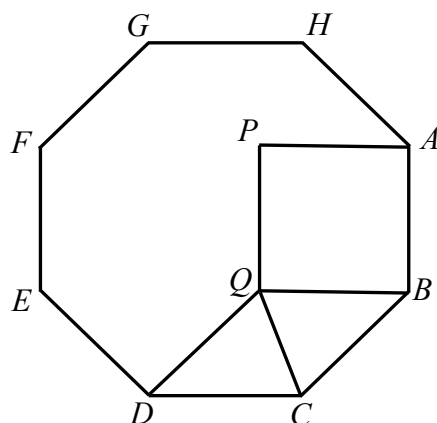
Calculate the distance, in kilometres, between these two cities.

Answer km [2]

(ii) The area of a plantation is 280.5 km^2 .

Calculate the area, in square centimetres, of the plantation on the map.

Answer cm^2 [2]



The diagram shows a regular octagon, a square and two triangles.

- (a) Calculate angle BQC .

Answer^o [3]

- (b) Explain why the quadrilateral $BCDQ$ is a rhombus.

Answer

.....

 [2]

- 24 (a) Box X contains 3 balls numbered 2, 3 and 4.

Box *Y* contains another 3 balls numbered 1, 5 and 6.

In a game, Hafi drew a ball at random from each box, and the sum of both numbers is obtained.

- (i) Complete the possibility diagram below.

		Box <i>Y</i>		
Box <i>X</i>	+	1	5	6
	2	3		
	3		8	
	4			10

[2]

- (ii) Find the probability that the sum is a multiple of **one** of the two numbers drawn.

Answer [1]

- (b) Min wants to do a survey on reading.
She uses this question in the survey.

How many books did you read?
Tick one box.

☐
 0 – 1

☐
 1 – 4

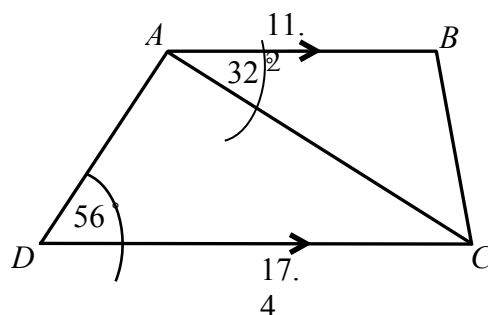
☐
 4 – 7

☐
 more than 7

Give **two** reasons why her data might be unreliable.

Answer

1.
2. [2]



$ABCD$ is a trapezium.

$AB = 11.2$ cm, $CD = 17.4$ cm, angle $BAC = 32^\circ$ and angle $ADC = 56^\circ$.

Calculate

(a) angle CAD ,

Answer[°] [2]

(b) the area of trapezium.

Answer cm² [4]

26 In supermarket H, prawns cost \$18 per kg, salmon costs \$30 per kg and squid costs \$25 per kg.

In supermarket J, prawns cost \$1.50 more per kg, salmon costs \$2.50 less per kg and squid costs \$0.80 more per kg than supermarket H.

$$\mathbf{Q} = \begin{matrix} & \begin{matrix} \text{H} & \text{J} \end{matrix} \\ \begin{pmatrix} 18 & 1.50 \\ 30 & -2.50 \\ 25 & 0.80 \end{pmatrix} & \begin{matrix} \text{prawns} \\ \text{salmon} \\ \text{squid} \end{matrix} \end{matrix}$$

The information can be represented by the matrix

- (a) Natalie and Mike go shopping.
Natalie buys 3 kg of prawns, 2 kg of salmon and 1 kg of squid.
Mike buys 5 kg of prawns and 4 kg of salmon.

Represent their purchases in a 2×3 matrix $\mathbf{P}$.

Answer $\mathbf{P} = \begin{pmatrix} & & \\ & & \end{pmatrix}$ [1]

- (b) Evaluate the matrix $\mathbf{R} = \mathbf{PQ}$.

Answer $\mathbf{R} =$ [2]

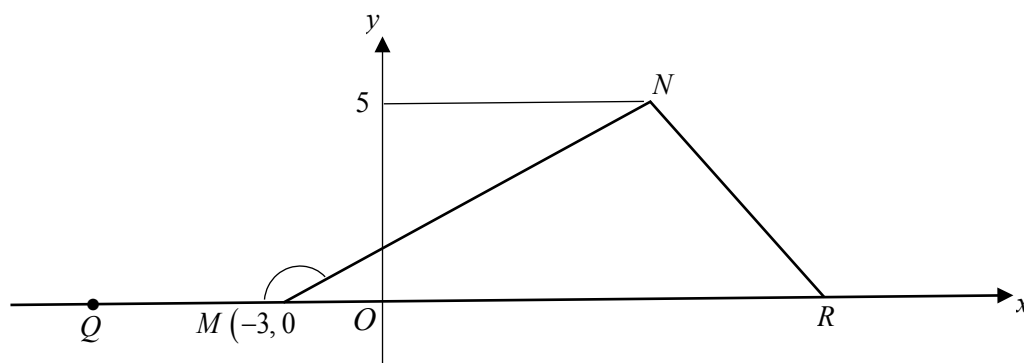
- (c) How much money would Mike save by shopping in supermarket J?

Answer \$ [1]

- (d) Natalie shops in supermarket H.
She uses a shopping voucher that gives a discount of 15%.
How much does she pay altogether for her items?

Answer \$ [2]

- 27 (a) In triangle MNR , point M is $(-3, 0)$ and $\sin \angle NMR = \frac{5}{13}$.
 Q is a point on the negative x -axis.



- (i) The area of triangle MNR is 50 square units.
 Find the coordinates of R .

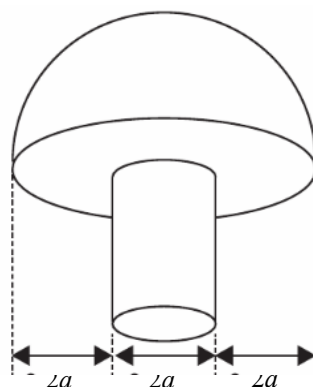
Answer (.....,) [2]

- (ii) Express $\cos \angle NMQ$ as a fraction.

Answer [2]

(b)

[Turn over



A toy mushroom is made by joining a solid hemisphere to a solid cylinder with dimensions shown above.

The height of the cylinder is four times its radius.

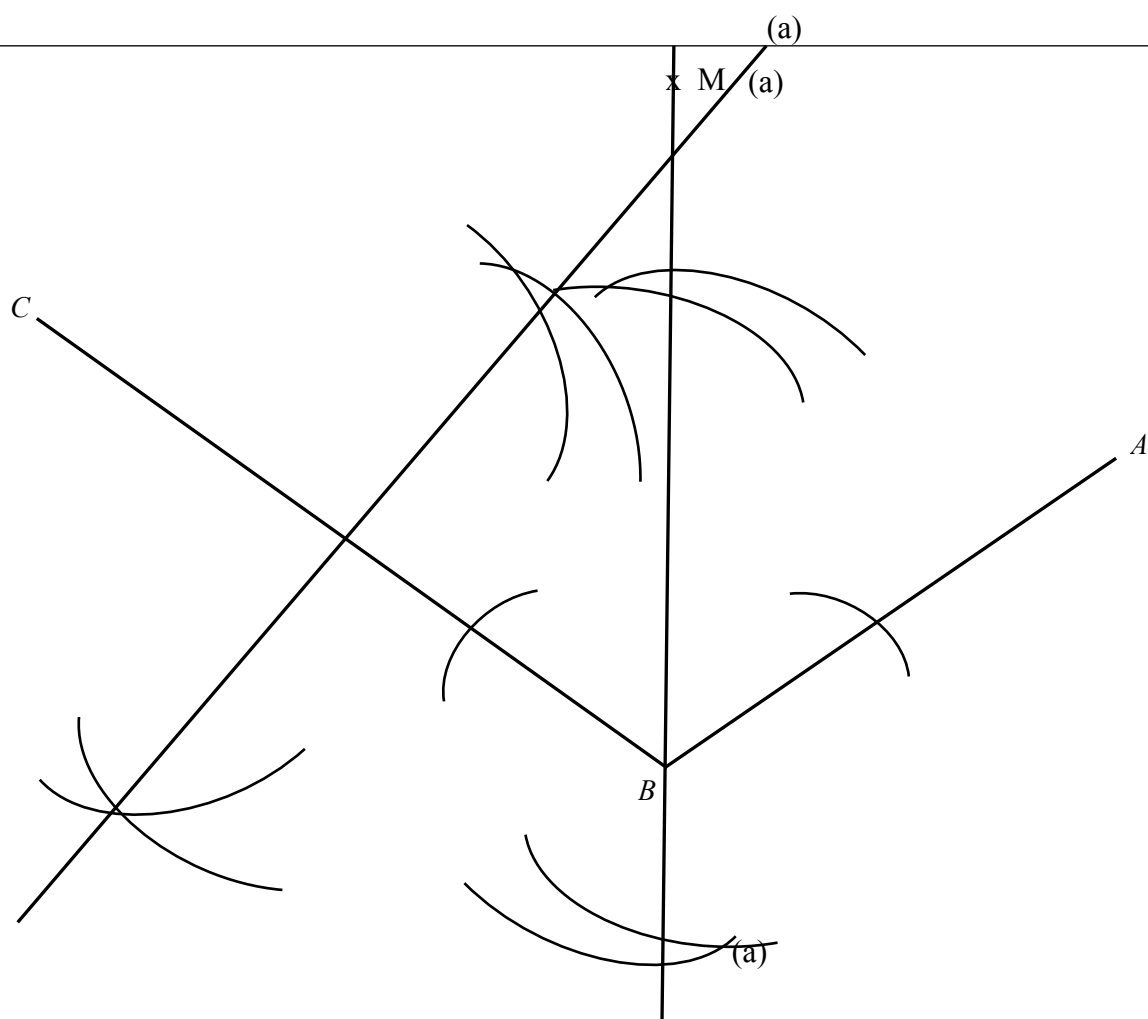
Find in terms of π and a , the total surface area of the toy.

Answer cm² [3]

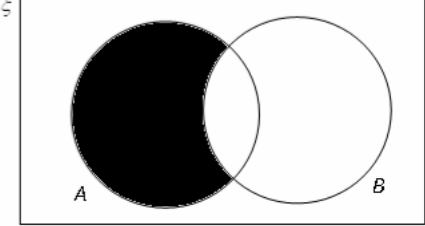
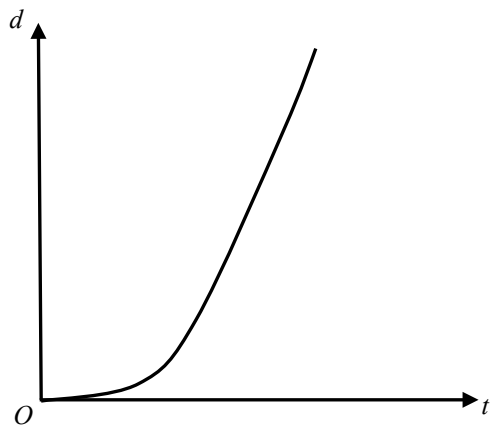
END OF PAPER

Qn		Answer Key
1		2450
2		$-2\frac{1}{4}$
3		$7a - 2b$
4	(a)	8593.41
	(b)	8600
5	(a)	3, 10, 17

	(b)	$7n - 4$								
6	(a)	270%								
	(b)	Pie Chart								
7		0.464 or 1.11 rad								
8	(a)	160								
	(b)	300								
9		$\frac{x + 8}{12}$								
10	(a)	161.4 cm								
	(b)	8.03 cm								
	(c)	Mean will increase by 2 cm. No change to the standard deviation.								
11	(a)	$2 \times 3^2 \times 5^2$								
	(b)	75 and 90 (see working below) <table><tr><td>75 =</td><td>$2^0 \times 3 \times 5^2$</td></tr><tr><td>90 =</td><td>$2^1 \times 3^2 \times 5$</td></tr><tr><td>450 = LCM</td><td>$2^1 \times 3^2 \times 5^2$</td></tr><tr><td>15 = HCF</td><td>3×5</td></tr></table>	75 =	$2^0 \times 3 \times 5^2$	90 =	$2^1 \times 3^2 \times 5$	450 = LCM	$2^1 \times 3^2 \times 5^2$	15 = HCF	3×5
75 =	$2^0 \times 3 \times 5^2$									
90 =	$2^1 \times 3^2 \times 5$									
450 = LCM	$2^1 \times 3^2 \times 5^2$									
15 = HCF	3×5									
12	(a)	\$16 486.57								
	(b)	9.91%								
13										



14		$u = \pm \sqrt{\frac{2t}{1-v^2}}$
15	(a)	$8x(1+4y)$
	(b)	$(3x-2y)(2a-3b)$
16	(a)	$k = 4$
	(b)	$8 = -(0-1)^2 + q$ $q = 9$ Max. point (1, 9)
17		1) $AB = EB$ (sides of an equilateral triangle) 2) $BD = BC$ (sides of an equilateral triangle) 3) $\angle ABD = 180^\circ - 60^\circ$ (adj. $\angle$ on a st. line) $\quad = \angle EBC$ $\quad = 120^\circ$ $\therefore$ triangle ABD is congruent to triangle EBC (SAS)
18	(a)	$3 < x \leq 11\frac{1}{2}$
	(b)	9

19	(a)	18 cm
	(b)	162g of paint
20	(a)	(i) P is the set of prime numbers (ii) 4 elements (iii) $R \subset Q$
	(b)	
21	(a)	
	(b)	$d = 3t^2$
	(c)	$d = 192$
22	(a)	0.000475 km/litre $\therefore 1 \text{ km} \rightarrow \frac{1}{0.000475}$ $= 2105.26 \approx 2110 \text{ litres/km}$
	(b)	(i) 320 km (ii) 280.5 km^2 is represented by 0.4488 cm^2
23	(a)	$\angle BQC = 67.5^\circ$
	(b)	By symmetry, BC is parallel to QD and BQ is parallel to CD In addition, $BQ = AB$ (sides of a square) Therefore, $AB = BC = CD$ (sides of a regular polygon) Conclude that $BCDQ$ is a rhombus
24	(a)	

		Box X + 2 3 4 Box Y 1 3 4 5 5 7 8 9 6 8 9 10 The probability is $\frac{5}{9}$
	(b)	1. The question does not indicate a time frame. 2. The intervals for the number of books read are not continuous / inconsistently used.
25	(a)	$\angle CAD = 180^\circ - 32^\circ - 56^\circ$ $= 92^\circ$
	(b)	Area of $ABCD$ 109 cm^2 (3 s.f.)
26	(a)	$\mathbf{P} = \begin{pmatrix} 3 & 2 & 1 \\ 5 & 4 & 0 \end{pmatrix}$
	(b)	$\begin{pmatrix} 139 & 0.3 \\ 210 & -2.50 \end{pmatrix}$
	(c)	Mike will save \$2.50
	(d)	Amount paid = \$118.15
27	(a)	(i) $R(17, 0)$ (ii) $\cos \angle NMQ = -\frac{12}{13}$
	(b)	$35\pi a^2$