

Please check the examination details below before entering your candidate information

Candidate surname

Other names

Centre Number

Candidate Number

**Pearson Edexcel Level 1/Level 2 GCSE (9–1)**

**Wednesday 14 June 2023**

Morning (Time: 1 hour 30 minutes)

**Paper  
reference**

**1MA1/3H**

**Mathematics**  
**PAPER 3 (Calculator)**  
**Higher Tier**



**You must have:** Ruler graduated in centimetres and millimetres, protractor, pair of compasses, pen, HB pencil, eraser, calculator, Formulae Sheet (enclosed). Tracing paper may be used.

Total Marks

### Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided  
– *there may be more space than you need.*
- You must **show all your working**.
- Diagrams are **NOT** accurately drawn, unless otherwise indicated.
- **Calculators may be used.**
- If your calculator does not have a  $\pi$  button, take the value of  $\pi$  to be 3.142 unless the question instructs otherwise.

### Information

- The total mark for this paper is 80
- The marks for **each** question are shown in brackets  
– *use this as a guide as to how much time to spend on each question.*

### Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

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## Higher Tier Formulae Sheet

### Perimeter, area and volume

Where  $a$  and  $b$  are the lengths of the parallel sides and  $h$  is their perpendicular separation:

$$\text{Area of a trapezium} = \frac{1}{2} (a + b) h$$

Volume of a prism = area of cross section  $\times$  length

Where  $r$  is the radius and  $d$  is the diameter:

$$\text{Circumference of a circle} = 2\pi r = \pi d$$

$$\text{Area of a circle} = \pi r^2$$

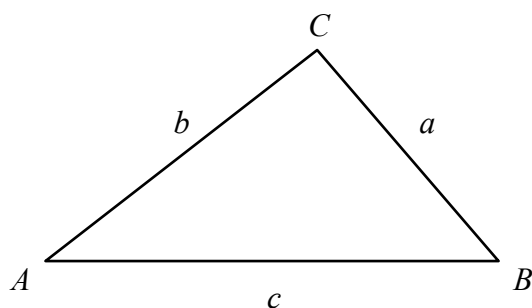
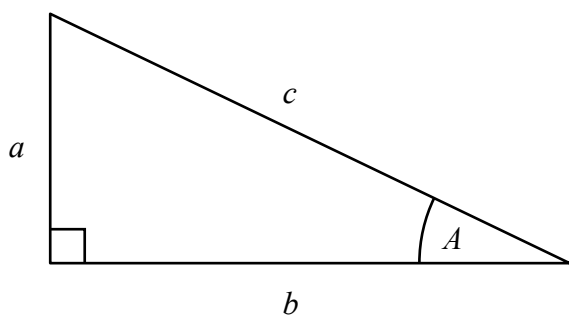
### Quadratic formula

The solution of  $ax^2 + bx + c = 0$

where  $a \neq 0$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

### Pythagoras' Theorem and Trigonometry



In any right-angled triangle where  $a$ ,  $b$  and  $c$  are the length of the sides and  $c$  is the hypotenuse:

$$a^2 + b^2 = c^2$$

In any right-angled triangle  $ABC$  where  $a$ ,  $b$  and  $c$  are the length of the sides and  $c$  is the hypotenuse:

$$\sin A = \frac{a}{c} \quad \cos A = \frac{b}{c} \quad \tan A = \frac{a}{b}$$

In any triangle  $ABC$  where  $a$ ,  $b$  and  $c$  are the length of the sides:

$$\text{sine rule: } \frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$\text{cosine rule: } a^2 = b^2 + c^2 - 2bc \cos A$$

$$\text{Area of triangle} = \frac{1}{2} a b \sin C$$

### Compound Interest

Where  $P$  is the principal amount,  $r$  is the interest rate over a given period and  $n$  is number of times that the interest is compounded:

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

### Probability

Where  $P(A)$  is the probability of outcome  $A$  and  $P(B)$  is the probability of outcome  $B$ :

$$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$$

$$P(A \text{ and } B) = P(A \text{ given } B) P(B)$$

**END OF EXAM AID**



Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 (a) Simplify  $(m^2)^3$

.....  
(1)

(b) Simplify  $x^5 \times x^8$

.....  
(1)

(c) Expand  $4p(p^2 + 3p)$

.....  
(2)

(Total for Question 1 is 4 marks)

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- 2 Jonny wants to know how much coffee he will need for 800 people at a meeting.

Each person who drinks coffee will drink 2 cups of coffee.  
10.6 g of coffee is needed for each cup of coffee.

Jonny assumes 68% of the people will drink coffee.

- (a) Using this assumption, work out the amount of coffee Jonny needs.  
Give your answer correct to the nearest gram.

..... g  
(4)

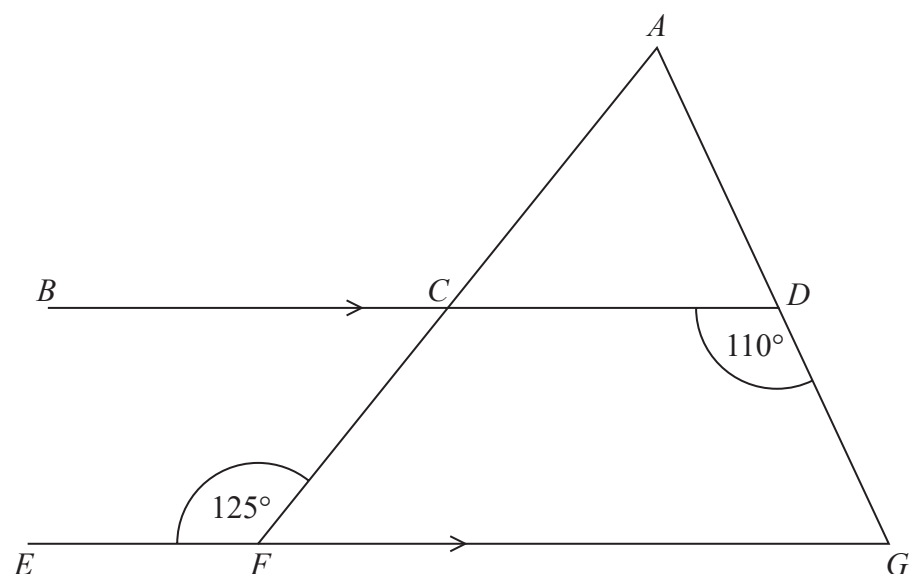
Jonny's assumption is wrong.  
72% of the people will drink coffee.

- (b) How does this affect your answer to part (a)?

(1)

(Total for Question 2 is 5 marks)

- 3  $ACF$  and  $ADG$  are straight lines.  
 $BCD$  and  $EFG$  are parallel lines.



Show that triangle  $ACD$  is isosceles.  
 Give a reason for each stage of your working.

(Total for Question 3 is 5 marks)

- 4 It takes 14 hours for 5 identical pumps to fill a water tank.

How many hours would it take 4 of these pumps to fill another water tank of the same size?

..... hours

(Total for Question 4 is 2 marks)

5  $A$  and  $B$  are numbers such that

$$A = 2^2 \times 3^4 \times 7$$

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

(a) Find the highest common factor (HCF) of  $A$  and  $B$ .

(1)

(b) Find the lowest common multiple (LCM) of  $A$  and  $B$ .

(2)

(Total for Question 5 is 3 marks)

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- 6 Lava flows from a volcano at a constant rate of  $11.9\text{m}^3/\text{s}$

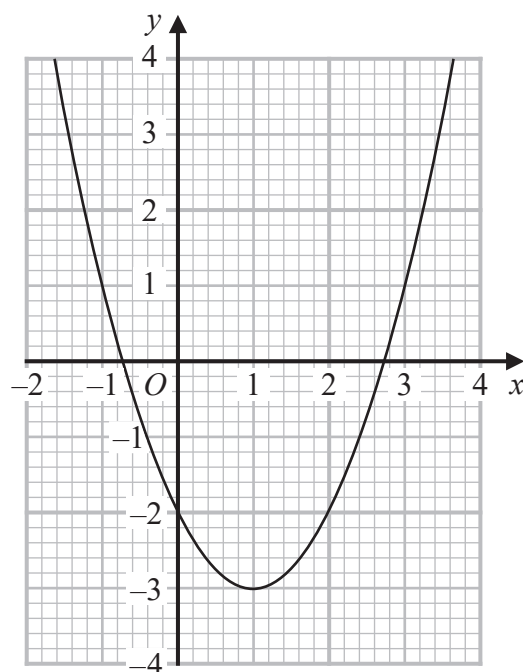
How many days does it take for  $67\,205\,600\text{m}^3$  of lava to flow from the volcano?  
Give your answer correct to the nearest day.

..... days

(Total for Question 6 is 3 marks)



7 Here is the graph of  $y = x^2 - 2x - 2$



(a) Write down the coordinates of the turning point on the graph of  $y = x^2 - 2x - 2$

( ..... , ..... )  
(1)

(b) Write down an estimate for one of the roots of  $x^2 - 2x - 2 = 0$

.....  
(1)

(Total for Question 7 is 2 marks)

- 8 A solid cuboid is made of metal.

The metal has a density of  $9 \text{ g/cm}^3$   
The volume of the cuboid is  $72 \text{ cm}^3$

Work out the mass of the cuboid.

..... g

(Total for Question 8 is 2 marks)

- 9 Some people were asked if they wanted a new television.

70% of the people said yes.

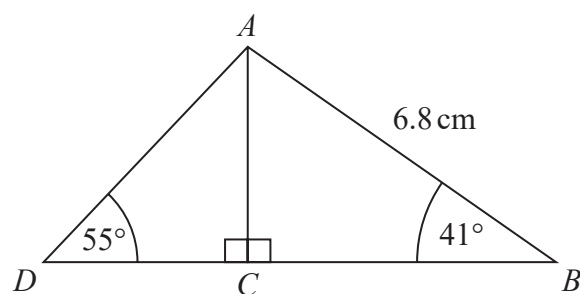
80% of the people who said yes wanted a television with a large screen.

What percentage of the people asked said they wanted a television with a large screen?

..... %

(Total for Question 9 is 2 marks)

- 10  $ABD$  is a triangle.  
 $C$  is a point on  $BD$ .



Work out the length of  $DC$ .  
Give your answer correct to 1 decimal place.

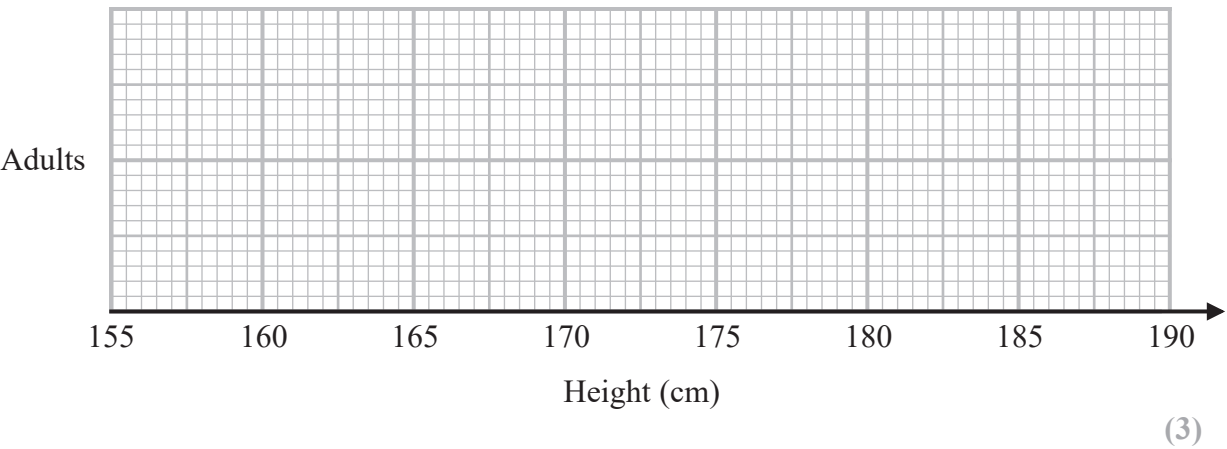
..... cm

(Total for Question 10 is 3 marks)

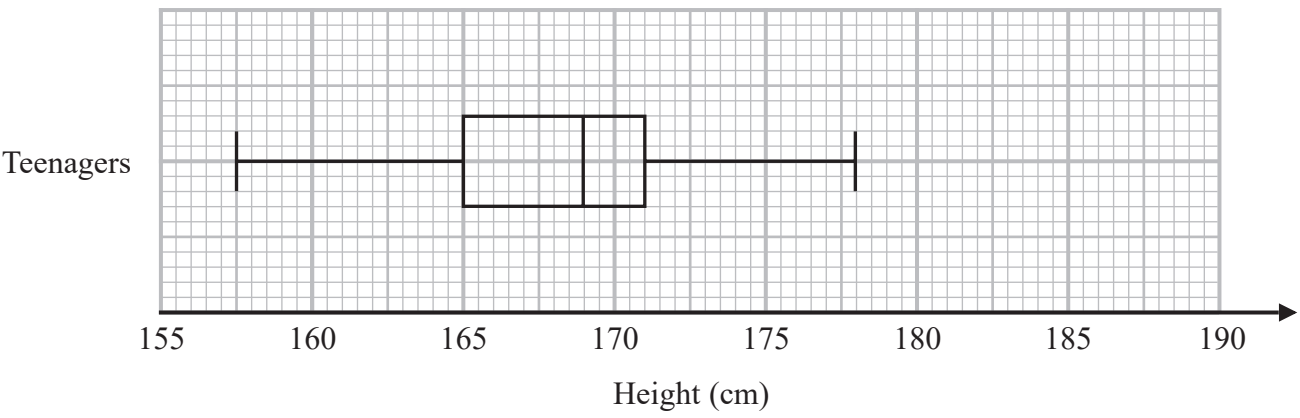
11 The table shows some information about the heights of a group of adults.

least height	169 cm
greatest height	186 cm
median	177 cm
lower quartile	174 cm
upper quartile	180 cm

(a) On the grid, draw a box plot for the information in the table.



The box plot below shows the distribution of the heights of a group of teenagers.



(b) Compare the distribution of the heights of the adults with the distribution of the heights of the teenagers.

(2)

(Total for Question 11 is 5 marks)

- 12 Show that  $(x - 1)(x + 3)(x - 5)$  can be written in the form  $ax^3 + bx^2 + cx + d$  where  $a$ ,  $b$ ,  $c$  and  $d$  are integers.

(Total for Question 12 is 3 marks)

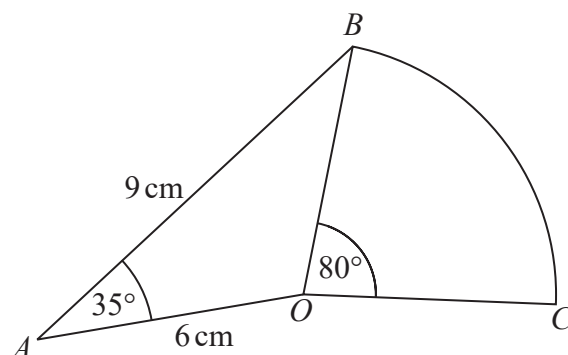
- 13 An expression for the  $n$ th term of the sequence of triangular numbers is  $\frac{n(n + 1)}{2}$

Prove that the sum of any two consecutive triangular numbers is a square number.

(Total for Question 13 is 3 marks)



- 14  $OAB$  is a triangle.  
 $OBC$  is a sector of a circle, centre  $O$ .



Calculate the area of  $OBC$ .  
Give your answer correct to 3 significant figures.

.....  $\text{cm}^2$

(Total for Question 14 is 4 marks)

15 (a) Factorise  $a^2 - b^2$

(1)

(b) Show that  $2^{40} - 1$  is the product of two consecutive odd numbers.

(2)

(Total for Question 15 is 3 marks)

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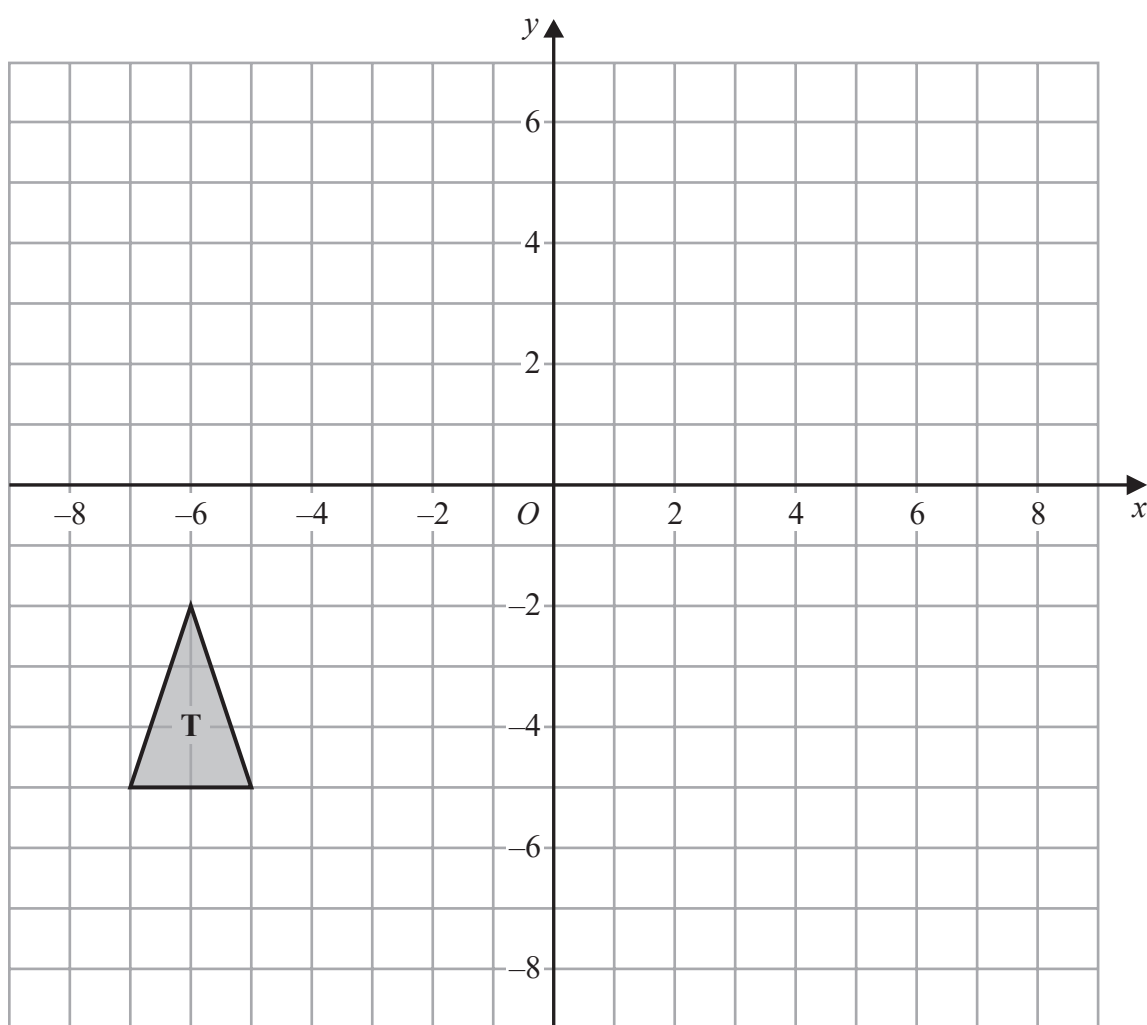
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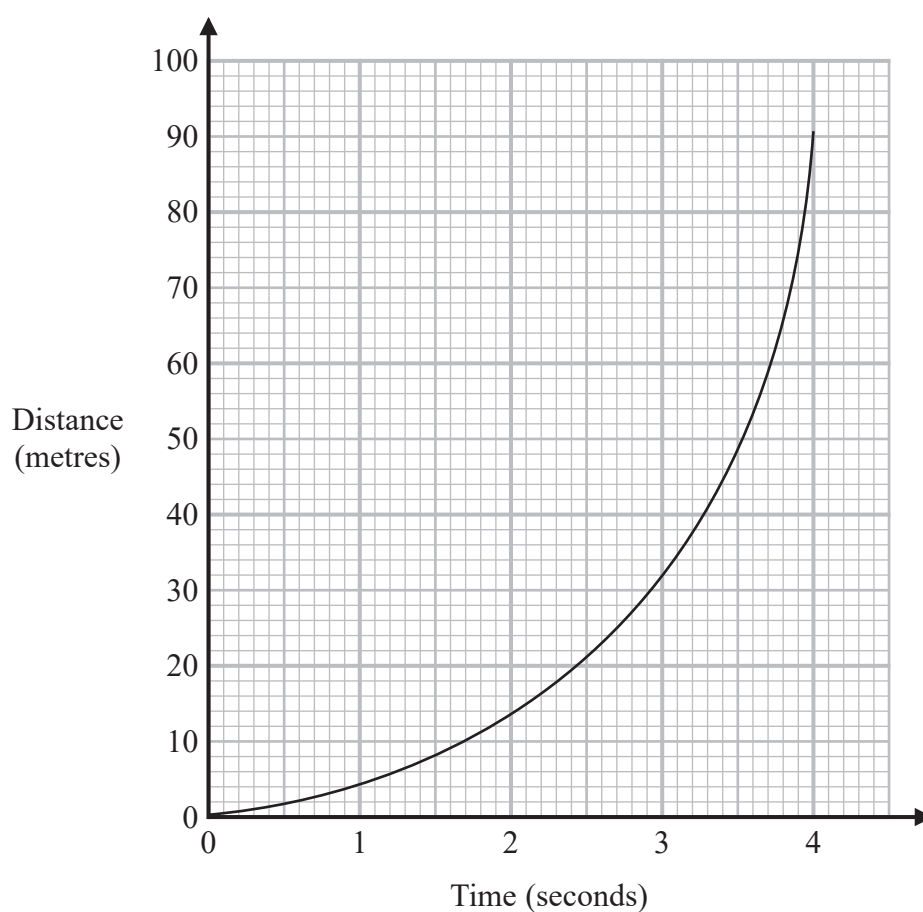


On the grid, enlarge triangle T by scale factor  $-2$  with centre of enlargement  $(-2, -2)$

(Total for Question 16 is 2 marks)



17 Here is a distance-time graph.



- (a) Find an estimate of the gradient of the graph at time 2.5 seconds.  
You must show how you get your answer.

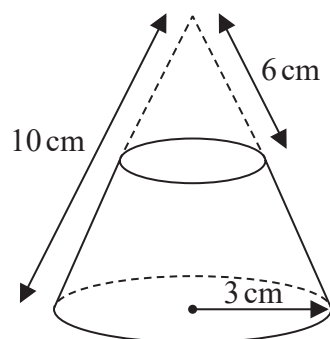
(3)

- (b) What does the gradient of the graph represent?

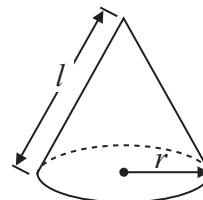
(1)

(Total for Question 17 is 4 marks)

- 18 A solid frustum is made by removing a small cone from a large cone as shown in the diagram.



Curved surface area of cone =  $\pi r l$



The slant height of the small cone is 6 cm.  
The slant height of the large cone is 10 cm.  
The radius of the base of the large cone is 3 cm.

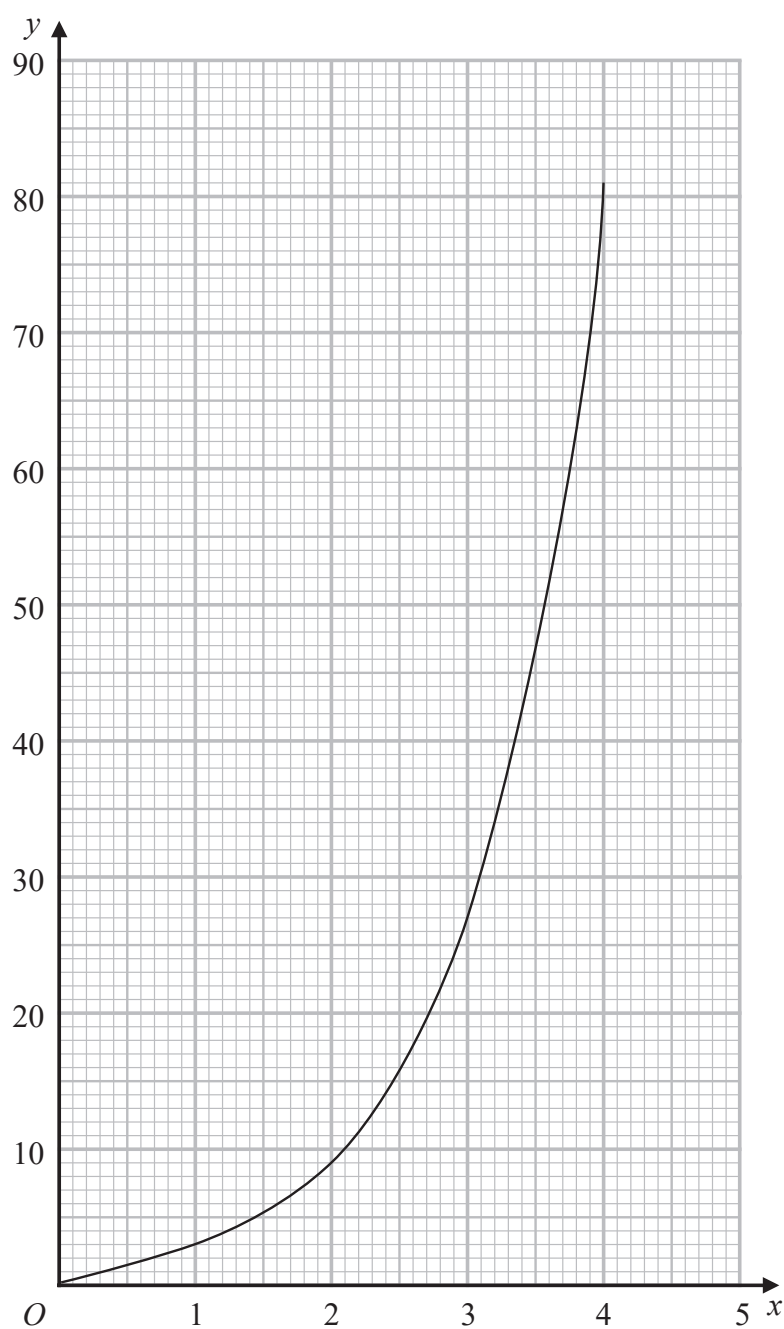
Calculate the total surface area of the frustum.  
Give your answer correct to 3 significant figures.

..... cm<sup>2</sup>

(Total for Question 18 is 5 marks)

19 Sana needs to draw the graph of  $y = 3^x$  for  $0 \leq x \leq 4$

She draws the graph shown on the grid.



Write down one thing Sana has done wrong.

(Total for Question 19 is 1 mark)

20 Prove algebraically that  $0.1\dot{2}\dot{3}$  can be written as  $\frac{61}{495}$

(Total for Question 20 is 3 marks)

21 Solve  $\frac{1}{x+4} + \frac{3}{2-2x} = 1$

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(Total for Question 21 is 4 marks)



- 22 Given that the vector  $a\begin{pmatrix} 2 \\ 6 \end{pmatrix} + b\begin{pmatrix} 8 \\ 2 \end{pmatrix}$  is parallel to the vector  $\begin{pmatrix} 13 \\ 6 \end{pmatrix}$   
find an expression for  $b$  in terms of  $a$ .

(Total for Question 22 is 3 marks)

23 A circle has equation  $x^2 + y^2 = 25$

The point  $P$  with coordinates  $(-3, 4)$  lies on the circle.

Alex says that the tangent to the circle at  $P$  crosses the  $x$ -axis at the point  $(-8, 0)$

Is Alex correct?

You must show how you get your answer.

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(Total for Question 23 is 4 marks)

24 There is a total of  $y$  counters in a box.

There are  $x$  pink counters and 5 blue counters in the box.  
The rest of the counters are green.

$$x:y = 1:3$$

Freda takes at random two counters from the box.

Find, in terms of  $x$ , an expression for the probability that Freda takes two counters of the same colour.

Give your answer as a fraction in the form  $\frac{ax^2 + bx + c}{dx^2 + ex}$  where  $a, b, c, d$  and  $e$  are integers.

(Total for Question 24 is 5 marks)

**TOTAL FOR PAPER IS 80 MARKS**



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