

**Answer ALL TWENTY FOUR questions.**

**Write your answers in the spaces provided.**

**You must write down all the stages in your working.**

1 (a) Simplify  $a^7 \times a^4$

.....  
(1)

(b) Simplify  $w^{15} \div w^3$

.....  
(1)

(c) Simplify  $(8x^5y^3)^2$

.....  
(2)

(d) Make  $t$  the subject of  $c = t^3 - 8v$

.....  
(2)

**(Total for Question 1 is 6 marks)**



P 6 9 1 9 6 A 0 3 2 8

2 Danil, Gabriel and Hadley share some money in the ratios  $3:5:9$ .  
The difference between the amount of money that Gabriel receives and the amount of money that Hadley receives is 196 euros.

Work out the amount of money that Danil receives.

..... euros

**(Total for Question 2 is 3 marks)**

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



# January 2022 Paper 1H

3 The diagram shows triangle  $ABC$

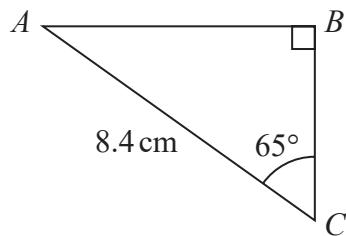


Diagram **NOT**  
accurately drawn

Work out the length of the side  $AB$

Give your answer correct to 3 significant figures.

..... cm

(Total for Question 3 is 3 marks)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



4 Sarah makes and sells mugs.

One day she makes 150 mugs.

Her total cost for making these mugs is £1140

Of these mugs

$\frac{2}{5}$  are small mugs

32% are medium mugs

and the rest are large mugs

Here is Sarah's price list for selling each mug.

MUGS	
Small	£8.50
Medium	£11.20
Large	£14.20

Sarah sells all 150 mugs.

Work out her percentage profit.

Give your answer correct to the nearest whole number.

.....%

**(Total for Question 4 is 5 marks)**



P 6 9 1 9 6 A 0 5 2 8

5 Jenny has six cards.

Each card has a whole number written on it so that

the smallest number is 5  
the largest number is 24  
the median of the six numbers is 14  
the mode of the six numbers is 8

Jenny arranges her cards so that the numbers are in order of size.

5					24
	.....	.....	.....	.....	

(a) For the remaining four cards, write on each dotted line a number that could be on the card.

(3)

A basketball team plays 6 games.

After playing 5 games, the team has a mean score of 21 points per game.

After playing 6 games, the team has a mean score of 23 points per game.

(b) Work out the number of points the team scored in its 6th game.

.....

(3)

(Total for Question 5 is 6 marks)



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

6 (a) Solve the inequality  $5x - 7 \leq 2$

.....  
(2)

(b) (i) Factorise  $y^2 - 2y - 35$

.....  
(2)

(ii) Hence, solve  $y^2 - 2y - 35 = 0$

.....  
(1)

**(Total for Question 6 is 5 marks)**



P 6 9 1 9 6 A 0 7 2 8

# January 2022 Paper 1H

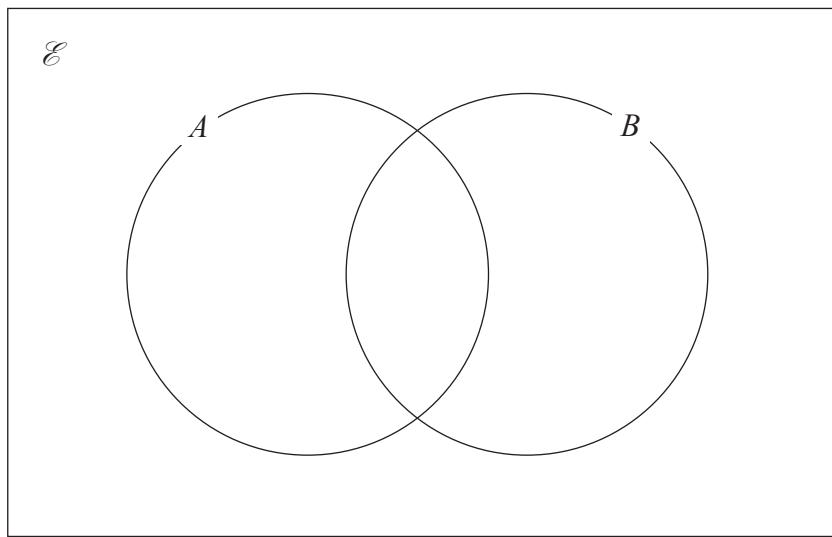
7  $\mathcal{E} = \{4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15\}$

$$A \cap B = \{5, 10, 15\}$$

$$B' = \{7, 8, 9, 11, 12, 13, 14\}$$

$$A' = \{4, 6, 7, 8, 14\}$$

Complete the Venn diagram for this information.



(Total for Question 7 is 3 marks)



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

8

$$a = 4.2 \times 10^{-24}$$

$$b = 3 \times 10^{145}$$

Work out the value of  $a \times b$

Give your answer in standard form.

(Total for Question 8 is 2 marks)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



9 The diagram shows isosceles triangle  $ABC$

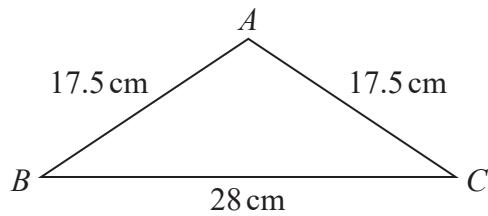


Diagram **NOT**  
accurately drawn

$$AB = AC = 17.5 \text{ cm}$$

$$BC = 28 \text{ cm}$$

Calculate the area of triangle  $ABC$

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

(Total for Question 9 is 4 marks)

10 The straight line **L** has equation  $2y + 7x = 10$

(a) Find the gradient of **L**

.....  
(2)

(b) Find the coordinates of the point where **L** crosses the  $y$ -axis.

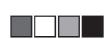
(....., .....)  
(1)

**(Total for Question 10 is 3 marks)**

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

11 Himari invests 200 000 yen for 3 years in a savings account paying compound interest.

The rate of interest is 1.8% for the first year and  $x\%$  for each of the second year and the third year.

The value of the investment at the end of the third year is 209 754 yen.

Work out the value of  $x$

Give your answer correct to one decimal place.

$$x = \dots$$

(Total for Question 11 is 3 marks)



P 6 9 1 9 6 A 0 1 1 2 8

12 The table gives information about the times, in minutes, taken by 80 customers to do their shopping in a supermarket.

Time taken ( $t$ minutes)	Frequency
$0 < t \leq 10$	7
$10 < t \leq 20$	26
$20 < t \leq 30$	24
$30 < t \leq 40$	14
$40 < t \leq 50$	7
$50 < t \leq 60$	2

(a) Complete the cumulative frequency table.

Time taken ( $t$ minutes)	Cumulative frequency
$0 < t \leq 10$	
$0 < t \leq 20$	
$0 < t \leq 30$	
$0 < t \leq 40$	
$0 < t \leq 50$	
$0 < t \leq 60$	

(1)

(b) On the grid opposite, draw a cumulative frequency graph for your table.

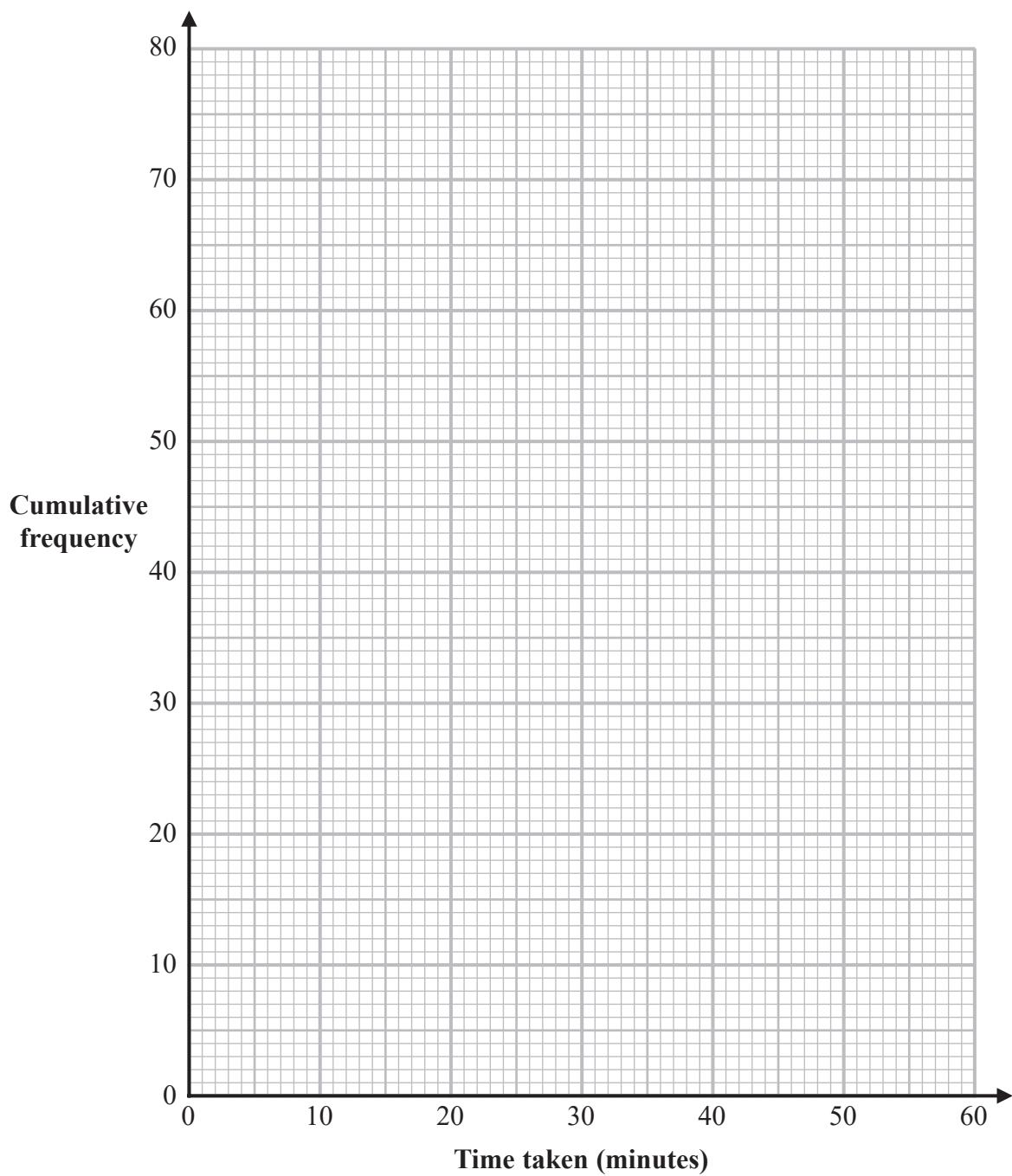
DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



DO NOT WRITE IN THIS AREA



(2)

(c) Use your graph to find an estimate for the median time taken.

..... minutes  
(1)

One of the 80 customers is chosen at random.

(d) Use your graph to find an estimate for the probability that the time taken by this customer was more than 42 minutes.

.....  
(2)

**(Total for Question 12 is 6 marks)**



P 6 9 1 9 6 A 0 1 3 2 8

13 (a) Expand and simplify  $5x(x + 2)(3x - 4)$

.....  
(3)

(b) Simplify completely  $\left(\frac{16w^8}{y^{20}}\right)^{-\frac{3}{4}}$

.....  
(3)

**(Total for Question 13 is 6 marks)**

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



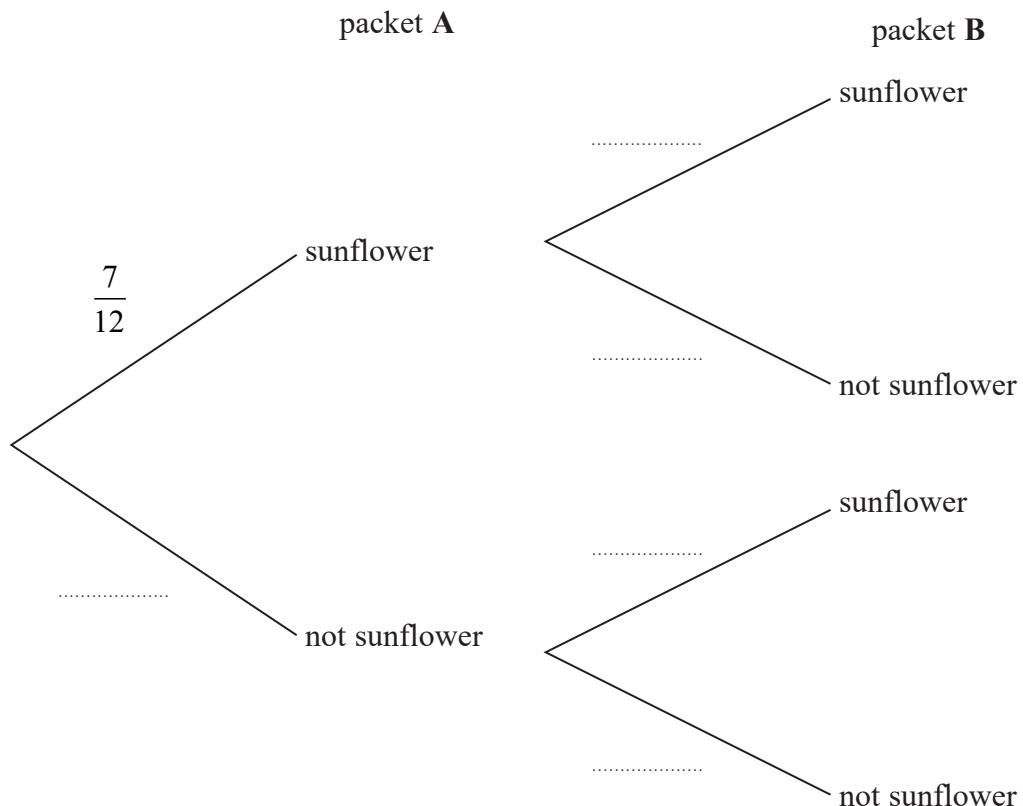
14 Aika has 2 packets of seeds, packet A and packet B

There are 12 seeds in packet A and 7 of these are sunflower seeds.

There are 15 seeds in packet B and 8 of these are sunflower seeds.

Aika is going to take at random a seed from packet A and a seed from packet B

(a) Complete the probability tree diagram.



(2)

(b) Calculate the probability that Aika will take two sunflower seeds.

(2)

**(Total for Question 14 is 4 marks)**



P 6 9 1 9 6 A 0 1 5 2 8

# January 2022 Paper 1H

**15**  $A$  is inversely proportional to  $C^2$

$A = 40$  when  $C = 1.5$

Calculate the value of  $C$  when  $A = 1000$

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

$C = \dots$

**(Total for Question 15 is 3 marks)**



16 The diagram shows a circle with centre  $O$

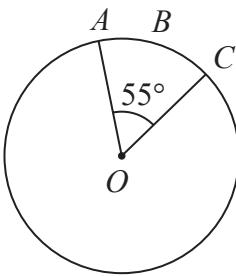


Diagram NOT  
accurately drawn

$A$ ,  $B$  and  $C$  are points on the circle so that the length of the arc  $ABC$  is 5 cm.

Given that angle  $AOC = 55^\circ$

work out the area of the circle.

Give your answer correct to one decimal place.

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

**(Total for Question 16 is 4 marks)**

17 A and B are two similar vases.

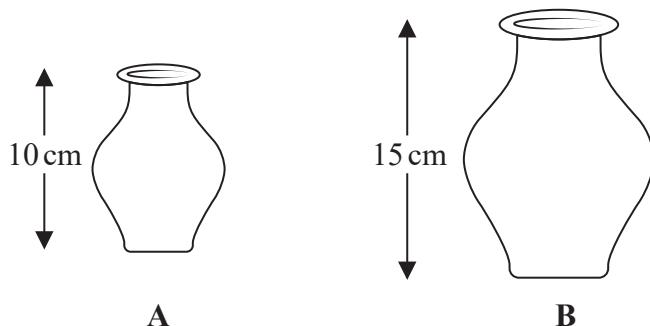


Diagram NOT  
accurately drawn

Vase A has height 10 cm.

Vase B has height 15 cm.

The difference between the volume of vase A and the volume of vase B is  $1197 \text{ cm}^3$

Calculate the volume of vase A

.....  $\text{cm}^3$

**(Total for Question 17 is 4 marks)**



18  $A = w - \frac{x^2}{y}$

$w = 3.45$  correct to 2 decimal places.

$x = 1.9$  correct to 1 decimal place.

$y = 5$  correct to the nearest whole number.

Work out the lower bound of the value of  $A$

Show your working clearly.

**(Total for Question 18 is 3 marks)**

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



P 6 9 1 9 6 A 0 1 9 2 8

19 Solve the simultaneous equations

$$\begin{aligned}3x^2 + y^2 - xy &= 5 \\y &= 2x - 3\end{aligned}$$

Show clear algebraic working.

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(Total for Question 19 is 5 marks)



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

20 (a) Express  $7 + 12x - 3x^2$  in the form  $a + b(x + c)^2$  where  $a$ ,  $b$  and  $c$  are integers.

..... (3)

$C$  is the curve with equation  $y = 7 + 12x - 3x^2$   
The point  $A$  is the maximum point on  $C$

(b) Use your answer to part (a) to write down the coordinates of  $A$

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

**(Total for Question 20 is 4 marks)**



21 The diagram shows the prism  $ABCDEFGHJK$  with horizontal base  $AEFG$

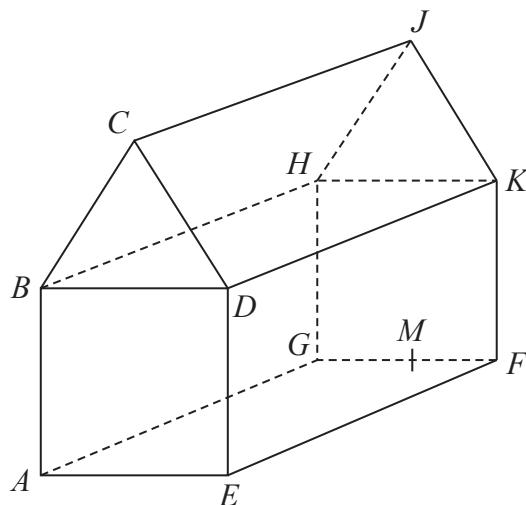


Diagram NOT  
accurately drawn

$ABCDE$  is a cross section of the prism where

$ABDE$  is a square

$BCD$  is an equilateral triangle

$$EF = 2 \times AE$$

$M$  is the midpoint of  $GF$  so that  $JM$  is vertical.

$$\text{Angle } MAJ = y^\circ$$

$$\text{Given that } \tan y^\circ = T$$

find the value of  $T$ , giving your answer in the form  $\frac{\sqrt{p} + \sqrt{q}}{17}$  where  $p$  and  $q$  are integers.

$$T = \dots$$

(Total for Question 21 is 5 marks)



22 The diagram shows triangle  $OAB$

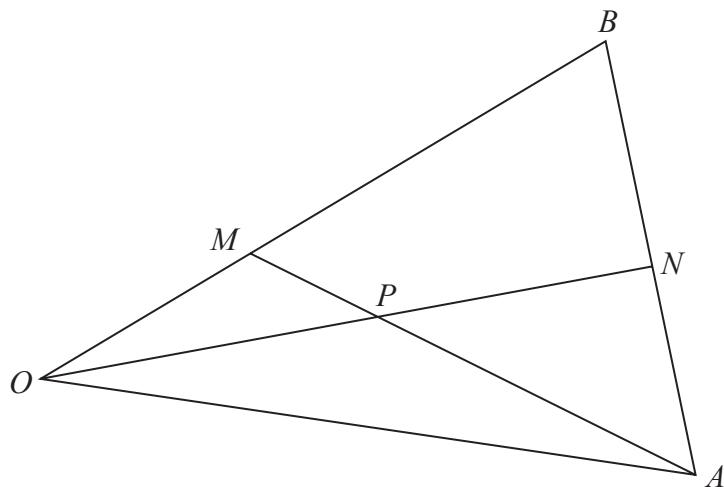


Diagram NOT  
accurately drawn

$$\overrightarrow{OA} = 8\mathbf{a} \quad \overrightarrow{OB} = 6\mathbf{b}$$

$M$  is the point on  $OB$  such that  $OM:MB = 1:2$

$N$  is the midpoint of  $AB$

$P$  is the point of intersection of  $ON$  and  $AM$

Using a vector method, find  $\overrightarrow{OP}$  as a simplified expression in terms of  $\mathbf{a}$  and  $\mathbf{b}$

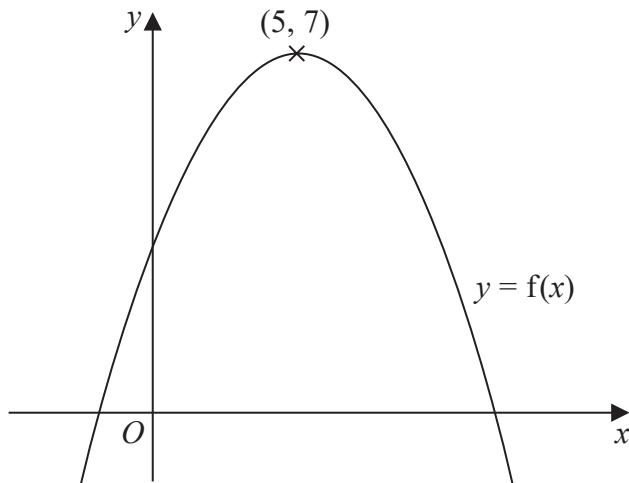
Show your working clearly.

$$\overrightarrow{OP} = \dots$$

(Total for Question 22 is 5 marks)



23 The diagram shows a sketch of the curve with equation  $y = f(x)$



There is only one maximum point on the curve.

The coordinates of this maximum point are (5, 7)

Write down the coordinates of the maximum point on the curve with equation

(i)  $y = f(x + 9)$

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

(ii)  $y = f(x) + 3$

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

**(Total for Question 23 is 2 marks)**

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



24 The curve **C** has equation  $y = ax^3 + bx^2 - 12x + 6$  where  $a$  and  $b$  are constants.

The point  $A$  with coordinates  $(2, -6)$  lies on **C**

The gradient of the curve at  $A$  is 16

Find the  $y$  coordinate of the point on the curve whose  $x$  coordinate is 3

Show clear algebraic working.

$$y = \dots$$

**(Total for Question 24 is 6 marks)**

**TOTAL FOR PAPER IS 100 MARKS**

