TARGET A STAR PAPER

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TOTAL		105

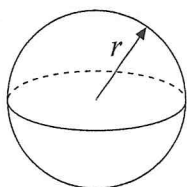## GCSE Mathematics (Linear) 2540

Formulae: Higher Tier

You must not write on this formulae page.
Anything you write on this formulae page will gain NO credit.

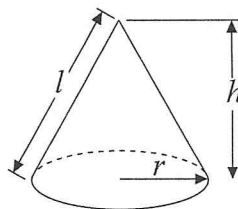**Volume of a prism** = area of cross section × length
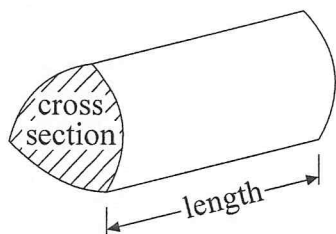
Volume of sphere $= \frac{4}{3}\pi r^3$

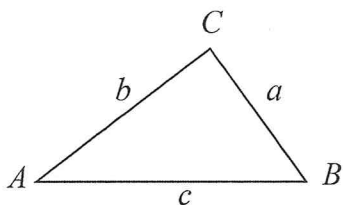**Surface area of sphere** $= 4\pi r^2$

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

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

In any triangle ABC

The Quadratic Equation

The solutions of $ax^2 + bx + c = 0$
where $a \neq 0$, are given by
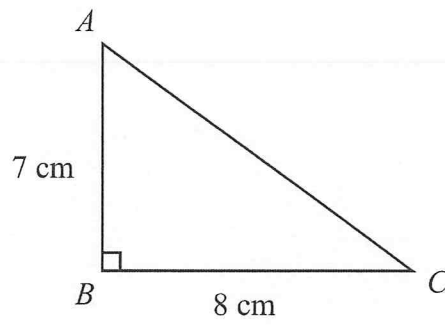
$$x = \frac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$$

Sine Rule $\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$

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

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

14.

A

7 cm

B

8 cm

C

Diagram **NOT** accurately drawn

ABC is a right-angled triangle.
$AB = 7$ cm,
$BC = 8$ cm.

(a) Work out the area of the triangle.

.... cm^2

(2)

(b) Work out the length of AC.
Give your answer correct to 2 decimal places.

.... cm

(3)

D

Diagram **NOT** accurately drawn

32 mm

y

F   46 mm   *E*
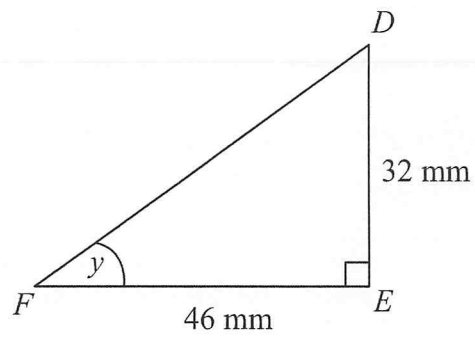
DEF is another right-angled triangle.
DE = 32 mm,
FE = 46 mm.

(c) Calculate the size of angle *y*.
     Give your answer correct to 1 decimal place.

°
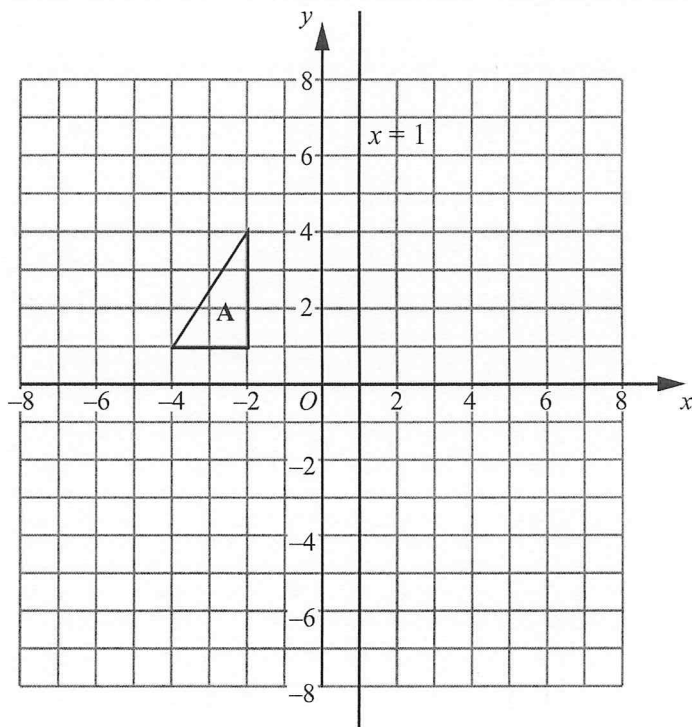....................................

(3)

Q14

(Total 8 marks)

15.

Triangle **A** is reflected in the *x*-axis to give triangle **B**.
Triangle **B** is reflected in the line *x* = 1 to give triangle **C**.

Describe the **single** transformation that takes triangle **A** to triangle **C**.

....

Q15

(Total 3 marks)

16. (a) Express 252 as a product of its prime factors.

....
(3)

James thinks of two numbers.
He says   "The Highest Common Factor (HCF) of my two numbers is 3
                 The Lowest Common Multiple (LCM) of my two numbers is 45"

(b) Write down two numbers that James could be thinking of.

.... and ....
(3)

(Total 6 marks)

Q16

17. The number of atoms in one kilogram of helium is 1.51×10^{26}

Calculate the number of atoms in 20 kilograms of helium.
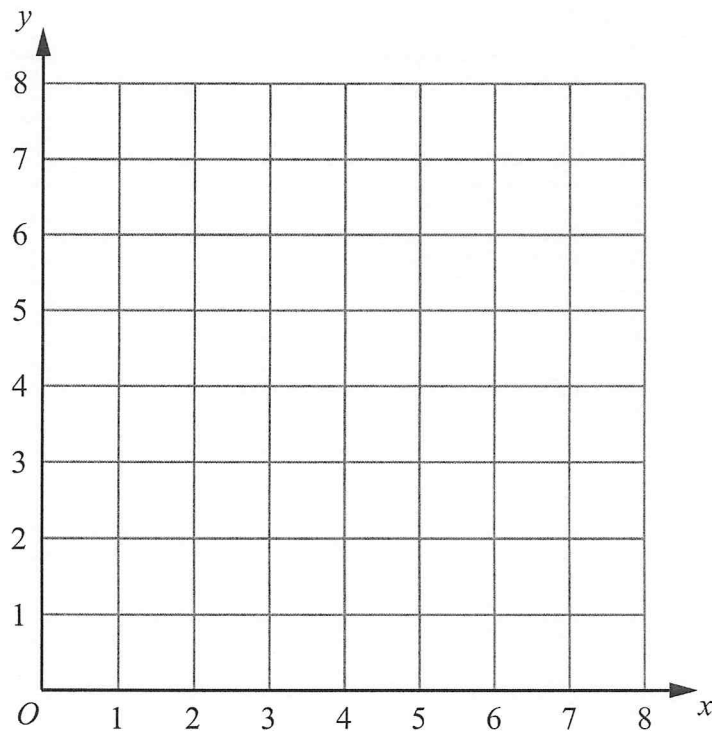Give your answer in standard form.

....

(Total 2 marks)

Q17

18. The region **R** satisfies the inequalities

$$x \geqslant 2, \quad y \geqslant 1, \quad x + y \leqslant 6$$

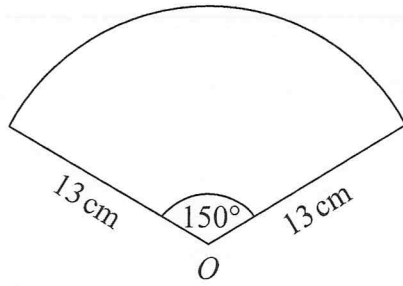On the grid below, draw straight lines and use shading to show the region **R**.

(Total 3 marks)

Q18

19.

Diagram **NOT** accurately drawn

The diagram shows a sector of a circle, centre O.
The radius of the circle is 13 cm.
The angle of the sector is 150°.

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

.... cm²

(Total 2 marks)

Q19

20. q is inversely proportional to the square of t.

When $t = 4$, $q = 8.5$

(a) Find a formula for q in terms of t.

$q =$ ....

(3)

(b) Calculate the value of q when $t = 5$

....

(1)

Q20

(Total 4 marks)

21. The incomplete histogram and table show information about the weights of some containers.

Weight (w) in kg	Frequency
$0 < w \leqslant 1000$	16
$1000 < w \leqslant 2000$	
$2000 < w \leqslant 4000$	
$4000 < w \leqslant 6000$	16
$6000 < w \leqslant 8000$	
$8000 < w \leqslant 12000$	8

(a) Use the information in the histogram to complete the table.

(2)

(b) Use the information in the table to complete the histogram.

(2)

Weight (w) in kg
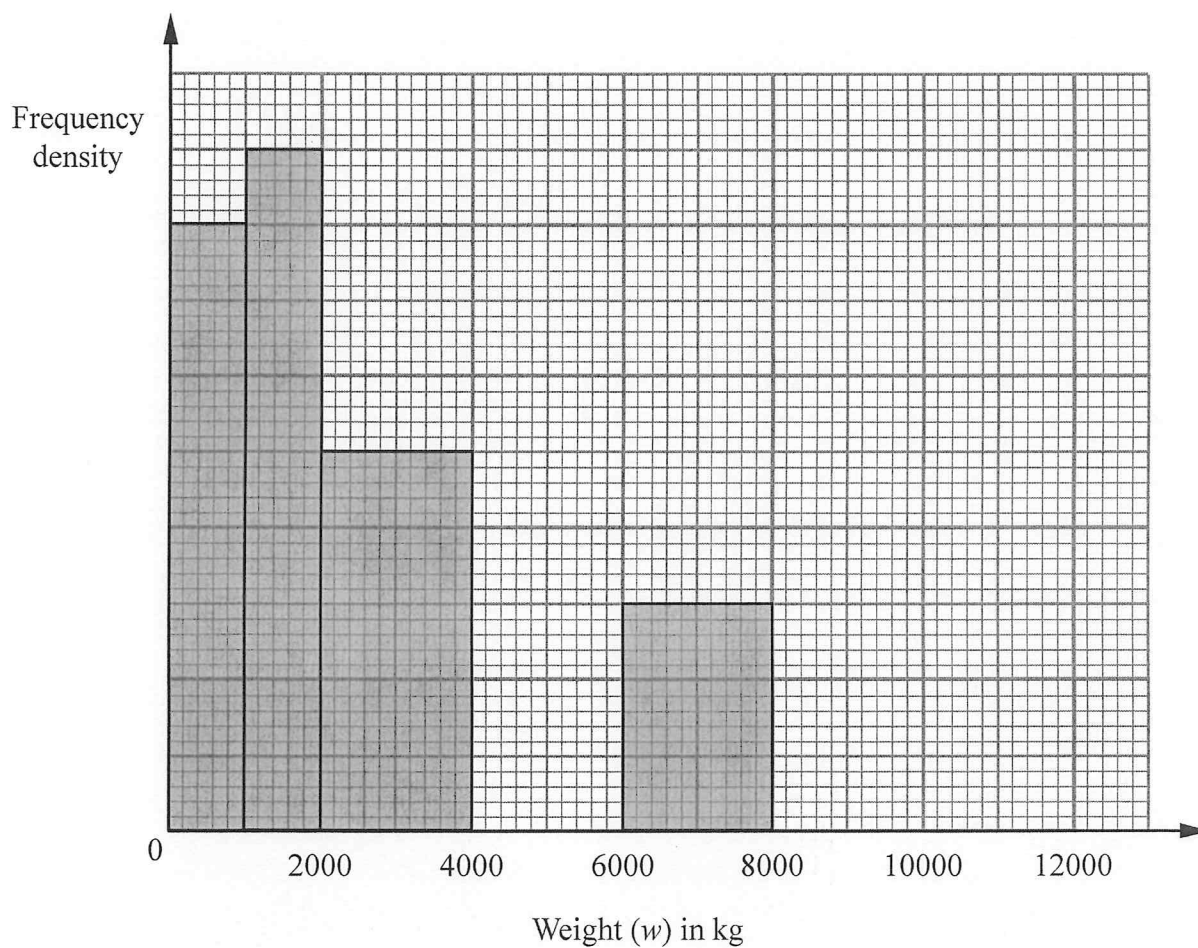
(Total 4 marks)

22. Katy drove for 238 miles, correct to the nearest mile.
She used 27.3 litres of petrol, to the nearest tenth of a litre.

$$\text{Petrol consumption} = \frac{\text{Number of miles travelled}}{\text{Number of litres of petrol used}}$$

Work out the upper bound for the petrol consumption for Katy's journey.
Give your answer correct to 2 decimal places.

.... miles per litre

(Total 3 marks)

Q22

23. (a) Show that the equation

$$\frac{5}{x+2} = \frac{4-3x}{x-1}$$

can be rearranged to give $3x^2 + 7x - 13 = 0$

(3)

(b) Solve $3x^2 + 7x - 13 = 0$
Give your solutions correct to 2 decimal places.

$x =$ .... or $x =$ ....

(3)

Q23

(Total 6 marks)

24.

Diagram **NOT** accurately drawn

A

10 m

12 m

C

B

15 m
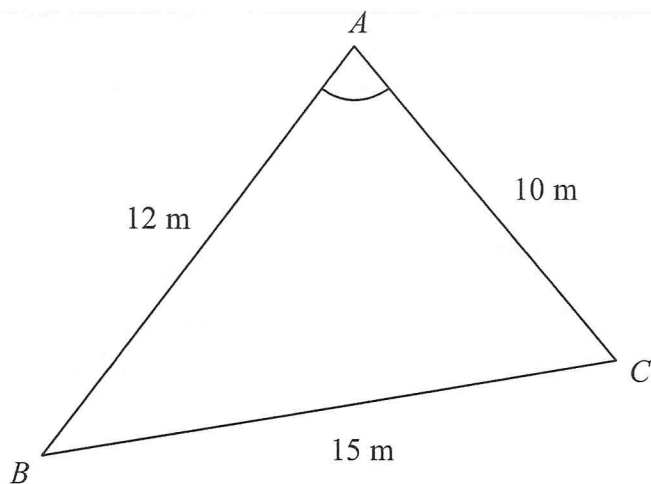
ABC is a triangle.
AB = 12 m.
AC = 10 m.
BC = 15 m.

Calculate the size of angle *BAC*.
Give your answer correct to one decimal place.
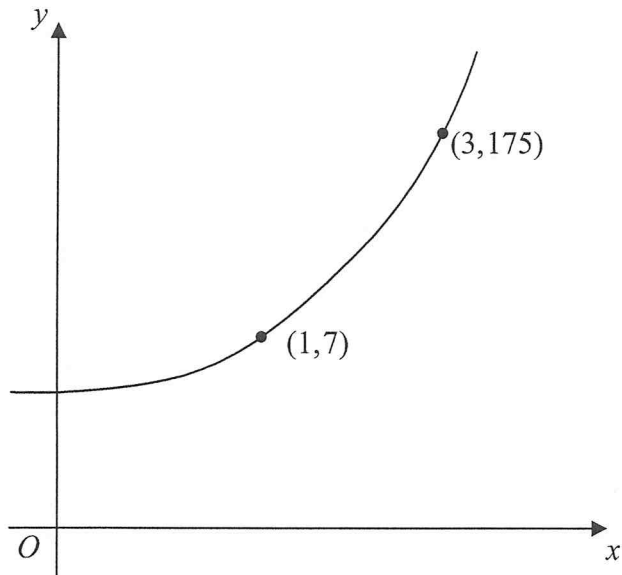
..............................°

Q24

(Total 3 marks)

25.

Diagram **NOT** accurately drawn

The sketch shows a curve with equation

$$y = ka^x$$

where k and a are constants, and $a > 0$

The curve passes through the points $(1, 7)$ and $(3, 175)$.

Calculate the value of k and the value of a.

$k =$ ....

$a =$ ....

(Total 3 marks)

Q25

TOTAL FOR PAPER: 100 MARKS

END

13. Find the Lowest Common Multiple (LCM) of 24 and 36

....

(Total 2 marks)

14. (a) Expand and simplify $3(x + 4) + 5(2x + 1)$

....

(2)

(b) Simplify $t^4 \times t^6$

....

(1)

(c) Simplify $p^8 \div p^5$

....

(1)

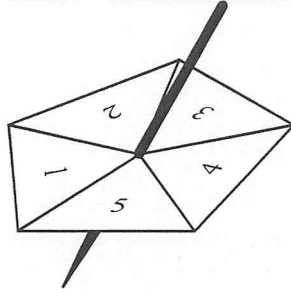(d) Simplify $(x^4)^3$

....

(1) Q14

(Total 5 marks)

15. Here is a 5-sided spinner.

The sides of the spinner are labelled 1, 2, 3, 4 and 5
The spinner is biased.
The probability that the spinner will land on each of the numbers 1, 2, 3 and 4 is given in the table.

Number	1	2	3	4	5
Probability	0.15	0.05	0.2	0.25	x

Work out the value of x.

$x = $ ....

(Total 2 marks)

16.

Diagram **NOT**
accurately drawn
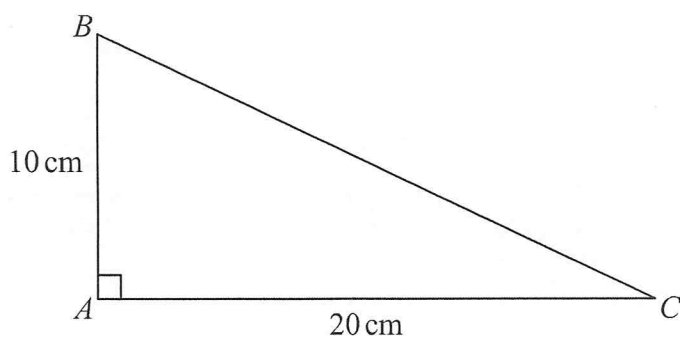
In triangle ABC,

$AB = 10\,cm$
$AC = 20\,cm$
angle $BAC = 90°$

Work out the length of BC.
Give your answer correct to 3 significant figures.
You must state the units in your answer.

....   Q16

(Total 4 marks)

17. Majid carried out a survey of the number of school dinners 32 students had in one week.

The table shows this information.

Number of school dinners	Frequency	
0	0	
1	8	
2	12	
3	6	
4	4	
5	2	

Calculate the mean.

....

(Total 3 marks)

Q17

18. The value of a car depreciates by 35% each year.

At the end of 2007 the value of the car was £5460

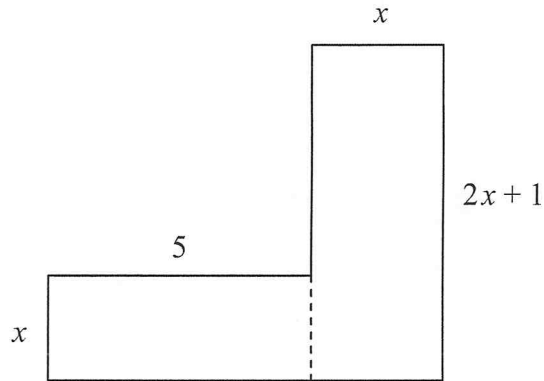Work out the value of the car at the end of 2006

£ ....

(Total 3 marks)

Q18

15

Turn over

19. The diagram below shows a 6-sided shape.
All the corners are right angles.
All the measurements are given in centimetres.

Diagram **NOT**
accurately drawn

x

$2x + 1$

5

x

The area of the shape is $95\,\text{cm}^2$.

(a) Show that $2x^2 + 6x - 95 = 0$

(3)

(b) Solve the equation

$$2x^2 + 6x - 95 = 0$$

Give your solutions correct to 3 significant figures.

$x =$ .... or $x =$ ....

(3) Q19

(Total 6 marks)

20. The nth even number is $2n$.

The next even number after $2n$ is $2n + 2$

(a) Explain why.

....

....

(1)

(b) Write down an expression, in terms of n, for the next even number after $2n + 2$

....

(1)

(c) Show algebraically that the sum of any 3 consecutive even numbers
is always a multiple of 6

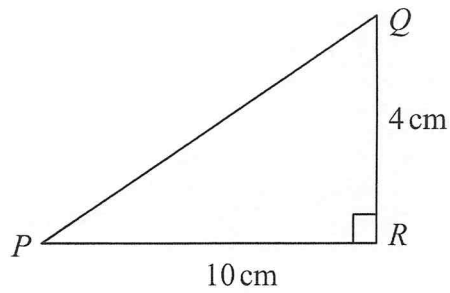**(3)** Q20

(Total 5 marks)

21.

Diagram **NOT**
accurately drawn

PQR is a right-angled triangle.

QR = 4 cm
PR = 10 cm

Work out the size of angle *RPQ*.
Give your answer correct to 3 significant figures.

..................................°

Q21

(Total 3 marks)

22. *D* is proportional to S^2.

D = 900 when *S* = 20

Calculate the value of *D* when *S* = 25

D = ...

Q22

(Total 4 marks)

23. A ball is thrown vertically upwards with a speed V metres per second.

The height, H metres, to which it rises is given by

$$H = \frac{V^2}{2g}$$

where $g\,\text{m/s}^2$ is the acceleration due to gravity.

$V = 24.4$ correct to 3 significant figures.
$g = 9.8$ correct to 2 significant figures.

(i) Write down the lower bound of g.

....

(ii) Calculate the upper bound of H.
Give your answer correct to 3 significant figures.

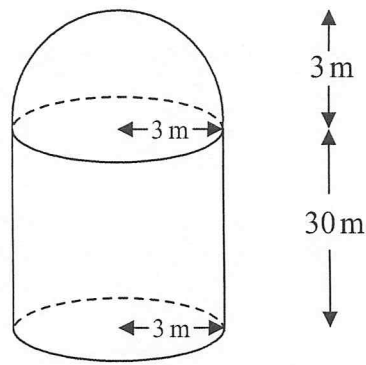... Q23

(Total 3 marks)

24. The diagram shows a storage tank.

Diagram **NOT** accurately drawn

The storage tank consists of a hemisphere on top of a cylinder.

The height of the cylinder is 30 metres.
The radius of the cylinder is 3 metres.
The radius of the hemisphere is 3 metres.

(a) Calculate the total volume of the storage tank.
Give your answer correct to 3 significant figures.

.... m³

(3)

A sphere has a volume of 500 m³.

(b) Calculate the radius of the sphere.
Give your answer correct to 3 significant figures.

.... m

(3)

(Total 6 marks)

Q24

25.

	Male	Female
First year	399	602
Second year	252	198

The table gives information about the numbers of students in the two years of a college course.

Anna wants to interview some of these students.
She takes a random sample of 70 students stratified by year and by gender.

Work out the number of students in the sample who are male and in the first year.
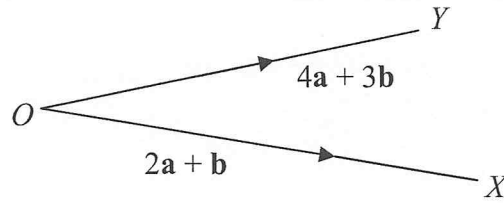
....
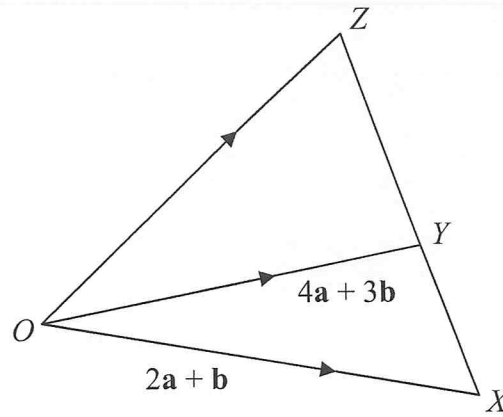
Q25

(Total 3 marks)

26.

Diagram **NOT** accurately drawn

$\overrightarrow{OX} = 2\mathbf{a} + \mathbf{b}$

$\overrightarrow{OY} = 4\mathbf{a} + 3\mathbf{b}$

(a) Express the vector $\overrightarrow{XY}$ in terms of $\mathbf{a}$ and $\mathbf{b}$

Give your answer in its simplest form.

....

(2)

Diagram **NOT**
accurately drawn

XYZ is a straight line.
XY : *YZ* = 2 : 3

(b) Express the vector $\overrightarrow{OZ}$ in terms of **a** and **b**
Give your answer in its simplest form.

....

(3)

(Total 5 marks)

Q26

27.
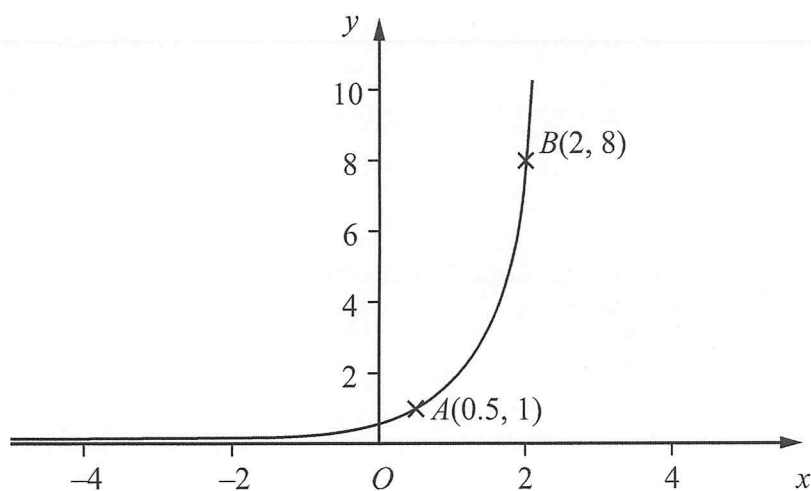
The diagram shows a sketch of the graph $\quad y = ab^x$
The curve passes through the points A (0.5, 1) and B (2, 8).

The point C (−0.5, k) lies on the curve.

Find the value of k.

....

(Total 4 marks)

Q27

TOTAL FOR PAPER: 100 MARKS

END