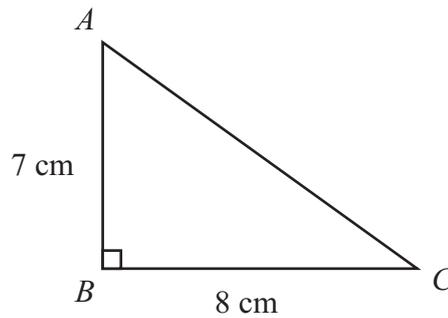


14.

Diagram **NOT**
accurately drawn ABC is a right-angled triangle. $AB = 7$ cm, $BC = 8$ cm.

(a) Work out the area of the triangle.

$$\begin{aligned} \text{Area } \triangle &= \frac{1}{2}bh \\ &= \frac{1}{2} \times 8 \times 7 \\ &= 28 \text{ cm}^2 \end{aligned}$$

..... 28 ✓ cm^2
(2)

2

(b) Work out the length of AC .

Give your answer correct to 2 decimal places.

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

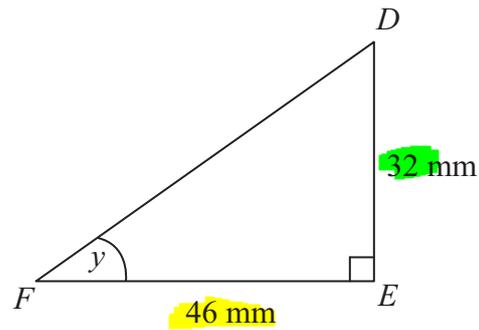
$$\begin{aligned} AC^2 &= 7^2 + 8^2 \\ &= 49 + 64 = 113 \end{aligned}$$

$$AC = \sqrt{113} = 10.63$$

..... 10.63 ✓ cm
(3)

3



Leave
blankDiagram **NOT**
accurately drawn DEF is another right-angled triangle. $DE = 32$ mm, $FE = 46$ mm.

SOHCAHTOA

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

$$\tan y^\circ = \frac{32}{46}$$

$$y = \tan^{-1}\left(\frac{32}{46}\right) = 34.8^\circ$$

34.8°

(3)

(Total 8 marks)

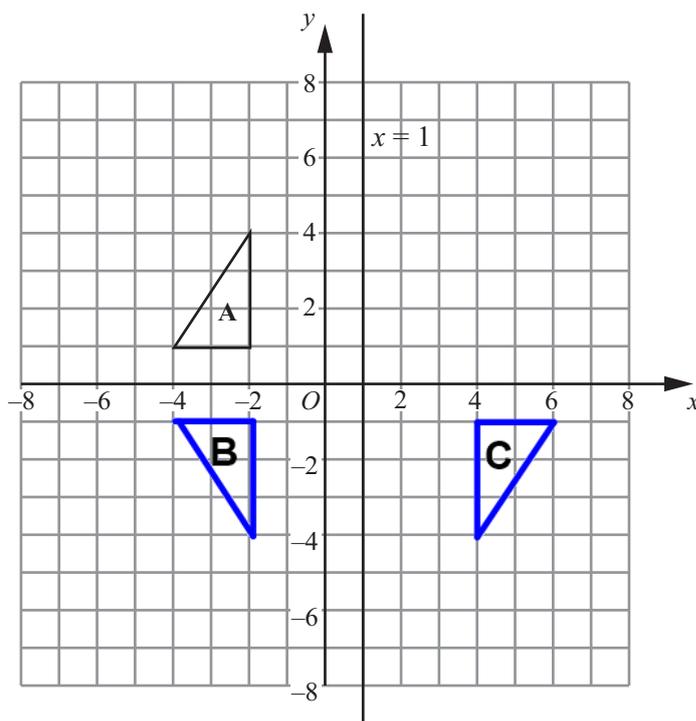
3

Q14

8



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**.

ROTATION of 180° with centre $(1, 0)$

(Total 3 marks)

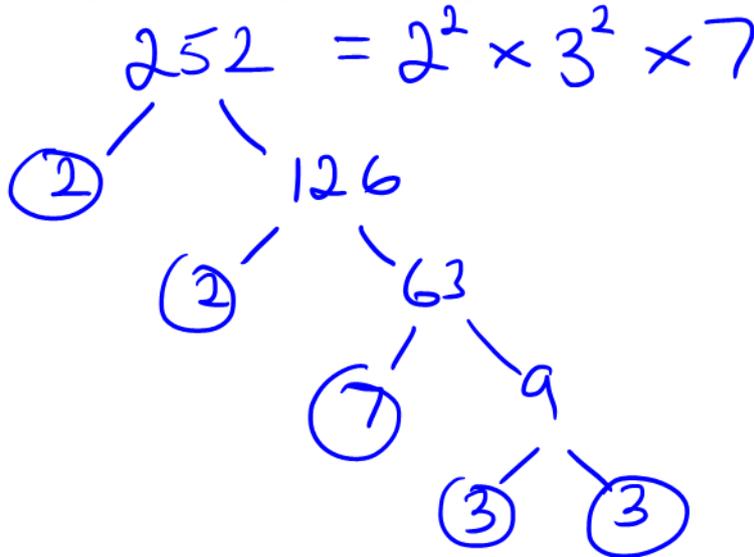
Q15

3



Leave blank

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



$$\underline{2^2 \times 3^2 \times 7}$$

(3)

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.

HCF is 3 LCM 45
 3, 6, 9, 12, 15, 18, 21, 24, 27, 30, 33, 36, 39, 42, 45
 9, 18, 27, 36, 45
 15, 30, 45

9 ✓ and 15 ✓
 and
 (3)

3

(Total 6 marks)

Q16
6

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.

$$20 \times 1.51 \times 10^{26} = 3.02 \times 10^{27}$$

↑
type this
into your calculator!

$$\underline{3.02 \times 10^{27}}$$

2

(Total 2 marks)

Q17
2

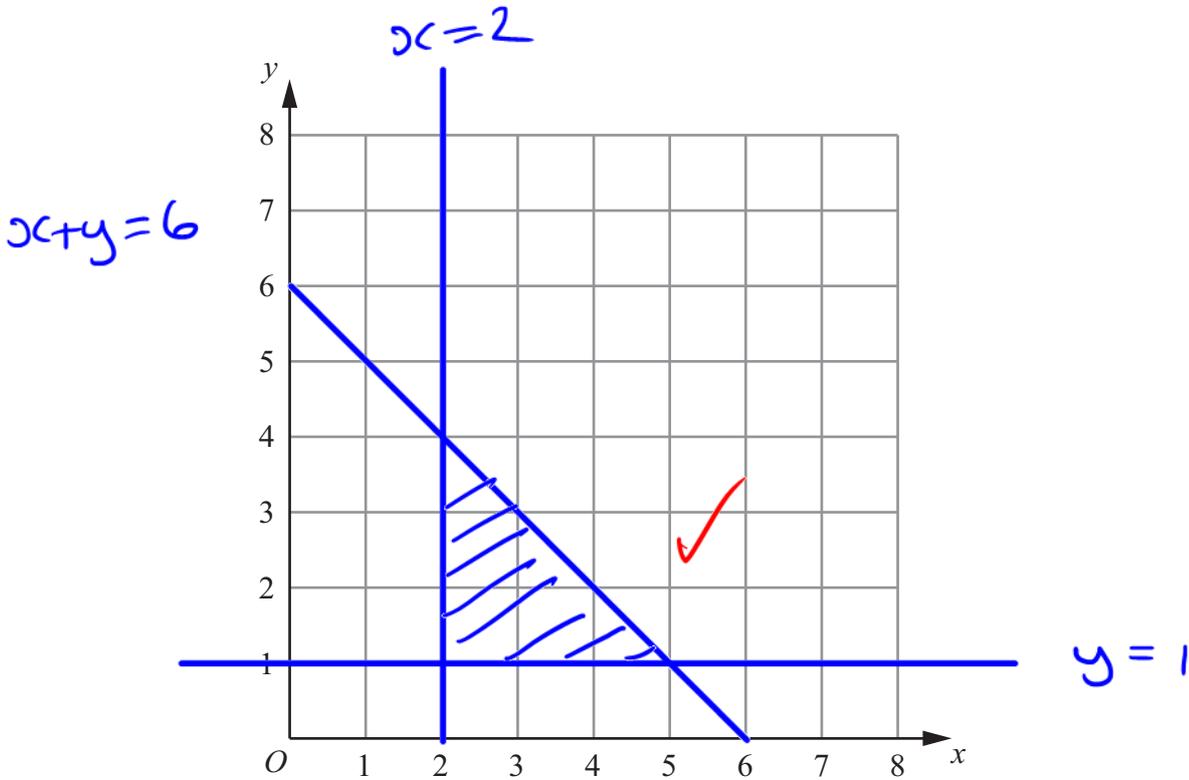


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18. The region **R** satisfies the inequalities

$$x \geq 2, \quad y \geq 1, \quad x + y \leq 6$$

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

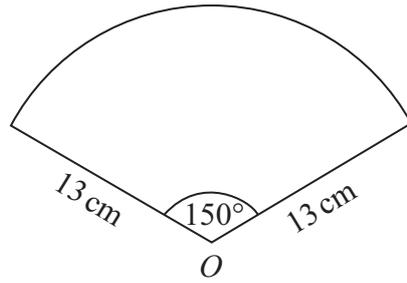


(Total 3 marks)

Q18
3



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.

$$\begin{aligned} \text{Area of circle} &= \pi r^2 \\ &= \pi \times 13^2 \\ &= 169\pi \end{aligned}$$

Area of
Sector

$$\begin{aligned} \frac{150^\circ}{360^\circ} \times 169\pi &= 221.2204827 \\ &= 221\text{ cm}^2 \text{ (3sf)} \end{aligned}$$

221 ✓

..... cm²

(Total 2 marks)

Q19

2

↑
Type this
in your
calculator



Leave
blank

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 .

$$q \propto \frac{1}{t^2}$$

$$q = \frac{k}{t^2}$$

$$8.5 = \frac{k}{4^2}$$

$$k = 16 \times 8.5 \\ = 136$$

$$q = \frac{136}{t^2}$$

$$q = \frac{136}{t^2} \checkmark$$

(3)

3

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

$$q = \frac{136}{t^2}$$

$$= \frac{136}{25} = 5.44$$

$$5.44 \checkmark$$

(1)

1

(Total 4 marks)

Q20

4



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



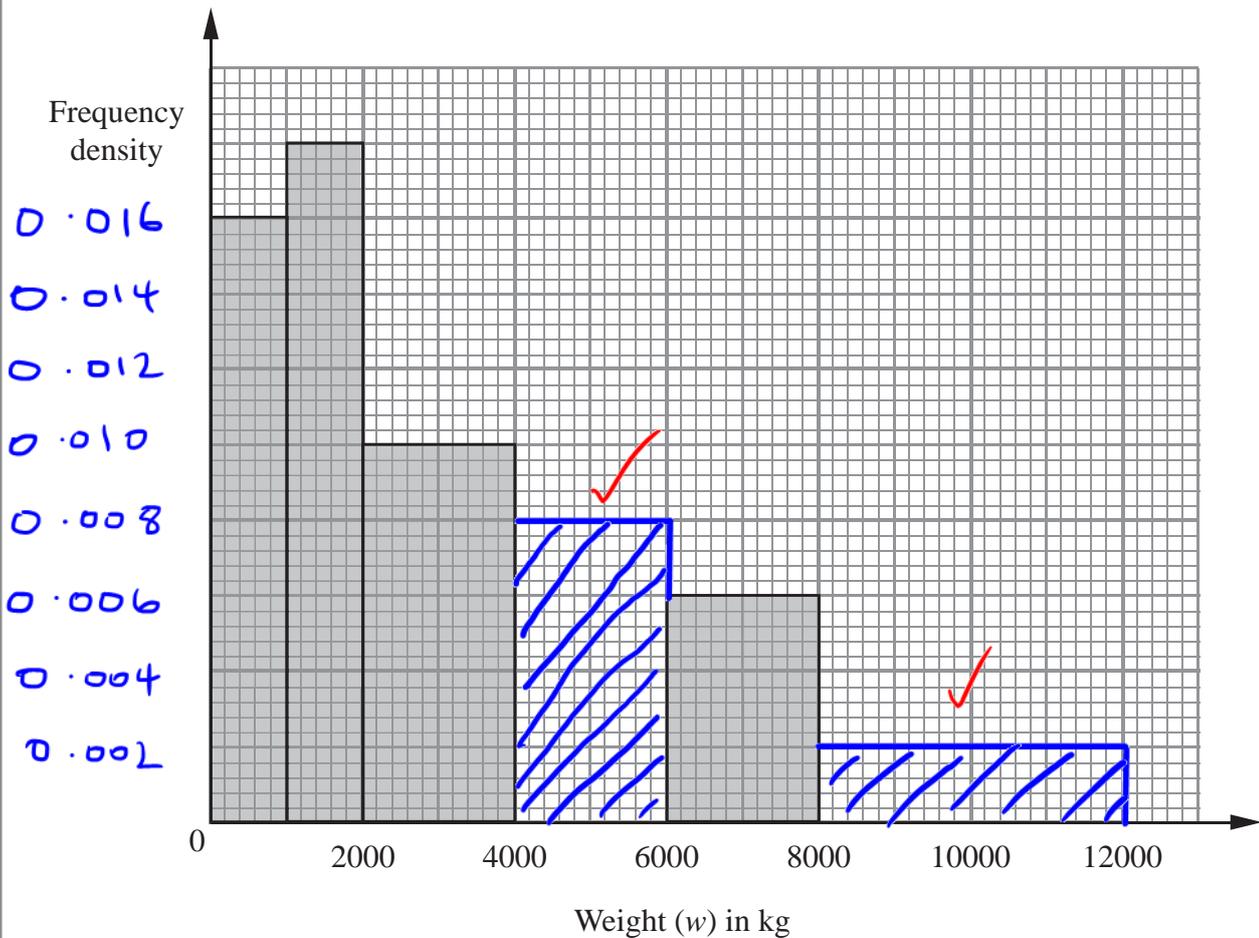
$$FD = \frac{F}{W}$$

$$F = FD \times W$$

Weight (w) in kg	Frequency	WIDTH	FD
$0 < w \leq 1000$	16	1000	0.016
$1000 < w \leq 2000$	18 ✓	1000	0.018
$2000 < w \leq 4000$	20 ✓	2000	0.010
$4000 < w \leq 6000$	16	2000	0.008
$6000 < w \leq 8000$	12 ✓	2000	0.006
$8000 < w \leq 12000$	8	4000	0.002

(a) Use the information in the histogram to complete the table. (2)

(b) Use the information in the table to complete the histogram. (2)



(Total 4 marks)

2

2

Q21
4



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.

		accuracy	tolerance	UB	LB
Distance	238	1	0.5	238.5	237.5
Litres	27.3	0.1	0.05	27.35	27.25

$$\begin{aligned} \text{UB of Petrol consumption} &= \frac{\text{UB of miles}}{\text{LB of litres}} \\ &= \frac{238.5}{27.25} \end{aligned}$$

$$= 8.752293578$$

$$= 8.75 \text{ miles per litre (2dp)}$$

8.75 ✓

..... miles per litre

(Total 3 marks)

Q22

3



Leave blank

23. (a) Show that the equation

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

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

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

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

$$x(x-1) \cdot 5(x-1) = (4-3x)(x+2)$$

$$5x - 5 = 4x + 8 - 3x^2 - 6x$$

$$3x^2 + 5x - 4x + 6x - 5 - 8 = 0$$

$$3x^2 + 7x - 13 = 0 \quad \checkmark$$

(3)

(b) Solve $3x^2 + 7x - 13 = 0$

Give your solutions correct to 2 decimal places.

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

$a = 3$

$b = 7$

$c = -13$

$$= \frac{-7 \pm \sqrt{7^2 - (4 \times 3 \times -13)}}{2 \times 3}$$

$$= \frac{-7 \pm \sqrt{205}}{6}$$

$x = 1.22$ or $x = -3.55$

(3)

(Total 6 marks)

3

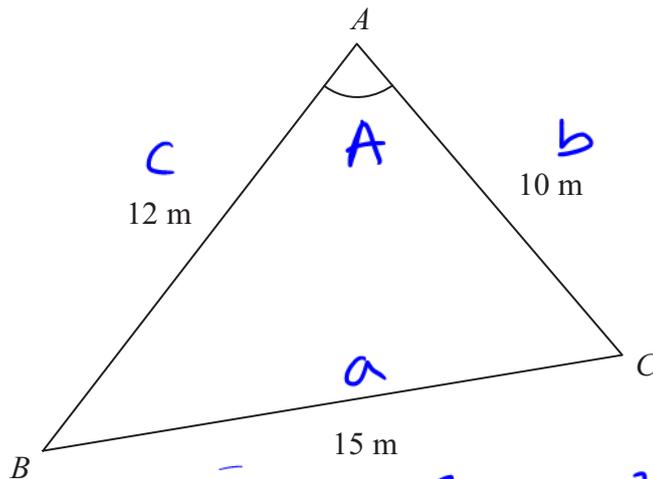
3

Q23

6



24.

Diagram **NOT**
accurately drawn

ABC is a triangle.
 $AB = 12\text{ m}$.
 $AC = 10\text{ m}$.
 $BC = 15\text{ m}$.

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

Calculate the size of angle BAC .

Give your answer correct to **one decimal place**.

$$15^2 = 10^2 + 12^2 - (2 \times 10 \times 12 \times \cos A)$$

$$225 = 100 + 144 - (240 \times \cos A)$$

$$-19 = -240 \cos A$$

$$\cos A = \frac{-19}{-240}$$

$$A = \cos^{-1}\left(\frac{-19}{-240}\right) = 85.45933267$$

85.5 ° ✓

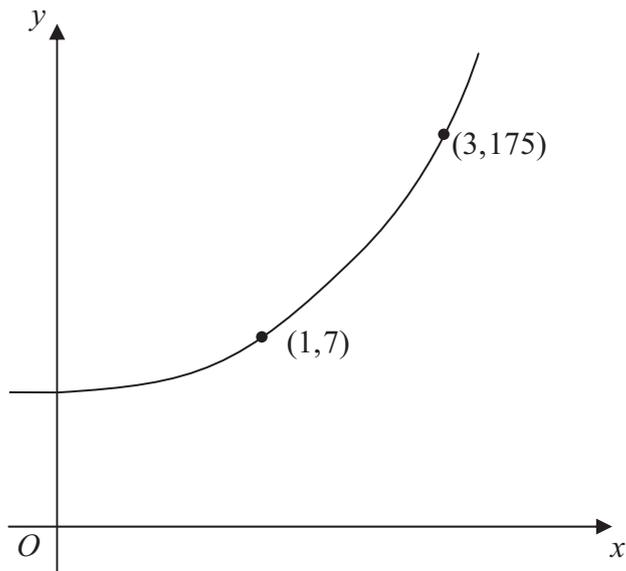
(Total 3 marks)

Q24

3



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 .

$$x = 1 \quad y = 7$$

$$x = 3 \quad y = 175$$

$$7 = ka^1$$

$$175 = ka^3$$

Substitute in

$$ka \times a^2 = 175$$

$$7a^2 = 175$$

$$a^2 = 25$$

$$a = 5$$

$$k = \frac{7}{5} = 1.4$$

$$k = 1.4 \quad \checkmark$$

$$a = 5 \quad \checkmark$$

(Total 3 marks)

Q25

3

TOTAL FOR PAPER: 100 MARKS

END



Leave
blank

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

$$24, 48, 72$$

$$36, 72$$

$$72 \checkmark$$

(Total 2 marks)

Q13

2

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

$$3(x + 4) + 5(2x + 1)$$

$$= 3x + 12 + 10x + 5$$

$$= 13x + 17$$

$$13x + 17 \checkmark$$

(2)

2

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

$$t^4 \times t^6 = t^{4+6} = t^{10}$$

$$t^{10} \checkmark$$

(1)

1

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

$$p^8 \div p^5 = p^{8-5} = p^3$$

$$p^3 \checkmark$$

(1)

1

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

$$(x^4)^3 = x^{4 \times 3} = x^{12}$$

$$x^{12} \checkmark$$

(1)

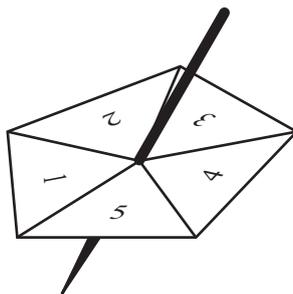
Q14

5

(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 .

$$\begin{array}{r}
 0.15 \\
 0.05 \\
 0.20 \\
 0.25 \\
 \hline
 0.65 \\
 1
 \end{array}$$

$$\begin{aligned}
 x &= 1 - 0.65 \\
 &= 0.35
 \end{aligned}$$

$$x = 0.35 \checkmark$$

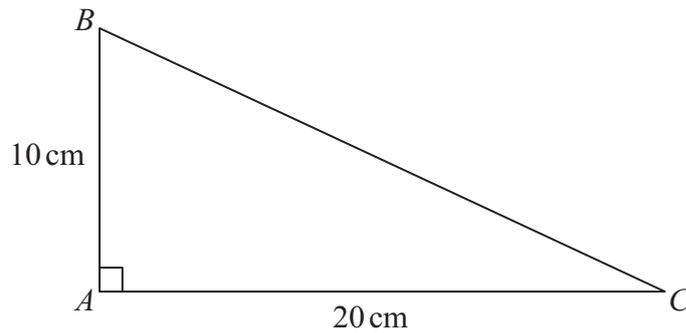
Q15

2

(Total 2 marks)



16.

Diagram NOT
accurately drawnIn triangle ABC ,

$$AB = 10 \text{ cm}$$

$$AC = 20 \text{ cm}$$

$$\text{angle } BAC = 90^\circ$$

Work out the length of BC .

Give your answer correct to 3 significant figures.

You must state the units in your answer.

PYTHAGORAS

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

$$c^2 = 10^2 + 20^2$$

$$c^2 = 100 + 400$$

$$c^2 = 500$$

$$c = \sqrt{500}$$
$$= 22.4$$

22.4

cm

(Total 4 marks)

Q16

4



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	fx
0	0	0
1	8	8
2	12	24
3	6	18
4	4	16
5	2	10

Calculate the mean.

TOTAL 32 76

$$\text{Mean} = \frac{\sum fx}{\sum f} = \frac{76}{32} = 2.375$$

2.375 ✓

(Total 3 marks)

Q17

3

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

REVERSE PERCENTAGE

$$2006 \text{ PRICE} \times 0.65 = 5460$$

$$\therefore 2006 \text{ PRICE} = \frac{5460}{0.65} = \underline{8400}$$

$$35\% = 0.35$$

$$\text{multiplier} = 1 - 0.35$$

$$= 0.65$$

£ 8400 ✓

(Total 3 marks)

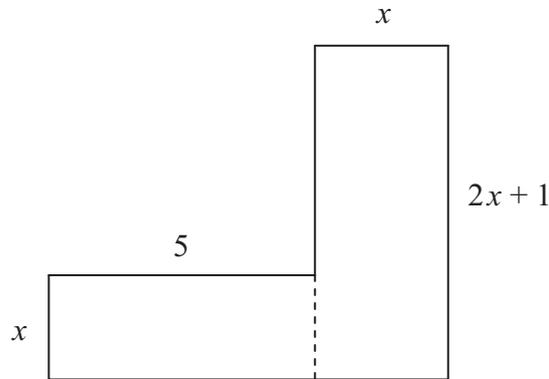
Q18

3



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



The area of the shape is 95 cm^2 .

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

$$\text{Area} = 5x + x(2x + 1) = 95$$

$$5x + 2x^2 + x = 95$$

$$2x^2 + 6x - 95 = 0 \quad \checkmark$$

(3)

- (b) Solve the equation

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

Give your solutions correct to 3 significant figures.

use Quadratic
Formula!

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-6 \pm \sqrt{36 - (4 \times 2 \times -95)}}{4}$$

$$a = 2$$

$$b = 6$$

$$c = -95$$

$$= \frac{-6 \pm \sqrt{796}}{4}$$

$$x = 5.55 \quad \checkmark \quad \text{or } x = -8.55 \quad \checkmark$$

(3)

Q19

(Total 6 marks)

6



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

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

(a) Explain why.

Because the sequence of even numbers
has a gap of 2 between each term in
the sequence. (1)

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

$$2n + 4 \quad (1)$$

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

$$\begin{aligned} & 2n + 2n + 2 + 2n + 4 \\ &= 6n + 6 \\ &= 6(n+1) \end{aligned}$$

each number in the sequence is a multiple of 6

(3)

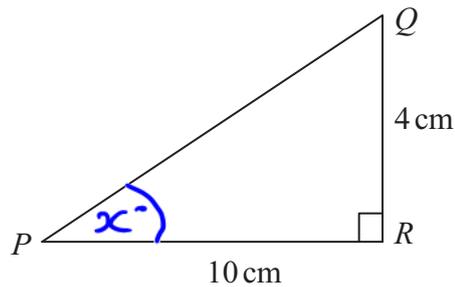
(Total 5 marks)

Q20

5



21.

Diagram NOT
accurately drawn PQR is a right-angled triangle. $QR = 4 \text{ cm}$
 $PR = 10 \text{ cm}$ SOHCAHTOA
use tanWork out the size of angle RPQ .

Give your answer correct to 3 significant figures.

$$\tan x^\circ = \frac{4}{10}$$

$$x^\circ = \tan^{-1}\left(\frac{4}{10}\right)$$

$$= 21.80140949$$

$$= 21.8$$

21.8 ✓

(Total 3 marks)

Q21

3

22. D is proportional to S^2 . $D = 900$ when $S = 20$ Calculate the value of D when $S = 25$

$$D \propto S^2$$

$$D = kS^2$$

$$900 = k \times 20^2$$

$$900 = 400k$$

$$k = \frac{900}{400} = \frac{9}{4} = 2.25$$

$$D = 2.25 S^2$$

$$= 2.25 \times 25^2$$

$$= 2.25 \times 625$$

$$= 1406.25$$

$$D = 1406.25 \checkmark$$

(Total 4 marks)

Q22

4



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 .

9.7 9.8 9.9
 ↑
 9.75

9.75 ✓

(ii) Calculate the upper bound of H .

Give your answer correct to 3 significant figures.

$$\text{UB of } H = \frac{\text{UB of } v^2}{\text{LB of } 2g} = \frac{24.45^2}{2 \times 9.75}$$

$$\text{UB of } v = 24.45$$

$$= 30.65653846$$

$$= 30.7$$

30.7 ✓

(Total 3 marks)

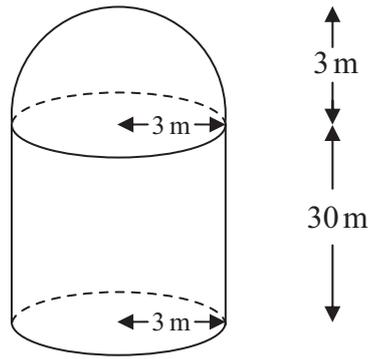
Q23

3



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.

Volume of hemisphere
 $= 36\pi \div 2$
 $= 18\pi$

Vol. of cylinder
 $\pi r^2 h = \pi \times 3^2 \times 30$
 $= 270\pi$

Vol. of sphere = $\frac{4}{3}\pi r^3$
 $= \frac{4}{3} \times \pi \times 3^3$
 $= 36\pi$

Total Vol.

$270\pi + 18\pi = 288\pi$

$905 \checkmark$
 m³
 (3)

3

A sphere has a volume of 500 m³.

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

$\frac{4}{3}\pi r^3 = 500$

$\pi r^3 = \frac{3}{4} \times 500$

$r^3 = \frac{375}{\pi}$

$r = \sqrt[3]{\frac{375}{\pi}}$
 $= 4.923725109 \text{ m}$
 $= 4.92 \text{ m}$
 $4.92 \checkmark$

..... m
 (3)

3

(Total 6 marks)

Q24
6



25.

	Male	Female
First year	399	602
Second year	252	198

1001
450
1451

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.

$$\frac{399}{1451} \times 70 = 19.24879394$$

$$= 19 \text{ students (to nearest whole)}$$

19 ✓

.....

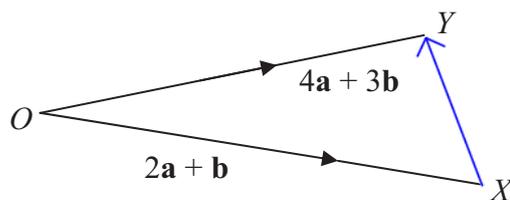
(Total 3 marks)

Q25

3



26.

Diagram **NOT**
accurately drawn

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

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

- (a) Express the vector \vec{XY} in terms of \mathbf{a} and \mathbf{b}
Give your answer in its simplest form.

$$\begin{aligned} \vec{XY} &= \vec{OY} - \vec{OX} \\ &= \underline{4\mathbf{a}} + \underline{3\mathbf{b}} \\ &\quad - \underline{2\mathbf{a}} + \underline{\mathbf{b}} \\ &\quad \hline &\quad \underline{2\mathbf{a}} + \underline{2\mathbf{b}} \\ &= 2(\underline{\mathbf{a}} + \underline{\mathbf{b}}) \end{aligned}$$

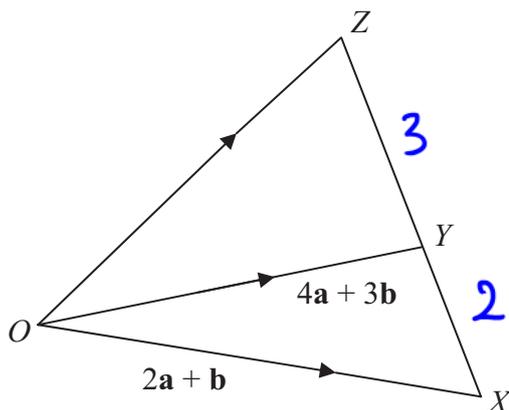
$$\vec{XY} = 2(\mathbf{a} + \mathbf{b}) \quad (2)$$

2



Leave blank

Diagram NOT accurately drawn



XYZ is a straight line.

$XY : YZ = 2 : 3$

- (b) Express the vector \vec{OZ} in terms of \mathbf{a} and \mathbf{b}
Give your answer in its simplest form.

$$\vec{XY} = 2(\underline{a} + \underline{b})$$

$$\vec{YZ} = 3(\underline{a} + \underline{b})$$

$$= 3\underline{a} + 3\underline{b}$$

$$\vec{OZ} = \vec{OY} + \vec{YZ}$$

$$= 4\underline{a} + 3\underline{b} + 3\underline{a} + 3\underline{b}$$

$$= 7\underline{a} + 6\underline{b}$$

$$\underline{7a} + \underline{6b} \checkmark$$

3

(3)

Q26

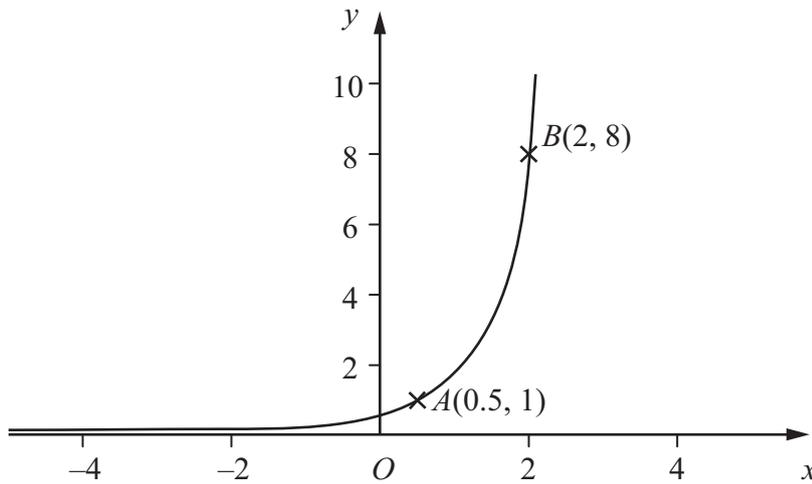
5

(Total 5 marks)



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27.



The diagram shows a sketch of the graph $y = ab^x$
 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.

Rewrite using $ab^{0.5}$

$$8 = ab^{0.5} \times b^{1.5}$$

$$= 1 \times b^{1.5}$$

$$b^{1.5} = 8$$

$$b = \sqrt[1.5]{8} = 4$$

$$y = a4^x$$

$$1 = a4^{0.5}$$

$$1 = 2a$$

$$a = \frac{1}{2}$$

$$y = ab^x$$

$$1 = ab^{0.5}$$

$$8 = ab^2$$

$$y = \frac{1}{2} \times 4^x$$

$$k = \frac{1}{2} \times 4^{-0.5}$$

$$k = \frac{1}{4}$$

$$\underline{k = \frac{1}{4}}$$

(Total 4 marks)

Q27

4

TOTAL FOR PAPER: 100 MARKS

END

