Do not write outside the box

Answer **all** questions in the spaces provided.

1 Expand $5x(x^2 + 3)$

[1 mark]

Answer $5x^3 + 15x$

2 (a) Write 1.52 as an improper fraction in its simplest form.

[1 mark]

$\frac{152}{100}$

$= \frac{38}{25}$

Answer

2 (b) Work out 60 as a percentage of 20

[1 mark]

$\frac{60}{20} \times 100$

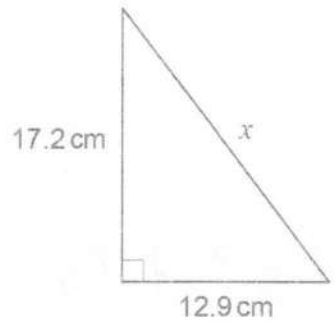
300

Answer %

Do not write outside the box

3 Use Pythagoras' theorem to work out the value of x.

[3 marks]



Not drawn accurately

$x = \sqrt{17.2^2 + 12.9^2}$

$= \sqrt{462.25}$

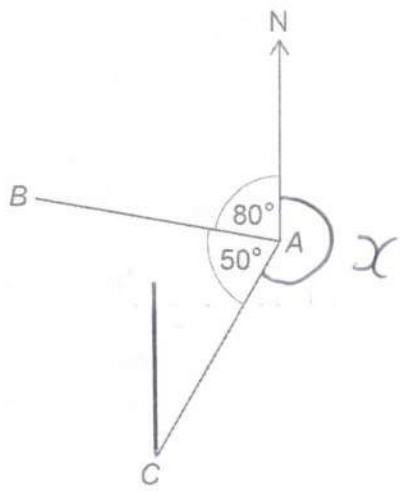
$x =$ 21.5 cm

Turn over for the next question

6

Do not write outside the box

4 *A*, *B* and *C* are three points.



Not drawn accurately

Work out the bearing of *C* from *A*.

[1 mark]

$x = 360 - (80 - 50)$

Answer 230 °

Do not write outside the box

5 Three shops sell the same type and size of lip balm stick.

Shop A

£2.39 each

Shop B

£3.08 each

Buy one, get one half price

Shop C

Pack of 4

Was £11.40

Now $\frac{1}{6}$ off

Which shop is the best value for 8 sticks and what is the total cost in that shop?
Show working to support your answer.

[5 marks]

A = 8 x 2.39 = £19.12

B = (4 x 3.08) + (4 x 1.54) = £18.48

C = 2 x 11.40 x $\frac{5}{6}$ = £19

Shop B Total cost £ 18.48

6

Do not write outside the box

6 Round 1 of voting for Head Student is taking place in a school.

6 (a) To reach round 2, a student must receive **at least** $\frac{4}{15}$ of the votes.

3x4 = 12
3 left

What is the largest possible number of students that can reach round 2?

Circle your answer.

[1 mark]

15 11 (3) 4

6 (b) There are 900 votes in round 1

Sean receives 180 votes.

Amy draws a pie chart to represent the results.

Here is her method to work out the angle needed for Sean.

180 ÷ 900 × 100 = 20 The angle should be 20°

Is Amy's method correct?

Tick a box.

Yes ☐ No ☑

Give a reason for your answer.

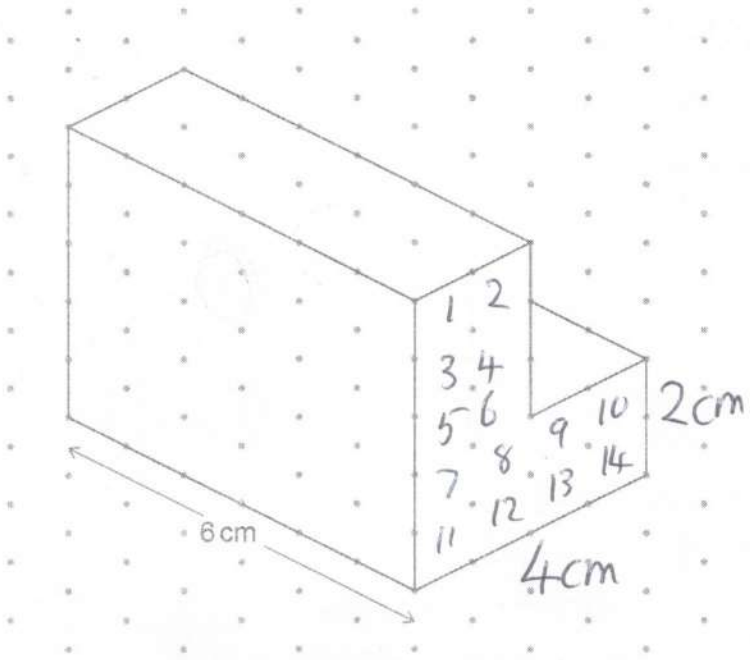
[1 mark]

She's worked out Sean's %

His angle is $\frac{180}{900} \times 360 = 72°$

Do not write outside the box

7 Here is a prism drawn on an isometric grid.



Work out the volume of the prism.

[3 marks]

14 x 6

84

Answer _____ cm^3

5

Do not write outside the box

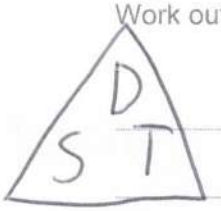
8 Tasha drove 198 miles.

(A) Her average speed for the first 3 hours was 45 miles per hour.

(B) Her average speed for the rest of the journey was 31.5 miles per hour.

Work out her average speed for the whole journey.

[4 marks]



(A) $D = S \times T = 3 \times 45 = 135$ miles

$198 - 135 = 63$ miles left

(B) $T = \frac{63}{31.5} = 2$ hrs

Total time = 5 hrs
Total distance = 198

$S = \frac{198}{5}$

Answer 39.6 miles per hour

Do not write outside the box

9 Here is the term-to-term rule for a sequence.

Double the previous term and add 3

The first three terms of the sequence are $a + 1$ $2a + 5$ $4a + 13$

Show that the sum of the first **four** terms is a multiple of 3

[3 marks]

4th = $2(4a+13) + 3$

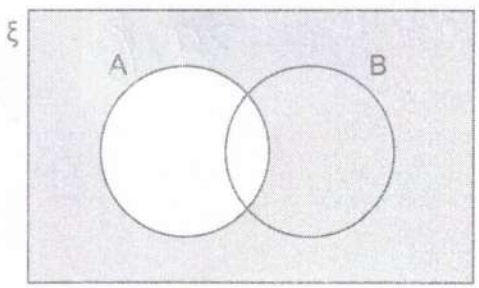
= $8a + 26 + 3$ = $8a + 29$

$(a+1)+(2a+5)+(4a+13)+(8a+29)$

$= 15a + 48$

$= 3(5a + 16)$ hence divides by 3

10



Which of these represents the shaded region?

Circle your answer.

[1 mark]

B A' ∪ B A' ∩ B (A')

8

Do not write outside the box

11 A fair coin is thrown a number of times.

The probability that **every** throw results in Heads is $\frac{1}{64}$

How many times is the coin thrown?

[1 mark]

$\left(\frac{1}{2}\right)^n = \frac{1}{64}$ $\quad 2^n = 64$

Answer $n = 6$

12 Here is some information about the members of a basketball club.

	Number of members	Mean height of members
Junior	30	1.6 m
Senior	20	2.05 m
	50	

Work out the mean height of all 50 members of the club.

Give your answer as a decimal.

[3 marks]

J: Total = $30 \times 1.6 = 48$

S: Total = $20 \times 2.05 = 41$

$\frac{(48 + 41)}{50}$

Answer 1.78 m

Do not write outside the box

13 A straight line passes through (3, 14) and (12, 32)

Work out the equation of the line.

Give your answer in the form $y = mx + c$

[3 marks]

$$m = \frac{32-14}{12-3} = \frac{18}{9} = 2$$

$$y = 2x + c$$

$x = 3$, $y = 14$

$$14 = 2 \times 3 + c$$
$$8 = c$$

Answer $y = 2x + 8$

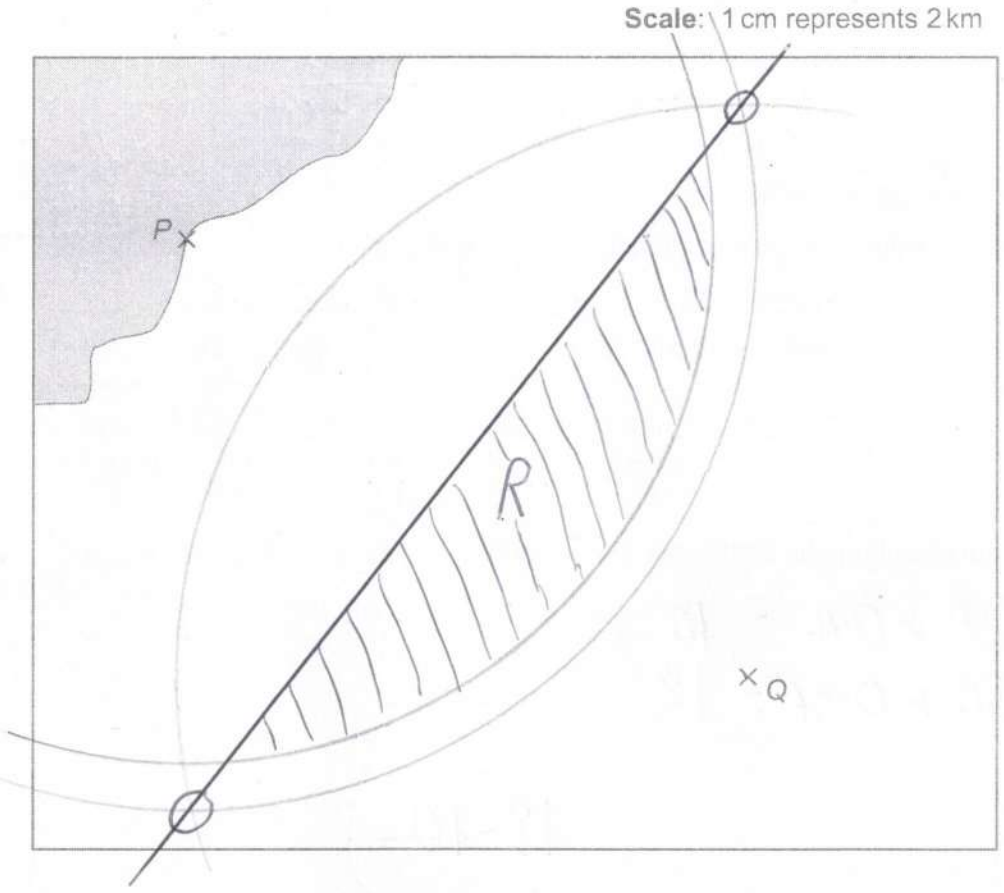
Turn over for the next question

7

Do not write outside the box

14 Use a ruler and compasses in this question.

The scale diagram shows port *P* and lighthouse *Q*.



A ship is

less than 14 km from *P* ⇒ 14km = 7cm

and

closer to *Q* than to *P*. ⇒ ⊾ bisector

Label the region, R, where the ship could be.

Show all your construction lines.

[4 marks]

Do not write outside the box

15 A bag contains discs.

Trial

A disc is chosen at random from the bag.

The colour of the disc is noted.

The disc is put back into the bag.

The trial is carried out 100 times.

The table shows the relative frequency of a blue disc after every 25 trials.

Total number of trials	25	50	75	100
Relative frequency of a blue disc	0.4	0.36	0.4	0.32

15 (a) For the trials from the 26th to the 50th, how many times was a blue disc chosen?

[2 marks]

$25 \times 0.4 = 10$

$50 \times 0.36 = 18$

$18 - 10$

Answer 8

15 (b) There is a total of 1000 discs in the bag.

Work out the **best** estimate of the number of blue discs in the bag.

[1 mark]

1000×0.32

Answer 320

7

Do not write outside the box

16 $a > 0$ and $b < 0$ so a = +ve b = -ve

Circle the correct statement.

[1 mark]

$a - b < 0$ $\quad -\frac{b}{a} < 0$ $\quad \frac{1}{a} < 0$ $\quad b^3 < 0$

17 190 people were asked how much they spent on takeaways one month.
The table shows information about the results.

Amount, x (£)	Cumulative frequency
$0 < x \leqslant 10$	16
$0 < x \leqslant 20$	64
$0 < x \leqslant 30$	140
$0 < x \leqslant 40$	184
$0 < x \leqslant 50$	190

f
16
48
76
44
6

17 (a) How many people spent **more** than £20 ?

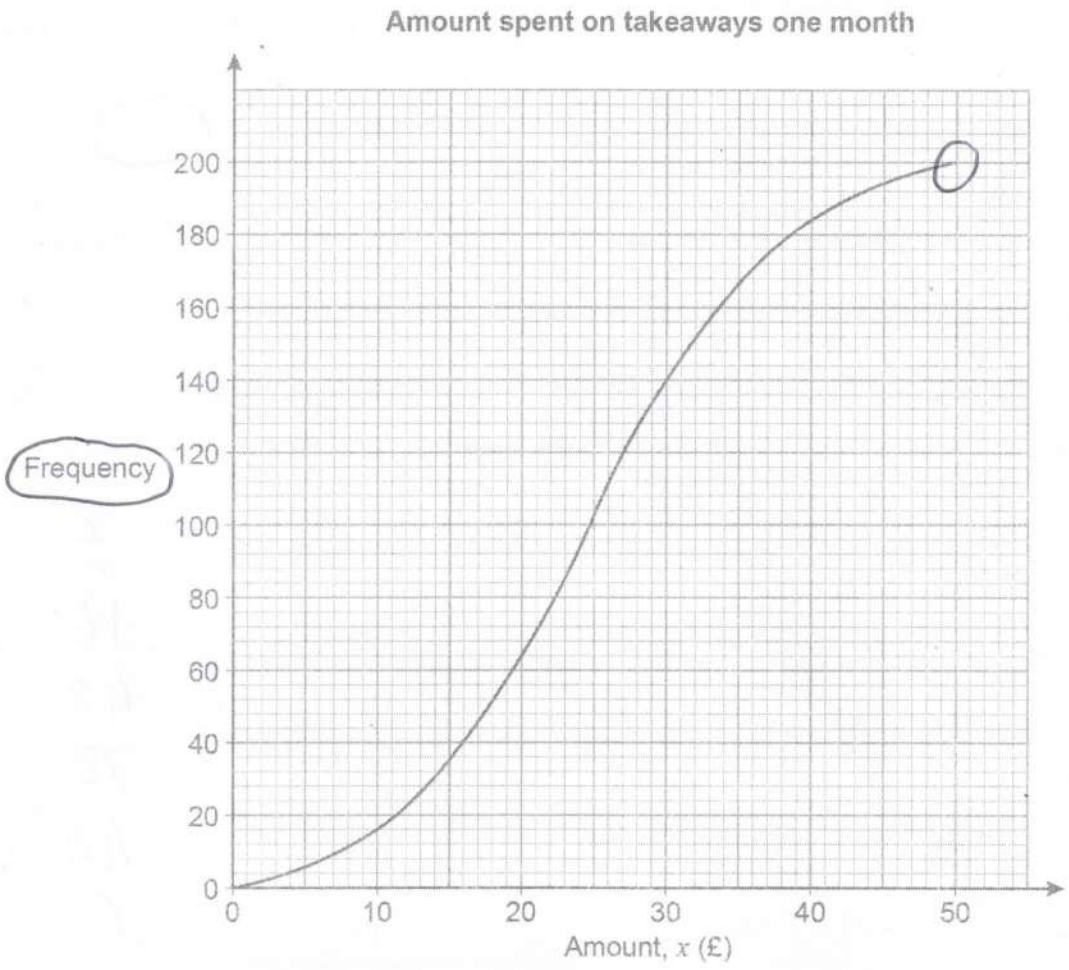
[2 marks]

76 + 44 + 6

Answer 126

Do not write outside the box

17 (b) Farah draws this cumulative frequency curve to represent the results.



Give **two** criticisms of her graph.

[2 marks]

Criticism 1 (50, 200) should be (50, 190)

Criticism 2 y-axis should state cumulative frequency

5

Do not write outside the box

18 By completing the square, prove that $x^2 + 6x + 13$ is always positive.

[3 marks]

$= (x+3)^2 - 9 + 13$

$= (x+3)^2 + 4$

Vertex → min point at $x = -3$, $y = 4$

so $(x+3)^2 + 4 > 0$

Do not write outside the box

19 A is directly proportional to B^4

The value of B is doubled.

Pete thinks that the value of A will be 8 times bigger because 4×2 is 8

Is he correct?

Tick a box.

Yes ☐ No ☑

Give a reason for your answer.

[1 mark]

$A = cB^4$

$B \rightarrow 2B$

$A = c(2B)^4 = c \times 16B$

Turn over for the next question

4

Do not write outside the box

20 Rearrange $p = \frac{2m+1}{1-m}$ to make m the subject.

[4 marks]

$p(1-m) = 2m+1$

$p - pm = 2m+1$

$p - 1 = 2m + pm$

$p - 1 = m(2+p)$

Answer $m = \frac{p-1}{2+p}$

Do not write outside the box

21 Jack is loading a van.

The van can safely carry 1375 kg of furniture.

Jack has already loaded 1200 kg of furniture to the nearest 50 kg

A table has mass 140 kg to the nearest 10 kg

Can the table safely be added to the furniture in the van?

You **must** show your working.

[3 marks]

$1200 < \begin{matrix}1225\\1175\end{matrix}$

$140 < \begin{matrix}145\\135\end{matrix}$

$1375 - 1225$

space = 150

UBound table < space left

so YES

22 Factorise $25a^2 - b^2$

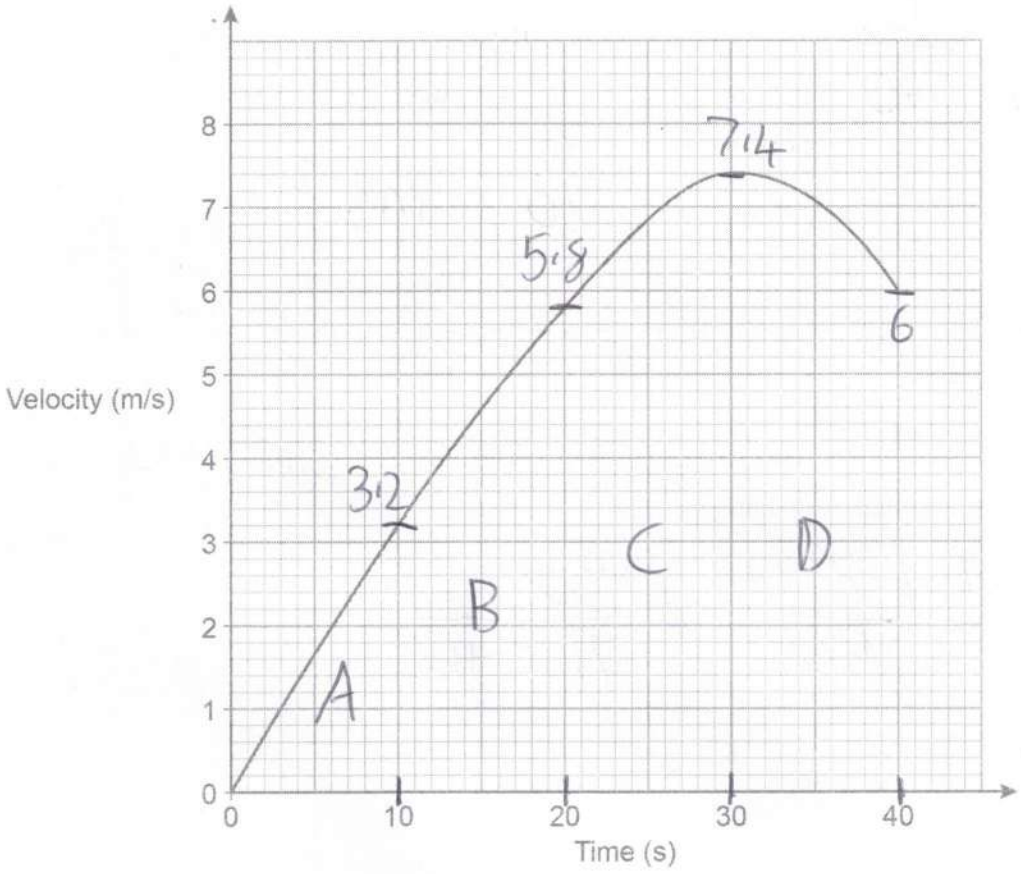
[1 mark]

Answer $(5a - b)(5a + b)$

8

Do not write outside the box

23 Here is the velocity-time graph of a cyclist for 40 seconds.



23 (a) By dividing the area under the graph into four sections of equal widths, estimate the distance travelled during the 40 seconds.

[3 marks]

$A = \frac{1}{2} \times 10 \times 3{\cdot}2 = 16$

$B = \frac{1}{2}(3{\cdot}2 + 5{\cdot}8) \times 10 = 45$ +

$C = \frac{1}{2}(5{\cdot}8 + 7{\cdot}4) \times 10 = 66$ +

$D = \frac{1}{2}(7{\cdot}4 + 6) \times 10 = 67$ +

Answer 194 m

Do not write outside the box

23 (b) Work out the average acceleration of the cyclist during the 40 seconds.

State the units of your answer.

[2 marks]

$\frac{6}{40}$

Answer $\frac{3}{20}$ ms^{-2}

24 Simplify fully $\frac{8x^2+4}{5x} \times \frac{3x}{14x^2+7}$

You **must** show your working.

[3 marks]

$\frac{4(2x^2+1)}{5x} \times \frac{3x}{7(2x^2+1)}$

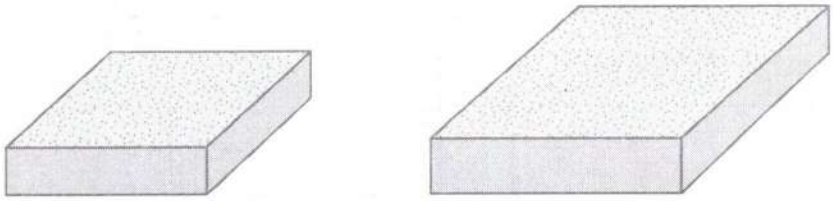
Answer $\frac{12}{35}$

8

Do not write outside the box

25 Here are two square-based paving stones.

The stones are similar solids.



The price per cm^3 is the same for both stones.

The price of the **larger** stone is £17.50

Work out the price of the smaller stone.

[4 marks]

Linear scale factor : $\frac{25}{20} = 1.25$

$17.50 \div 1.25^3$

Answer £ 8.96

Do not write outside the box

26 Rick borrows £1500 from a bank.

He pays back £100 each month.

This iterative formula works out the amount he still owes at the end of each month.

$$A_{n+1} = 1.02 \times A_n - 100$$

$A_0 = 1500$

Work out the amount he still owes at the end of the 2nd month.

[3 marks]

M1 = 1.02 x 1500 - 100 = 1430

M2 = 1.02 x 1430 - 100 = 1358.6

Answer £ 1358.60

Turn over for the next question

7

Do not write outside the box

27 $g(x) = a \times b^x$ where a and b are constants.

$g(0) = 8$ and $g(3) = 343$

Work out the value of g(1)

[4 marks]

$g(0) = a \times b^0 = 8$ so $a = 8$

$g(3) = 8 \times b^3 = 343$

$b = \sqrt[3]{\frac{343}{8}} = \frac{7}{2}$

$g(1) = 8 \times \left(\frac{7}{2}\right)^1 = \frac{56}{2}$

Answer 28

Do not write outside the box

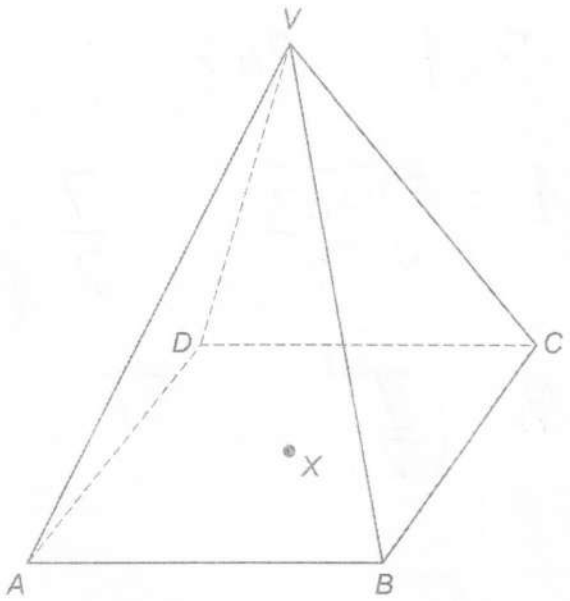
28 *VABCD* is a pyramid with a horizontal square base.

X is the centre of the base.

V is vertically above *X*.

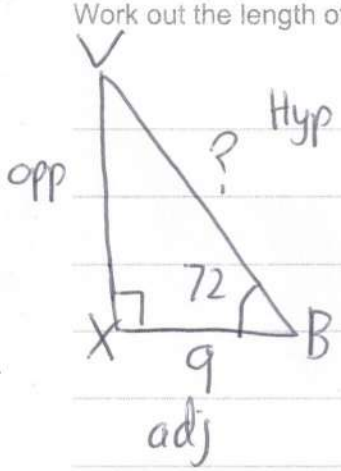
$BD = 18$ cm

Angle $VBX = 72°$



Work out the length of *VB*.

[3 marks]



A
C H

$VB = \frac{9}{\cos 72}$

$= 29.12...$

Answer 29.1 cm

7

Do not write outside the box

29 A code is three letters, each of which is in the word LOGIC

Vinny assumes that letters in the code may be used more than once.

He works out how many possible codes there are.

In fact, the first two letters are the same and the third is different.

How many of Vinny's codes are **not** possible?

[2 marks]

Initial = 5 × 5 × 5 = 125 possibilities

5 × 1 × 4 = 20 actual possibilities

Answer 105

END OF QUESTIONS

2