

1 Make t the subject of the formula $w = 3t + 11$

$$\begin{array}{rcl} & -11 & -11 \\ w - 11 & = & 3t \\ \div 3 & & \div 3 \\ \hline \frac{w - 11}{3} & = & t \end{array}$$

$$\frac{w - 11}{3}$$

(Total for Question 1 is 2 marks)

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- 2 Three companies sell the same type of furniture.

The price of the furniture from Pooles of London is £1480

The price of the furniture from Jardins of Paris is €1980

The price of the furniture from Outways of New York is \$2250

The exchange rates are

$$£1 = €1.34$$

$$£1 = \$1.52$$

Which company sells this furniture at the lowest price?

You must show how you get your answer.

London

£1480

Paris

€1980

÷ 1.34

= £1477.61

New York

\$2250

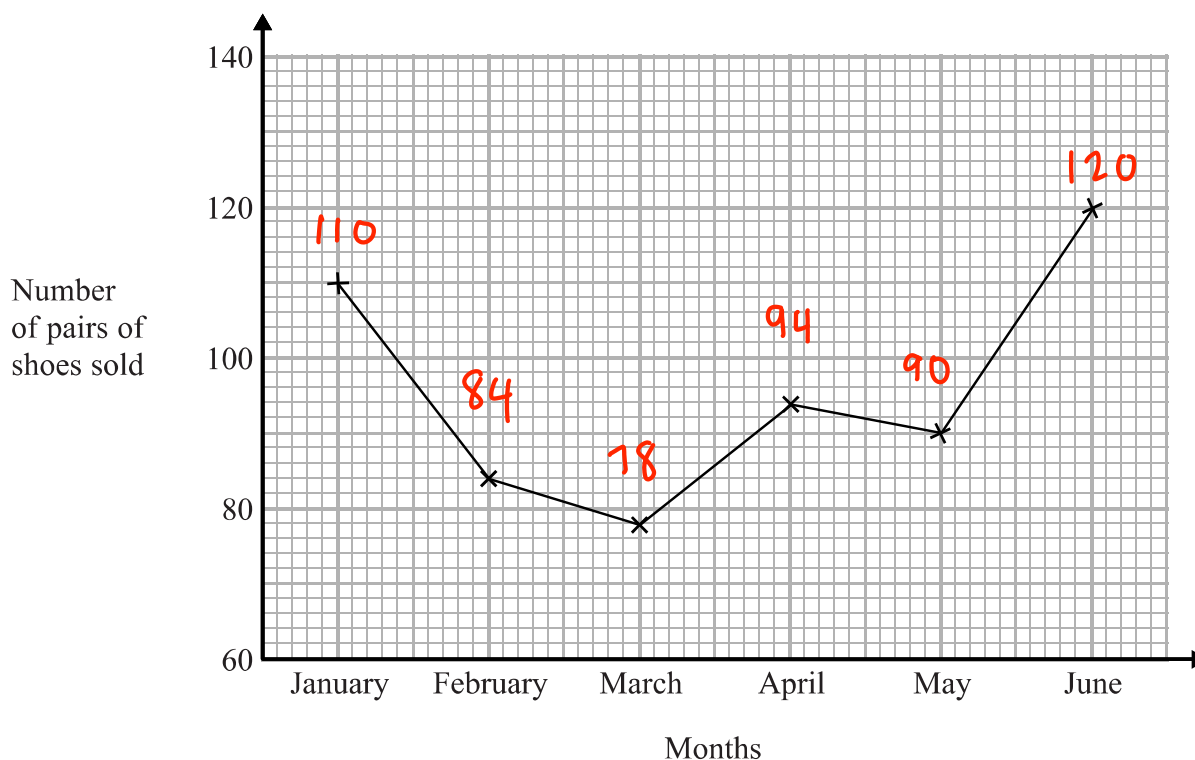
÷ 1.52

= £1480.26

Jardins of Paris

(Total for Question 2 is 3 marks)

- 3 The time-series graph gives some information about the number of pairs of shoes sold in a shoe shop in the first six months of 2014



The sales target for the first six months of 2014 was to sell a mean of 96 pairs of shoes per month.

Did the shoe shop meet this sales target?
You must show how you get your answer.

$$\frac{110 + 84 + 78 + 94 + 90 + 120}{6} = 96$$

They met the target

(Total for Question 3 is 3 marks)

- 4 The grouped frequency table gives information about the heights of 30 students.

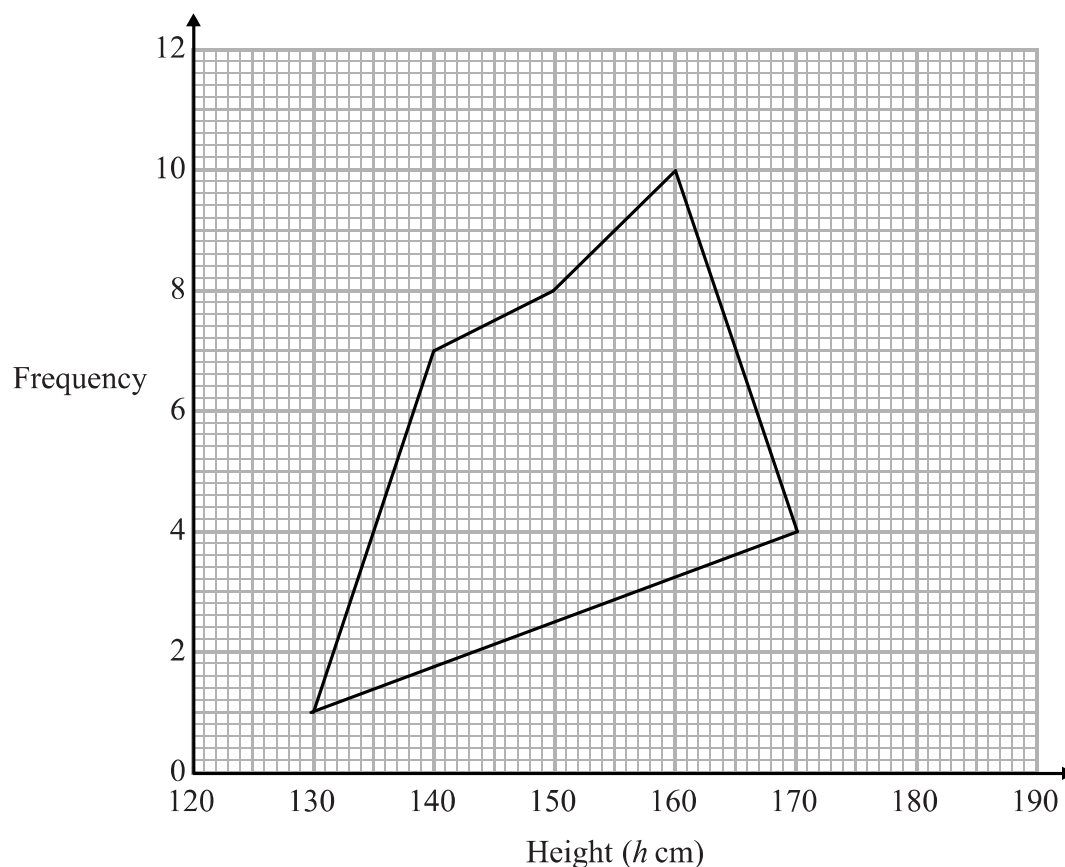
Height (h cm)	Frequency
$130 < h \leq 140$	1
$140 < h \leq 150$	7
$150 < h \leq 160$	8
$160 < h \leq 170$	10
$170 < h \leq 180$	4

- (a) Write down the modal class interval.

$160 < h \leq 170$

(1)

This incorrect frequency polygon has been drawn for the information in the table.



- (b) Write down two things wrong with this incorrect frequency polygon.

1 Points should be plotted at midpoint

2 The first and last point should not be connected

(2)

(Total for Question 4 is 3 marks)

- 5 At 9 am, Bradley began a journey on his bicycle.

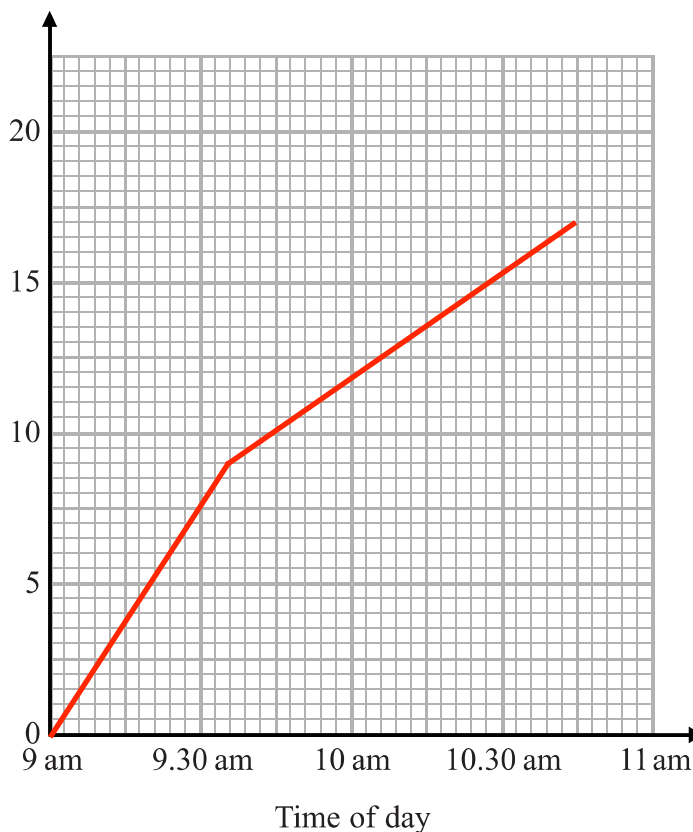
From 9 am to 9.36 am, he cycled at an average speed of 15 km/h.

From 9.36 am to 10.45 am, he cycled a further 8 km.

- (a) Draw a travel graph to show Bradley's journey.



Distance
in km



$$15 \text{ mins} = 0.25 \text{ hours}$$

(3)

From 10.45 am to 11 am, Bradley cycled at an average speed of 18 km/h.

- (b) Work out the distance Bradley cycled from 10.45 am to 11 am.

$$\begin{aligned} D &= S \times T \\ &= 18 \times 0.25 = 4.5 \end{aligned}$$

4.5 km
(2)

(Total for Question 5 is 5 marks)

- 6 Toby invested £7500 for 2 years in a savings account.
He was paid 4% per annum compound interest.

How much money did Toby have in his savings account at the end of 2 years?

$$7500 \times 1.04^2 = 8112$$

£ 8112

(Total for Question 6 is 2 marks)

- 7 Becky has some marbles.
Chris has two times as many marbles as Becky.
Dan has seven more marbles than Chris.

They have a total of 57 marbles.

Dan says,

“If I give some marbles to Becky, each of us will have the same number of marbles.”

Is Dan correct?

You must show how you get your answer.

$$B = x$$

$$C = 2x$$

$$D = 2x + 7$$

$$x + 2x + 2x + 7 = 57$$

$$5x + 7 = 57$$

$$\begin{array}{r|l} -7 & -7 \end{array}$$

$$\begin{array}{r|l} 5x & = 50 \end{array}$$

$$\begin{array}{r|l} \div 5 & \div 5 \end{array}$$

$$\begin{array}{r|l} x & = 10 \end{array}$$

$$B = 10$$

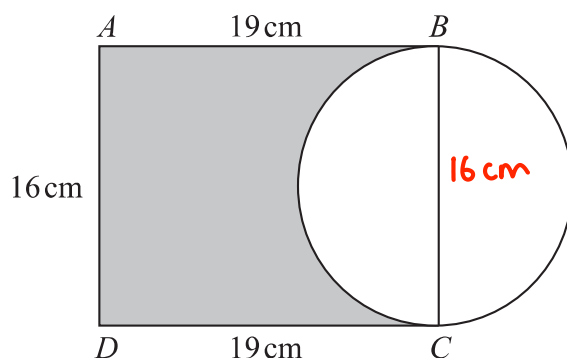
$$C = 20$$

$$D = 27$$

Dan is incorrect, he has 17 more marbles than Becky and so would have to give her 8.5 marbles for them to have the same amount, which is not possible.

(Total for Question 7 is 3 marks)

- 8 Here is a diagram showing a rectangle, $ABCD$, and a circle.



BC is a diameter of the circle.

Calculate the percentage of the area of the rectangle that is shaded.
Give your answer correct to 1 decimal place.

$$\pi \times 8^2 = 64\pi \div 2 = 32\pi$$

$$16 \times 19 = 304$$

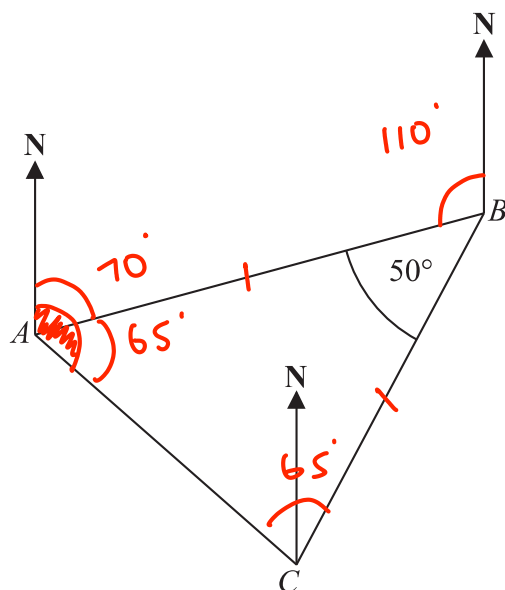
$$304 - 32\pi = 203.469 \text{ cm}^2 \text{ (Shaded area)}$$

$$\frac{203.469}{304} \times 100 = 66.93 \dots$$

66.9 %

(Total for Question 8 is 4 marks)

- 9 The diagram shows the positions of three points, A , B and C , on a map.



The bearing of B from A is 070°

Angle ABC is 50°

$AB = CB$

Work out the bearing of C from A .

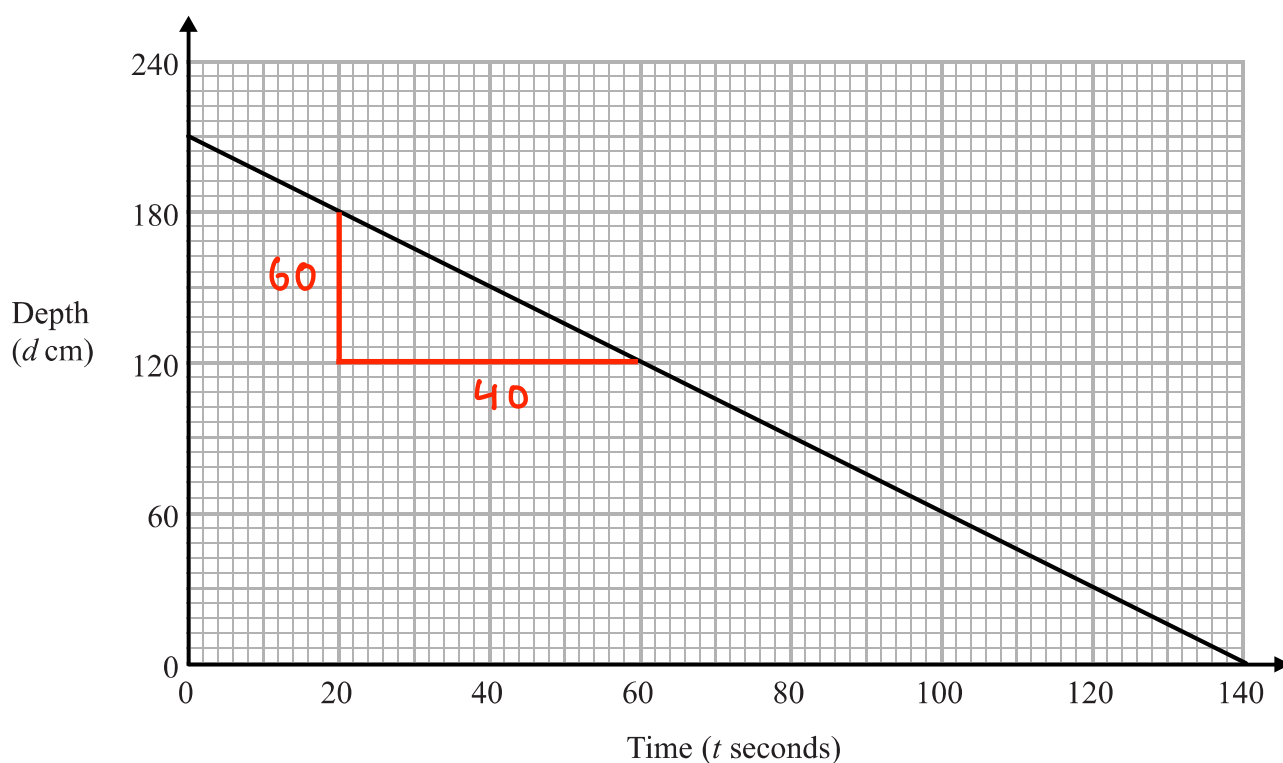
$$\frac{180 - 50}{2} = 65^\circ$$

$$65 + 70 = 135$$

135°

(Total for Question 9 is 3 marks)

10 The graph shows the depth, d cm, of water in a tank after t seconds.



(a) Find the gradient of this graph.

$$60 \div 40 = 1.5$$

$$- 1.5$$

(2)

(b) Explain what this gradient represents.

The decrease in depth per second

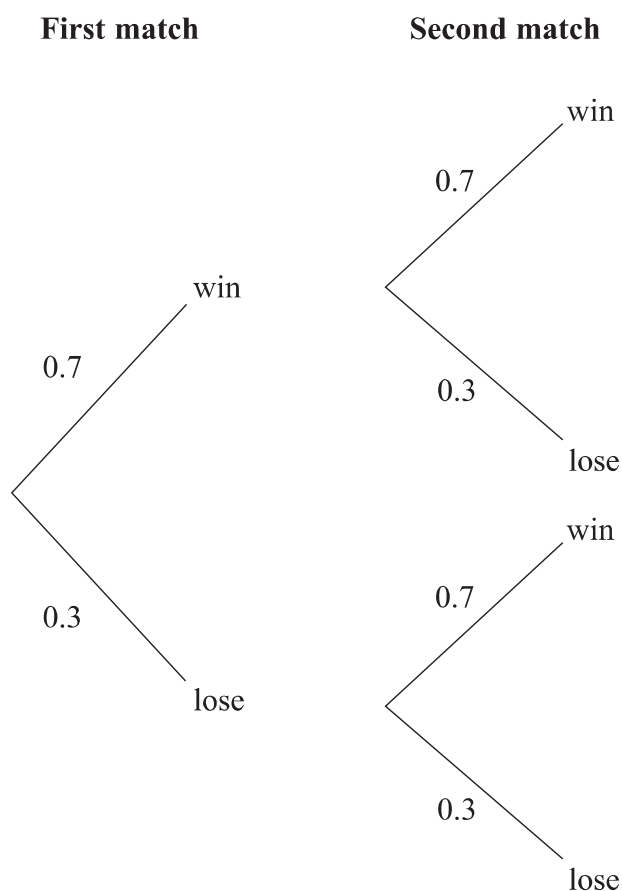
(1)

(Total for Question 10 is 3 marks)



11 Finlay plays two tennis matches.

The probability that he will win a match and the probability that he will lose a match are shown in the probability tree diagram.



- (a) Work out the probability that Finlay wins both matches.

$$P(W, W) = 0.7 \times 0.7 =$$

$$\underline{0.49}$$

(2)

- (b) Work out the probability that Finlay loses at least one match.

$$1 - 0.49 = 0.51$$

$$\underline{0.51}$$

(2)

(Total for Question 11 is 4 marks)

12 (a) Find the reciprocal of 2.5

$$\frac{1}{2.5} = \frac{2}{5}$$

$$\frac{2}{5}$$

(1)

(b) Work out $\sqrt[3]{\frac{4.3 \times \tan 39^\circ}{23.4 - 6.06}}$

Give your answer correct to 3 significant figures.

$$0.58559342233$$

$$0.586$$

(2)

(Total for Question 12 is 3 marks)

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13 Show that

$$(3x-1)(x+5)(4x-3) = 12x^3 + 47x^2 - 62x + 15$$

for all values of x .

Tip: Just work out the answer

$$3x^2 + 15x - x - 5$$

$$= 3x^2 + 14x - 5$$

$$(3x^2 + 14x - 5)(4x - 3)$$

$$= 12x^3 - 9x^2 + 56x - 42x - 20x + 15$$

$$= 12x^3 + 47x^2 - 62x + 15$$

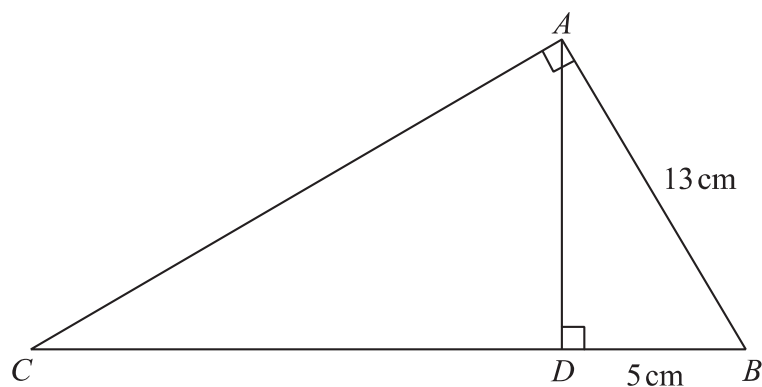
(Total of Question 13 is 3 marks)

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14 ABC and ABD are two right-angled triangles.

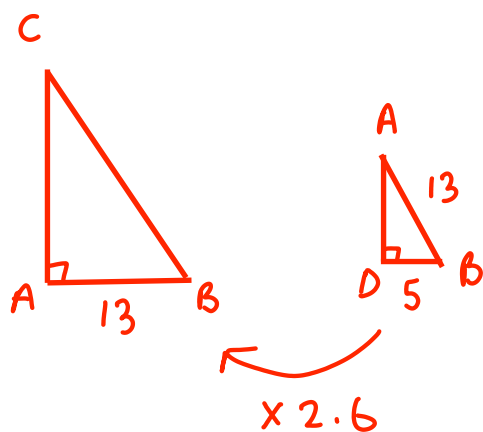


Angle $BAC = \text{angle } ADB = 90^\circ$

$AB = 13 \text{ cm}$

$DB = 5 \text{ cm}$

Work out the length of CB .



$$13 \times 2.6 = 33.8$$

$$13 \div 5 = 2.6$$

33.8 cm

(Total for Question 14 is 3 marks)

- 15 A pendulum of length L cm has time period T seconds.
 T is directly proportional to the square root of L .

The length of the pendulum is increased by 40%. $\rightarrow 1.4L$

Work out the percentage increase in the time period.

$$T \propto \sqrt{L}$$

$$T = k\sqrt{L}$$

$$\begin{aligned} T &= k\sqrt{1.4L} \\ &= 1.183k\sqrt{L} \end{aligned}$$

$$\sqrt{1.4} = 1.183\dots$$

18.3% increase

18.3 %

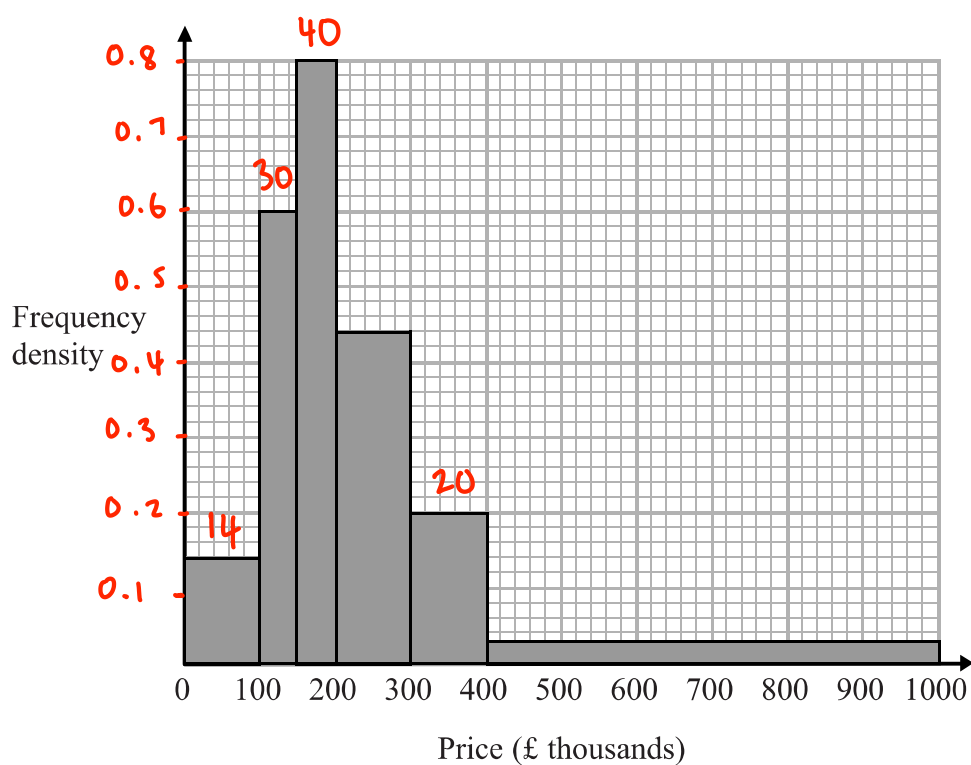
(Total for Question 15 is 3 marks)

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16 The histogram gives information about house prices in a village in 2015



20 houses in the village have a price between £300 000 and £400 000

Work out the number of houses in the village with a price under £200 000



$$FD = \frac{F}{CW} \quad \frac{20}{100} = 0.2$$

$$F = FD \times CW$$

$$14 + 30 + 40 = 84$$

84

(Total for Question 16 is 3 marks)

17 Here are the first 5 terms of a quadratic sequence.

1 3 7 13 21

Find an expression, in terms of n , for the n th term of this quadratic sequence.

$+2$ $+4$ $+6$
 $+2$ $+2$ $\rightarrow n^2$

terms	1	3	7
n^2	1	4	9
	0	-1	-2

-1	-2	-3
0	-1	-2
	$\rightarrow$	$\rightarrow$
-1	-1	

n^{th} term:
 $-n + 1$

$n^2 - n + 1$

(Total for Question 17 is 3 marks)

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18 $f(x) = 3x^2 - 2x - 8$

Express $f(x + 2)$ in the form $ax^2 + bx$

$$3(x+2)^2 - 2(x+2) - 8$$

$$3(x+2)(x+2) - 2(x+2) - 8$$

$$3(x^2 + 2x + 2x + 4) - 2x - 4 - 8$$

$$3(x^2 + 4x + 4) - 2x - 12$$

$$3x^2 + 12x + 12 - 2x - 12$$

$$3x^2 + 10x$$

$$3x^2 + 10x$$

(Total for Question 18 is 3 marks)

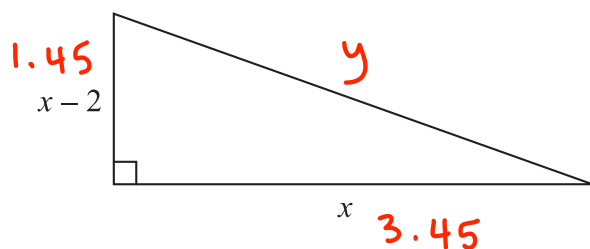
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19 Here is a right-angled triangle.



All measurements are in centimetres.
The area of the triangle is 2.5 cm^2 .

Find the perimeter of the triangle.
Give your answer correct to 3 significant figures.
You must show all of your working.

$$\begin{aligned} \frac{1}{2} \times x \times (x-2) &= 2.5 \\ \frac{1}{2} \times (x^2 - 2x) &= 2.5 \\ \times 2 & \qquad \qquad \times 2 \\ x^2 - 2x &= 5 \\ -5 & \qquad \qquad -5 \\ x^2 - 2x - 5 &= 0 \end{aligned}$$

$$\begin{aligned} 1.45^2 + 3.45^2 &= y^2 \\ 14.005 &= y^2 \\ 3.74 &= y \end{aligned}$$

$$\begin{aligned} 1.45 + 3.74 \\ + 3.45 &= 8.64 \end{aligned}$$

Tip: Because we have been asked for an answer to 3 significant figures, we need to use the Quadratic Formula

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

$$\begin{aligned} x &= 3.45 \checkmark \\ \text{or } x &= -1.45 \times \end{aligned}$$

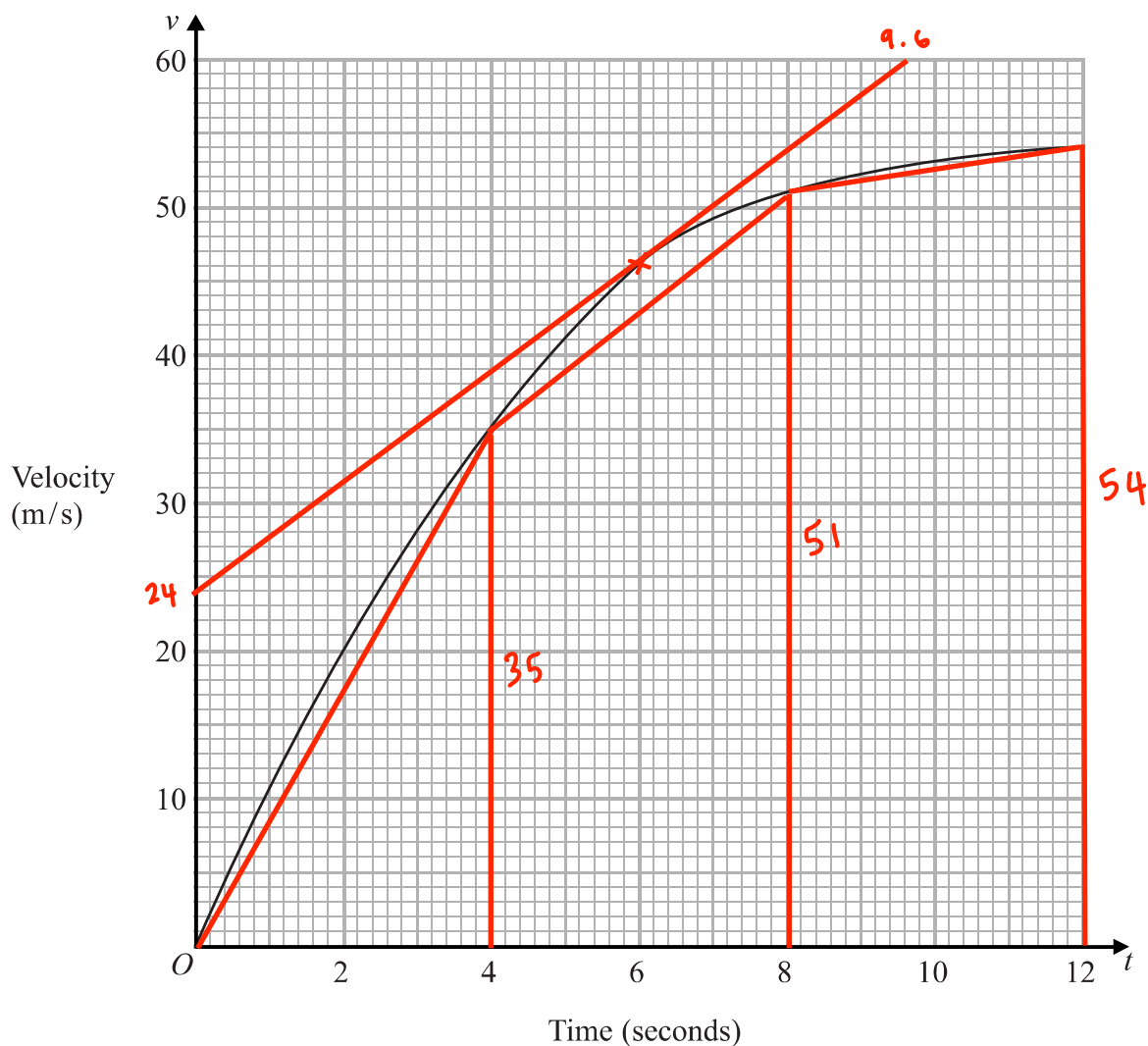
$$a = 1, b = -2, c = -5$$

$$\frac{-(-2) \pm \sqrt{(-2)^2 - 4(1)(-5)}}{2(1)}$$

$$8.64 \text{ cm}$$

(Total for Question 19 is 6 marks)

- 20 The graph shows information about the velocity, v m/s, of a parachutist t seconds after leaving a plane.



- (a) Work out an estimate for the acceleration of the parachutist at $t = 6$

$$\frac{60 - 24}{9.6 - 0}$$

$$\frac{3.75}{(3 \text{ to } 4)} \text{ m/s}^2 \quad (2)$$

- (b) Work out an estimate for the distance fallen by the parachutist in the first 12 seconds after leaving the plane.
Use 3 strips of equal width.

$$\frac{1}{2} (4 \times 35) + \frac{1}{2} (35 + 51) 4 + \frac{1}{2} (51 + 54) 4 = 452 \text{ m} \quad (3)$$

(Total for Question 20 is 5 marks)



- 21 The number of bees in a beehive at the start of year n is P_n .
The number of bees in the beehive at the start of the following year is given by

$$P_{n+1} = 1.05(P_n - 250)$$

At the start of 2015 there were 9500 bees in the beehive.

How many bees will there be in the beehive at the start of 2018?

(3 years)

$$P_1 = 1.05(9500 - 250) = 9712.5$$

$$P_2 = 1.05(9712.5 - 250) = 9935.625$$

$$P_3 = 10169.90625$$

10169

(Total for Question 21 is 3 marks)

22 $D = \frac{x}{y}$

$x = 99.7$ correct to 1 decimal place.

$y = 67$ correct to 2 significant figures.

$$UB = 99.75$$

$$LB = 66.5$$

Work out an upper bound for D .

$$D_u = \frac{x_u}{y_l} = \frac{99.75}{66.5} = 1.5$$

$$1.5$$

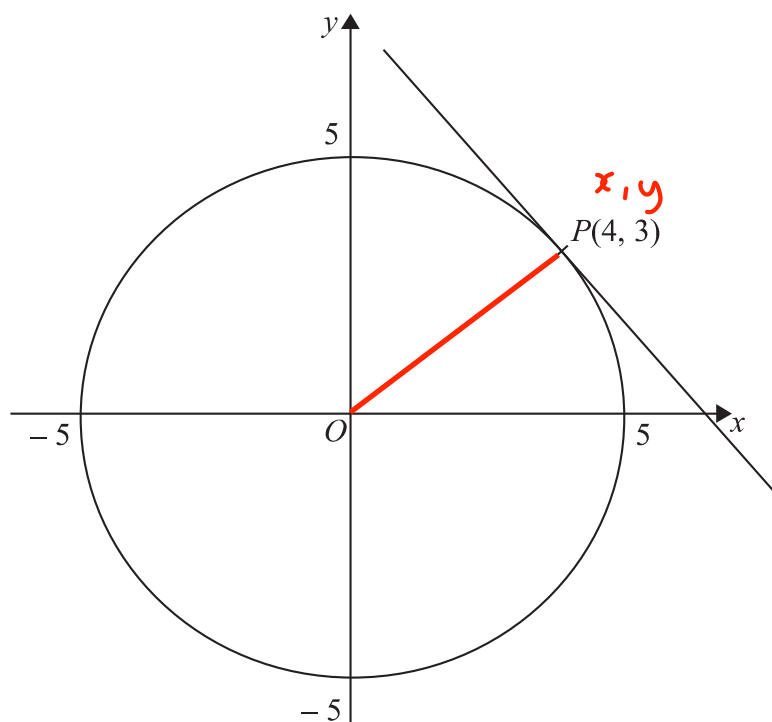
(Total for Question 22 is 3 marks)

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23 Here is a circle, centre O , and the tangent to the circle at the point $P(4, 3)$ on the circle.



Find an equation of the tangent at the point P .

$$\text{Gradient } OP = \frac{3}{4}$$

$$\text{Gradient of tangent} = -\frac{4}{3}$$

$$y = -\frac{4}{3}x + c$$

$$3 = -\frac{4}{3}(4) + c$$

$$3 = -\frac{16}{3} + c$$

$$y = -\frac{4}{3}x + \frac{25}{3}$$

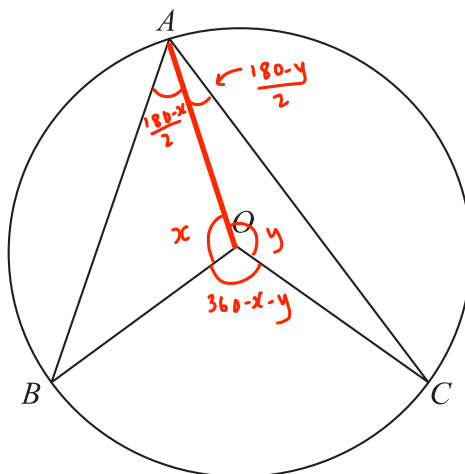
$$+\frac{16}{3} \quad +\frac{16}{3}$$

$$\frac{25}{3} = c$$

(Total for Question 23 is 3 marks)



24 A , B and C are points on the circumference of a circle centre O .



Prove that angle BOC is twice the size of angle BAC .

Let $AOB = x$

Let $AOC = y$

$$\text{Therefore, } \angle BAO = \frac{180 - x}{2}$$

$$\text{and } \angle AOC = \frac{180 - y}{2}$$

because the base angles in an Isosceles triangle are the same.

$$\angle BOC = 360 - x - y$$

because angles around a point add to 360 degrees

$$\angle BAC = \frac{180 - x}{2} + \frac{180 - y}{2} = \frac{360 - x - y}{2}$$

Therefore, $\angle BOC$ is twice the size of angle BAC

(Total for Question 24 is 4 marks)

TOTAL FOR PAPER IS 80 MARKS