Please check the examination details below before entering your candidate information

| Candidate surname | Other names |
|---|---|
| | |

Centre Number | Candidate Number

# Pearson Edexcel Level 1/Level 2 GCSE (9–1)

**Time** 1 hour 30 minutes

**Paper reference** **1MA1/2H**

## Mathematics

**PAPER 2 (Calculator)**

**Higher Tier**

LH November 2022

Worked Solutions

**You must have:** Ruler graduated in centimetres and millimetres, protractor, pair of compasses, pen, HB pencil, eraser, calculator, Formulae Sheet (enclosed). Tracing paper may be used.

Total Marks

### Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*
- You must **show all your working**.
- Diagrams are **NOT** accurately drawn, unless otherwise indicated.
- **Calculators may be used.**
- If your calculator does not have a $\pi$ button, take the value of $\pi$ to be 3.142 unless the question instructs otherwise.

### Information

- The total mark for this paper is 80
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*

### Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

*Turn over* ▶

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B:1/1/1/1/1/1/

P 6 8 7 2 3 A 0 1 2 4

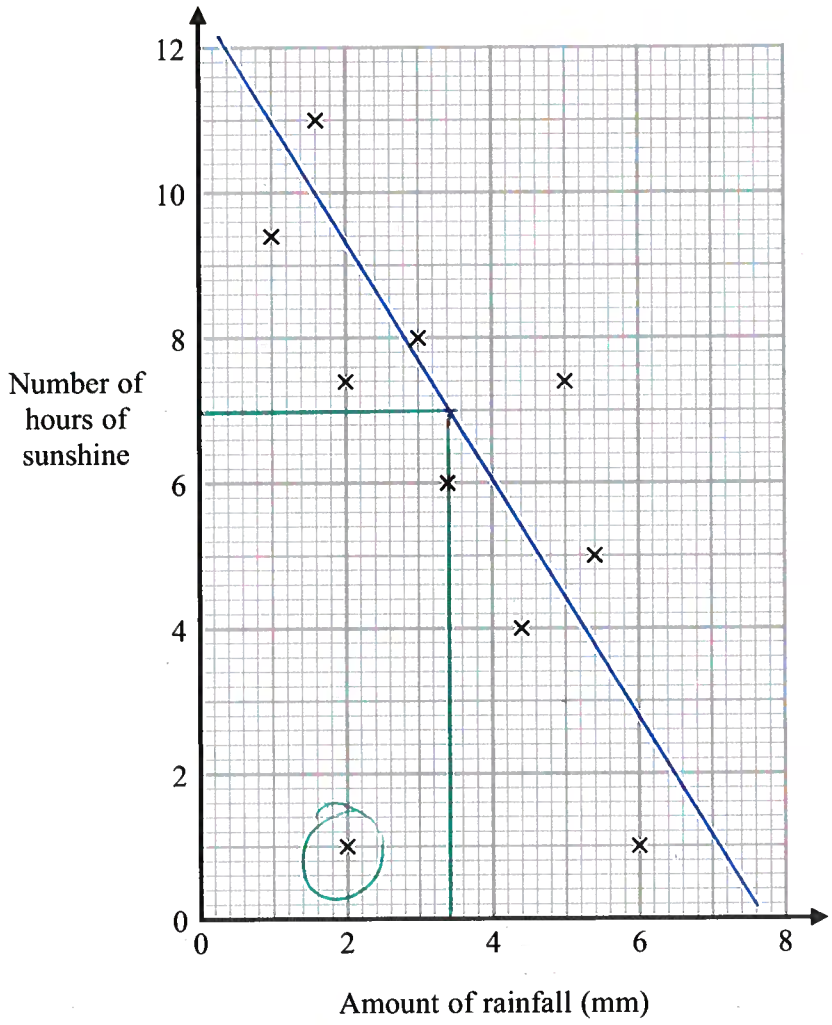
Pearson

**Answer ALL questions.**

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

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

1 The scatter graph shows information about the amount of rainfall, in mm, and the number of hours of sunshine for each of ten English towns on the same day.




One of the points is an outlier.

(a) Write down the coordinates of this point.

( 2 , 1 )

(1)

DO NOT WRITE IN THIS AREA

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(b) Ignoring the outlier, describe the relationship between the amount of rainfall and the number of hours of sunshine.

negative correlation
The more hours of sunshine, the less rainfall

(1)

On the same day in another English town there were 7 hours of sunshine.

(c) Using the scatter graph, estimate the amount of rainfall in this town on this day.

must use a line of best fit

answer in range 3 → 4 3.4 mm

(2)

**(Total for Question 1 is 4 marks)**

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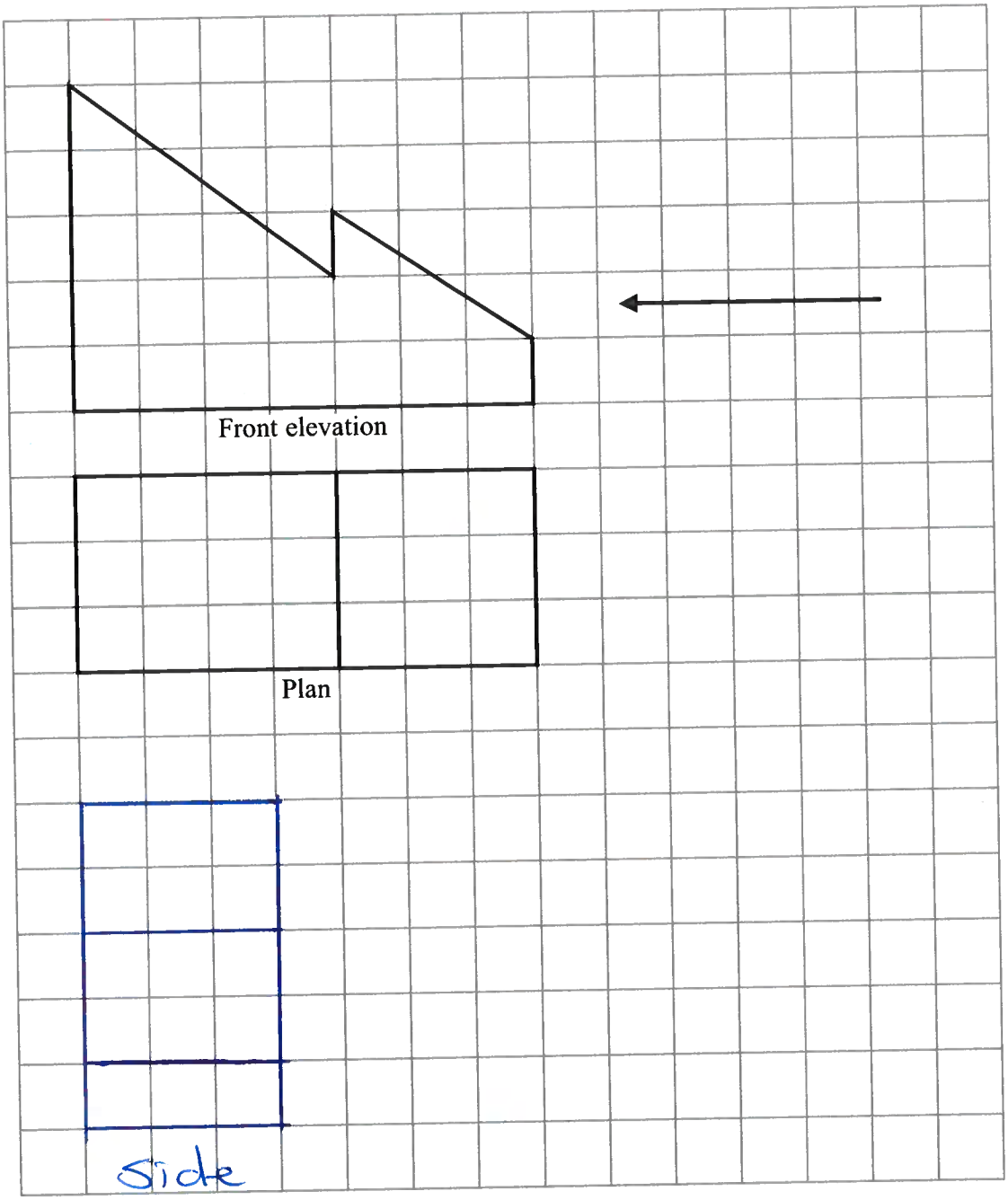
2 The front elevation and the plan of a solid are shown on the grid.

On the grid, draw the side elevation of the solid from the direction of the arrow.




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

3 Here are the first five terms of an arithmetic sequence.

1 7 13 19 25 31 (+6, +6, +6)

(a) Find an expression, in terms of $n$, for the $n$th term of this sequence.

$6n + 1$

$6n+1$

(2)

The $n$th term of a different sequence is $8 - 6n$

(b) Is $-58$ a term of this sequence?
You must show how you get your answer.

$8 - 6n = -58$ [$-8$

$-6n = -66$ [$\div -6$

$n = 11$

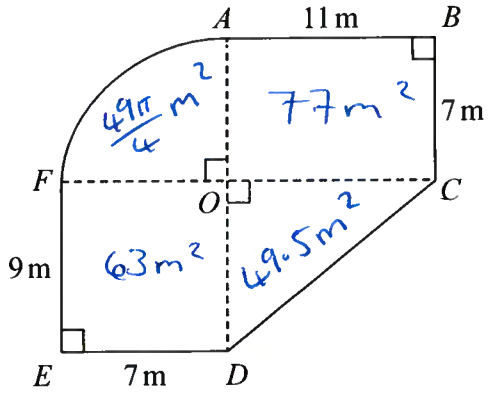
Yes. $-58$ is the 11th term in the sequence $8-6n$

(2)

**(Total for Question 3 is 4 marks)**

4 The diagram shows a plan of Jason's garden.

*ABCO* and *DEFO* are rectangles.
*CDO* is a right-angled triangle.
*AFO* is a sector of a circle with centre *O* and angle *AOF* = 90°




Jason is going to cover his garden with grass seed.
Each bag of grass seed covers 14 m² of garden.
Each bag of grass seed costs £10.95

Work out how much it will cost Jason to buy all the bags of grass seed he needs.

Area rectangle DEFO = 9m × 7m = 63 m²
Area rectangle ABCO = 11m × 7m = 77 m²
Area triangle CDO = $\frac{1}{2}$ × 11m × 9m = 49.5 m²
Area Sector AFO = $\frac{1}{4}$ × π × 7² = $\frac{49\pi}{4}$ m²

Total Area of garden = 227.98451 m²

Number bags needed = $\frac{\text{total Area}}{14}$

$= \frac{227.98451}{14}$

= 16.284....

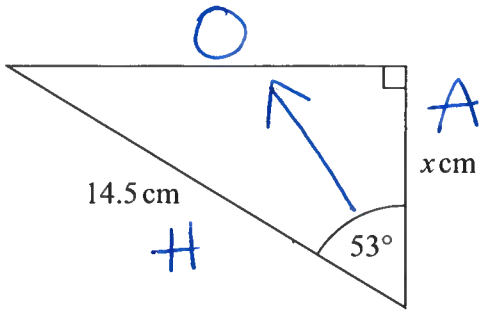
Jason needs 17 bags

Cost = 17 × £10.95
= £186.15

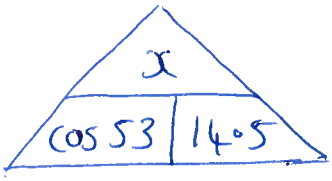
£ 186.15

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

**5**




Work out the value of $x$.
Give your answer correct to 3 significant figures.


$x = \cos(53) \times 14.5$
$= 8.726317$

$x =$ 8.73 cm

**(Total for Question 5 is 2 marks)**

**6** Ella invests £7000 for 2 years in an account paying compound interest.

In the first year, the rate of interest is 3%
In the second year, the rate of interest is 1.5%

Work out the value of Ella's investment at the end of 2 years.

£7000 × 103% × 101.5% = £7318.15

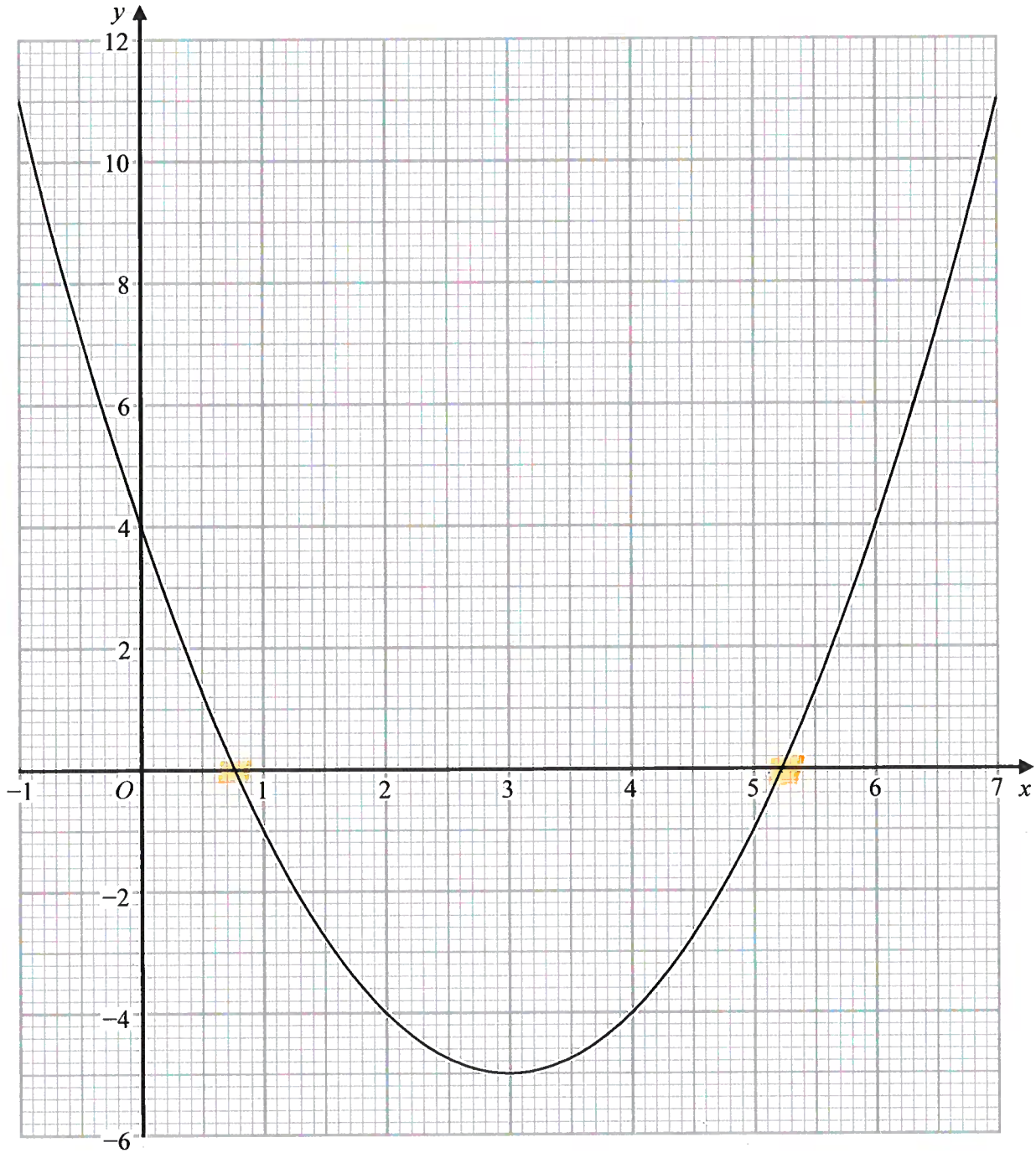
OR

7000 × 1.03 × 1.015

£ 7318.15

**(Total for Question 6 is 3 marks)**

7 Here is the graph of $y = x^2 - 6x + 4$



(a) Write down the $y$ intercept of the graph of $y = x^2 - 6x + 4$

4

(1)

(b) Write down the coordinates of the turning point of the graph of $y = x^2 - 6x + 4$

( 3 , -5 )

(1)

(c) Use the graph to find estimates for the roots of $x^2 - 6x + 4 = 0$

Acceptable answers

0.7 → 0.9

5.1 → 5.3

0.8, 5.2

(2)

**(Total for Question 7 is 4 marks)**

**8** Chanda buys a necklace for £120
She sells the necklace for £135

Work out her percentage profit.

$$\%\ \text{profit} = \frac{£135 - £120}{£120} \times 100$$

$$= \frac{15}{120} \times 100$$

$$= 12.5$$

12.5 %

**(Total for Question 8 is 3 marks)**

**9** Here are the equations of two straight lines.

$$y = \frac{1}{2}x - 6 \qquad 6y = 3x + 7$$

Oscar says that these lines are parallel.

Is Oscar correct?
You must give a reason for your answer.

$y = \frac{1}{2}x - 6$ gradient $= \frac{1}{2}$

$6y = 3x + 7$

$y = \frac{3}{6}x + \frac{7}{6}$

$y = \frac{1}{2}x + \frac{7}{6}$ gradient $= \frac{1}{2}$

**(Total for Question 9 is 2 marks)**

Both lines have gradient $\frac{1}{2}$
therefore Oscar is correct.

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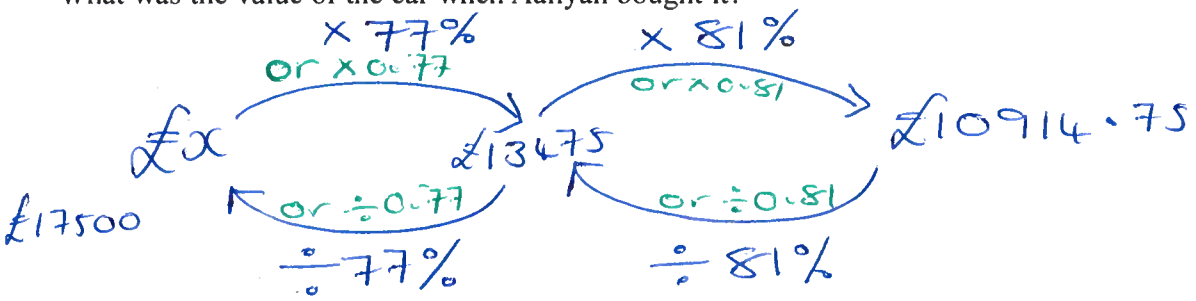
**10** Aaliyah bought a car.

In the first year after she bought the car, its value depreciated at a rate of 23% per annum.
In the second year after she bought the car, its value depreciated at a rate of 19% per annum.

At the end of the second year the car was worth £10914.75

What was the value of the car when Aaliyah bought it?

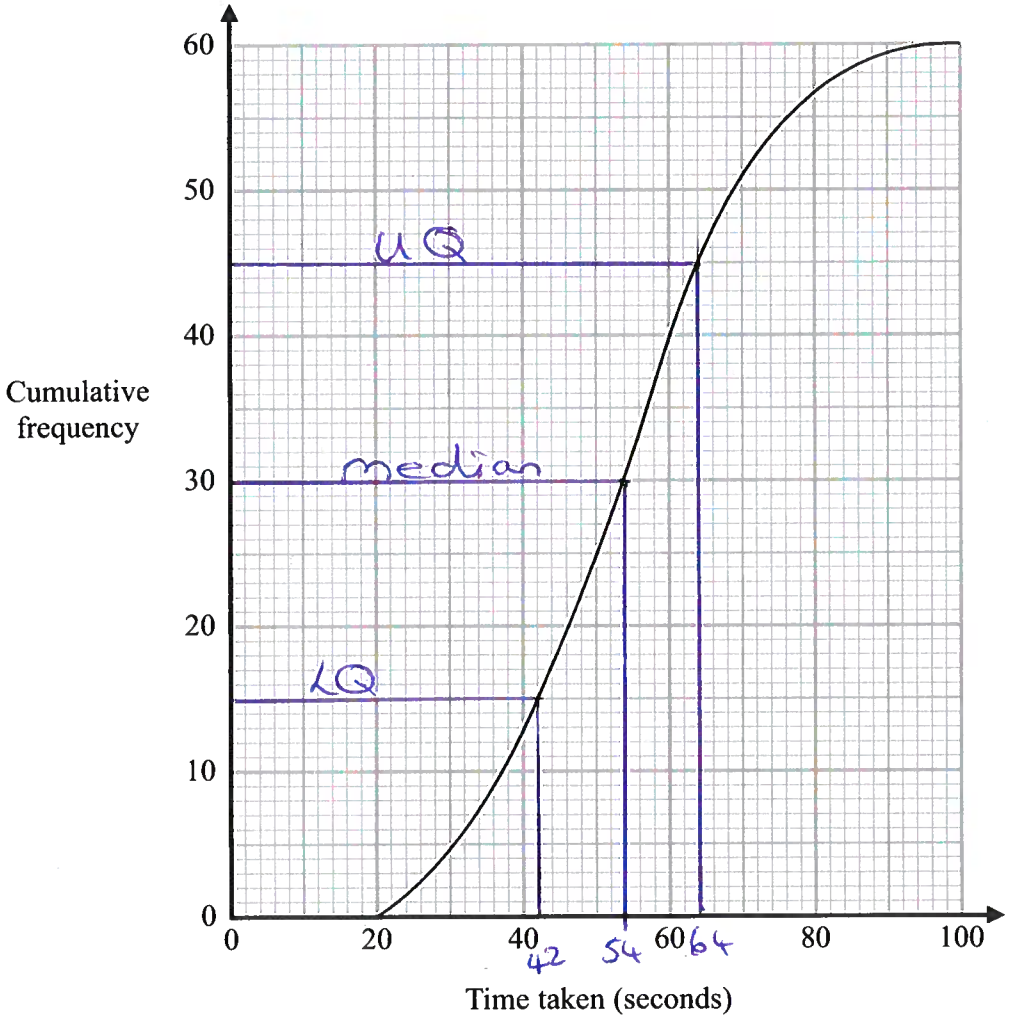



£ 17500

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

**11** In an experiment, 60 students each completed a puzzle.

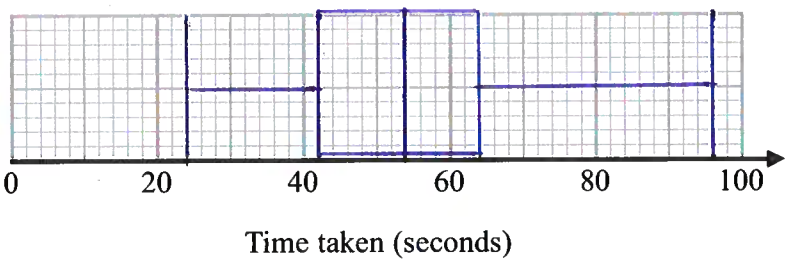
The cumulative frequency graph shows information about the times taken for the 60 students to complete the puzzle.




For these 60 students,

the least time taken was 24 seconds
the greatest time taken was 96 seconds.

On the grid below, draw a box plot for the distribution of the times taken by the students.




**(Total for Question 11 is 3 marks)**

**12** The number of insects in a population at the start of the year $n$ is $P_n$

The number of insects in the population at the start of year $(n + 1)$ is $P_{n+1}$ where

$$P_{n+1} = kP_n$$

Given that $k$ has a constant value of 1.13

(a) find out how many years it takes for the number of insects in the population to double. You must show how you get your answer.

$P_{n+1} = 1.13 P_n$

Start $P_n$
Year 1 $P_{n+1} = 1.13 P_n$
Year 2 $P_{n+2} = (1.13)^2 P_n$
Year 3 $P_{n+2} = (1.13)^3 P_n$

↑ when does this become $\geq 2$ so that the original population $P_n$ has doubled.

$(1.13)^n > 2$

use trial and improvement

$(1.13)^2 = 1.2769$
$(1.13)^3 = 1.442897$
$(1.13)^4 = 1.630473$
$(1.13)^5 = 1.842435$
$(1.13)^6 = 2.08195$

$n = 6$

6 years

(2)

The value of $k$ actually increases year on year from its value of 1.13 in year 1

(b) How does this affect your answer to part (a)?

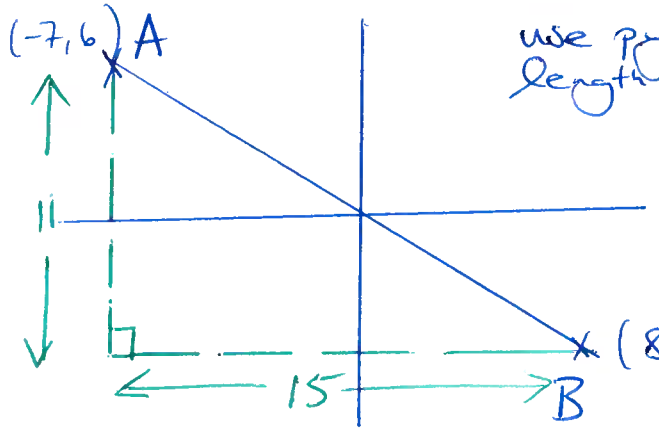
It will take less years for the initial population to double.

(1)

**(Total for Question 12 is 3 marks)**

**13** $A$ and $B$ are points on a centimetre grid.
$A$ is the point with coordinates $(-7, 6)$
$B$ is the point with coordinates $(8, -5)$

Work out the length of $AB$.
Give your answer correct to 1 decimal place.




use Pythagoras' theorem to find length of AB

$AB^2 = 11^2 + 15^2$
$= 346$
$AB = \sqrt{346}$
$= 18.60107$

18.6 cm

**(Total for Question 13 is 2 marks)**

**14** Using algebra, prove that $1.06\dot{2}$ can be written as $1\frac{14}{225}$

$x = 1.062222\ldots$
one digit recurs $\therefore \times 10$

$10x = 10.62222\ldots$
$x = 1.062222\ldots$

$9x = 9.56$ $\div 9$

$x = \frac{9.56}{9}$

$= \frac{956}{900}$

$= 1\frac{56}{900}$

$= 1\frac{28}{450}$

$= 1\frac{14}{225}$ as required

**(Total for Question 14 is 3 marks)**

**15** Faiza is studying the population of rabbits in a park.
She wants to estimate the number of rabbits in the park.

On Monday she catches a random sample of 20 rabbits in the park, marks each rabbit with a tag and releases them back into the park.

On Tuesday she catches a random sample of 42 rabbits in the park.
12 of the rabbits are marked with a tag.

(a) Find an estimate for the number of rabbits in the park.

Monday $\frac{20}{T}$ = Tuesday $\frac{12}{42}$

$\frac{T}{20} = \frac{42}{12}$

$T = \frac{42}{12} \times 20 = 70$

(3)

Albie is studying the population of rabbits in a wood.

One day, he catches 55 rabbits and finds that 40 of these rabbits are marked with a tag.

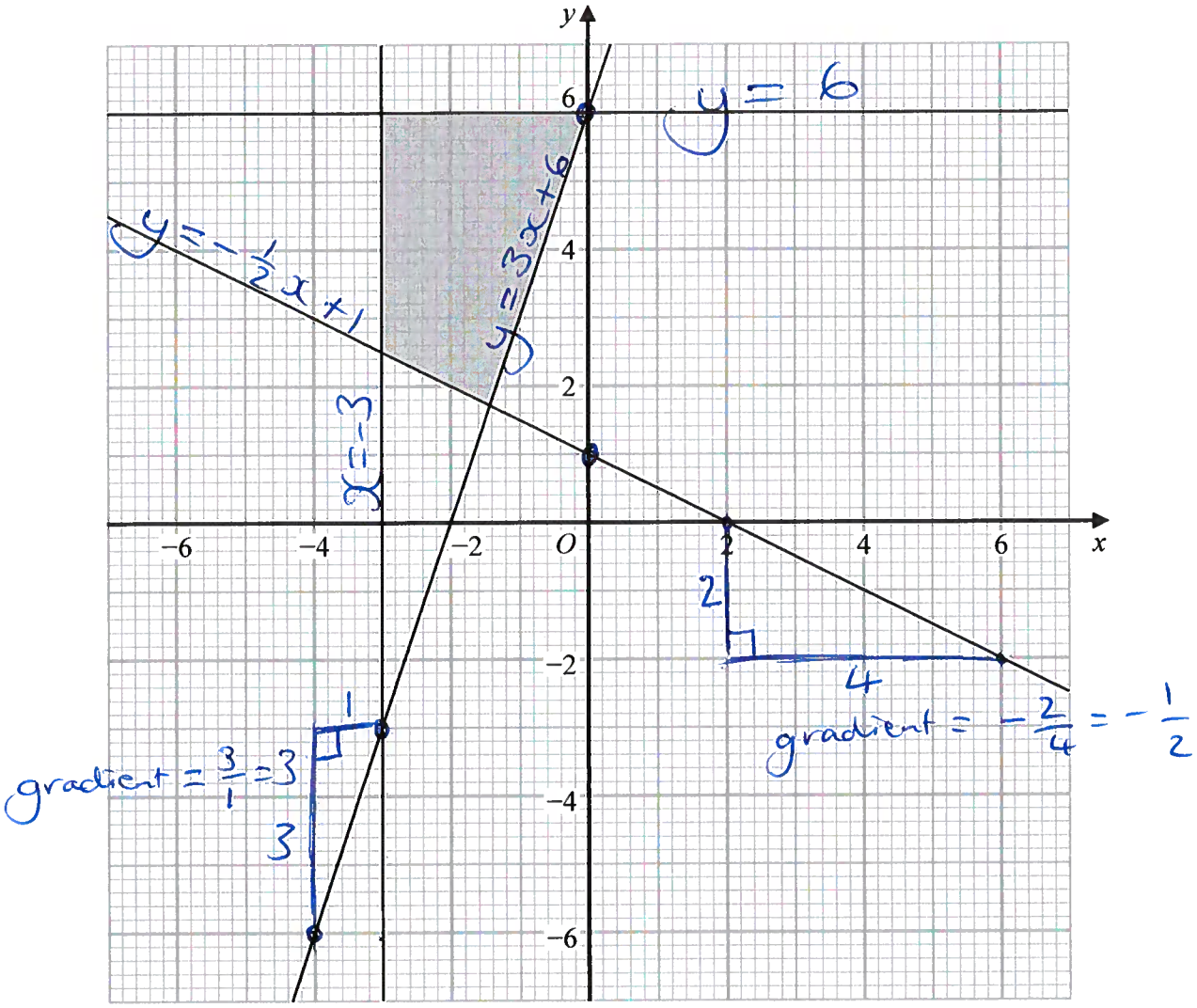
Albie estimates there are 50 rabbits in the wood.

(b) Explain why Albie's estimate cannot be correct.

50 is less than 55
If he catches 55 there cannot be less than this number in the wood.
(the sample size cannot be greater than the population). (1)

**(Total for Question 15 is 4 marks)**

**16** The shaded region shown on the grid is bounded by four straight lines.




Find the four inequalities that define the shaded region.

$y \leqslant 6$

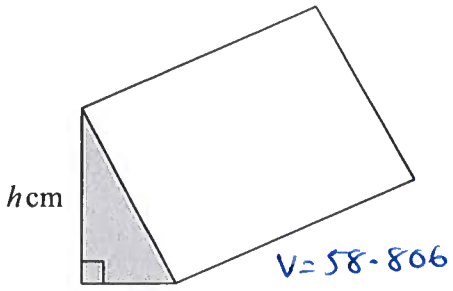
$x \geqslant -3$

$y \geqslant -\frac{1}{2}x + 1$

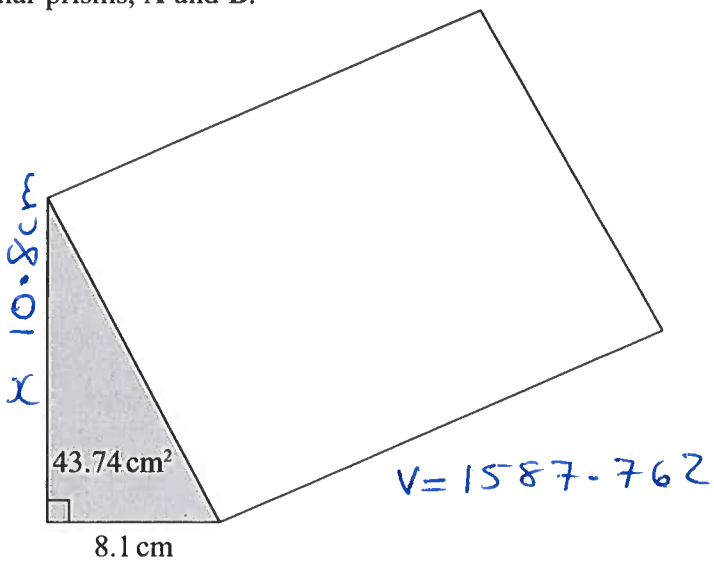
$y \geqslant 3x + 6$

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

**17** The diagram shows two similar solid triangular prisms, **A** and **B**.




Prism **A**




Prism **B**

The volume of prism **A** is 58.806 cm³
The volume of prism **B** is 1587.762 cm³

The cross section of each prism is a right-angled triangle.

For prism **B**
the length of the base of the triangle is 8.1 cm
the area of the triangle is 43.74 cm²

The height of the triangle for prism **A** is *h* cm.

Work out the value of *h*.

height of triangle B $\frac{x \times 8.1}{2} = 43.74$ [$\times 2$

$8.1x = 87.48$ [$\div 8.1$

$x = 10.8$

Scale Factor Volume

$k^3 = \frac{1587.762}{58.806} = 27$

Scale Factor Length

$k = \sqrt[3]{27} = 3$

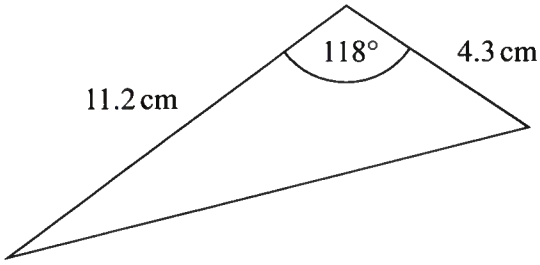
height of A = height of B $\div 3$

$= 10.8 \div 3$

$h =$ 3.6 cm

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

**18** Here is a triangle.




Work out the area of the triangle.
Give your answer correct to 3 significant figures.

Sine rule

$\text{Area} = \frac{1}{2}(11.2)(4.3)\sin 118$

$= 21.261378\ldots$

$= 21.3\ \text{cm}^2\ (3\text{sf})$

21.3 ..... cm²

**(Total for Question 18 is 2 marks)**

**19** Solve $6x^2 + 5x - 6 = 0$

$(3x - 2)(2x + 3) = 0$

$3x - 2 = 0$ or $2x + 3 = 0$

$3x = 2$ $\quad$ $2x = -3$

$x = \frac{2}{3}$ $\quad$ $x = -\frac{3}{2}$

It is ok to use formula here but the Q didn't ask for answers to SF's or dp's which is a clue that it factorises

$x = \frac{2}{3}, -\frac{3}{2}$

**(Total for Question 19 is 3 marks)**

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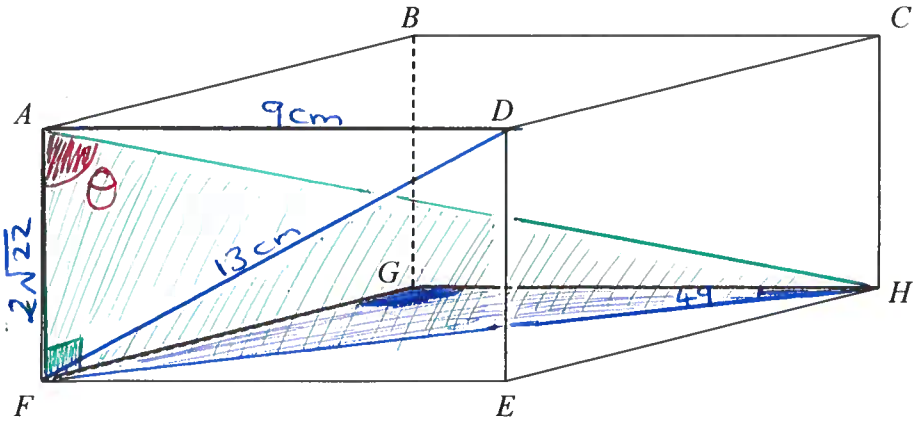
**20** *ABCDEFGH* is a cuboid.

step 1

Find AF

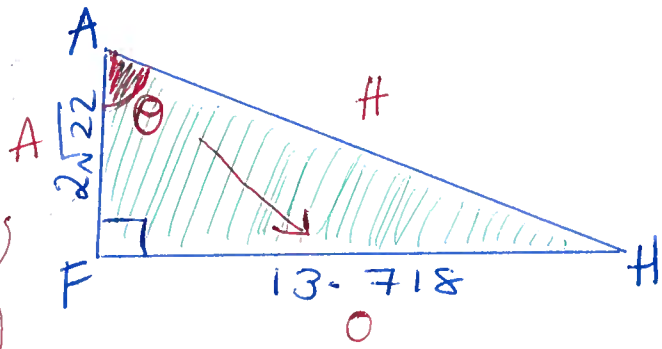
$AF = \sqrt{13^2 - 9^2}$

$= 2\sqrt{22}$



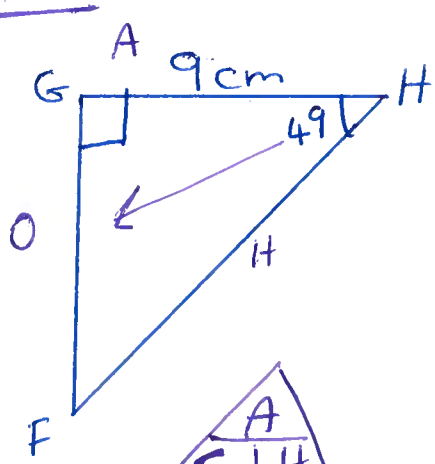

$AD = 9$ cm
$FD = 13$ cm
Angle $GHF = 49°$

Work out the size of angle *FAH*.
Give your answer correct to the nearest degree.

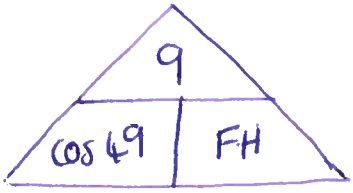



step 2

Find FH





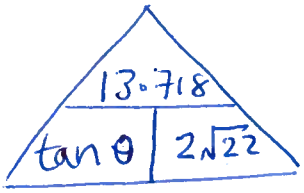



$FH = \dfrac{9}{\cos 49}$

$= 13.718$

step 3

Find angle FAH


$\tan\theta = \dfrac{13.718}{2\sqrt{22}}$

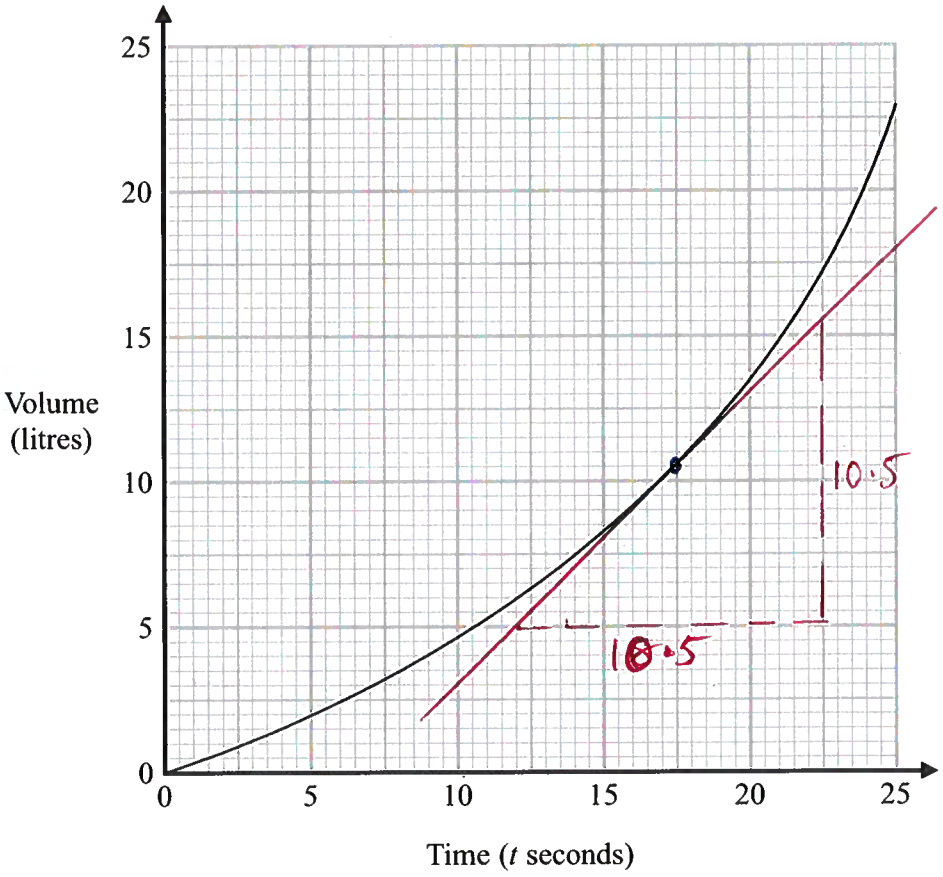
$\theta = \tan^{-1}\left(\dfrac{13.718}{2\sqrt{22}}\right)$

$= 55.63$

$= 56°$ (to nearest °)

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

**21** The graph below gives the volume, in litres, of water in a container $t$ seconds after the water starts to fill the container.




(a) Calculate an estimate for the gradient of the graph when $t = 17.5$
You must show how you get your answer.

gradient $\approx \frac{10.5}{10.5} = 1$

Answers in range 0.9 → 1.2

(3)

(b) Describe fully what the gradient in part (a) represents.

The container fills at a rate of 1 litre every second (the rate of change of volume with respect to time).

(1)

**(Total for Question 21 is 4 marks)**

**22** $f(x) = \sqrt[3]{x}$
$g(x) = 2x + 3$

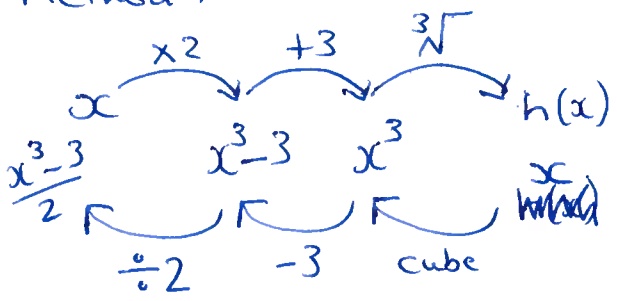
$h(x) = fg(x)$

Find $h^{-1}(x)$

$f[g(x)] = \sqrt[3]{2x+3}$

$\therefore h(x) = \sqrt[3]{2x+3}$

Finding the inverse method 1




$h^{-1}(x) = \frac{x^3-3}{2}$

Finding the inverse method 2

$y = \sqrt[3]{2x+3}$

$x = \sqrt[3]{2y+3}$ [cube

$x^3 = 2y+3$ [−3

$x^3 - 3 = 2y$ [÷2

$\frac{x^3-3}{2} = y$

$h^{-1}(x) = \frac{x^3-3}{2}$

$h^{-1}(x) = \frac{x^3-3}{2}$

**(Total for Question 22 is 3 marks)**

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**23** A race is measured to have a distance of 10.6 km, correct to the nearest 0.1 km.
Sam runs the race in a time of 31 minutes 48 seconds, correct to the nearest second.

Sam's average speed in this race is $V$ km/hour.

By considering bounds, calculate the value of $V$ to a suitable degree of accuracy.
You must show all your working and give a reason for your answer.

Distance

10.5 — 10.6 — 10.7 km

lower bound 10.55 km

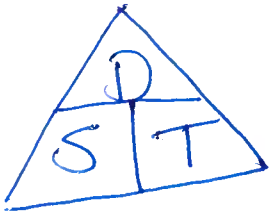
upper bound 10.65 km

Time

47 — 48 — 49 seconds

lower bound: 31 mins 47.5 secs = 1907.5 secs = 0.529861... hours

upper bound: 31 mins 48.5 secs = 1908.5 secs = 0.530138... hours




$$\text{Speed} = \frac{D}{T}$$

$$\text{Speed upper bound} = \frac{\text{Upper Bound Distance}}{\text{Lower Bound Time}}$$

$$= \frac{10.65}{0.529861111}$$

$$= 20.09960682 \text{ km/hour}$$

$$\text{Speed lower bound} = \frac{\text{Lower Bound Distance}}{\text{Upper Bound Time}}$$

$$= \frac{10.55}{0.53013888}$$

$$= 19.90044571 \text{ km/hour}$$

Both agree to 2sf

$\therefore V = 20$ km/h (2sf)

**(Total for Question 23 is 5 marks)**

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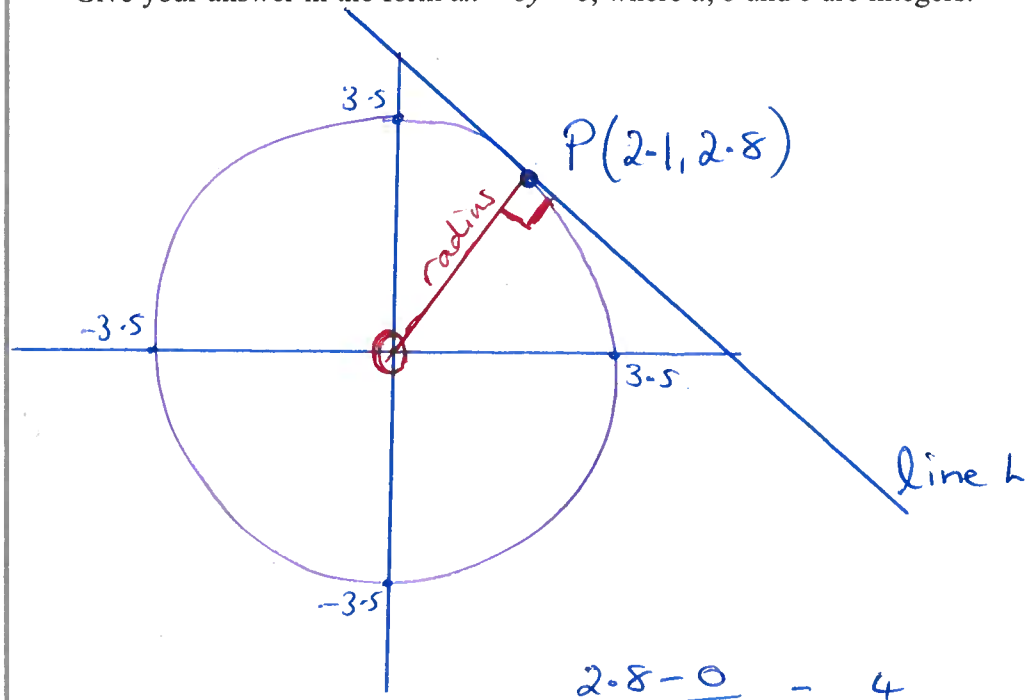
**24** A circle has equation $x^2 + y^2 = 12.25$

centre (0,0)
radius $\sqrt{12.25} = 3.5$

The point $P$ lies on the circle.
The coordinates of $P$ are (2.1, 2.8)

The line **L** is the tangent to the circle at point $P$.

Find an equation of **L**.
Give your answer in the form $ax + by = c$, where $a$, $b$ and $c$ are integers.




gradient of radius $= \frac{2.8-0}{2.1-0} = \frac{4}{3}$

tangent is perpendicular to radius $\therefore$ gradient $= -\frac{3}{4}$

equation of tangent L

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

when $x = 2.1$, $y = 2.8$

$2.8 = -\frac{3}{4}(2.1) + C$

$2.8 = -1.575 + C$

$4.375 = C$

$\frac{35}{8} = C$

$y = -\frac{3}{4}x + \frac{35}{8}$ [x 8

$8y = -6x + 35$

$6x + 8y = 35$

**(Total for Question 24 is 4 marks)**

**TOTAL FOR PAPER IS 80 MARKS**

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