Answer **all** the questions.

1 Calculate.

$$\sqrt[3]{\frac{210}{10^2 - 5^2}}$$

Give your answer correct to 3 significant figures.

$3\sqrt{1.68}$ $=$ $1.18878 \rightarrow$

......................1.19.................................... [3]

2 The ratio 50 grams to 1 kilogram can be written in the form 1 : n.

Find the value of n.

$n =$ ....20................................ [2]

3 (a) Anne, Barry and Colin share a prize in the ratio 3 : 4 : 5.
Colin gives $\frac{1}{3}$ of his share to a charity.

What fraction of the whole prize does Colin give to the charity?

$$\frac{5}{3+4+5} \times \frac{1}{3} = \frac{5}{12} \times \frac{1}{3} =$$

(a) ....$\frac{5}{36}$.................................. [3]

(b) Delia, Edwin and Freya share some money in the ratio 5 : 7 : 8.
Freya's share is £1600.

How much money did they share?

$5+7+8 = 20.$ $\frac{20}{8} \times 1600$

(b) £.............4000.................................. [2]

4 A bus timetable shows the following information.

- A bus following route T leaves for the train station every 20 minutes.
- A bus following route A leaves for the airport every 18 minutes.
- A bus following route T and a bus following route A both leave at 8.37 am.

(a) When is the next time one of each bus is timetabled to leave at the same time?

LCM of 20 and $18 = 180$.

180 min $= 3$ hr. $8:37$ am $+ 3$ hr $=$

$11:37$ am.

(a) .... **[4]**

(b) Write down one assumption that was necessary to solve this problem.

...Buses keep to time table (i.e. no delays)....

.... **[1]**

5 Bennie is 7 years older than Ayesha.
Chloe is twice as old as Bennie.
The sum of their three ages is 57.

Work out the ages of Ayesha, Bennie and Chloe.

$b = 7 + a \quad \Rightarrow \quad a = b - 7$

$c = 2b.$

$a + b + c = 57$

$b - 7 + b + 2b = 57$

$\Rightarrow \quad 4b = 64.$

$\Rightarrow b = 16 \Rightarrow a = 9, c = 32$

Ayesha's age is ......9......

Bennie's age is ......16......

Chloe's age is ......32...... **[6]**

Turn over

6 120 students in Year 10 and Year 11 sit a test.

- 61 of the students are in Year 10.
- 83 of the students are right-handed.
- 20 of the students in Year 11 are left-handed.

One of the students in Year 10 and one of the students in Year 11 are chosen at random.

Which one is more likely to be left-handed?
Show your working. You may use the table if you wish.

	Left	Right	
Y10	17	44	61
Y11	20	39	59
	37	83	120

Y10: $\dfrac{17}{61}$ Y11: $\dfrac{20}{59}$.

$$\dfrac{20}{59} > \dfrac{17}{61}$$

So the Year 11 student is more likely to be left handed.

Year 11.

.... **[6]**

7   The diagram shows a shape ABCDE.
    The shape is made from a rectangle, a right-angled triangle and a quarter of a circle.
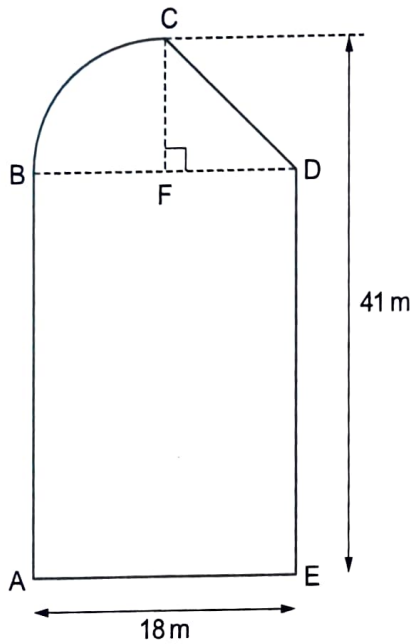
Not to scale

F is the mid-point of BD.
AE = 18 m and the perpendicular distance from C to AE is 41 m.

Work out the **perimeter** of the shape ABCDE.

Radius of BCF = 9m ⟹ arc BC is $\frac{\pi}{2} \times 9 = \frac{9\pi}{2}$ m.

AB = DE = 41 − 9 = 32m.

AE = 18m.

$CD^2 = 9^2 + 9^2$ ⟹ $CD = \sqrt{162}$

⟹ Perimeter = $32 + 18 + 32 + \sqrt{162} + \frac{9}{2}\pi$ m

= 108·865 m

.............108·9............... m **[6]**

Turn over

8   Triangle **A** and triangle **B** are drawn on the coordinate grid.
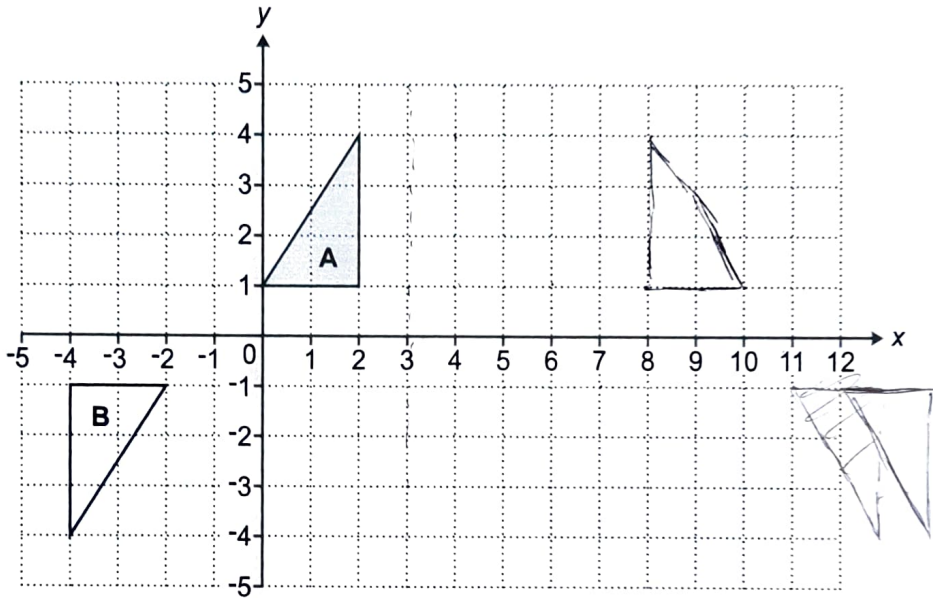
(a) Describe fully the **single** transformation that maps triangle **A** onto triangle **B**.
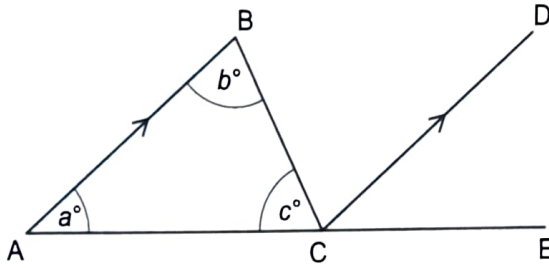
Rotation   180°   about the   centre (-1, 0).

.... [3]

(b) Describe fully the **single** transformation that is equivalent to:

   •   a reflection in the line $x = 3$, followed by

   •   a translation by $\begin{pmatrix} 4 \\ 0 \end{pmatrix}$.

   You may use the grid above to help you.

Reflection in $x = 5$.

.... [3]

9 The diagram shows triangle ABC.
CD is parallel to AB.
A, C and E lie in a straight line.
Angles of size $a°$, $b°$ and $c°$ are shown.

Not to scale

(a) Insert $a°$, $b°$ or $c°$ to make this statement true.
Give a reason for your answer.

Angle DCE = ...a... because ....It....corresponds....to....the....angle................

......∠ BAC.. **[2]**

(b) Use the diagram and the answer to part **(a)** to show that the angles of a triangle
add up to 180°.
Give a reason for each statement you make. **[3]**

∠ BCD = ∠ ABC, as these angles are alternate.

∠ ACB + ∠ BCD + ∠ DCE = 180° as they are
↑   ↑   ↑   on a straight
c b a line.

$a + b + c = 180°$

10 Claudia invests £25 000 at a rate of 2% per year compound interest.

Calculate the total amount of **interest** she will have earned after 5 years.
Give your answer correct to the nearest penny.

$$25000 \times 1.02^5 = 27602.02$$

$$27602.02 - 25000$$

£.............2602.02................. **[4]**

11 The area of a rectangle is 56 m², correct to the nearest m².
The length of the rectangle is 9.2 m, correct to the nearest 0.1 m.

Calculate the smallest possible width of the rectangle.

$$\frac{55.5}{9.25} = 6$$

.............................6.............................. m **[4]**

13 **(a)** The cumulative frequency graph shows the distribution of the heights of members of a rowing club.
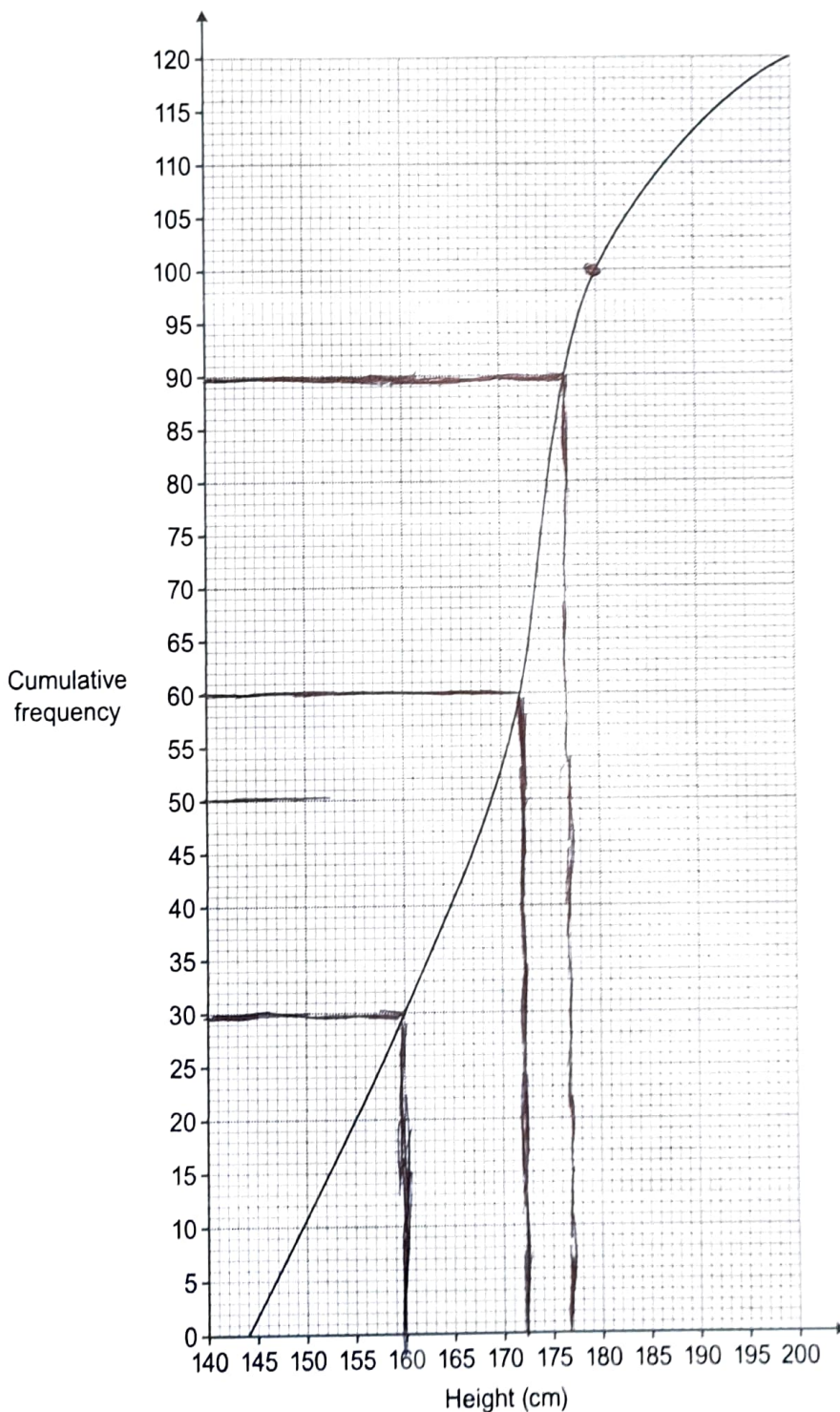
(i) Find the median.

(a)(i) ....172............ cm [1]

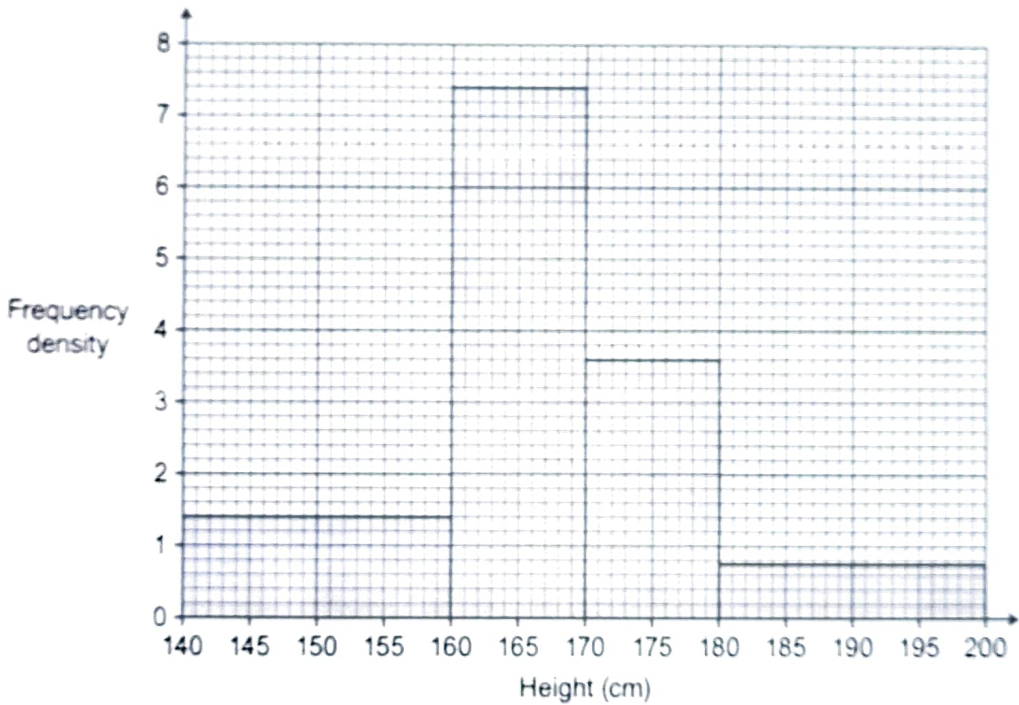(ii) Find the interquartile range.

$176.5 - 160 =$

(ii) .... **16.5** .... cm **[2]**

(iii) Calculate the percentage of the members who are at least 180 cm tall.

$\dfrac{120 - 100}{120} \times 100 =$

(iii) .... **16.7** .... % **[3]**

(b) The histogram summarises the heights of the 153 members of a swimming club.

Which club has the greater median height?
You must show all your working.

Median height in SC is the 77th member.
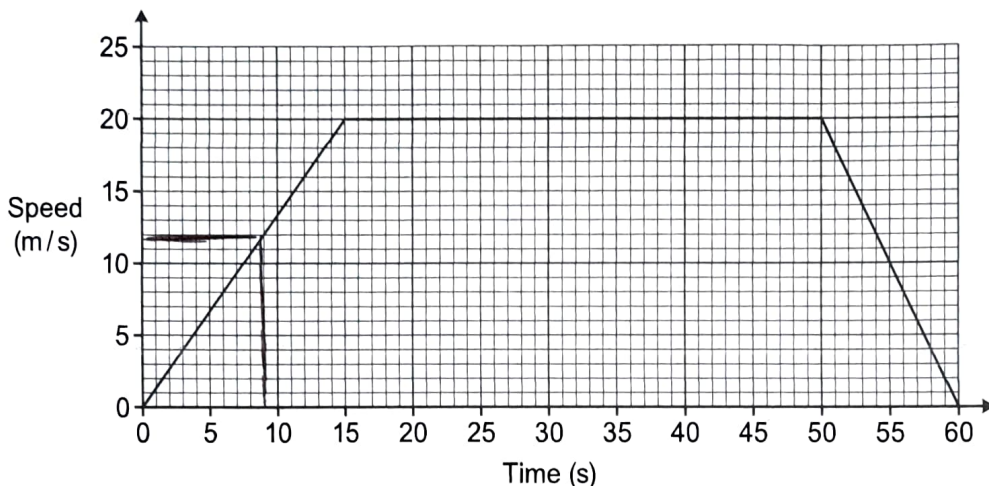
28 in 140-160cm range ⇒ 102 under 170cm.

The median for the SC is between 160cm and 170cm.

⇒ 172 > SC.
   RC

.... Rowing club. .... **[5]**

Turn over

14 The graph shows the speed of a train during the first 60 seconds of motion.

Speed (m/s) vs Time (s) graph showing the train's speed rising from 0 at 0s to 20 m/s at 15s, remaining constant at 20 m/s until 50s, then decreasing to 0 at 60s.

(a) What is the speed of the train after 9 seconds?

(a) ....12........................ m/s **[1]**

(b) What does the straight line suggest about the speed of the train over the first 15 seconds?

........Acceleration is constant........................

.... **[1]**

(c) Work out the average speed of the train, in m/s, during the 60 seconds.

$$\text{Distance} = (\tfrac{1}{2} \times 15 \times 20) + (35 \times 20) + (\tfrac{1}{2} \times 10 \times 20)$$

$$= 150 + 700 + 100$$

$$= 950\text{m}.$$

$$\frac{950}{60} =$$

(c) ....15.83........................ m/s **[5]**

15 The diagram shows triangle OAB and points C and D.

Not to scale

A

$3a$

C

D

O

$3b$

B
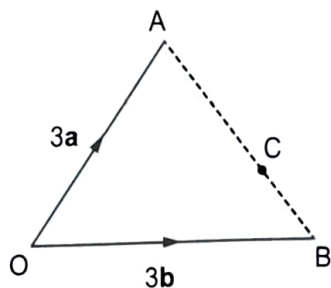
$\overrightarrow{OA} = 3\mathbf{a}$ and $\overrightarrow{OB} = 3\mathbf{b}$.

C lies on AB such that AC = 2CB.

D is such that $\overrightarrow{BD} = 2\mathbf{a} + \mathbf{b}$.

Show, using vectors, that OCD is a straight line.

[5]

$$\overrightarrow{OC} = \overrightarrow{AC} + \overrightarrow{OA}$$

$$\overrightarrow{AC} = \tfrac{2}{3}\overrightarrow{AB}$$

$$\overrightarrow{AB} = 3\underline{b} - 3\underline{a}$$

$$\Rightarrow \overrightarrow{AC} = 2\underline{b} - 2\underline{a}$$

$$\overrightarrow{OC} = 2\underline{b} - 2\underline{a} + 3\underline{a} = 2\underline{b} + \underline{a} = \underline{a} + 2\underline{b}$$

$$\overrightarrow{OD} = \overrightarrow{OB} + \overrightarrow{BD} = 3\underline{b} + 2\underline{a} + \underline{b} = 2\underline{a} + 4\underline{b}$$

$$\overrightarrow{OD} = 2\overrightarrow{OC} \quad \text{so} \quad OCD \text{ must be a straight line.}$$

16 (a) The table shows values of x and y.

x	4	16	36
y	6	3	2

Show that these values fit the relationship that y is inversely proportional to $\sqrt{x}$. [2]

$$y = \frac{k}{\sqrt{x}} \quad \Rightarrow \quad k = y\sqrt{x}.$$

$6 \times \sqrt{4} = 12.$

$3 \times \sqrt{16} = 12.$

$2 \times \sqrt{36} = 12.$

The value of k is consistent for all pairs of x and y.

(b) a is inversely proportional to b^2 and a = 3.75 when b = 4.

Find a formula linking a and b.

$$a = \frac{k}{b^2}$$

$$3.75 \times 4 \times 4 = k = 60.$$

(b) ....$a = \frac{60}{b^2}$........ [3]

17 Show that $(a^3)^{-\frac{1}{3}} \times (a^2)^{\frac{1}{2}} = 1$. **[3]**

$$(a^3)^{-\frac{1}{3}} = a^{-1}.$$

$$(a^2)^{\frac{1}{2}} = a^1.$$

$$a^{-1} \times a^1 = a^0 = \underline{1}.$$

18 Region **R** satisfies these inequalities.

$$y > 3$$
$$y \geqslant x$$
$$x + y \leqslant 9$$

By drawing three straight lines on the grid, find and label the region **R**.
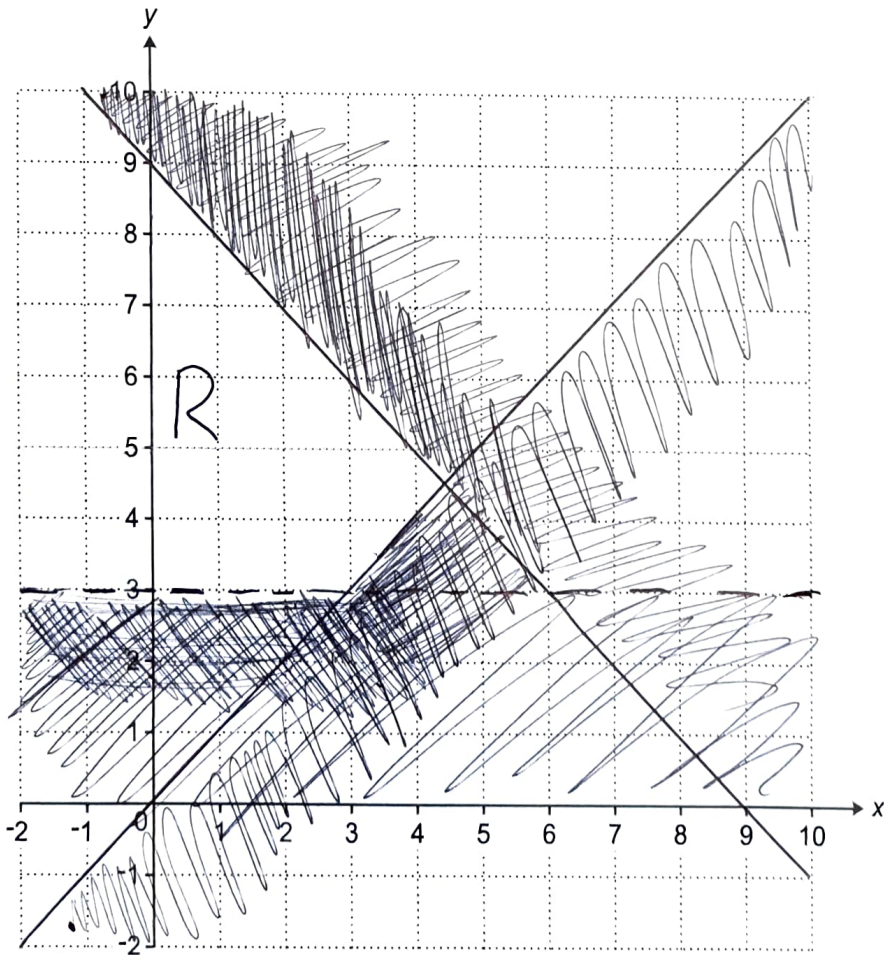
[6]

Turn over for Question 19

19 Solve this equation algebraically.
    Give your solutions correct to 2 decimal places.

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

$$x = \frac{-8 \pm \sqrt{8^2 - (4 \times -5 \times 3)}}{3 \times 2}$$

$$= \frac{-8 \pm \sqrt{64 + 60}}{6}$$

$$= \frac{-8 \pm \sqrt{124}}{6} \qquad = 0.52, \; -3.19$$

$x = \underline{\;-3.19\;}$ or $x = \underline{\;0.52\;}$ **[4]**

END OF QUESTION PAPER