UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

*4745867181*

**MATHEMATICS** **0581/32**

Paper 3 (Core) **October/November 2011**

**2 hours**

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator, Mathematical tables (optional), Geometrical instruments, Tracing paper (optional)

**READ THESE INSTRUCTIONS FIRST**

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
If working is needed for any question it must be shown below that question.
Electronic calculators should be used.
If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.
For $\pi$, use either your calculator value or 3.142.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total of the marks for this paper is 104.

This document consists of **16** printed pages.

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UNIVERSITY of CAMBRIDGE International Examinations

**1** Mr and Mrs Sayed and their 3 children go on holiday.
They travel to the airport by train.

**(a)** The train departs at 16 20.

**(i)** They leave home 45 minutes before the train departs.

Find the time at which they leave home.

*Answer(a)*(i) .................................. [1]

**(ii)** Write 16 20 using the 12-hour clock.

*Answer(a)*(ii) .................................. [1]

**(b)** The train fare is $24 for an adult.

The train fare for a child is $\frac{2}{3}$ of an adult fare.

Find

**(i)** the fare for a child,

*Answer(b)*(i) $ .................................. [1]

**(ii)** the total fare for Mr and Mrs Sayed and their 3 children.

*Answer(b)*(ii) $ .................................. [2]

**2** Aminata buys a business costing $23 000.

**(a)** She pays part of this cost with $12 000 of her own money.

Calculate what percentage of the $23 000 this is.

*Answer(a)* .............................. % [1]

**(b)** Aminata's brother gives her 32% of the remaining $11 000.

Show that $7 480 is still needed to buy the business.

*Answer(b)*

[2]

**(c)** Aminata borrows the $7 480 at a rate of 3.5 % per year **compound** interest.

Calculate how much money she owes at the end of 3 years.

*Answer(c)* $ .............................. [3]

**(d)** In the first year Aminata spent $11 000 on salaries, equipment and expenses.

$\frac{2}{5}$ of this money was spent on salaries, 0.45 of this money was spent on equipment and the remainder was for expenses.

Calculate how much of the $11 000 was spent on

**(i)** salaries,

*Answer(d)*(i) $ .............................. [1]

**(ii)** equipment,

*Answer(d)*(ii) $ .............................. [1]

**(iii)** expenses.

*Answer(d)*(iii) $ .............................. [1]

**(e)** The three items in **part (d)** are in the ratio salaries : equipment : expenses = 0.4 : 0.45 : 0.15 .

Write this ratio in its simplest form.

*Answer(e)* ............. : ............. : ............. [2]

**3** **(a)**

$$\mathbf{r} = \begin{pmatrix} 3 \\ -2 \end{pmatrix} + \begin{pmatrix} -5 \\ -2 \end{pmatrix}$$

**(i)** Write down **r** as a single vector.

*Answer(a)*(i) **r** = $\begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [1]

**(ii)** The point *G*(3, 2) is translated by the vector **r** to the point *H*.

Find the co-ordinates of *H*.

*Answer(a)*(ii) ( .............. , ............. ) [1]

**(iii)** Write down the vector of the translation that maps *H* onto *G*.

*Answer(a)*(iii) $\begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [1]

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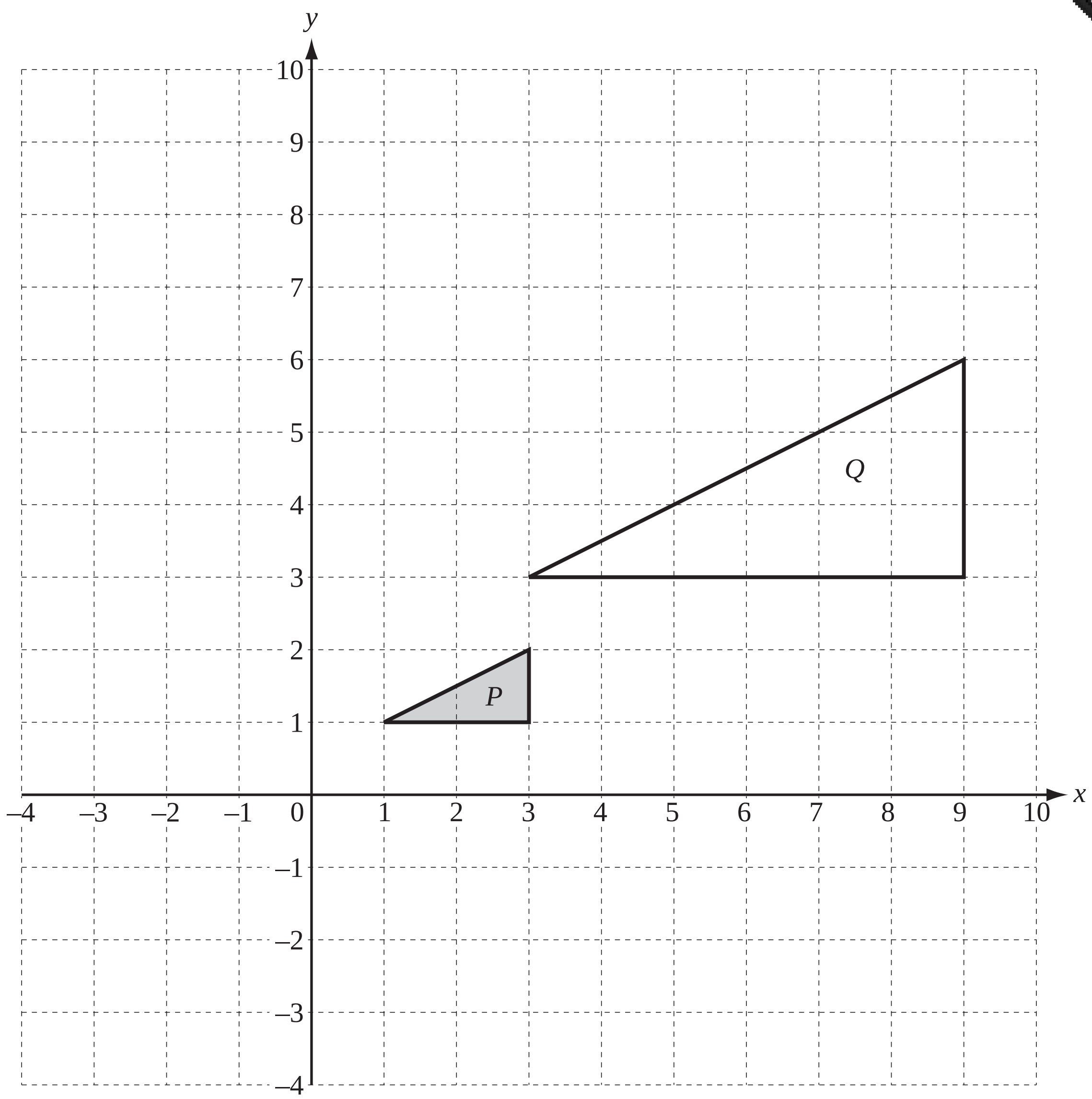
**(b)**




The diagram shows two triangles $P$ and $Q$.

**(i)** Describe fully the **single** transformation which maps $P$ onto $Q$.

*Answer(b)*(i) .................................................................................................... [3]

**(ii)** On the grid, draw the reflection of $P$ in the line $x = 0$. Label this image $R$. [2]

**(iii)** On the grid, rotate $P$ through 180° about (0, 0). Label this image $S$. [2]

**(iv)** Describe fully the **single** transformation which maps triangle $S$ onto triangle $R$.

*Answer(b)*(iv) .................................................................................................... [2]

**4** **(a)** Expand and simplify $3(2x + y) + 5(x - y)$.

*Answer(a)* .................................. [2]

**(b)** Expand $x^2(3x - 2y)$.

*Answer(b)* .................................. [2]

**(c)** Factorise completely $4y^2 - 10xy$.

*Answer(c)* .................................. [2]

**(d)** $y = \dfrac{4x^2}{3}$

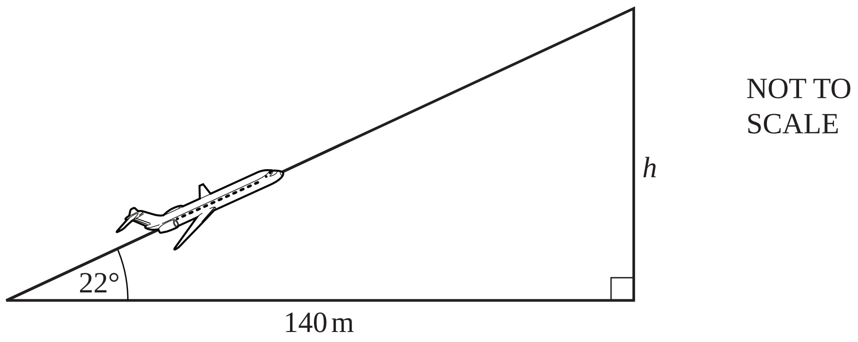
**(i)** Find the value of $y$ when $x = -3$.

*Answer(d)*(i) $y =$ .................................. [2]

**(ii)** Make $x$ the subject of the formula.

*Answer(d)*(ii) $x =$ .................................. [3]

**5** **(a)** An aeroplane takes off 140 metres before reaching the end of the runway.
It climbs at an angle of 22° to the horizontal ground.




Calculate the height of the aeroplane, *h*, when it is vertically above the end of the runway.

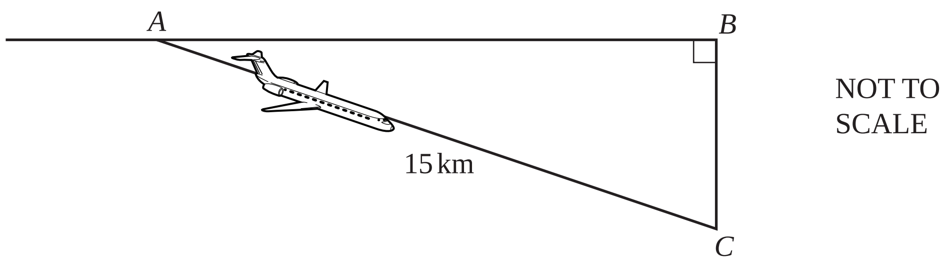
*Answer(a) h =* .................................. m [2]

**(b)** After 3 hours 30 minutes the aeroplane has travelled 1850 km.

Calculate the average speed of the aeroplane.

*Answer(b)* .................................. km/h [2]

**(c)**




The aeroplane descends from *A*, at a height of 12 000 metres, to *C*, at a height of 8 300 metres.

**(i)** Work out the vertical distance, *BC*, that the aeroplane descends.

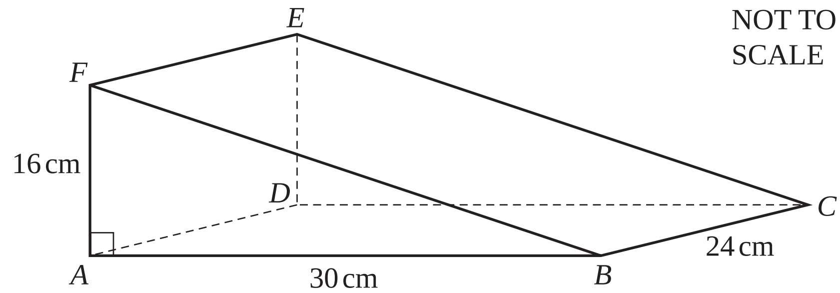
*Answer(c)*(i) ............................ m [1]

**(ii)** The distance *AC* is 15 **kilometres**.

Calculate angle *BAC*.

*Answer(c)*(ii) Angle *BAC* = .................................. [2]

**6**




The diagram shows a wedge in the shape of a triangular prism.

$AB = 30$ cm, $AF = 16$ cm and $BC = 24$ cm. Angle $BAF = 90°$.

**(a)** Calculate

**(i)** the area of triangle *ABF*,

*Answer(a)*(i) .................................... cm² [2]

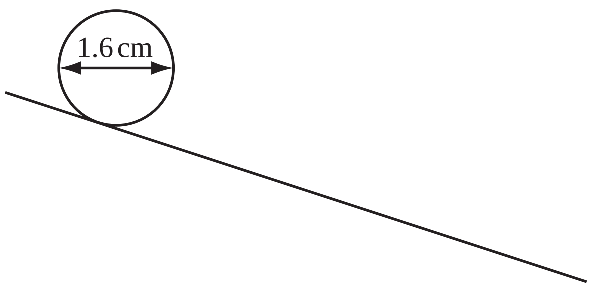
**(ii)** the volume of the wedge.

*Answer(a)*(ii) .................................... cm³ [1]

**(b)** **(i)** Calculate *BF*.

*Answer(b)*(i) .................................... cm [2]

**(ii)**




A coin with diameter 1.6 cm is rolled down the sloping surface of the wedge.
It travels in a straight line parallel to *BF*, starting on *FE* and ending on *BC*.

Calculate the number of **complete** turns it makes.

*Answer(b)*(ii) .................................... [3]

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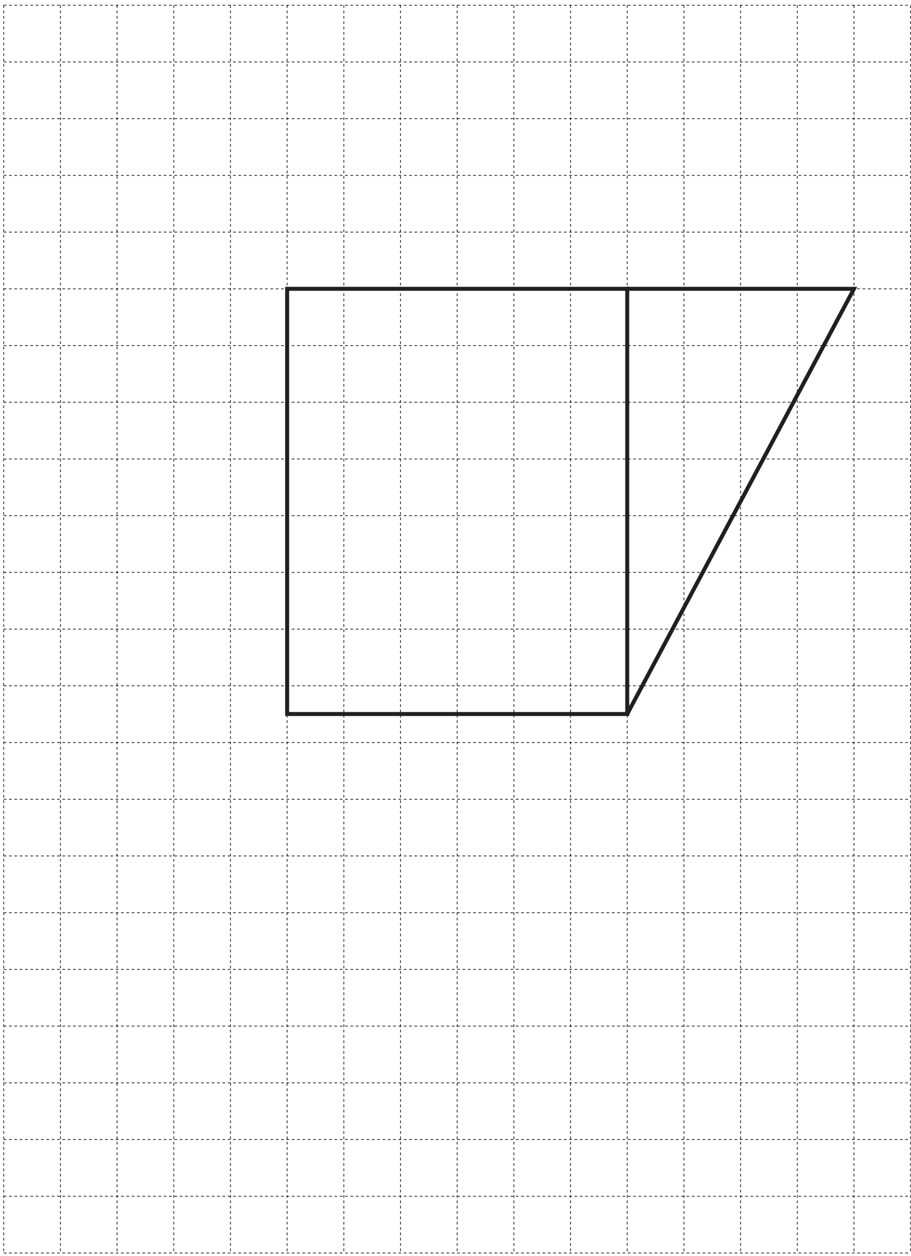
**(c)** On the grid, complete the net of the wedge.
The base and one of the triangles have been drawn for you.

Each square on the grid represents a square of side 4 centimetres.



[3]

**(d)** Calculate the surface area of the wedge.

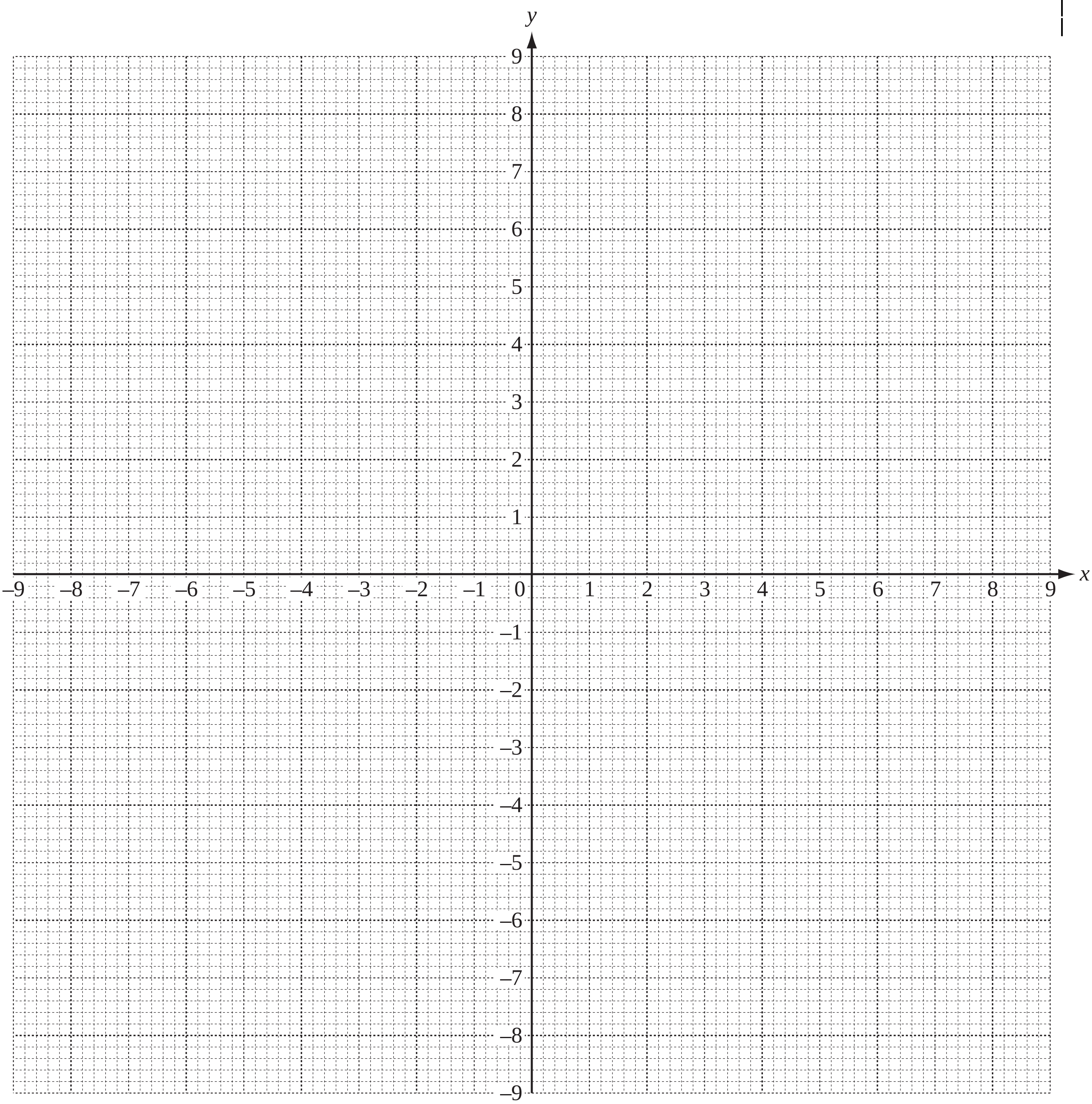
*Answer(d)* .................................. $cm^2$ [3]

**7** **(a)** The table shows some values for $y = \frac{18}{x}$.

| $x$ | −9 | −6 | −4 | −3 | −2 | | 2 | 3 | 4 | 6 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| $y$ | −2 | | −4.5 | | −9 | | | | 4.5 | 3 | |

**(i)** Complete the table. [2]

**(ii)** On the grid, draw the graph of $y = \frac{18}{x}$ for $-9 \leqslant x \leqslant -2$ and $2 \leqslant x \leqslant 9$.




[4]

**(iii)** Use your graph to solve the equation $\frac{18}{x} = -5$.

*Answer(a)*(iii) $x =$ .................................... [1]

**(b)** **(i)** Complete the table of values for $y = 2x + 3$.

| $x$ | $-4$ | $-3$ | 2 | 3 |
|---|---|---|---|---|
| $y$ | $-5$ | | 7 | |

[2]

**(ii)** On the grid, draw the graph of $y = 2x + 3$ for $-4 \leqslant x \leqslant 3$. [1]

**(iii)** Find the co-ordinates of the points of intersection of the graphs of

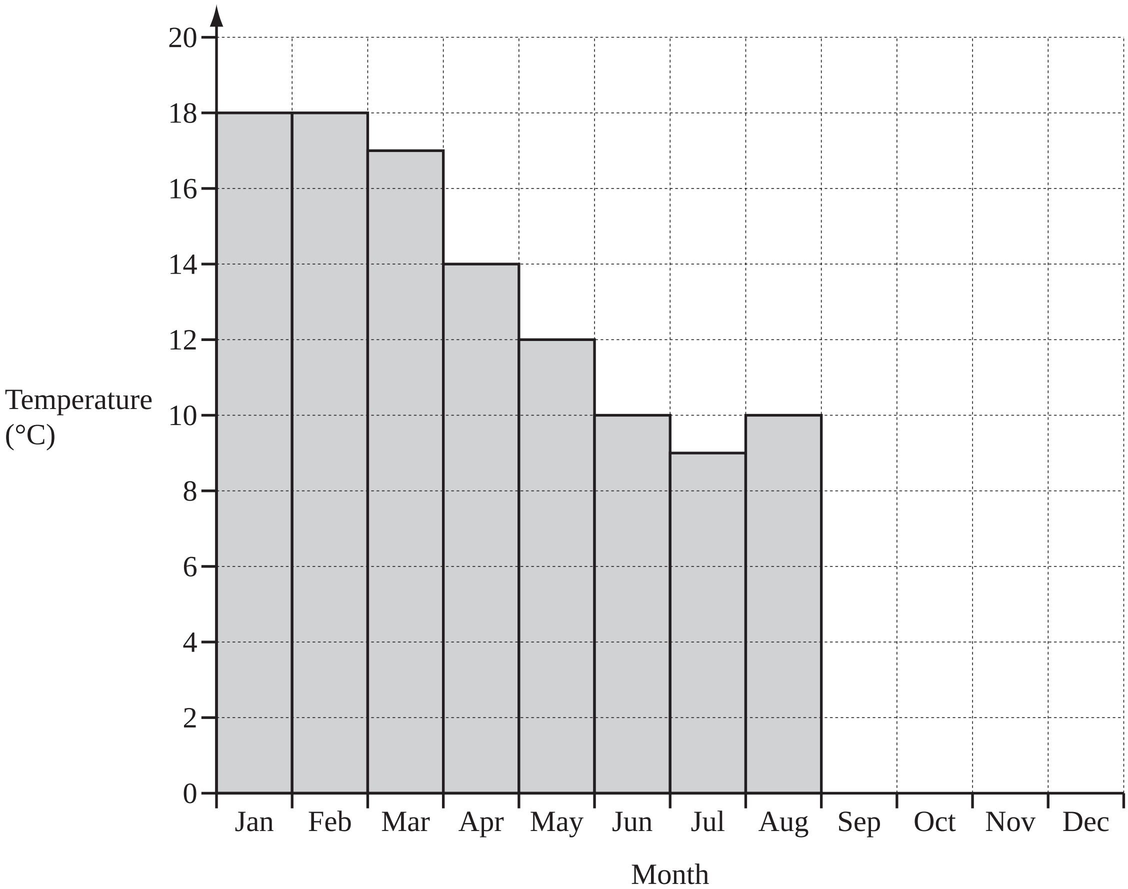
$$y = \frac{18}{x} \text{ and } y = 2x + 3.$$

*Answer(b)*(iii) ( .............. , .............. ) and ( .............. , .............. ) [2]

**8** The table shows the average temperature and rainfall each month at Wellington airport.

| Month | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Temperature (°C) | 18 | 18 | 17 | 14 | 12 | 10 | 9 | 10 | 11 | 13 | 15 | 16 |
| Rainfall (mm) | 67 | 48 | 76 | 87 | 99 | 113 | 111 | 106 | 82 | 81 | 74 | 74 |

**(a)** Complete the bar chart to show the **temperature** each month.




[2]

**(b)** For the **rainfall** calculate

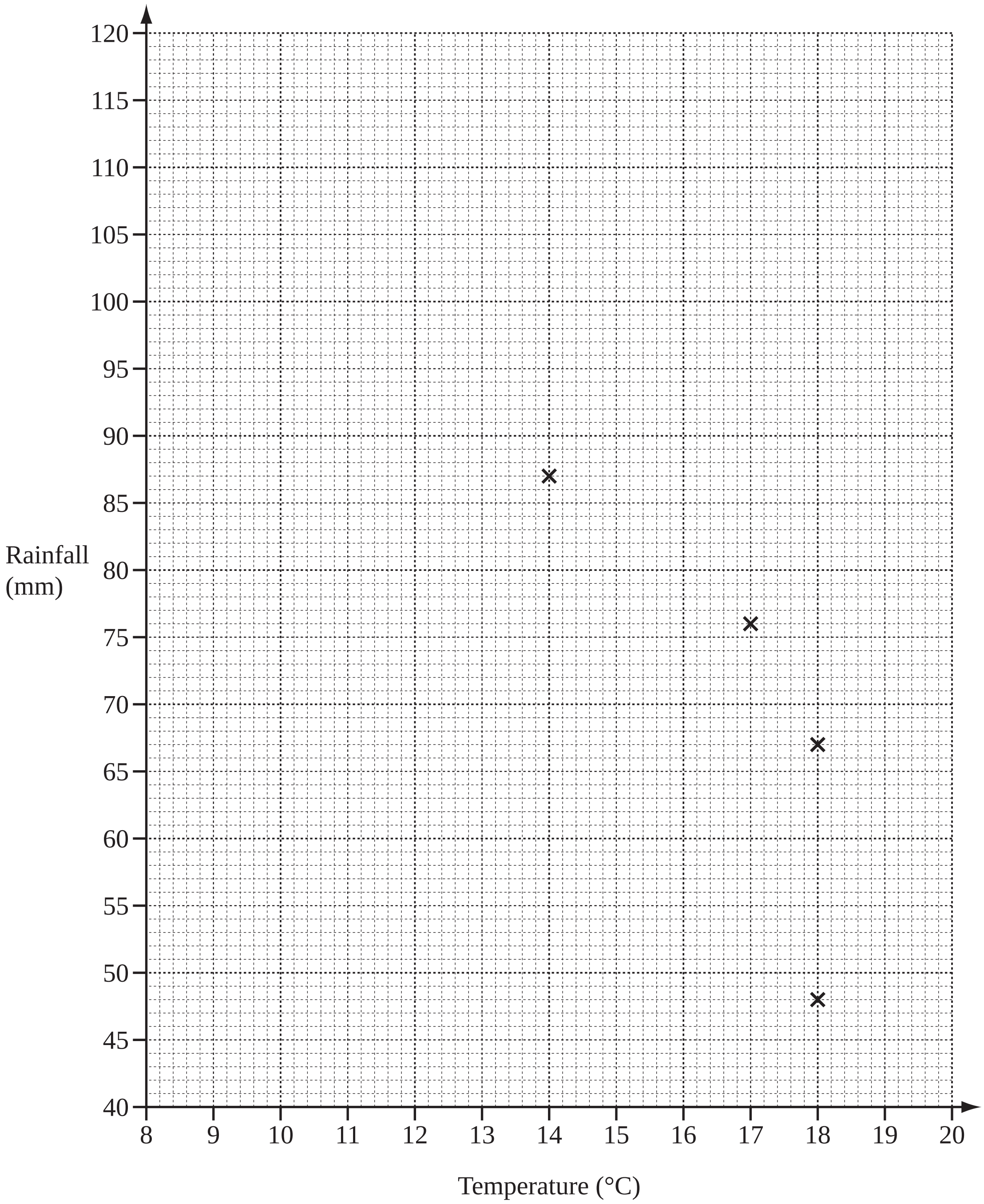
**(i)** the mean,

*Answer(b)*(i) .............................. mm [2]

**(ii)** the median.

*Answer(b)*(ii) .............................. mm [2]

**(c)** In the scatter diagram the rainfall for January to April is plotted against temperature.




**(i)** Complete the scatter diagram by plotting the values for the months May to December. [3]

**(ii)** Draw the line of best fit on the scatter diagram. [1]

**(iii)** What type of correlation does the scatter diagram show?

*Answer(c)*(iii) .............................. [1]

**9** On the scale drawing opposite, point *A* is a port.
*B* and *C* are two buoys in the sea and *L* is a lighthouse.

The scale is 1 cm = 3 km.

**(a)** A boat leaves port *A* and follows a straight line course that bisects angle *BAC*.

Using a straight edge and compasses only, construct the bisector of angle *BAC* on the scale drawing. [2]

**(b)** When the boat reaches a point that is equidistant from *B* and from *C*, it changes course.
It then follows a course that is equidistant from *B* and from *C*.

**(i)** Using a straight edge and compasses only, construct the locus of points that are equidistant from *B* and from *C*.
Mark the point *P* where the boat changes course. [2]

**(ii)** Measure the distance *AP* in centimetres.

*Answer(b)*(ii) .................................... cm [1]

**(iii)** Work out the actual distance *AP*.

*Answer(b)*(iii) .................................... km [1]

**(iv)** Measure the **obtuse** angle between the directions of the two courses.

*Answer(b)*(iv) ................................ [1]

**(c)** Boats must be more than 9 kilometres from the lighthouse, *L*.

**(i)** Construct the locus of points that are 9 kilometres from *L*. [2]

**(ii)** Mark the point *R* where the course of the boat meets this locus.
Work out the actual straight line distance, *AR*, in kilometres.

*Answer(c)*(ii) ......................... km [1]

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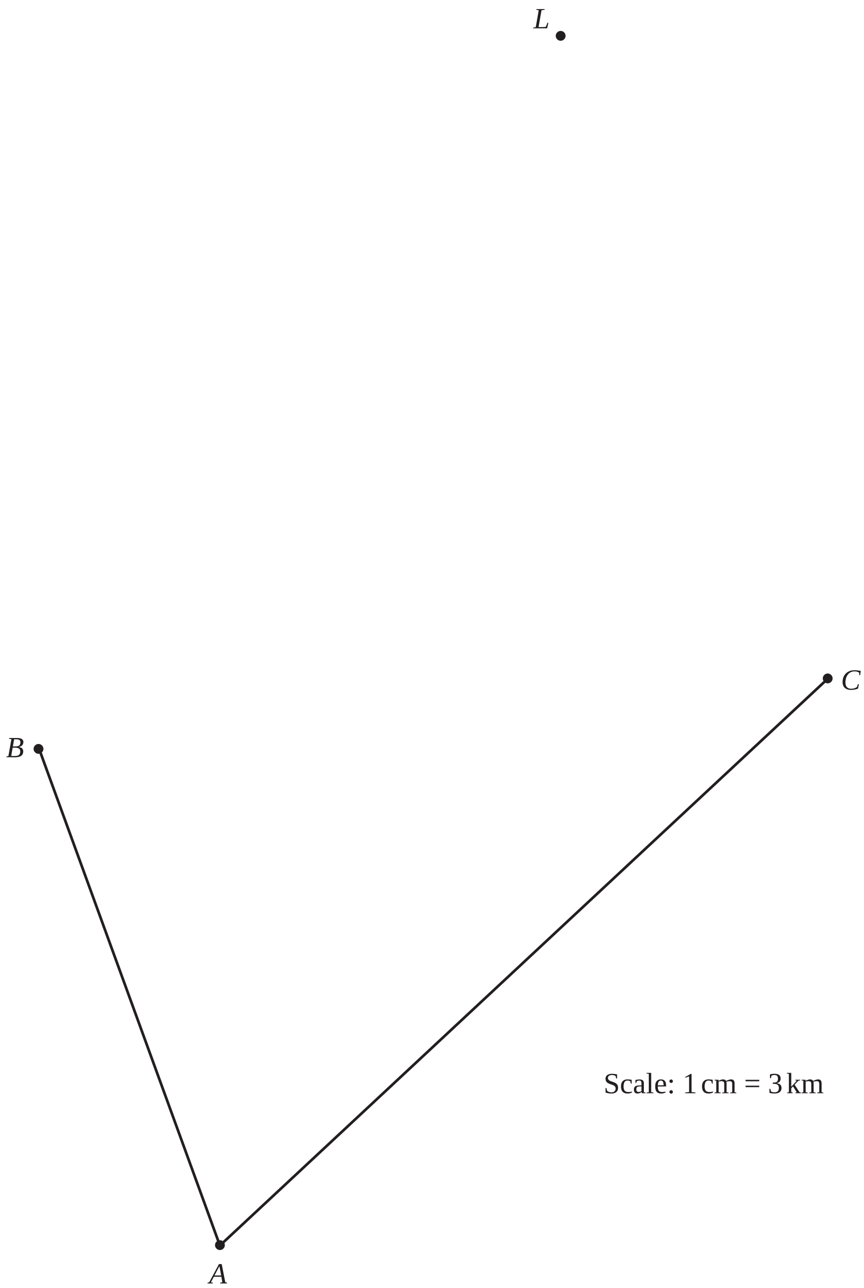


**Question 10 is printed on the next page.**

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**10** **(a)** Write down the next term in each of the following sequences.

**(i)** 2, 9, 16, 23, ........................... [1]

**(ii)** 75, 67, 59, 51, ........................... [1]

**(iii)** 2, 5, 9, 14, ........................... [1]

**(iv)** 2, 1, $\frac{1}{2}$, $\frac{1}{4}$, ........................... [1]

**(v)** 2, 4, 8, 16, ........................... [1]

**(b)** For the sequence in **part (a)(i)** write down

**(i)** the 10th term,

*Answer(b)*(i) .................................. [1]

**(ii)** the *n*th term.

*Answer(b)*(ii) .................................. [2]

**(c)** The *n*th term of the sequence in **part (a)(iii)** is $\frac{n^2 + 3n}{2}$.

Calculate the 50th term of this sequence.

*Answer(c)* .................................. [2]

**(d)** The *n*th term of the sequence in **part (a)(v)** is $2^n$.

Calculate the 12th term of this sequence.

*Answer(d)* .............................. [1]