1 **(a)** The Muller family are on holiday in New Zealand.

(i) They change some euros (€) and receive \$1962 (New Zealand dollars).
The exchange rate is €1 = \$1.635 .

Calculate the number of euros they change.

€ .... [2]

(ii) The family spend 15% of their New Zealand dollars on a tour.

Calculate the number of dollars they have left.

\$ .... [2]

(iii) The family visit two waterfalls, the Humboldt Falls and the Bridal Veil Falls.
The ratio of the heights Humboldt Falls : Bridal Veil Falls = 5 : 1.
The Humboldt Falls are 220 m higher than the Bridal Veil Falls.

Calculate the height of the Humboldt Falls.

.... m [2]

(b) **(i)** Water flows over the Browne Falls at a rate of 3680 litres per second.
After rain, this rate increases to 9752 litres per second.

Calculate the percentage increase in this rate.

.... % [3]

(ii) After rain, water flows over the Sutherland Falls at a rate of 74 240 litres per second.
This is an increase of 45% on the rate before the rain.

Calculate the rate before the rain.

.... litres/second [3]

2 **(a)** Solve $30 + 2x = 3(3 - 4x)$.

$x =$ .... [3]

(b) Factorise $12ab^3 + 18a^3b^2$.

.... [2]

(c) Simplify.

(i) $5a^3c^2 \times 2a^2c^7$

.... [2]

(ii) $\left(\dfrac{16a^8}{c^{12}}\right)^{\frac{3}{4}}$

.... [2]

(d) y is inversely proportional to the square of $(x + 2)$.
When $x = 3$, $y = 2$.

Find y when $x = 8$.

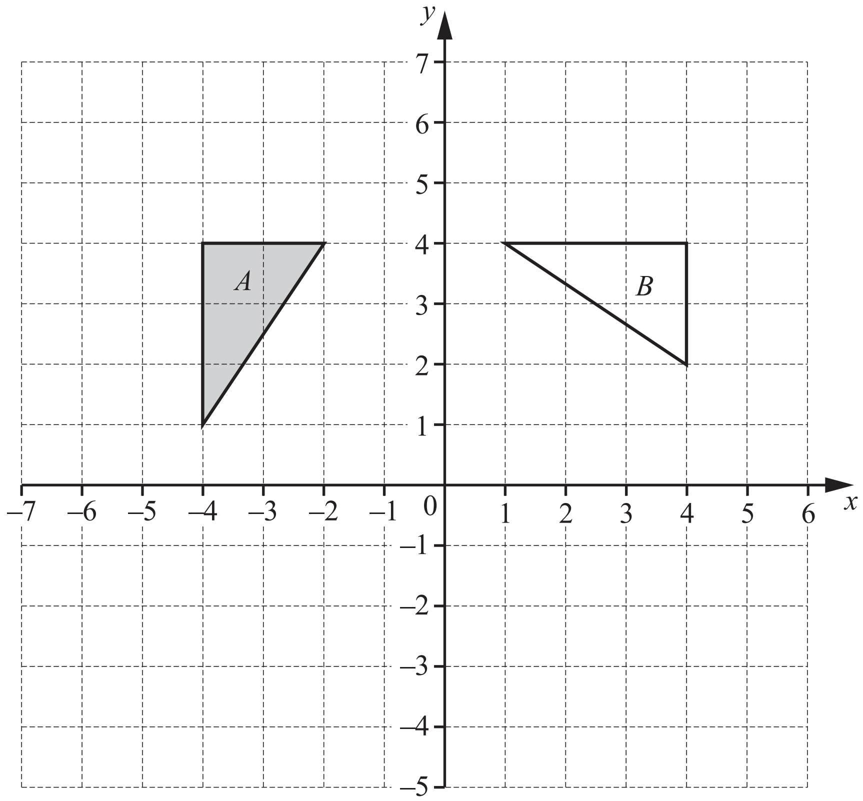
$y =$ .... [3]

(e) Write as a single fraction in its simplest form.

$$\frac{5}{x-2}-\frac{x-5}{2}$$

.... [3]

3



(a) Describe fully the **single** transformation that maps triangle A onto triangle B.

....

.... [3]

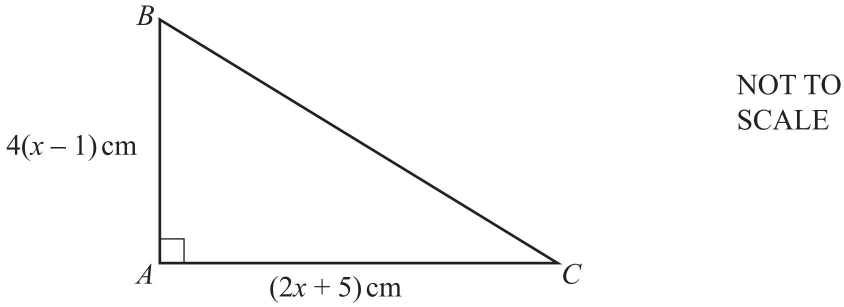
(b) On the grid, draw the image of

(i) triangle A after a reflection in the x-axis, [1]

(ii) triangle A after a translation by the vector $\begin{pmatrix} 7 \\ -5 \end{pmatrix}$, [2]

(iii) triangle A after the transformation represented by the matrix $\begin{pmatrix} 0.5 & 0 \\ 0 & 0.5 \end{pmatrix}$. [3]

4 The diagram shows a right-angled triangle ABC.



The area of this triangle is 30 cm^2.

(a) Show that $2x^2 + 3x - 20 = 0$.

[3]

(b) Use factorisation to solve the equation $2x^2 + 3x - 20 = 0$.

x = ... or x = ... [3]

(c) Calculate BC.

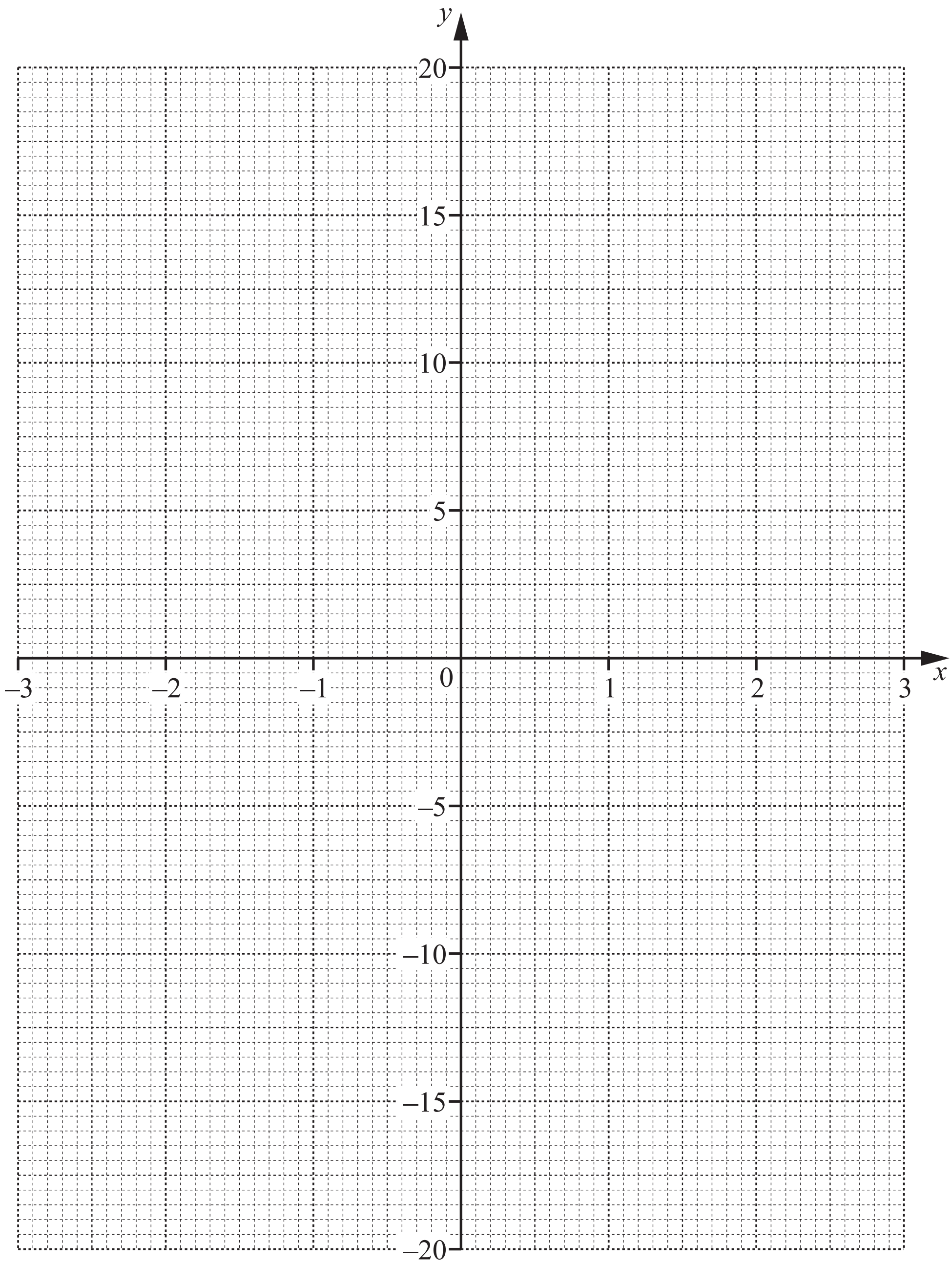
BC = ... cm [3]

5 The table shows some values of $y = x^3 - 3x - 1$.

x	–3	–2.5	–2	–1.5	–1	0	1	1.5	2	2.5	3
y	–19	–9.1		0.1	1	–1	–3	–2.1	1	7.1	

(a) Complete the table of values. [2]

(b) Draw the graph of $y = x^3 - 3x - 1$ for $-3 \leqslant x \leqslant 3$.



[4]

(c) A straight line through (0, –17) is a tangent to the graph of $y = x^3 - 3x - 1$.

(i) On the grid, draw this tangent. [1]

(ii) Find the co-ordinates of the point where the tangent meets your graph.

(................ , ...) [1]

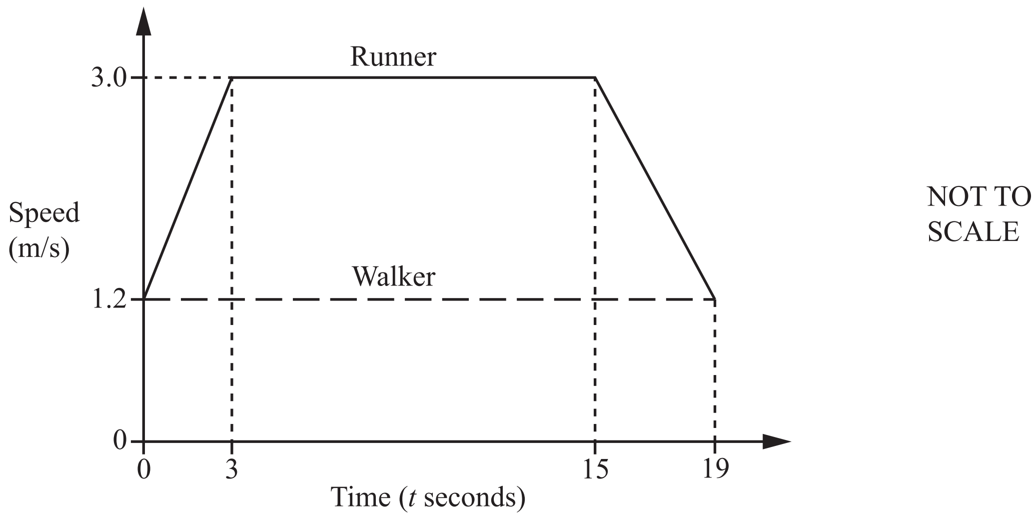
(iii) Find the equation of the tangent.
Give your answer in the form $y = mx + c$.

$y =$ .... [3]

(d) By drawing a suitable straight line on the grid, solve the equation $x^3 - 6x - 3 = 0$.

$x =$ .... or $x =$ .... or $x =$ .... [4]

6 The diagram shows the speed–time graph for part of a journey for two people, a runner and a walker.



(a) Calculate the acceleration of the runner for the first 3 seconds.

.... m/s^2 [1]

(b) Calculate the total distance travelled by the runner in the 19 seconds.

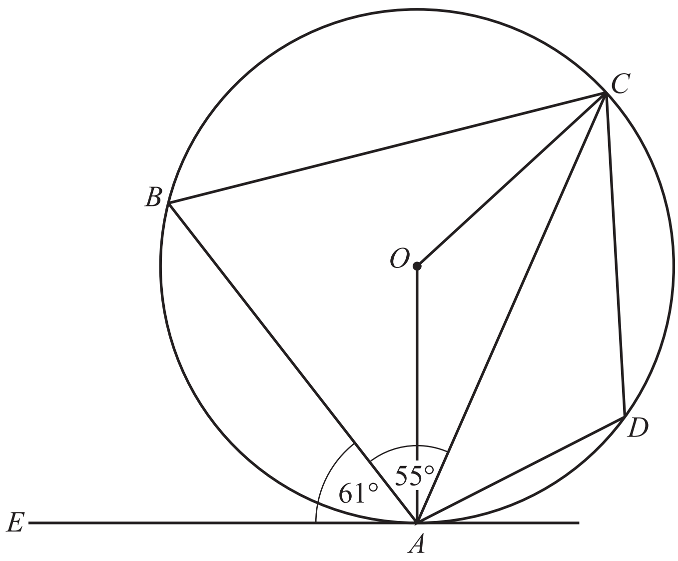
.... m [3]

(c) The runner and the walker are travelling in the same direction along the same path.
When $t = 0$, the runner is 10 metres behind the walker.

Find how far the runner is ahead of the walker when $t = 19$.

.... m [3]

7



In the diagram, A, B, C and D lie on the circle, centre O.
EA is a tangent to the circle at A.
Angle $EAB = 61°$ and angle $BAC = 55°$.

(a) Find angle BAO.

Angle BAO = ... [1]

(b) Find angle AOC.

Angle AOC = ... [2]

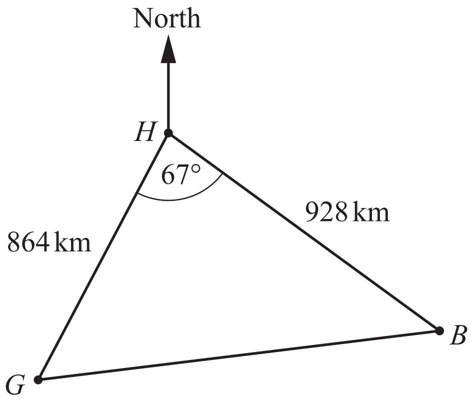
(c) Find angle ABC.

Angle ABC = ... [1]

(d) Find angle CDA.

Angle CDA = ... [1]

8 The diagram shows the positions of three cities, Geneva (G), Budapest (B) and Hamburg (H).



NOT TO SCALE

(a) A plane flies from Geneva to Hamburg.
The flight takes 2 hours 20 minutes.

Calculate the average speed in kilometres per hour.

.... km/h [2]

(b) Use the cosine rule to calculate the distance from Geneva to Budapest.

.... km [4]

(c) The bearing of Budapest from Hamburg is 133°.

(i) Find the bearing of Hamburg from Budapest.

.... [2]

(ii) Calculate the bearing of Budapest from Geneva.

.... [4]

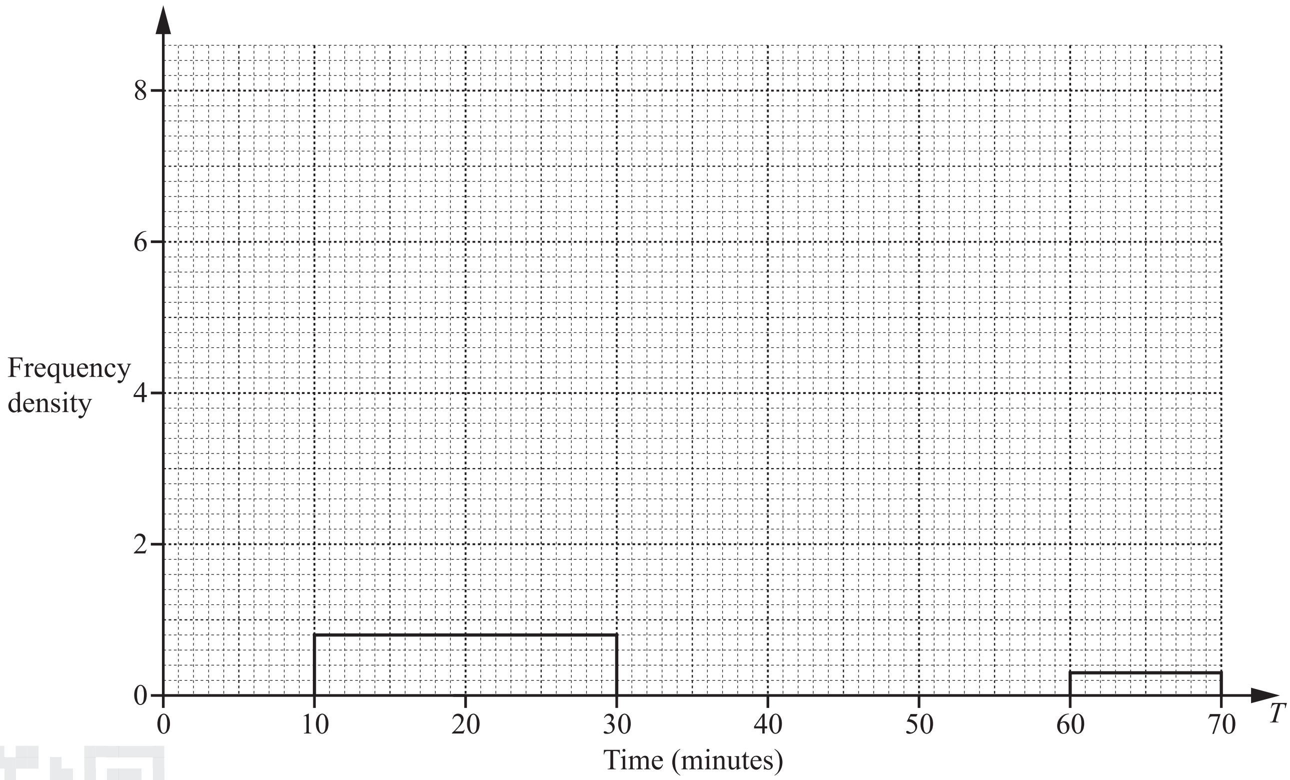
9 **(a)** The table shows the amount of time, T minutes, 120 people each spend in a supermarket one Saturday.

Time (T minutes)	Number of people
$10 < T \leqslant 30$	16
$30 < T \leqslant 40$	18
$40 < T \leqslant 45$	22
$45 < T \leqslant 50$	40
$50 < T \leqslant 60$	21
$60 < T \leqslant 70$	3

(i) Use the mid-points of the intervals to calculate an estimate of the mean.

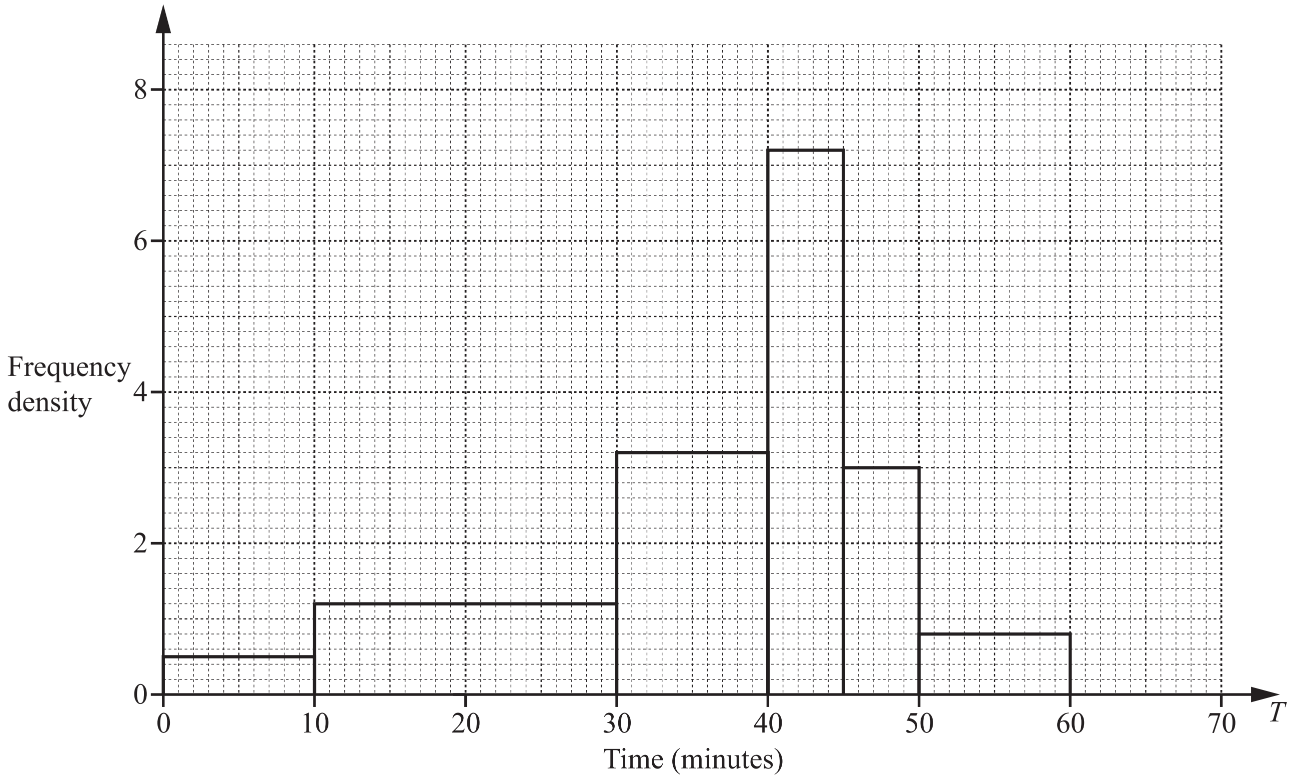
.... min [4]

(ii) Complete this histogram to show the information in the table.



[4]

(b) This histogram shows the amount of time, T minutes, 120 people each spend in the supermarket one Wednesday.



Make a comment comparing the distributions of the times for the two days.

....

.... [1]

10 (a) The lake behind a dam has an area of 55 hectares.
When the gates in the dam are open, water flows out at a rate of 75 000 litres per second.

(i) Show that 90 million litres of water flows out in 20 minutes.

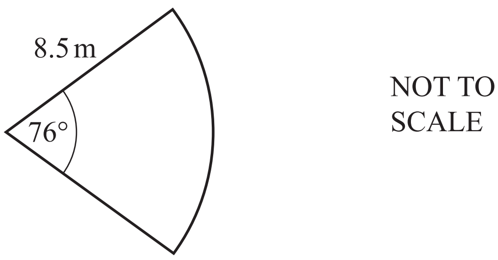
[1]

(ii) Beneath the surface, the lake has vertical sides.

Calculate the drop in the water level of the lake when the gates are open for 20 minutes.
Give your answer in centimetres.
[1 hectare = $10^4\,m^2$, 1000 litres = $1\,m^3$]

.... cm [3]

(iii)

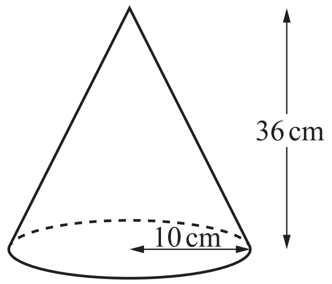


The cross-section of a gate is a sector of a circle with radius 8.5 m and angle 76°.

Calculate the perimeter of the sector.

.... m [3]

(b)



NOT TO SCALE

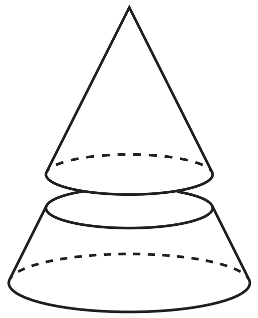
A solid metal cone has radius 10 cm and height 36 cm.

(i) Calculate the volume of this cone.

[The volume, V, of a cone with radius r and height h is $V = \frac{1}{3}\pi r^2 h$.]

.... cm^3 [2]

(ii) The cone is cut, parallel to its base, to give a smaller cone.



NOT TO SCALE

The volume of the smaller cone is half the volume of the original cone.
The smaller cone is melted down to make two different spheres.
The ratio of the radii of these two spheres is 1 : 2.

Calculate the radius of the smaller sphere.

[The volume, V, of a sphere with radius r is $V = \frac{4}{3}\pi r^3$.]

.... cm [4]

11 **(a)** $\mathbf{a} = \begin{pmatrix} -3 \\ 2 \end{pmatrix}$ $\mathbf{b} = \begin{pmatrix} 5 \\ 4 \end{pmatrix}$ $\mathbf{c} = \begin{pmatrix} 14 \\ 9 \end{pmatrix}$

(i) Find 3**a** – 2**b**.

$\begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [2]

(ii) Find | **a** |.

.... [2]

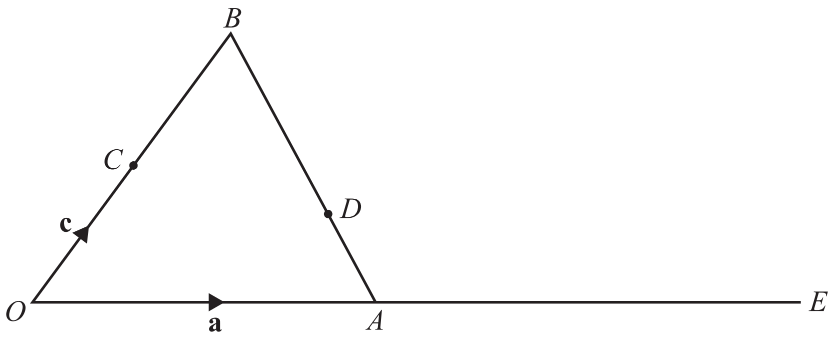
(iii) $m\mathbf{a} + n\mathbf{b} = \mathbf{c}$

Write down two simultaneous equations and solve them to find the value of *m* and the value of *n*.
Show all your working.

m = ...

n = ... [5]

(b)



NOT TO SCALE

OAB is a triangle and *C* is the mid-point of *OB*.
D is on *AB* such that $AD : DB = 3 : 5$.
OAE is a straight line such that $OA : AE = 2 : 3$.
$\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OC} = \mathbf{c}$.

(i) Find, in terms of **a** and **c**, in its simplest form,

(a) $\overrightarrow{AB}$,

$\overrightarrow{AB} =$ .... [1]

(b) $\overrightarrow{AD}$,

$\overrightarrow{AD} =$ .... [1]

(c) $\overrightarrow{CE}$,

$\overrightarrow{CE} =$ .... [1]

(d) $\overrightarrow{CD}$.

$\overrightarrow{CD} =$ .... [2]

(ii) $\overrightarrow{CE} = k\overrightarrow{CD}$

Find the value of k.

$k =$ .... [1]

Question 12 is printed on the next page.

12 A box contains 20 packets of potato chips.

6 packets contain barbecue flavoured chips.
10 packets contain salt flavoured chips.
4 packets contain chicken flavoured chips.

(a) Maria takes two packets at random **without replacement**.

(i) Show that the probability that she takes two packets of salt flavoured chips is $\frac{9}{38}$.

[2]

(ii) Find the probability that she takes two packets of different flavoured chips.

.... [4]

(b) Maria takes three packets at random, **without replacement**, from the 20 packets.

Find the probability that she takes **at least two** packets of chicken flavoured chips.

.... [3]