UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME									
CENTER NUMBER						CANDIDATE NUMBER			

CAMBRIDGE IGCSE MATHEMATICS (US) **0444/04**

Paper 4 (Extended) **For examination from 2012**

SPECIMEN PAPER

2 hours 30 minutes

Candidates answer on the Question Paper.

Additional Materials: Geometrical Instruments
Electronic calculator

READ THESE INSTRUCTIONS FIRST

Write your Center 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 work is needed for any question it must be shown in the space provided.
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 π, use either your calculator value or 3.142

The number of points is given in parentheses [ ] at the end of each question or part question.
The total of the points for this paper is 130.

For Examiner's Use

This document consists of **18** printed pages and **2** blank pages.

UNIVERSITY of CAMBRIDGE International Examinations

[Turn over

Formula List

For the equation $ax^2 + bx + c = 0$ $\quad x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Lateral surface area, A, of cylinder of radius r, height h. $\quad A = 2\pi rh$

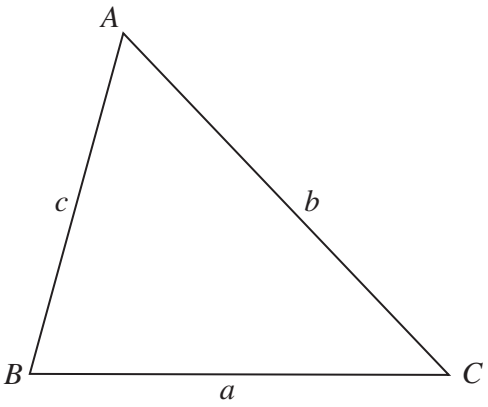
Lateral surface area, A, of cone of radius r, sloping edge l. $\quad A = \pi rl$

Surface area, A, of sphere of radius r. $\quad A = 4\pi r^2$

Volume, V, of pyramid, base area A, height h. $\quad V = \frac{1}{3}Ah$

Volume, V, of cone of radius r, height h. $\quad V = \frac{1}{3}\pi r^2 h$

Volume, V, of sphere of radius r. $\quad V = \frac{4}{3}\pi r^3$



$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc\cos A$$

$$\text{Area} = \tfrac{1}{2}bc\sin A$$

1 Marlene, Carolina, and Pedro receive \$800 from their grandmother in the ratio

Marlene : Carolina : Pedro = 7 : 5 : 4.

(a) Calculate how much money each receives.

Answer (a) Marlene \$ .....

Carolina \$ .....

Pedro \$ ..... [3]

(b) Marlene spends $\frac{2}{7}$ of her money and then invests the rest for two years at 5% per year **simple** interest.

How much money does Marlene have at the end of the two years?

Answer (b) \$ ..... [3]

(c) Carolina spends all of her money on a hi-fi set and two years later sells it at a loss of 20%.

How much money does Carolina have at the end of the two years?

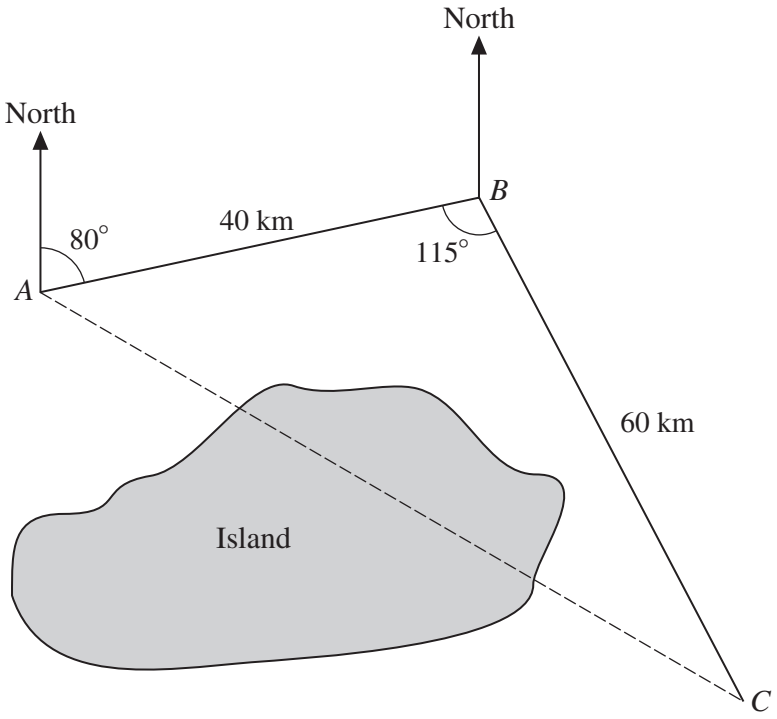
Answer (c) \$ ..... [2]

(d) Pedro spends some of his money and at the end of the two years he has \$100.

Write down and simplify the ratio of the amounts of money Maria, Carolina, and Pedro have at the end of the two years.

Answer (d) \$ ..... : \$ ..... : \$ ..... [2]

2



To avoid an island, a ship travels 40 kilometers from A to B and then 60 kilometers from B to C.
The bearing of B from A is 080° and angle ABC is 115°.

(a) The ship leaves A at 11:55.
It travels at an average speed of 35 km/h.

Calculate, to the nearest minute, the time it arrives at C.

Answer (a) ..... [3]

(b) Find the bearing of

(i) A from B,

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

(ii) C from B.

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

(c) Calculate the straight line distance AC.

Answer (c) ..... km [4]

(d) Calculate angle BAC.

Answer (d) ..... [3]

(e) Calculate how far C is **east** of A.

Answer (e) ..... km [3]

3 $f(x) = x^2 - 4x + 3$ and $g(x) = 2x - 1$.

(a) Solve $f(x) = 0$.

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

(b) Find $g^{-1}(x)$.

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

(c) Solve $f(x) = g(x)$, giving your answers correct to 2 decimal places.

Answer (c) ..... [5]

(d) Find the value of $g\big(f(-2)\big)$.

Answer (d) ..... [2]

(e) Find $f\big(g(x)\big)$. Simplify your answer.

Answer (e) ..... [3]

4 **(a)** A solid metal sphere has a radius of 3.5 cm.

One cubic centimeter of the metal has a mass of 5.6 grams.

Calculate

(i) the surface area of the sphere,

Answer (a)(i) ..... cm^2 [2]

(ii) the volume of the sphere,

Answer (a)(ii) ..... cm^3 [2]

(iii) the mass of the sphere.

Answer (a)(iii) ..... g [2]

(b)

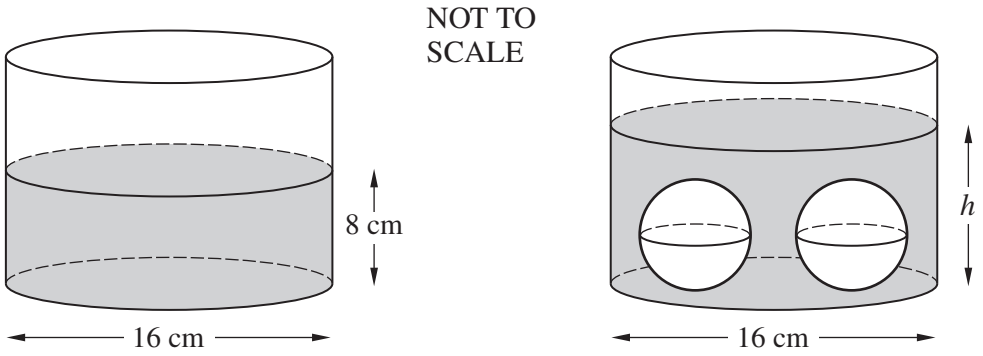


Diagram 1 Diagram 2

Diagram 1 shows a cylinder with a **diameter** of 16 cm.

It contains water to a depth of 8 cm.

Two spheres identical to the sphere in **part (a)** are placed in the water. This is shown in Diagram 2.

Calculate h, the new depth of water in the cylinder.

Answer (b) ..... cm [4]

5 $f(x) = 3x - \frac{1}{x^2} + 3, x \neq 0.$

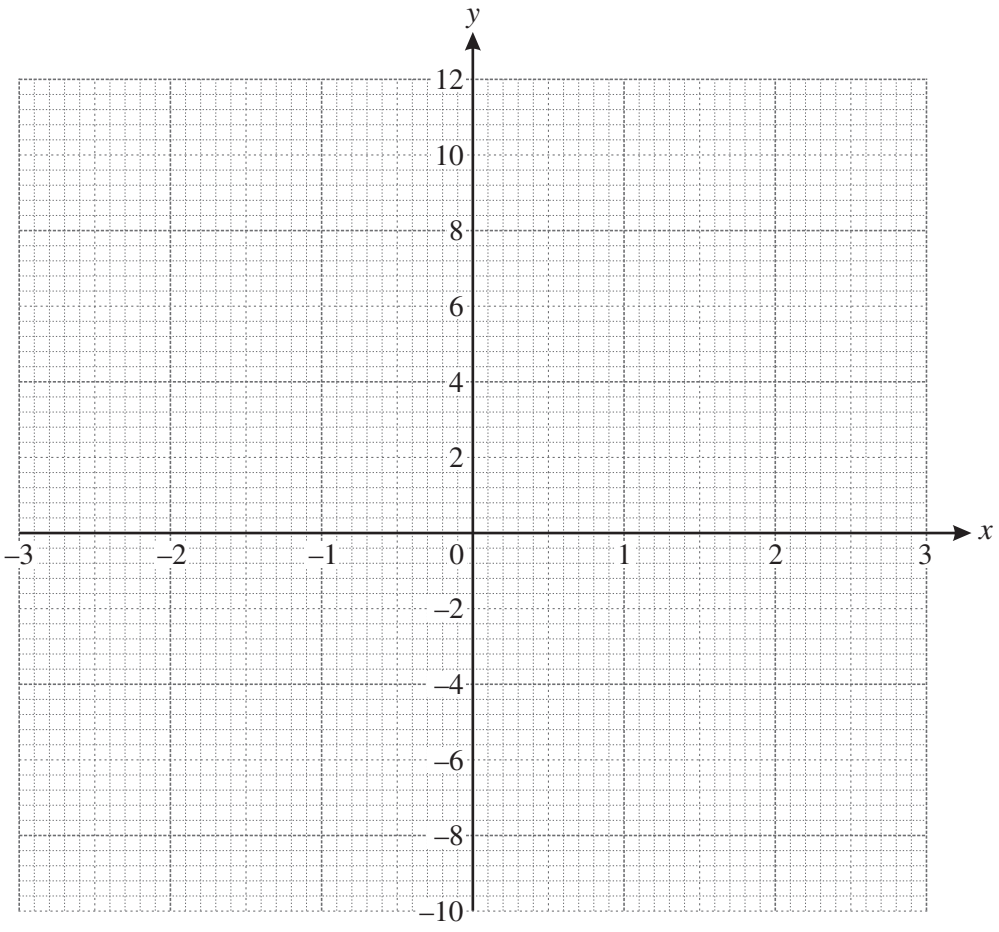
(a) The table shows some values of $f(x)$.

x	−3	−2.5	−2	−1.5	−1	−0.5	−0.4	−0.3	0.3	0.4	0.5	1	1.5	2	2.5	3
$f(x)$	p	−4.7	−3.3	−1.9	−1	−2.5	−4.5	−9.0	−7.2	−2.1	0.5	q	7.1	8.8	10.3	r

Find the values of p, q, and r.

Answer (a) p = ... , q = ... , r = ... [3]

(b) Draw the graph of $y = f(x)$ for $-3 \leqslant x \leqslant -0.3$ and $0.3 \leqslant x \leqslant 3$.



[5]

(c) Use your graph to solve the equations

(i) $3x - \frac{1}{x^2} + 3 = 0$,

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

(ii) $3x - \frac{1}{x^2} + 7 = 0$.

Answer (c)(ii) ..... [3]

(d) $g(x) = 3x + 3$.

On the grid on the previous page, draw the graph of $y = g(x)$ for $-3 \leqslant x \leqslant 3$. [2]

(e) **(i)** Describe briefly what happens to the graphs of $y = f(x)$ and $y = g(x)$ for large positive or negative values of x.

Answer (e)(i) .....

..... [1]

(ii) Estimate the slope of $y = f(x)$ when $x = 100$.

Answer (e)(ii) ..... [1]

6 Hank invests \$100 at 4% per year **compound** interest.

(a) How many dollars will Hank have after 2 years?

Answer (a) \$ ..... [2]

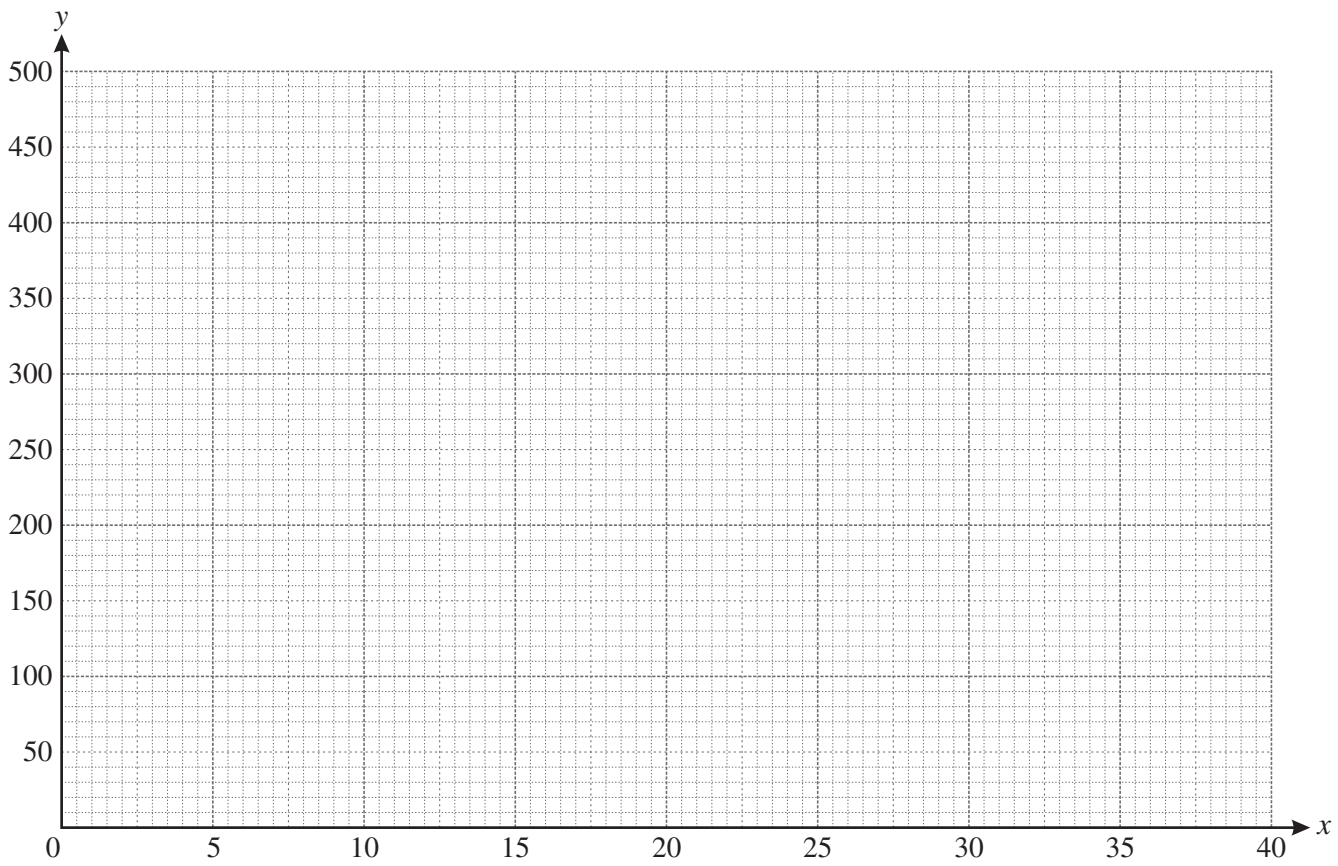
(b) After x years, Hank will have y dollars.
He knows a formula to calculate y.
The formula is $y = 100 \times 1.04^x$

x (Years)	0	10	20	30	40
y (Dollars)	100	p	219	q	480

Use this formula to calculate the values of p and q in the table.

Answer (b) p = ... , q = ... [2]

(c) Plot the five points in the table on the grid below and draw a smooth curve through them.



[4]

(d) Use your graph to estimate

(i) how many dollars Hank will have after 25 years,

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

(ii) how many years, to the nearest year, it takes for Hank to have $200.

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

(e) Avril invests $100 at 7% per year **simple** interest.

(i) Show that after 20 years Avril has $240.

Answer (e)(i)

[2]

(ii) How many dollars will Avril have after 40 years?

Answer (e)(ii) $ ..... [1]

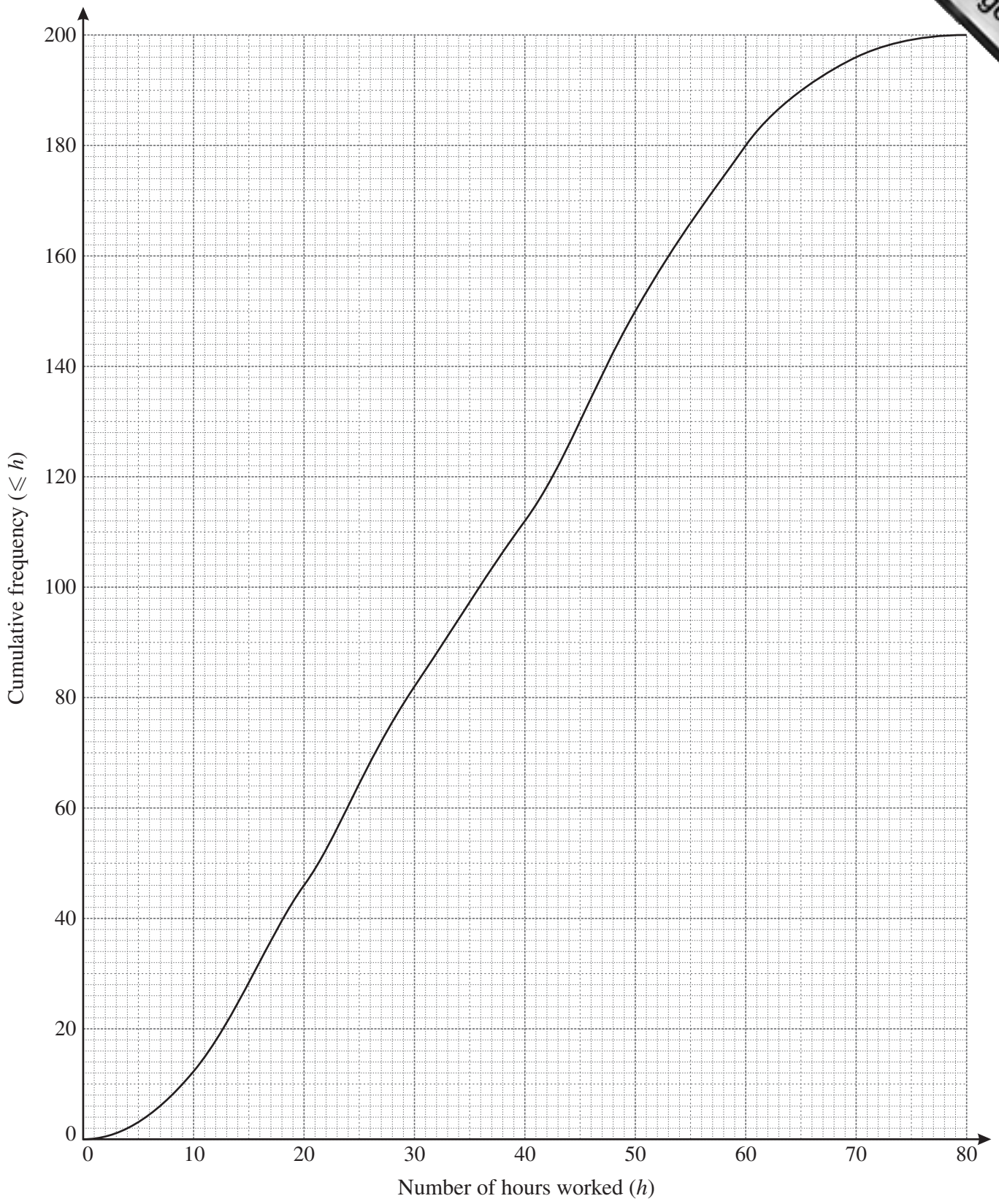
(iii) On the grid on the previous page, draw a graph to show how the $100 which Avril invests will increase during the 40 years. [2]

(f) Avril and Hank start with the same amount.

Use your graphs to find after how many years Hank will **start** to have more than Avril.

Answer (f) ..... [1]

7 200 people record the number of hours they work in a week.
The cumulative frequency graph below shows this information.



(a) Use the graph to find

(i) the median,

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

(ii) the upper quartile,

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

(iii) the inter-quartile range,

Answer (a)(iii) ..... h [1]

(iv) the number of people who work more than 60 hours in a week.

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

(b) Vernon uses the graph to make the following frequency table.

Hours worked (h)	$0 < h \leqslant 10$	$10 < h \leqslant 20$	$20 < h \leqslant 30$	$30 < h \leqslant 40$	$40 < h \leqslant 50$	$50 < h \leqslant 60$	$60 < h \leqslant 70$	$70 < h \leqslant 80$
Frequency	12	34	36	30	38	30	.....	.....

(i) Use the graph to complete the table. [2]

(ii) Calculate an estimate of the mean number of hours worked in a week.

Answer (b)(ii) ..... h [4]

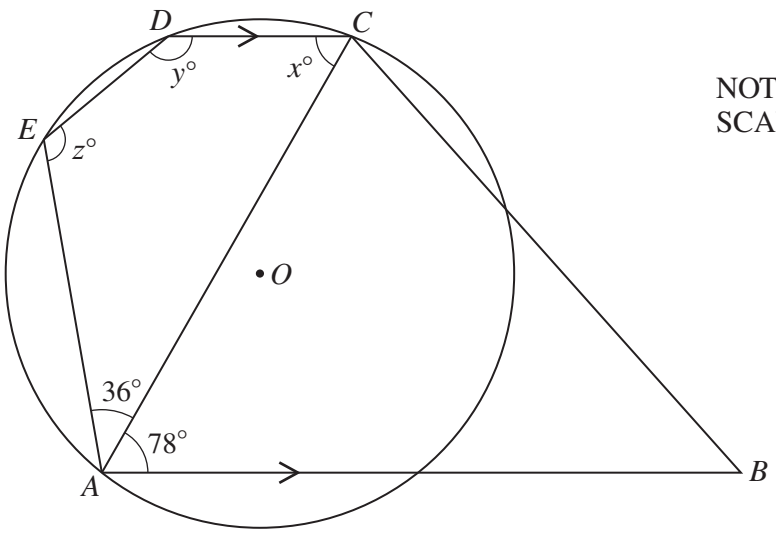
(c) Maria uses the graph to make a different frequency table.

Hours worked (h)	$0 < h \leqslant 30$	$30 < h \leqslant 40$	$40 < h \leqslant 50$	$50 < h \leqslant 80$
Frequency	82	30	38	50

When she draws a histogram, the height of the column for the interval $30 < h \leqslant 40$ is 9 cm.
Calculate the height of each of the other three columns.

Answer (c) ..... , ... , ... [4]

8 (a)



NOT TO SCALE

ABCDE is a pentagon.
A circle, center *O*, passes through the points *A*, *C*, *D*, and *E*.
Angle *EAC* = 36°, angle *CAB* = 78°, and *AB* is parallel to *DC*.

(i) Find the values of *x*, *y*, and *z*, giving a reason for each.

x = ...

Reason .....

y = ...

Reason .....

z = ...

Reason ..... [6]

(ii) Explain why *ED* is **not** parallel to *AC*.

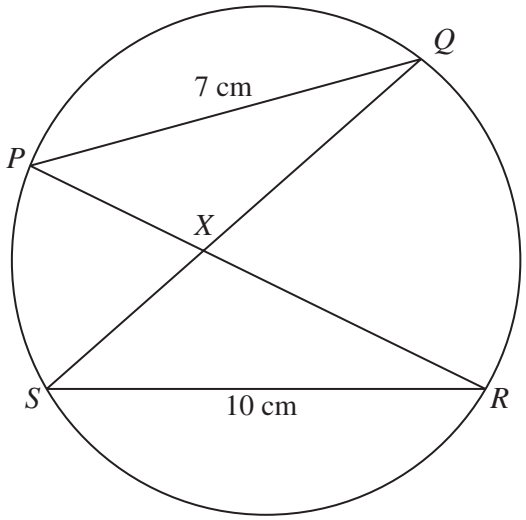
Answer (a)(ii) .....

..... [1]

(iii) Find the value of angle *EOC*.

Answer (a)(iii) ..... [1]

(b)



NOT TO SCALE

P, Q, R and S lie on a circle.
PQ = 7 cm and SR = 10 cm.
PR and QS intersect at X.
The area of triangle SRX = 20 cm^2.

(i) Write down the geometrical word which completes the following statement.

Triangle PQX is ..... to triangle SRX. [1]

(ii) Calculate the area of triangle PQX.

Answer (b)(ii) ..... cm^2 [2]

(iii) Calculate the length of the perpendicular height from X to RS.

Answer (b)(iii) ..... cm [2]

9

Diagram 1

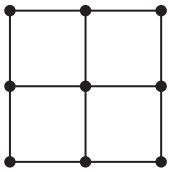


Diagram 2

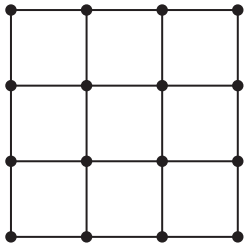


Diagram 3

The first three diagrams in a sequence are shown above.

The diagrams are made up of dots and lines. Each line is one centimeter long.

(a) Make a sketch of the next diagram in the sequence.

Answer (a)

[1]

(b) The table below shows some information about the diagrams.

Diagram	1	2	3	4	···	n
Area	1	4	9	16	···	x
Number of dots	4	9	16	p	···	y
Number of one centimeter lines	4	12	24	q	···	z

(i) Write down the values of p and q.

Answer (b)(i) p = ... , q = ... [2]

(ii) Write down each of x, y, and z in terms of n.

Answer (b)(ii) x = ...

y = ...

z = ... [4]

(c) The **total** number of one centimeter lines in the first n diagrams is given by the expr

$$\tfrac{2}{3}n^3 + fn^2 + gn.$$

(i) Use $n = 1$ in this expression to show that $f + g = \frac{10}{3}$.

Answer (c)(i)

[1]

(ii) Use $n = 2$ in this expression to show that $4f + 2g = \frac{32}{3}$.

Answer (c)(ii)

[2]

(iii) Find the values of f and g.

Answer (c)(iii) f = ...

g = ... [3]

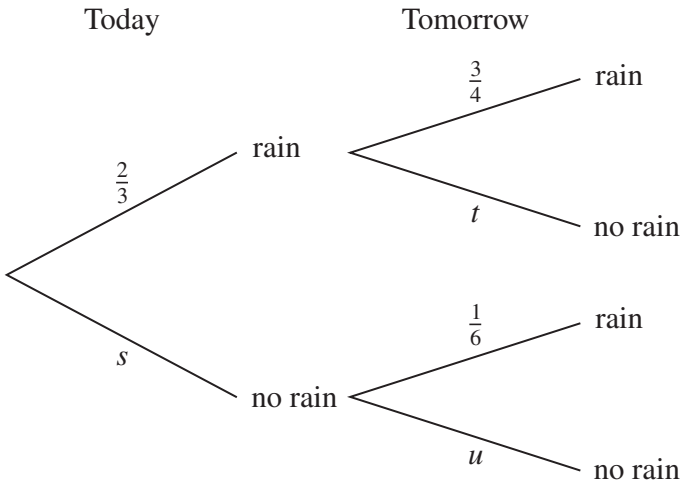
(iv) Find the total number of one centimeter lines in the first 10 diagrams.

Answer (c)(iv) ..... [1]

10 Give your answers to this question as fractions.

The probability that it rains today is $\frac{2}{3}$.
If it rains today, the probability that it will rain tomorrow is $\frac{3}{4}$.
If it does not rain today, the probability that it will rain tomorrow is $\frac{1}{6}$.

The tree diagram below shows this information.



(a) Write down, as fractions, the values of s, t and u.

Answer (a) $s =$, $t =$, $u =$ [3]

(b) Calculate the probability that it rains on both days.

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

(c) Calculate the probability that it will **not** rain tomorrow.

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

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