UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER			

8301609714

MATHEMATICS **0580/43**

Paper 4 (Extended) **May/June 2012**

2 hours 30 minutes

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 π 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 130.

This document consists of **19** printed pages and **1** blank page.

For Examiner's Use

1 A train travels from Paris to Milan.

(a) The train departs from Paris at 2028 and the journey takes 9 hours 10 minutes.

(i) Find the time the train arrives in Milan.

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

(ii) The distance between Paris and Milan is 850 km.

Calculate the average speed of the train.

Answer(a)(ii) ..... km/h [2]

(b) The total number of passengers on the train is 640.

(i) 160 passengers have tickets which cost $255 each.
330 passengers have tickets which cost $190 each.
150 passengers have tickets which cost $180 each.

Calculate the mean cost of a ticket.

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

For Examiner's Use

(ii) There are men, women and children on the train in the ratio

men : women : children = 4 : 3 : 1 .

Show that the number of women on the train is 240.

Answer(b)(ii)

[2]

(iii) 240 is an increase of 60% on the number of women on the train the previous day.

Calculate the number of women on the train the previous day.

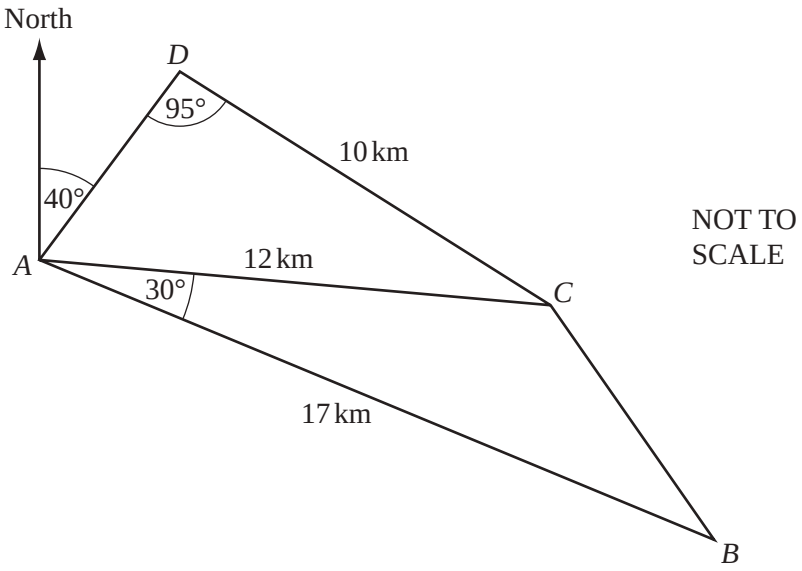
Answer(b)(iii) ..... [3]

(c) The length of the train is 210 m.
It passes through a station of length 340 m, at a speed of 180 km/h.

Calculate the number of seconds the train takes to pass completely through the station.

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

2



NOT TO SCALE

The diagram shows straight roads connecting the towns A, B, C and D.

$AB = 17$ km, $AC = 12$ km and $CD = 10$ km.

Angle $BAC = 30°$ and angle $ADC = 95°$.

(a) Calculate angle CAD.

Answer(a) Angle CAD = ... [3]

(b) Calculate the distance BC.

Answer(b) BC = ... km [4]

For Examiner's Use

For Examiner's Use

(c) The bearing of D from A is 040°.

Find the bearing of

(i) B from A,

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

(ii) A from B.

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

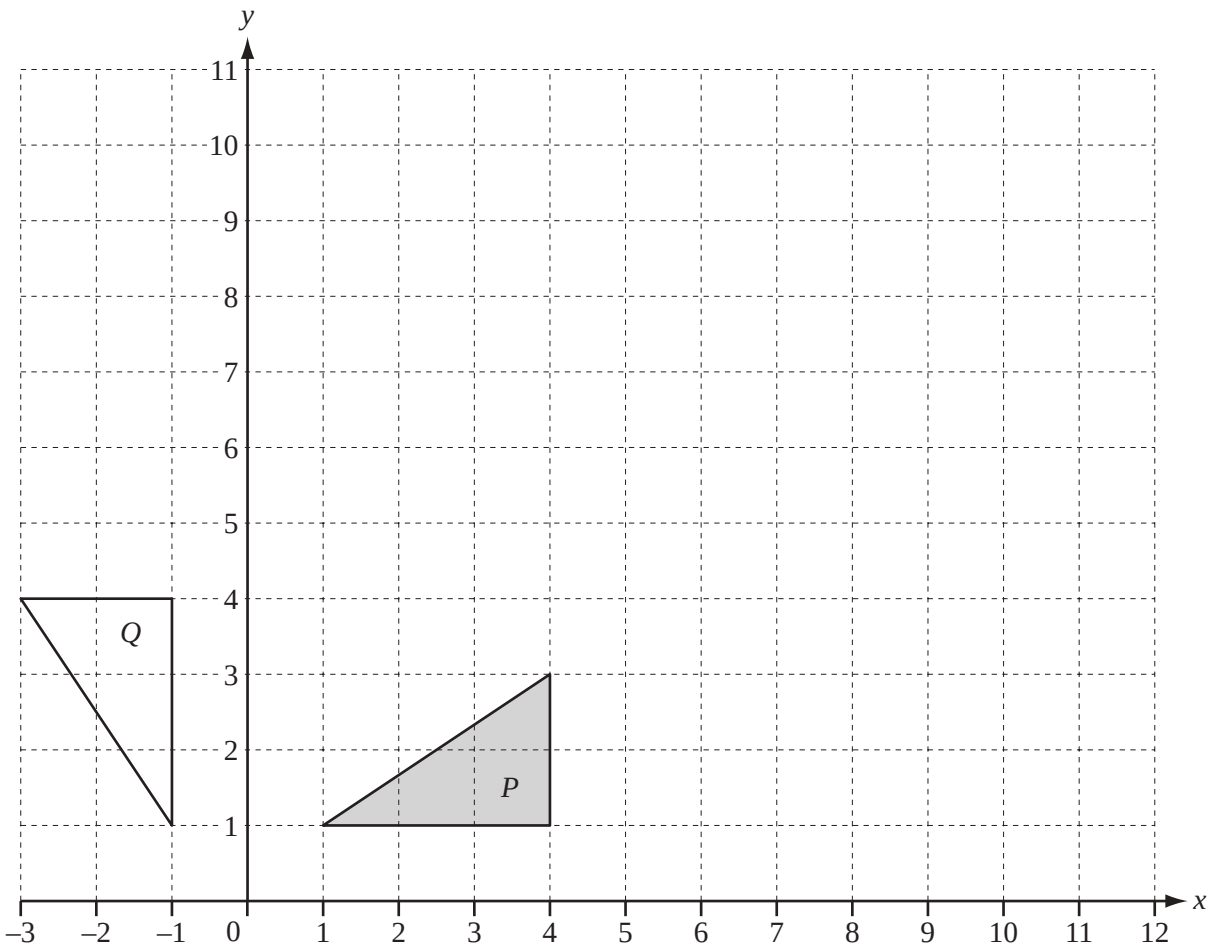
(d) Angle ACB is obtuse.

Calculate angle BCD.

Answer(d) Angle BCD = ... [4]

3

For Examiner's Use



(a) Draw the translation of triangle P by $\begin{pmatrix} 5 \\ 3 \end{pmatrix}$. [2]

(b) Draw the reflection of triangle P in the line $x = 6$. [2]

(c) **(i)** Describe fully the **single** transformation that maps triangle P onto triangle Q.

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

(ii) Find the 2 by 2 matrix which represents the transformation in **part(c)(i)**.

Answer(c)(ii) $\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

(d) **(i)** Draw the stretch of triangle P with scale factor 3 and the x-axis as the invariant line. [2]

(ii) Find the 2 by 2 matrix which represents a stretch, scale factor 3 and x-axis invariant.

Answer(d)(ii) $\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

For Examiner's Use

4 **(a)** In a football league a team is given 3 points for a win, 1 point for a draw and 0 points for a loss.

The table shows the 20 results for Athletico Cambridge.

Points	3	1	0
Frequency	10	3	7

(i) Find the median and the mode.

Answer(a)(i) Median = ...

Mode = ... [3]

(ii) Thomas wants to draw a pie chart using the information in the table.

Calculate the angle of the sector which shows the number of times Athletico Cambridge were given 1 point.

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

(b) Athletico Cambridge has 20 players.

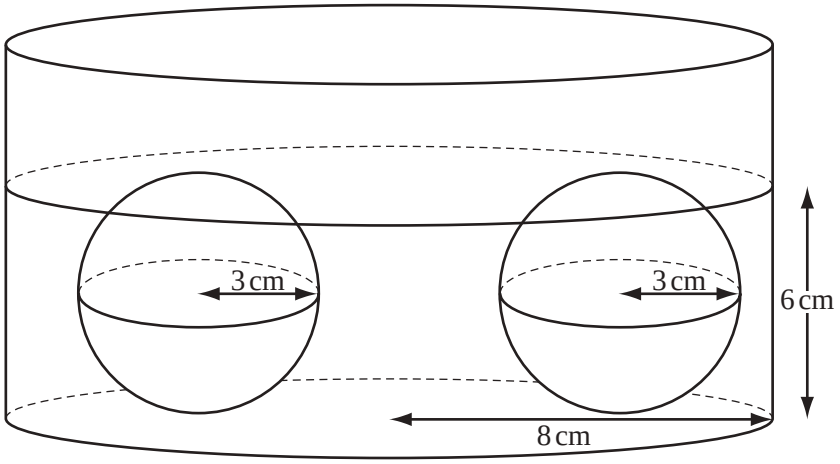
The table shows information about the heights (h centimetres) of the players.

Height (h cm)	$170 < h \leqslant 180$	$180 < h \leqslant 190$	$190 < h \leqslant 200$
Frequency	5	12	3

Calculate an estimate of the mean height of the players.

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

5



NOT TO SCALE

The diagram shows two solid spheres of radius 3 cm lying on the base of a cylinder of radius 8 cm.

Liquid is poured into the cylinder until the spheres are just covered.

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

(a) Calculate the volume of liquid in the cylinder in

(i) cm^3,

Answer(a)(i) ..... cm^3 [4]

(ii) litres.

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

For Examiner's Use

(b) One cubic centimetre of the liquid has a mass of 1.22 grams.

Calculate the mass of the liquid in the cylinder.

Give your answer in kilograms.

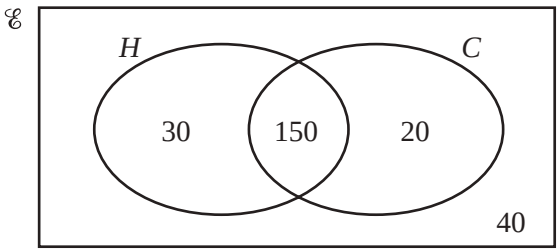
Answer(b) ..... kg [2]

(c) The spheres are removed from the cylinder.

Calculate the new height of the liquid in the cylinder.

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

6



For Examiner's Use

$\mathscr{E}$ = {240 passengers who arrive on a flight in Cyprus}

H = {passengers who are on holiday}

C = {passengers who hire a car}

(a) Write down the number of passengers who

(i) are on holiday,

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

(ii) hire a car but are not on holiday.

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

(b) Find the value of $n(H \cup C')$.

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

(c) One of the 240 passengers is chosen at random.

Write down the probability that this passenger

(i) hires a car,

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

(ii) is on holiday and hires a car.

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

For Examiner's Use

(d) Give your answers to this part correct to 4 decimal places.

Two of the 240 passengers are chosen at random.

Find the probability that

(i) they are both on holiday,

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

(ii) exactly one of the two passengers is on holiday.

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

(e) Give your answer to this part correct to 4 decimal places.

Two passengers are chosen at random from those on holiday.

Find the probability that they both hire a car.

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

7 $f(x) = 2^x$

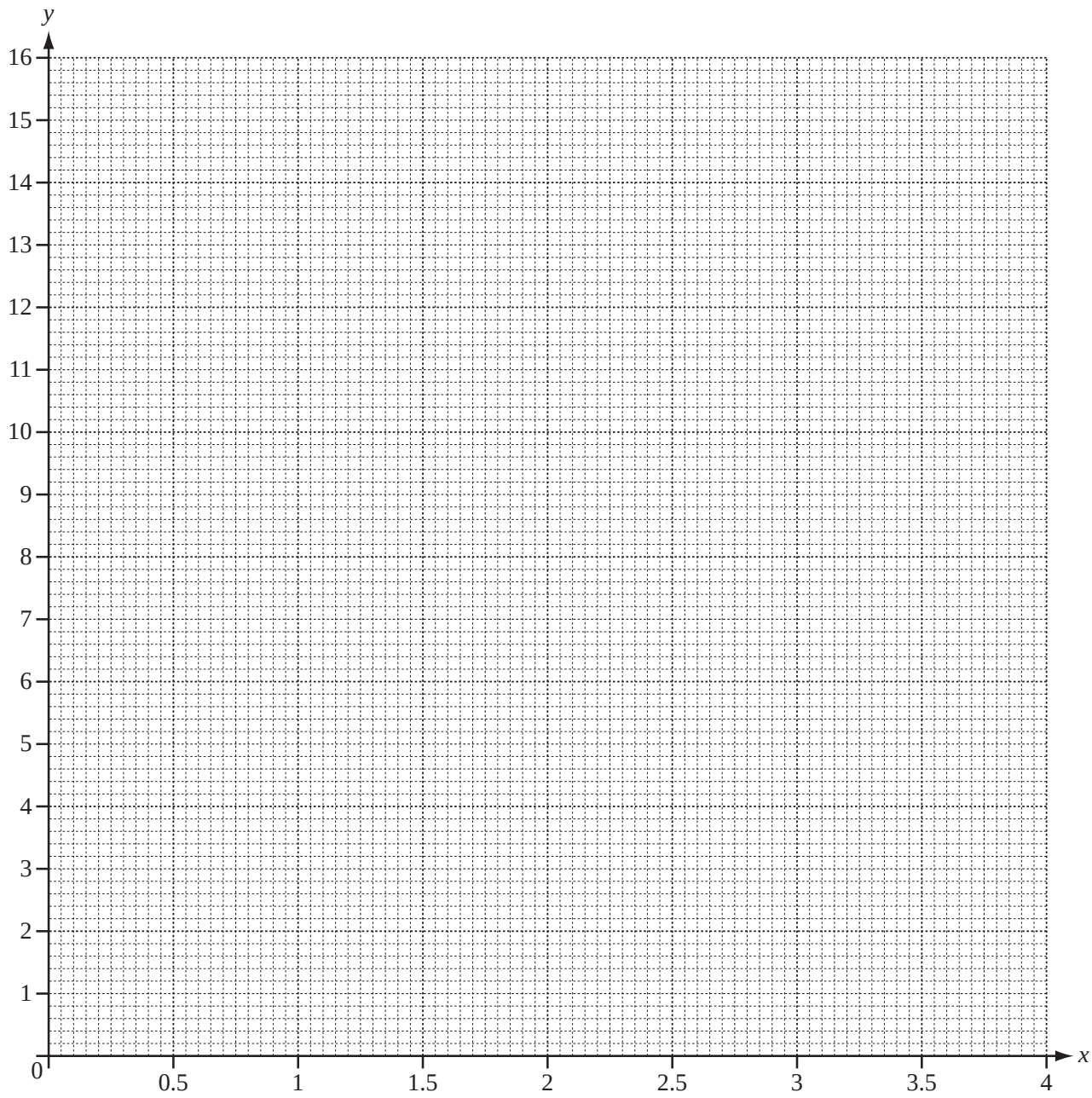
For Examiner's Use

(a) Complete the table.

x	0	0.5	1	1.5	2	2.5	3	3.5	4
$f(x)$		1.4	2	2.8	4	5.7	8		

[3]

(b) Draw the graph of $y = f(x)$ for $0 \leqslant x \leqslant 4$.



[4]

(c) Use your graph to solve the equation $2^x = 5$.

For Examiner's Use

Answer(c) $x =$ ..... [1]

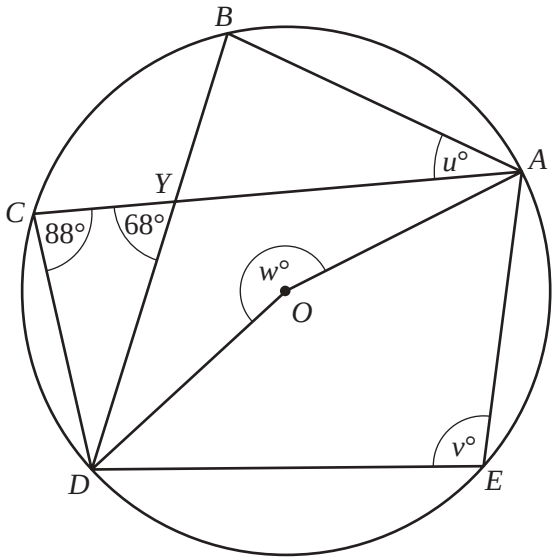
(d) Draw a suitable straight line and use it to solve the equation $2^x = 3x$.

Answer(d) $x =$ ..... or $x =$ ..... [3]

(e) Draw a suitable tangent and use it to find the co-ordinates of the point on the graph of $y = f(x)$ where the gradient of the graph is 3.

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

8 (a)



NOT TO SCALE

A, B, C, D and E lie on the circle, centre O.
CA and BD intersect at Y.
Angle $DCA = 88°$ and angle $CYD = 68°$.
Angle $BAC = u°$, angle $AED = v°$ and reflex angle $AOD = w°$.

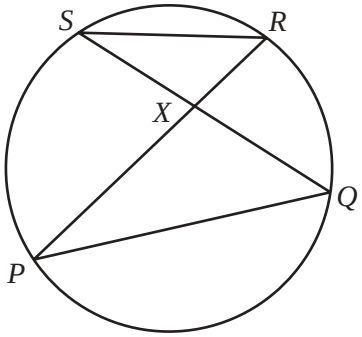
Calculate the values of u, v and w.

Answer(a) $u =$ .....

$v =$ .....

$w =$ ..... [4]

(b)



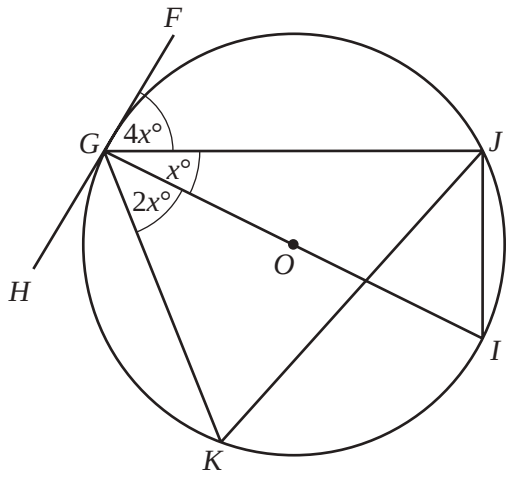
NOT TO SCALE

P, Q, R and S lie on the circle. PR and QS intersect at X.
The area of triangle $RSX = 1.2\,\text{cm}^2$ and $PX = 3\,SX$.

Calculate the area of triangle PQX.

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

(c)



NOT TO SCALE

For Examiner's Use

GI is a diameter of the circle.
FGH is a tangent to the circle at *G*.
J and *K* also lie on the circle.
Angle *JGI* = $x°$, angle *FGJ* = $4x°$ and angle *KGI* = $2x°$.

Find

(i) the value of x,

Answer(c)(i) x = ... [2]

(ii) the size of angle *JKG*,

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

(iii) the size of angle *GJK*.

Answer(c)(iii) Angle *GJK* = ... [1]

For Examiner's Use

9 $f(x) = 1 - 2x$ $\quad g(x) = \frac{1}{x},\ x \neq 0$ $\quad h(x) = x^3 + 1$

(a) Find the value of

(i) gf(2),

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

(ii) h(–2).

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

(b) Find fg(x).
Write your answer as a single fraction.

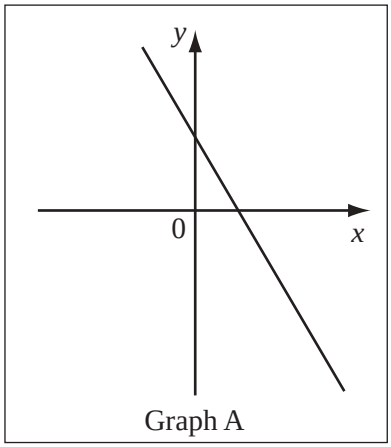
Answer(b) fg(x) = ... [2]

(c) Find $h^{-1}(x)$, the inverse of h(x).

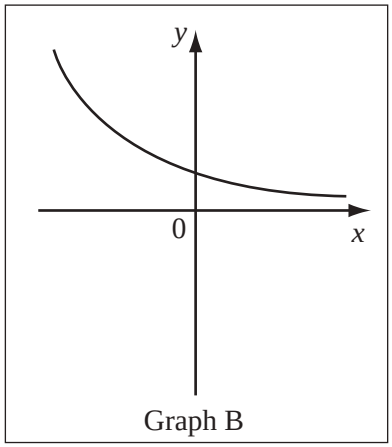
Answer(c) $h^{-1}(x)$ = ... [2]

For Examiner's Use

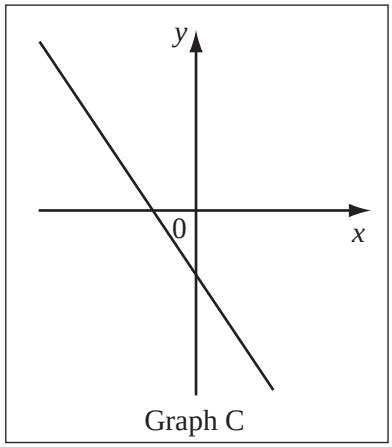
(d) Write down which of these sketches shows the graph of each of $y = f(x)$, $y = g(x)$ and $y = h(x)$.



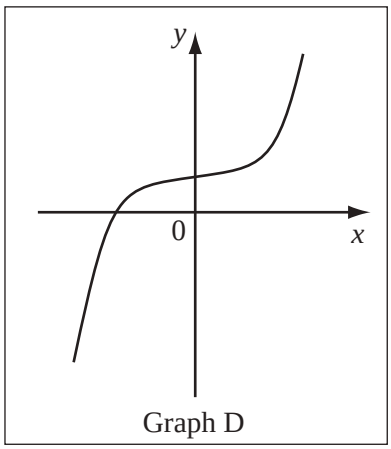
Graph A



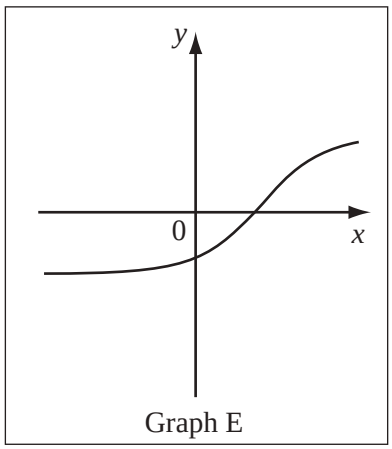
Graph B



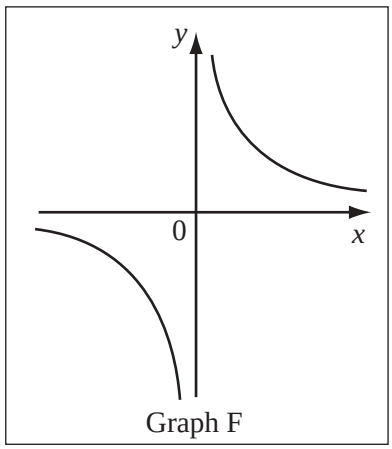
Graph C



Graph D



Graph E



Graph F

Answer(d) $y = f(x)$ Graph .....

$y = g(x)$ Graph .....

$y = h(x)$ Graph ..... [3]

(e) $k(x) = x^5 - 3$

Solve the equation $k^{-1}(x) = 2$.

Answer(e) $x =$ ..... [2]

For Examiner's Use

10 **(a)** Rice costs \$$x$ per kilogram.
Potatoes cost \$$(x + 1)$ per kilogram.
The total cost of 12 kg of rice and 7 kg of potatoes is \$31.70.

Find the cost of 1 kg of rice.

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

(b) The cost of a small bottle of juice is \$$y$.
The cost of a large bottle of juice is \$$(y + 1)$.
When Catriona spends \$36 on small bottles only, she receives 25 more bottles than when she spends \$36 on large bottles only.

(i) Show that $25y^2 + 25y - 36 = 0$.

Answer(b)(i)

[3]

(ii) Factorise $25y^2 + 25y - 36$.

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

(iii) Solve the equation $25y^2 + 25y - 36 = 0$.

Answer(b)(iii) $y =$ ..... or $y =$ ..... [1]

(iv) Find the total cost of 1 small bottle of juice and 1 large bottle of juice.

Answer(b)(iv) \$ ..... [1]

11

For Examiner's Use

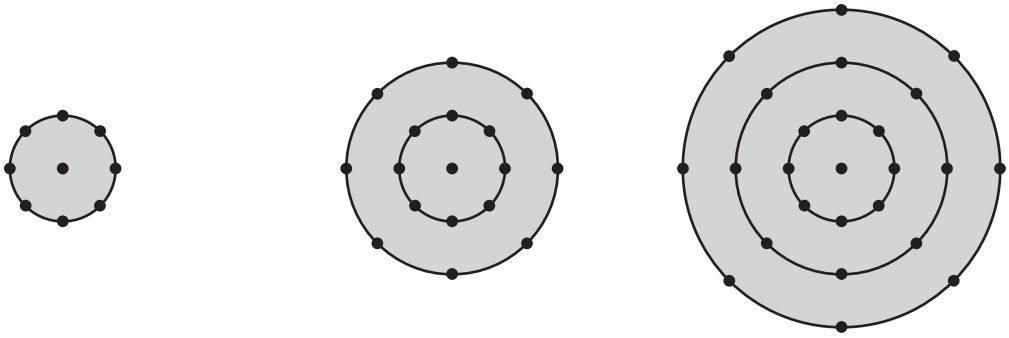


Diagram 1 Diagram 2 Diagram 3

The diagrams show a sequence of dots and circles.
Each diagram has one dot at the centre and 8 dots on each circle.
The radius of the first circle is 1 unit.
The radius of each new circle is 1 unit greater than the radius of the previous circle.

(a) Complete the table for diagrams 4 and 5.

Diagram	1	2	3	4	5
Number of dots	9	17	25		
Area of the largest circle	π	4π	9π		
Total length of the circumferences of the circles	2π	6π	12π		

[4]

(b) **(i)** Write down, in terms of n, the number of dots in diagram n.

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

(ii) Find n, when the number of dots in diagram n is 1097.

Answer(b)(ii) n = ... [2]

(c) Write down, in terms of n and π, the area of the largest circle in

(i) diagram n,

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

(ii) diagram $3n$.

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

(d) Find, in terms of n and π, the total length of the circumferences of the circles in diagram n.

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

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