

1 A train travels from Paris to Milan.

(a) The train departs from Paris at 20 28 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]

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

$$\text{men : women : children} = 4 : 3 : 1.$$

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.

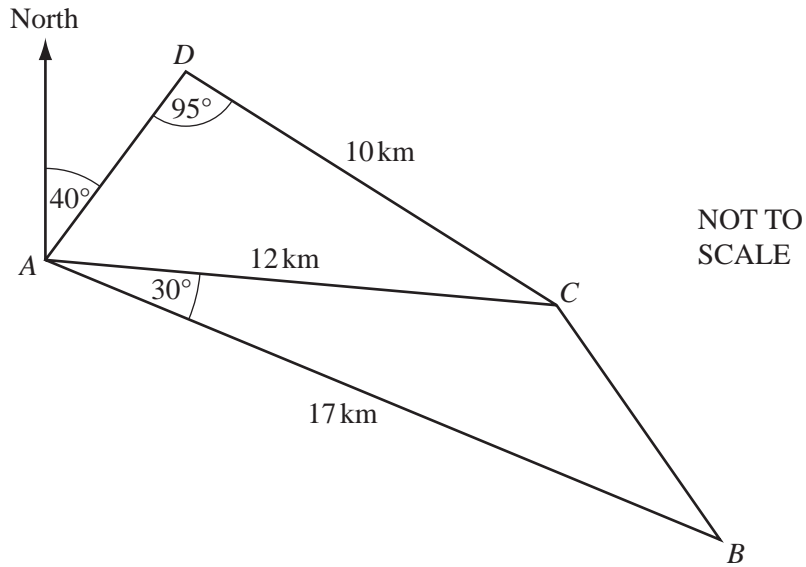
It passes through a station of length 340 m, at a speed of 180 km/h.

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

Answer(c) s [3]

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

$AB = 17\text{ km}$, $AC = 12\text{ km}$ and $CD = 10\text{ km}$.

Angle $BAC = 30^\circ$ and angle $ADC = 95^\circ$.

(a) Calculate angle CAD .

Answer(a) Angle $CAD = \dots\dots\dots$ [3]

(b) Calculate the distance BC .

Answer(b) $BC = \dots\dots\dots$ km [4]

(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 .

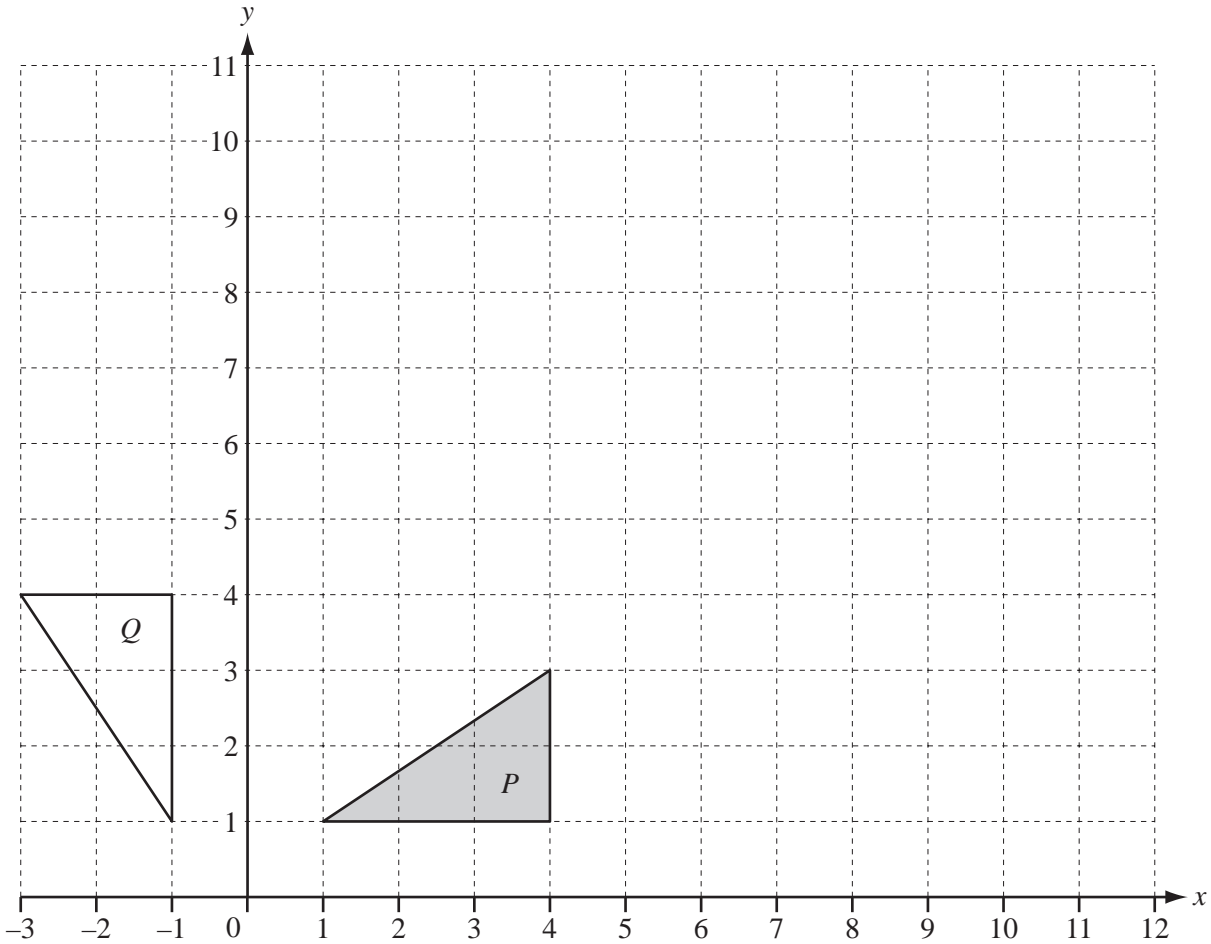
Answer(c)(ii) [1]

(d) Angle ACB is obtuse.

Calculate angle BCD .

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

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(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)

(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]

- 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.

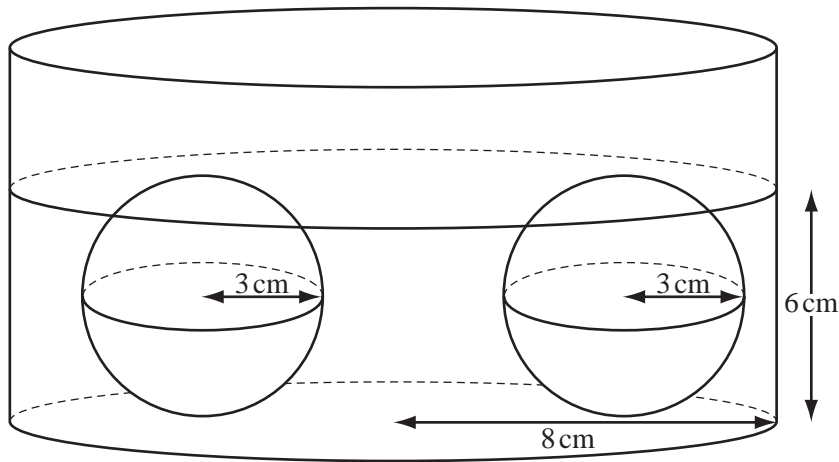
Height (h cm)	$170 < h \leq 180$	$180 < h \leq 190$	$190 < h \leq 200$
Frequency	5	12	3

Calculate an estimate of the mean height of the players.

Answer(b) cm [4]

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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]

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- (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]

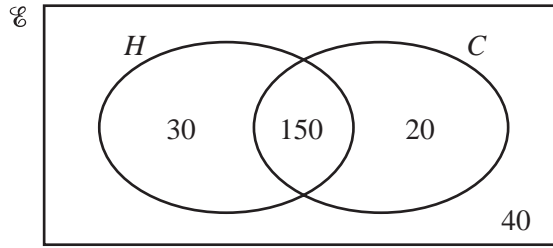
- (c) The spheres are removed from the cylinder.

Calculate the new height of the liquid in the cylinder.

Answer(c) cm [2]

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

$H = \{\text{passengers who are on holiday}\}$

$C = \{\text{passengers who hire a car}\}$

(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]

(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]

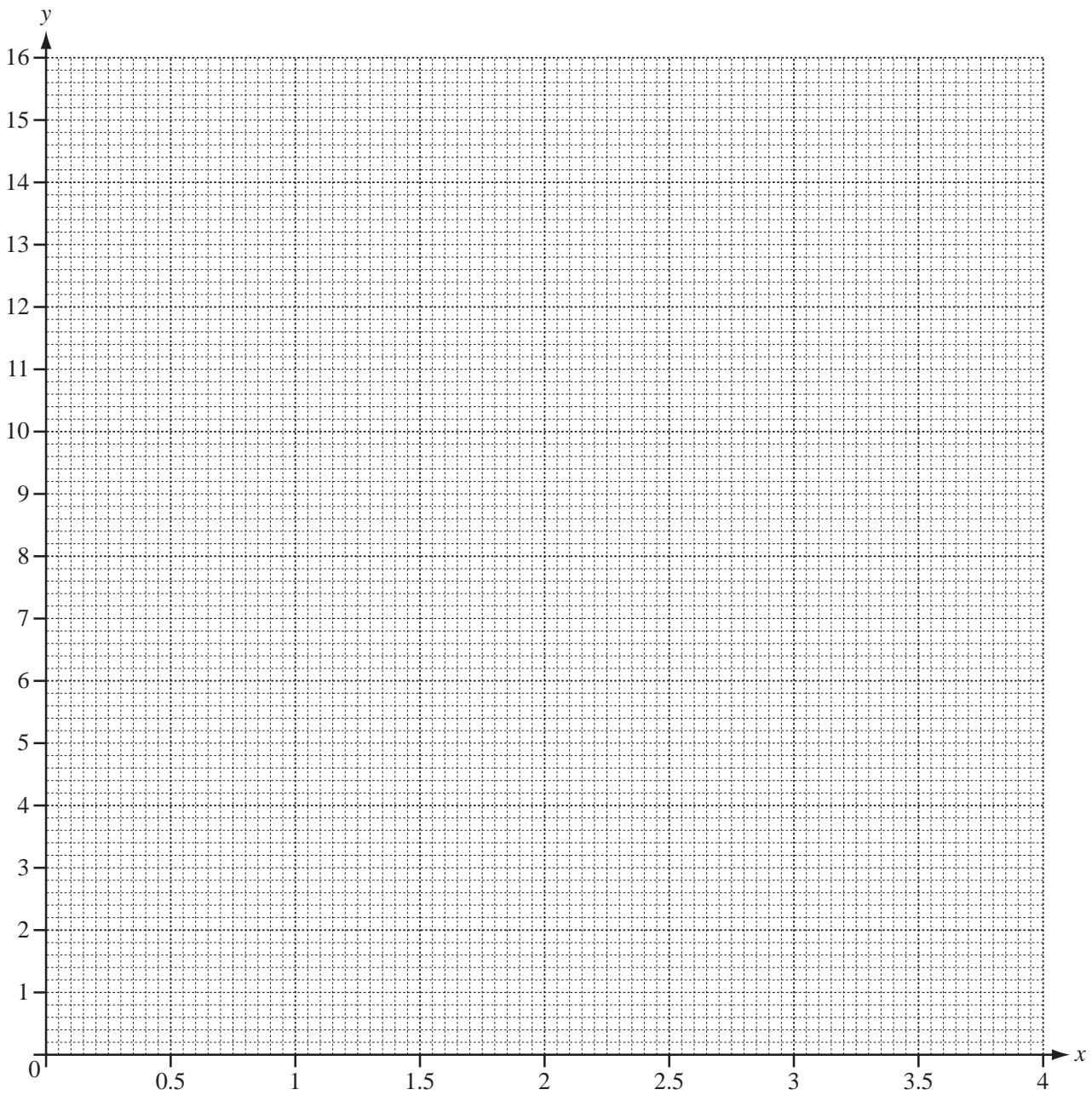
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7 $f(x) = 2^x$

(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 $0 \leq x \leq 4$.

[4]

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

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]

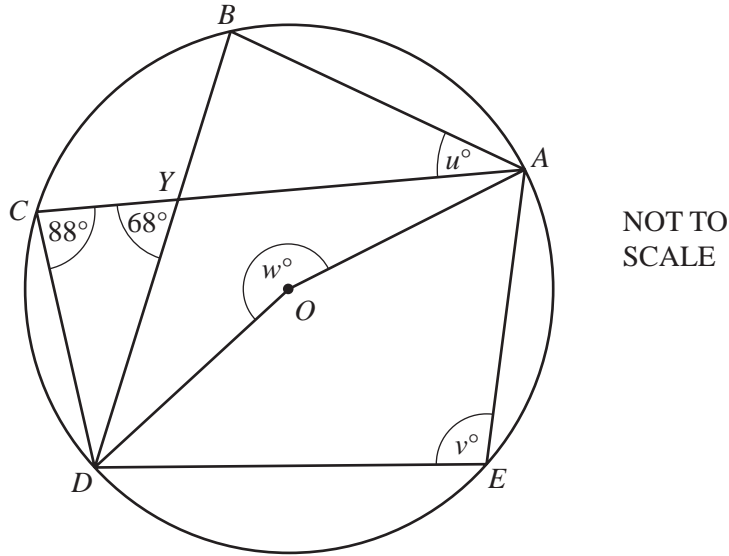
- (e) Draw a suitable tangent and use it to find the co-ordinates of the point on the graph of $y = f(x)$ where the gradient of the graph is 3.

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

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8 (a)

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

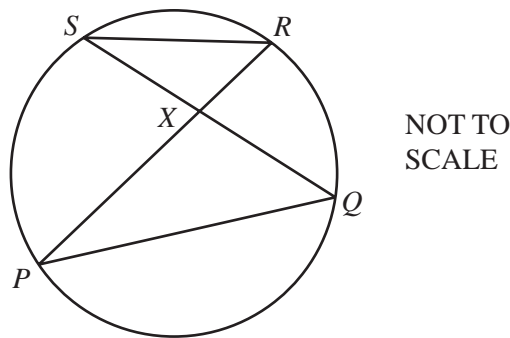
Calculate the values of u, v and w .

Answer(a) $u =$

$v =$

$w =$ [4]

(b)

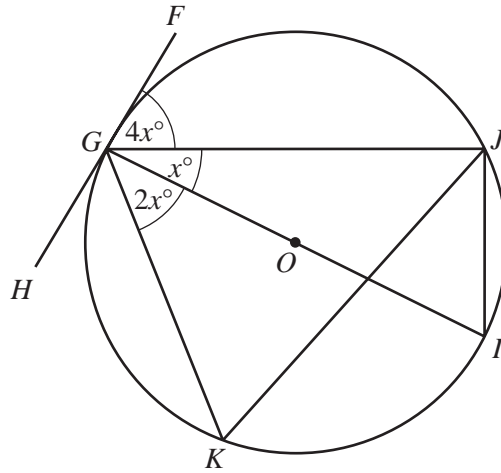


P, Q, R and S lie on the circle. PR and QS intersect at X .
 The area of triangle $RSX = 1.2 \text{ cm}^2$ and $PX = 3 SX$.

Calculate the area of triangle PQX .

Answer(b) cm^2 [2]

(c)



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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 $JGI = x^\circ$, angle $FGJ = 4x^\circ$ and angle $KGI = 2x^\circ$.

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]

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

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(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.

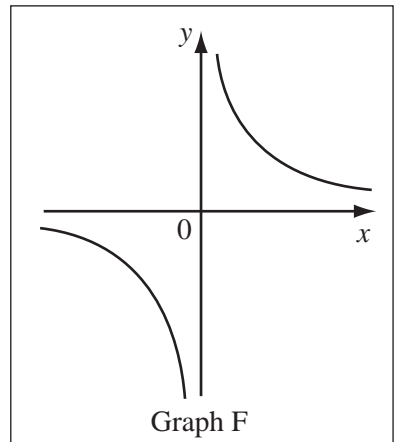
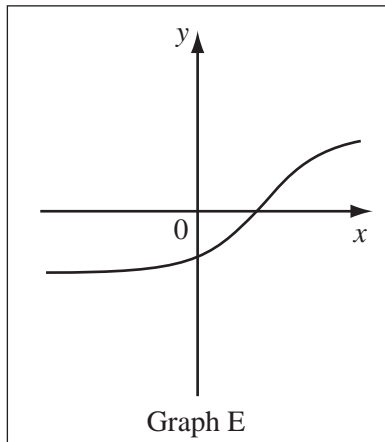
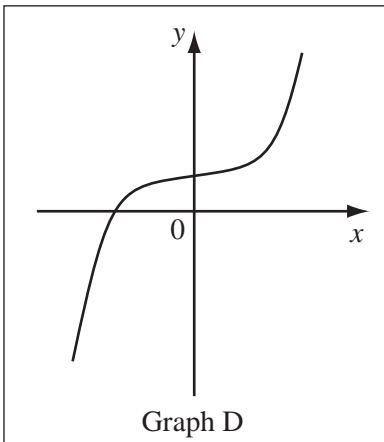
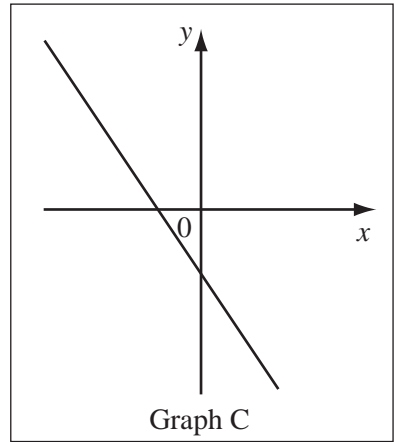
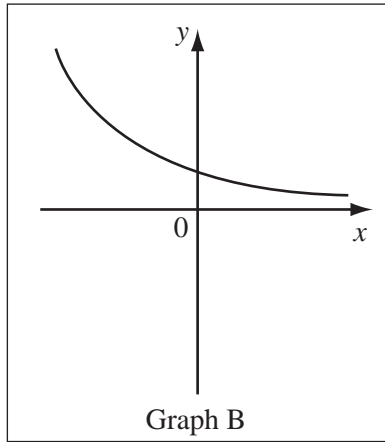
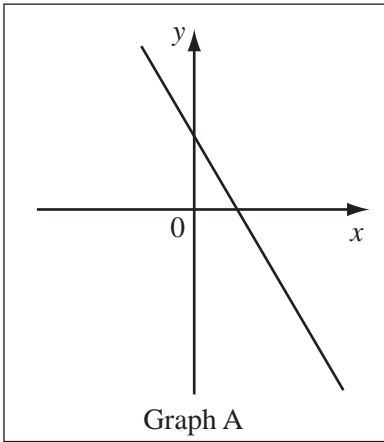
Answer(b) $fg(x) =$ [2]

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

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

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

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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]

- 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]

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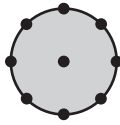


Diagram 1

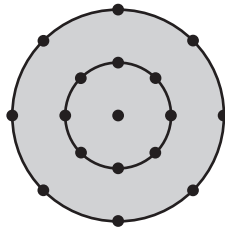


Diagram 2

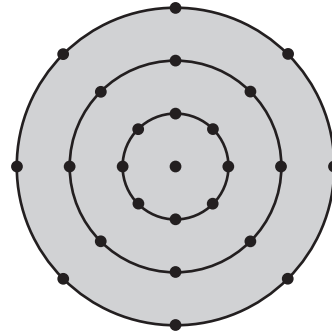


Diagram 3

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		

(b) (i) Write down, in terms of n , the number of dots in diagram n . [4]

Answer(b)(i)

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

Answer(b)(ii) $n =$

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

(i) diagram n ,

Answer(c)(i)

(ii) diagram $3n$.

Answer(c)(ii)

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

Answer(d)

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