



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.

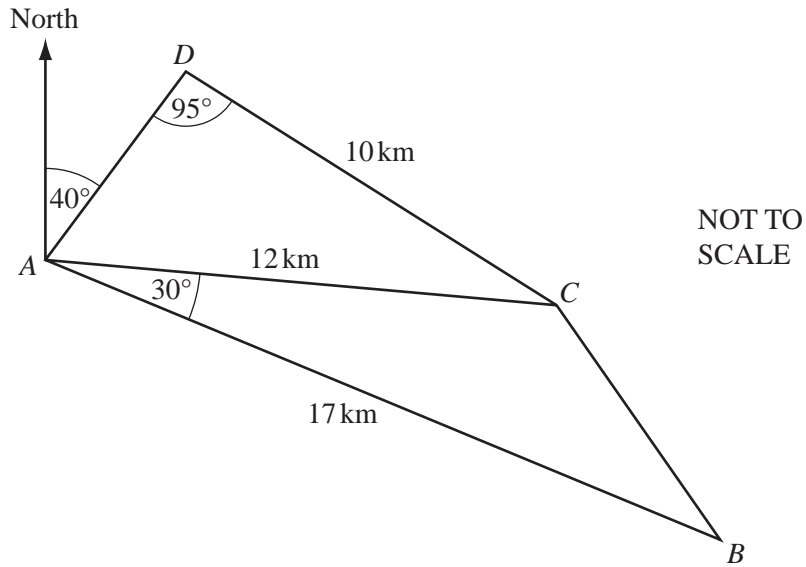
It passes through a station of length 340 m, at a speed of 180 km/h.

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  $040^\circ$ .

Find the bearing of

(i)  $B$  from  $A$ ,

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

(ii)  $A$  from  $B$ .

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

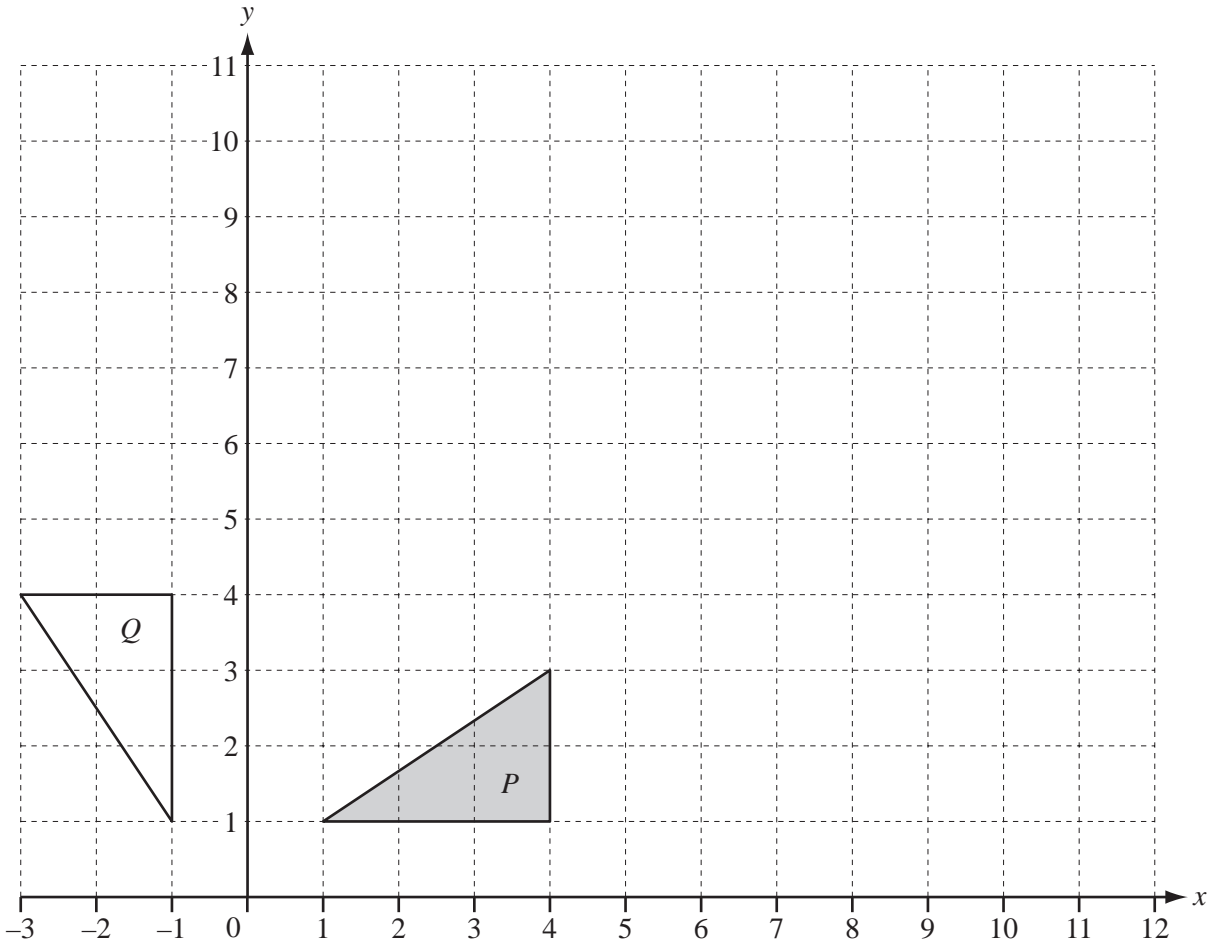
(d) Angle  $ACB$  is obtuse.

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.

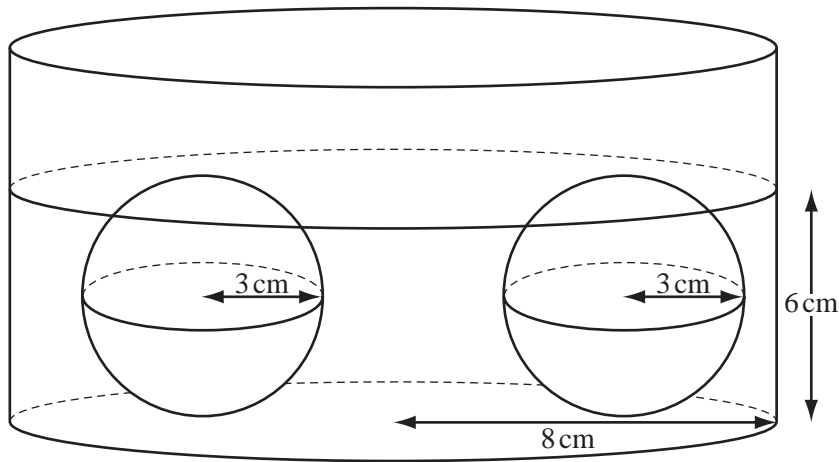
Height ( $h$ cm)	$170 < h \leq 180$	$180 < h \leq 190$	$190 < h \leq 200$
Frequency	5	12	3

Calculate an estimate of the mean height of the players.

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

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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)  $\text{cm}^3$ ,

Answer(a)(i) .....  $\text{cm}^3$  [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.

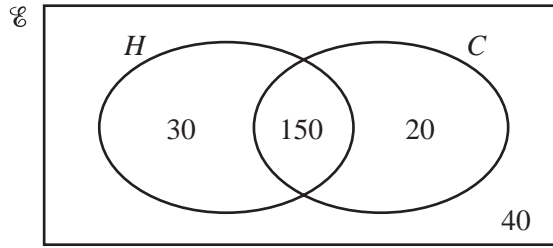
Calculate the new height of the liquid in the cylinder.

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

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For  
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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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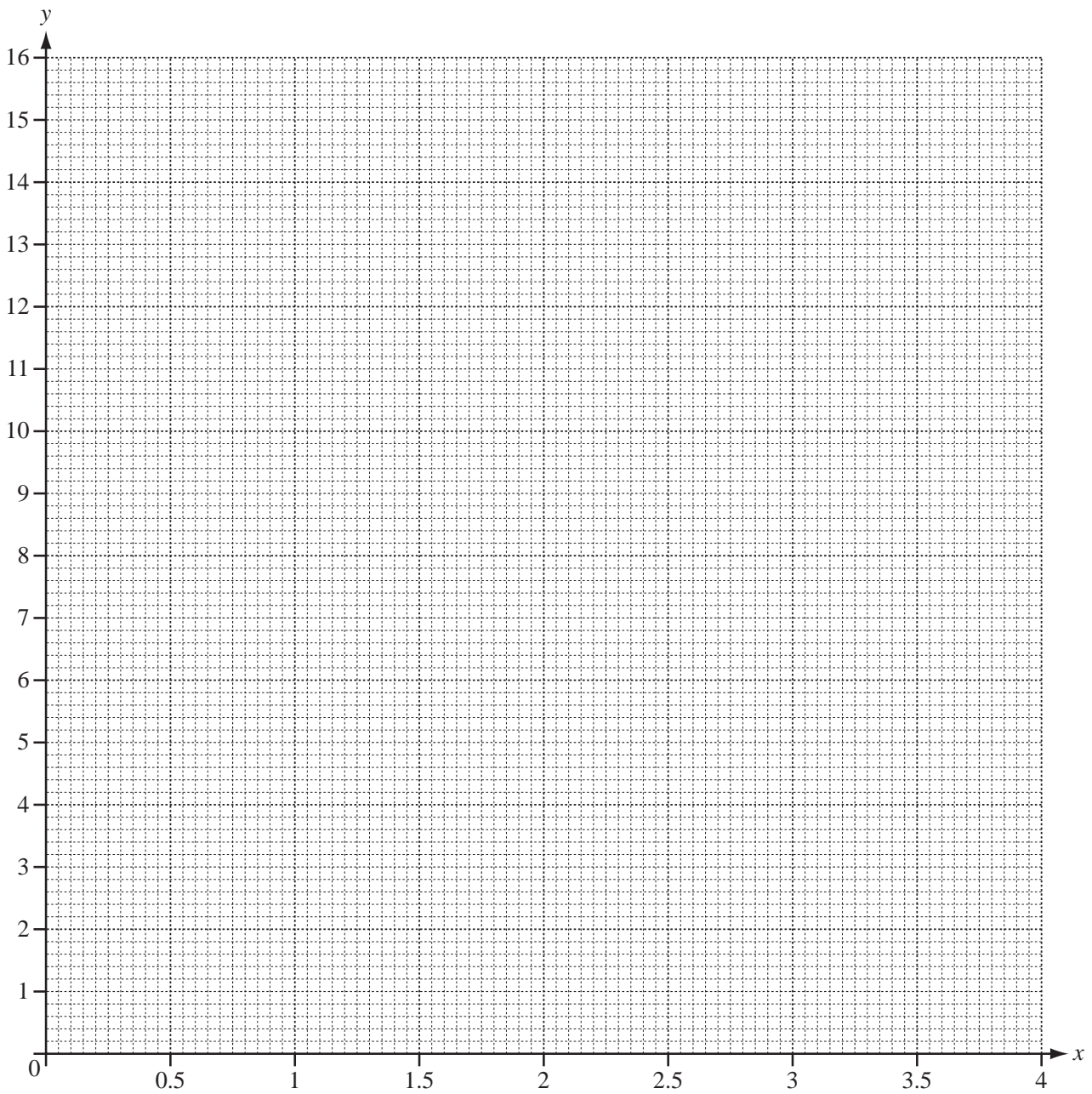
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7  $f(x) = 2^x$

(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.

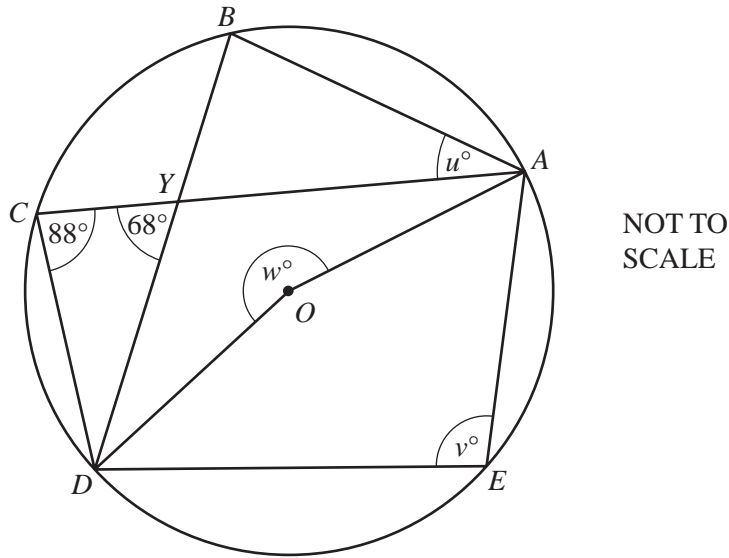
*Answer(e)* ( ..... , ..... ) [3]

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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  $AOD = w^\circ$ .

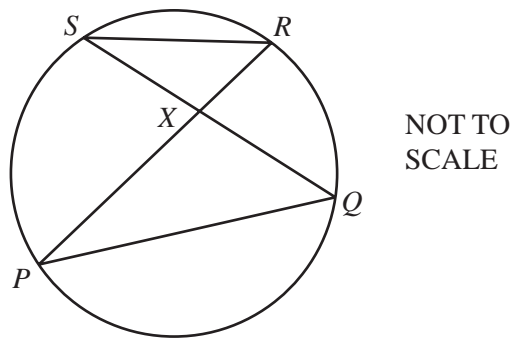
Calculate the values of  $u, v$  and  $w$ .

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

$v =$  .....

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

(b)

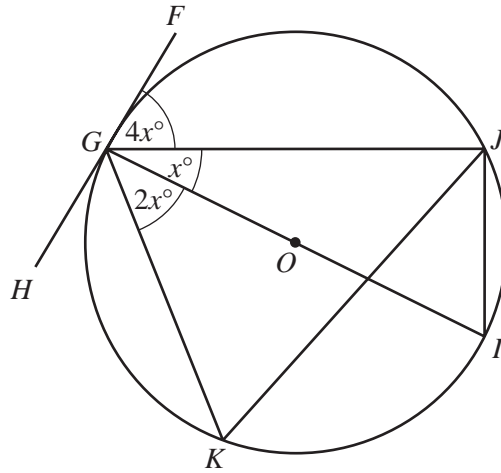


$P, Q, R$  and  $S$  lie on the circle.  $PR$  and  $QS$  intersect at  $X$ .  
 The area of triangle  $RSX = 1.2 \text{ cm}^2$  and  $PX = 3 SX$ .

Calculate the area of triangle  $PQX$ .

Answer(b) .....  $\text{cm}^2$  [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]

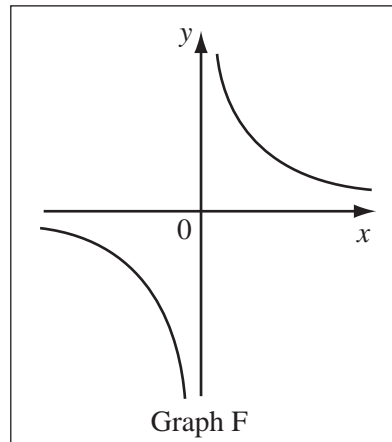
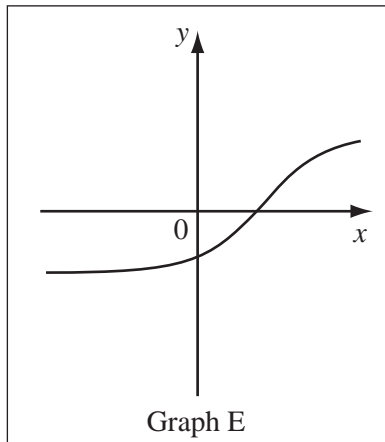
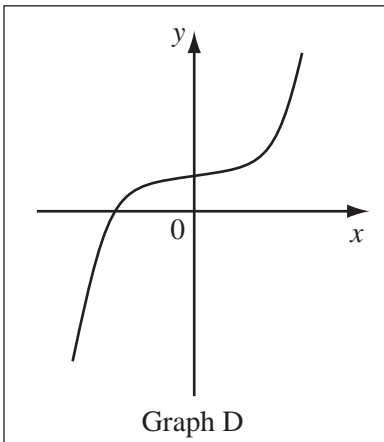
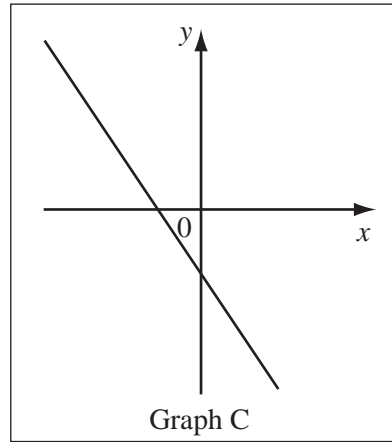
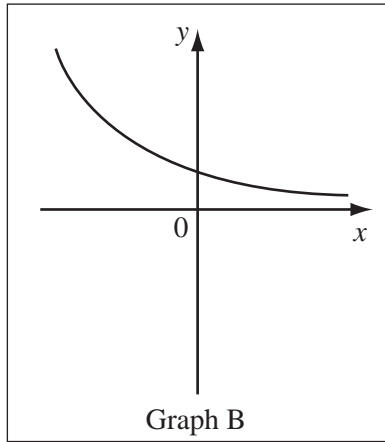
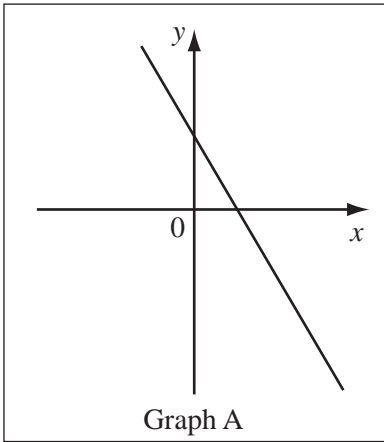
(c) Find  $h^{-1}(x)$ , the inverse of  $h(x)$ .

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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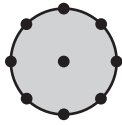


Diagram 1

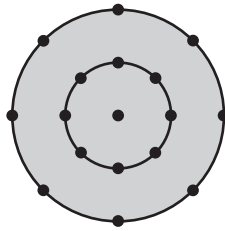


Diagram 2

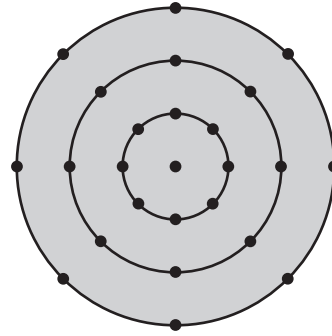


Diagram 3

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	$\pi$	$4\pi$	$9\pi$		
Total length of the circumferences of the circles	$2\pi$	$6\pi$	$12\pi$		

(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  $\pi$ , 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  $\pi$ , the total length of the circumferences of the circles in diagram  $n$ .

Answer(d) .....

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