

- 1 (a) Expand and simplify $3(2y - 5) + 7(y + 2)$

$$\begin{aligned} &= 6y - 15 + 7y + 14 \\ &= 13y - 1 \end{aligned}$$

$$\frac{13y - 1}{(2)}$$

- (b) Factorise fully $6x^2 + 15x$

$$\frac{3x(2x + 5)}{(2)}$$

- (c) Make g the subject of the formula $f = 3g + 11$

$$\begin{array}{rcl} & -11 & -11 \\ f - 11 & = & 3g \\ \div 3 & & \div 3 \\ \hline \frac{f - 11}{3} & = & g \end{array}$$

(2)

(Total for Question 1 is 6 marks)

2 Karen is organising a party for a charity.

She spends

£100 on food
£120 on a hall
£80 on a DJ. } £300

Karen sells 54 tickets for the party.

Each ticket costs £7.50

$$54 \times 7.50 = £405$$

Work out the percentage profit Karen makes for the charity.

$$\frac{\text{Change}}{\text{Original}} \times 100$$

$$= \frac{405 - 300}{300} \times 100 = 35$$

35 %

(Total for Question 2 is 4 marks)

- 3 Andrew invests £4500 in a savings account for 2 years.
The account pays compound interest at a rate of 3.4% per year.

Calculate how much Andrew has in this savings account at the end of the 2 years.

$$4500 \times 1.034^2 = 4811.202$$

£ 4811.20

(Total for Question 3 is 2 marks)

4 Solve $5x - 14 = 52 - x$

$$\begin{array}{rcl} & +x & \\ 5x - 14 & = & 52 \\ & +14 & \\ 6x & = & 66 \\ & \div 6 & \\ x & = & 11 \end{array}$$

$$x = 11$$

(Total for Question 4 is 3 marks)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



- 5 Chris, Debbie and Errol share some money in the ratio 3:4:2
Debbie gets £120

Chris then gives some of his share to Debbie and some of his share to Errol.
The money that Chris, Debbie and Errol each have is now in the ratio 2:5:3

How much money did Chris give to Errol?

$$\begin{array}{l} \div 4 \quad 120 = 4 \text{ parts} \\ \quad \quad 30 = 1 \text{ part} \quad \div 4 \end{array}$$

$$\begin{array}{l} C : D : E \\ 3 : 4 : 2 \\ \times 30 \quad \quad \quad \times 30 \\ 90 : 120 : 60 \end{array}$$

$$\underline{\text{Total} = \text{£} 270}$$

$$270 \div 10 = 27 \text{ (1 part)}$$

$$\begin{array}{l} C : D : E \\ 2 : 5 : 3 \\ \times 27 \quad \quad \quad \times 27 \\ 54 : 135 : 81 \end{array}$$

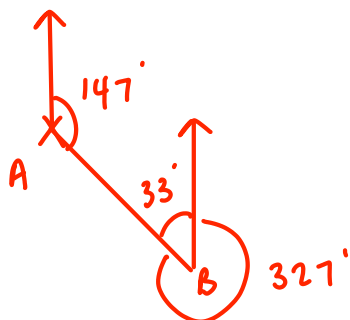
$$81 - 60 = 21$$

£ 21

(Total for Question 5 is 4 marks)

6 The bearing of port B from port A is 147°

Work out the bearing of port A from port B .

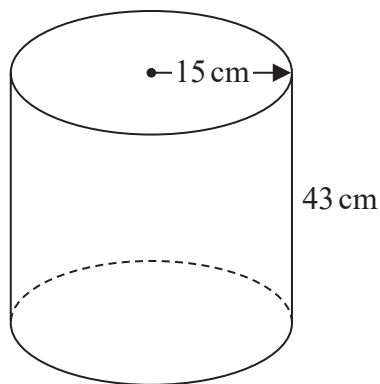


327°

(Total for Question 6 is 2 marks)



- 7 The diagram shows an empty tank in the shape of a cylinder.



The cylinder has radius 15 cm and height 43 cm.

Water flows into the tank at a rate of 0.47 litres per minute.

Calculate the number of minutes it will take to completely fill the tank. *VOLUME*
Give your answer correct to the nearest minute.

$$V = \pi r^2 h = \pi \times 15^2 \times 43 = 30394.91 \text{ cm}^3$$

$$\div 0.47 = 64670.02$$

$$\div 1000 = 64.67$$

Tip: 1L = 1000cm³

65 minutes

(Total for Question 7 is 4 marks)

8 A number x is written correct to 2 significant figures.

The result is 1.9

Complete the error interval for x .

$$\dots\dots\dots 1.85 \dots\dots\dots \leq x < \dots\dots\dots 1.95 \dots\dots\dots$$

(Total for Question 8 is 2 marks)

9 Expand and simplify $(x + 7)(x - 2)(x + 3)$

$$\begin{aligned}(x + 7)(x - 2) &= x^2 - 2x + 7x - 14 \\ &= x^2 + 5x - 14\end{aligned}$$

$$\begin{aligned}&(x^2 + 5x - 14)(x + 3) \\ &= x^3 + 3x^2 + 5x^2 + 15x - 14x - 42 \\ &= x^3 + 8x^2 + x - 42\end{aligned}$$

(Total for Question 9 is 3 marks)

- (a) Complete the probability tree diagram for this information.



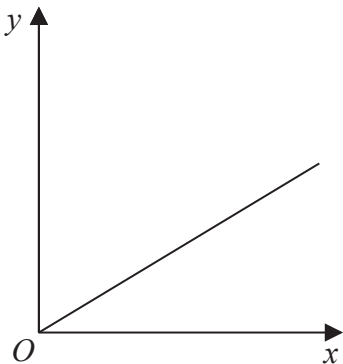
- 0.9649

(3)

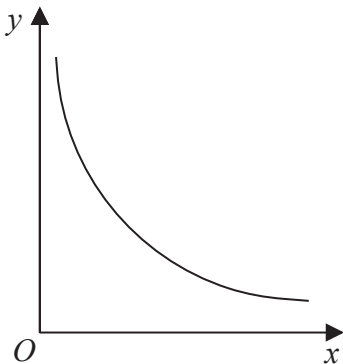
(Total for Question 10 is 5 marks)

11

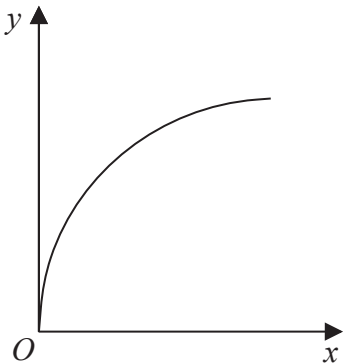
Graph A



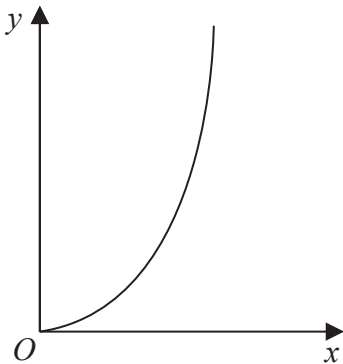
Graph B



Graph C



Graph D



The graphs of y against x represent four different types of proportionality.
Match each type of proportionality in the table to the correct graph.

Type of proportionality	Graph
$y \propto x^2$	D
$y \propto x$	A
$y \propto \frac{1}{x}$	B
$y \propto \sqrt{x}$	C

(Total for Question 11 is 2 marks)

- 12 A is the point with coordinates $(7, 13)$
 B is the point with coordinates $(-3, 21)$
 C is the point with coordinates $(15, 23)$

M is the midpoint of AB .

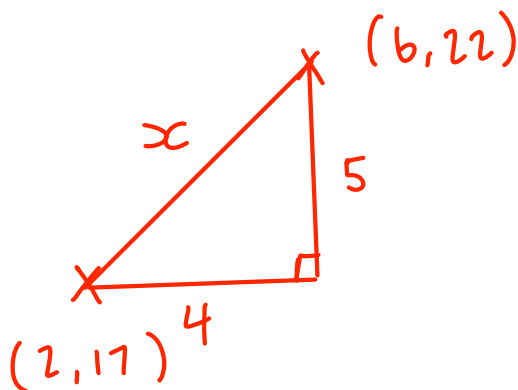
N is the midpoint of BC .

Work out the distance between M and N .

Give your answer correct to 1 decimal place.

Tip: to find the midpoint of any two coordinates, add the x coordinates together and divide by 2 and then add the y coordinates together and divide by 2.

$$M = (2, 17) \quad N = (6, 22)$$



$$4^2 + 5^2 = 41$$
$$\sqrt{41} = 6.4$$

6.4

(Total for Question 12 is 3 marks)



13 Prove algebraically that $0.0\dot{7}2\dot{3}$ can be written as $\frac{241}{3330}$

$$\begin{array}{r} 1000x = 72.3\overline{723} \dots \\ - \quad x = 0.0\overline{723} \dots \\ \hline \end{array}$$

Tip: because there are three recurring digits we multiply by 1000.

$$\begin{array}{r} 999x = 72.3 \\ \div 999 \quad \div 999 \\ \hline x = \frac{72.3}{999} = \frac{723}{9990} = \frac{241}{3330} \end{array}$$

$\xrightarrow{\times 10}$
 $\xrightarrow{\div 3}$

(Total for Question 13 is 3 marks)



14 y is proportional to x^2

$$y = 3 \text{ when } x = 0.5$$

x is inversely proportional to w

$$x = 2 \text{ when } w = 0.2$$

Find the value of y when $w = 2$

$$\begin{array}{l|l}
 y \propto x^2 & x \propto \frac{1}{w} \\
 y = kx^2 & x = \frac{k}{w} \\
 3 = k(0.5)^2 & \\
 \div 0.5^2 & \div 0.5^2 \\
 12 = k & \\
 y = 12x^2 & \\
 & x = \frac{0.4}{w} \\
 & 2 = \frac{k}{0.2} \\
 & \times 0.2 \\
 & 0.4 = k
 \end{array}$$

$$y = 0.48$$

(Total for Question 14 is 5 marks)

$$\text{When } w = 2$$

$$x = \frac{0.4}{2} = 0.2$$

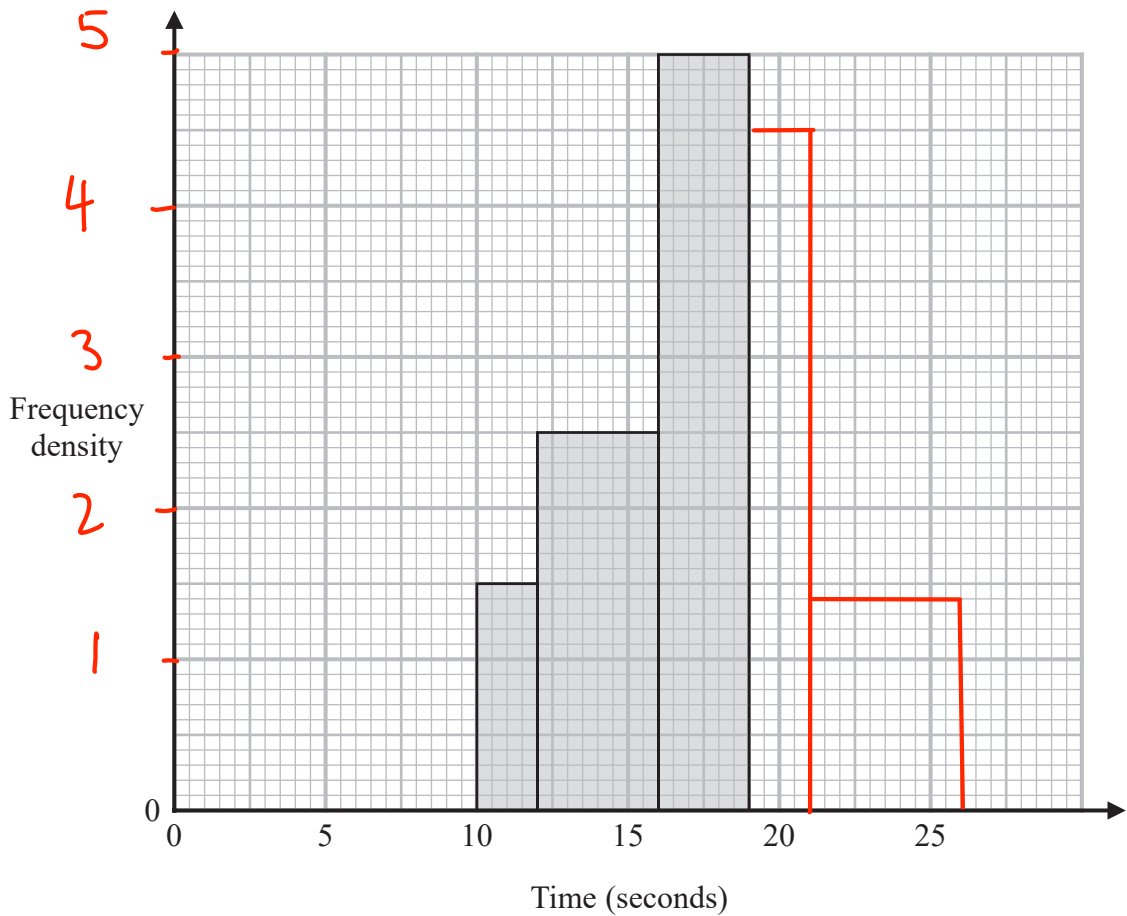
$$y = 12(0.2)^2 = 0.48$$

15 The incomplete table and the incomplete histogram give information about the times taken by some students to run a race.



Time (t seconds)	Frequency
$10 < t \leq 12$	3
$12 < t \leq 16$	10
$16 < t \leq 19$	15
$19 < t \leq 21$	9
$21 < t \leq 26$	7

FD
1.5
2.5
5
4.5
1.4



None of these students had a time for the race such that $t \leq 10$ or $t > 26$

(a) Use the histogram to complete the table.

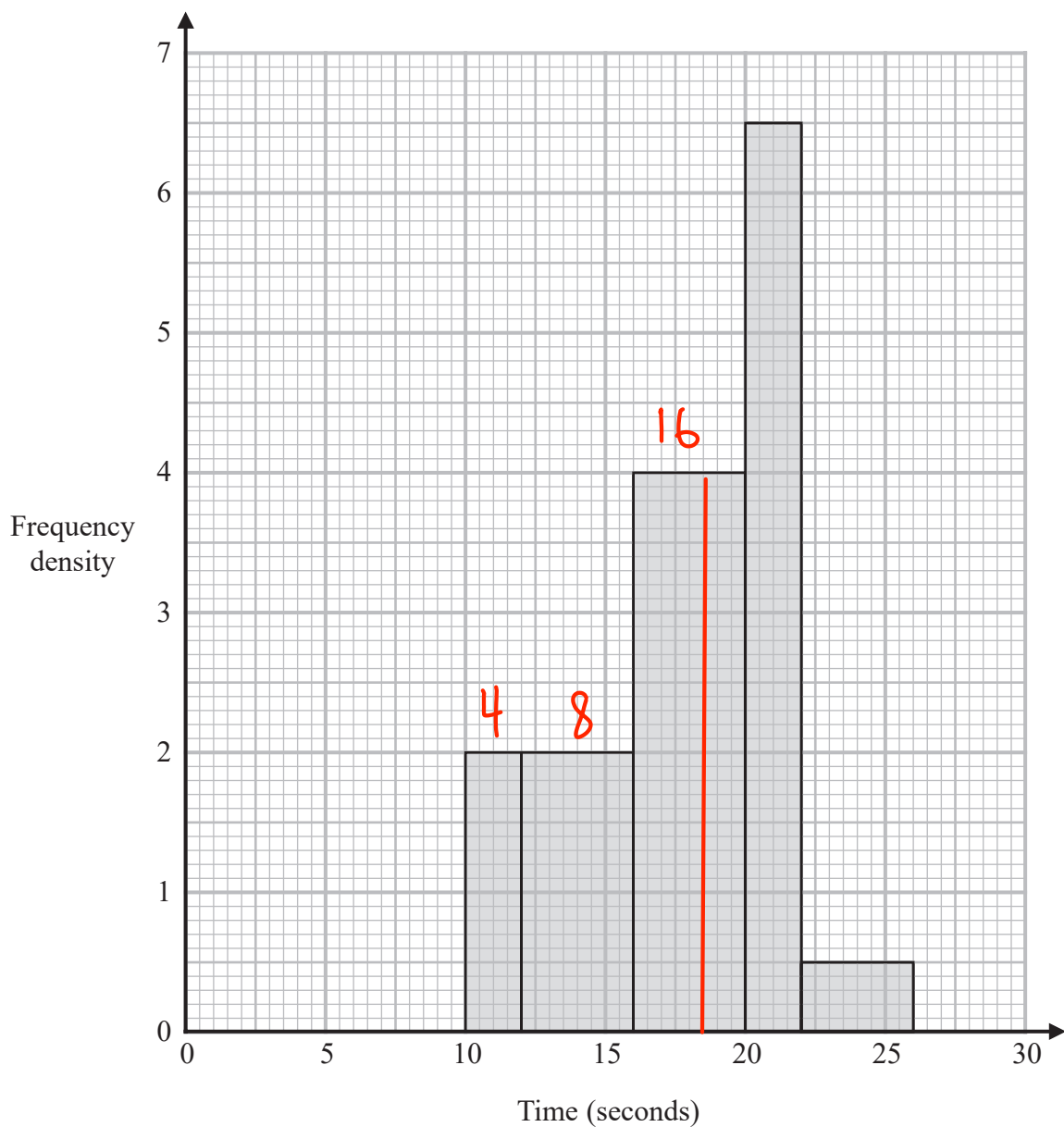
(1)

(b) Use the table to complete the histogram.

(2)



The histogram below gives information about the times taken by 43 students to run a different race.



- (c) Work out an estimate for the median of the times taken by these 43 students to run the race.

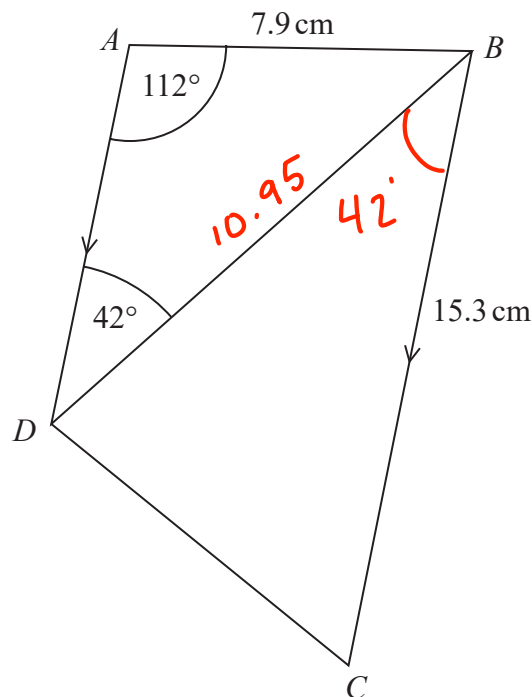
$$\frac{43 + 1}{2} = 22\text{nd value}$$

$$16 + \frac{10}{16} \times 4 = 17.5$$

18.5 seconds
(3)

(Total for Question 15 is 6 marks)

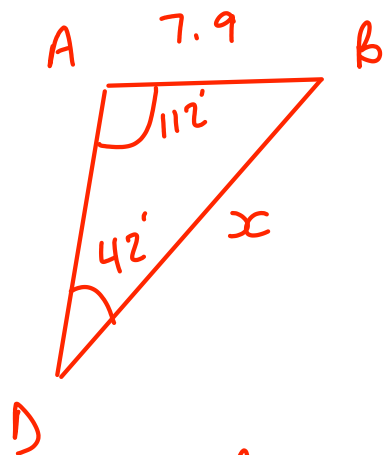
16 $ABCD$ is a trapezium.



AD is parallel to BC .

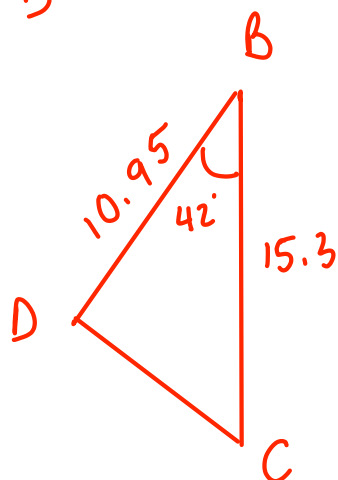
Calculate the area of triangle BCD .

Give your answer correct to 1 decimal place.



$$\frac{x}{\sin 112} = \frac{7.9}{\sin 42}$$

$$x \sin 112 = 10.95$$



$$\frac{1}{2} ab \sin c$$

$$= \frac{1}{2} (10.95)(15.3) \times \sin(42)$$

$$= 56.05$$

56.1 cm²

(Total for Question 16 is 4 marks)



- 17 (a) Show that the equation $x^3 + 2x - 6 = 0$ has a solution between $x = 1$ and $x = 2$

$$(1)^3 + 2(1) - 6 = -3$$

$$(2)^3 + 2(2) - 6 = 6$$

There has been a change in sign therefore there is a solution

(2)

- (b) Show that the equation $x^3 + 2x - 6 = 0$ can be rearranged to give $x = \frac{6}{x^2 + 2}$

$$\begin{array}{r|l} +6 & +6 \\ x^3 + 2x & = 6 \\ x(x^2 + 2) & = 6 \\ x & = \frac{6}{x^2 + 2} \end{array}$$

(1)

- (c) Starting with $x_0 = 1.45$

use the iteration formula $x_{n+1} = \frac{6}{x_n^2 + 2}$ twice to find an estimate for the solution of $x^3 + 2x - 6 = 0$

Give your answer correct to 4 decimal places.

$$x_0 = 1.45$$

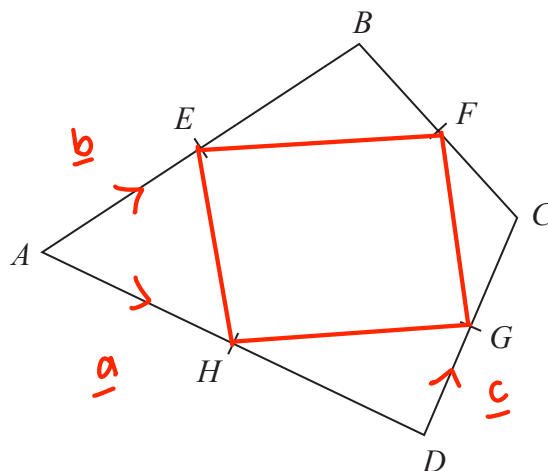
$$x_1 = \frac{6}{(1.45)^2 + 2} = 1.4625..$$

$$x_2 = 1.4496$$

$$1.4496$$

(3)

(Total for Question 17 is 6 marks)



$ABCD$ is a quadrilateral.

E , F , G and H are the midpoints of AB , BC , CD and DA .

$$\vec{AH} = \mathbf{a} \quad \vec{AE} = \mathbf{b} \quad \vec{DG} = \mathbf{c}$$

Prove, using vectors, that $EFGH$ is a parallelogram.

$$\begin{aligned} \vec{EF} &= \vec{AE} + \vec{bF} \\ &= \underline{\mathbf{b}} - \underline{\mathbf{b}} + \underline{\mathbf{a}} + \underline{\mathbf{c}} \\ &= \underline{\mathbf{a}} + \underline{\mathbf{c}} \end{aligned}$$

$$\begin{aligned} \vec{BC} &= -2\underline{\mathbf{b}} + 2\underline{\mathbf{a}} + 2\underline{\mathbf{c}} \\ \vec{BF} &= -\underline{\mathbf{b}} + \underline{\mathbf{a}} + \underline{\mathbf{c}} \\ \vec{FC} &= -\underline{\mathbf{b}} + \underline{\mathbf{a}} + \underline{\mathbf{c}} \end{aligned}$$

$$\vec{HG} = \underline{\mathbf{a}} + \underline{\mathbf{c}}$$

$$\therefore \vec{EF} = \vec{HG}$$

$$\vec{EH} = -\underline{\mathbf{b}} + \underline{\mathbf{a}}$$

$$\begin{aligned} \vec{FG} &= \vec{FC} + \vec{CG} \\ &= -\underline{\mathbf{b}} + \underline{\mathbf{a}} + \underline{\mathbf{c}} - \underline{\mathbf{c}} \\ &= -\underline{\mathbf{b}} + \underline{\mathbf{a}} \end{aligned}$$

$$\therefore \vec{EH} = \vec{FG}$$

So $EFGH$ is a parallelogram

(Total for Question 18 is 4 marks)

19 The functions f and g are such that

$$f(x) = (2x + 3)^2 \quad \text{and} \quad g(x) = 2x - 1$$

(a) Find $gf(-3)$

$$f(-3) = (2(-3) + 3)^2 = 9$$

$$g(9) = 2(9) - 1 = 17$$

17

(2)

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

$$\begin{array}{rcl} y & = & 2x - 1 \\ +1 & & +1 \\ \hline y + 1 & = & 2x \\ \div 2 & & \div 2 \\ \hline \frac{y+1}{2} & = & x \end{array}$$

Tip: to find the inverse function let $g(x) = y$ and then rearrange the equation to make x the subject

$$\frac{x+1}{2}$$

$$g^{-1}(x) = \frac{x+1}{2}$$

(2)

(Total for Question 19 is 4 marks)

20 Write

Tip: start and continue by factorising anything you can

$\frac{14}{3x-21} + \left[(x+4) \div \frac{2x^2-6x-56}{2x+3} \right]$ in the form $\frac{ax+b}{cx+d}$ where a, b, c and d are integers.

$$2x^2 - 6x - 56$$

$$\begin{array}{r} 2x^2 + 8x \quad | \quad -14x - 56 \\ 2x(x+4) \quad | \quad -14(x+4) \end{array}$$

$$(2x-14)(x+4)$$

$$\begin{array}{r} -112 \\ 4, 28 \times \\ \hline 8, -14 \end{array}$$

$$\frac{14}{3(x-7)} + \left[\frac{\cancel{x+4}}{1} \times \frac{2x+3}{(2x-14)\cancel{(x+4)}} \right]$$

$$\frac{14}{3(x-7)} + \frac{2x+3}{2x-14}$$

$$\frac{14}{3(x-7)} + \frac{2x+3}{2(x-7)}$$

$$\begin{array}{l} \downarrow \times 2 \qquad \qquad \qquad \downarrow \times 3 \\ \frac{28}{6(x-7)} + \frac{6x+9}{6(x-7)} = \frac{6x+37}{6(x-7)} \\ \\ = \frac{6x+37}{6x-42} \end{array}$$

(Total for Question 20 is 4 marks)



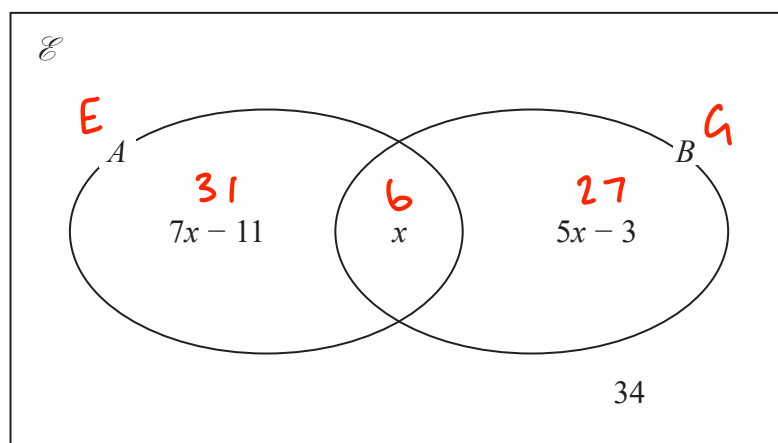
21 Vicky has a collection of medals.

The Venn diagram gives information about the number of medals in her collection where

$\mathcal{E} = \{\text{all medals}\}$

$A = \{\text{English medals}\}$

$B = \{\text{gold medals}\}$



Vicky is going to take at random a medal from her collection.

Given that the medal is gold, the probability that the medal is English is $\frac{2}{11}$

Work out the number of medals in Vicky's collection.

$$\frac{x}{5x-3} = \frac{2}{11}$$

When you have two fractions equal to each other you can cross multiply to start to solve

$$11x = 10x - 6$$

$$6 = x$$

98

(Total for Question 21 is 4 marks)

TOTAL FOR PAPER IS 80 MARKS