

1 Solve the simultaneous equations

$$x^2 + y^2 = 13$$

$$x = y - 5$$

$$(y - 5)^2 + y^2 = 13$$

$$(y - 5)(y - 5) + y^2 = 13$$

$$y^2 - 5y - 5y + 25 + y^2 = 13$$

$$2y^2 - 10y + 25 = 13$$

$$2y^2 - 10y + 12 = 0$$

$$y^2 - 5y + 6 = 0$$

$$(y - 3)(y - 2) = 0$$

$$\underline{\underline{y = 3}} \quad \underline{\underline{y = 2}}$$

$$x = (3) - 5 \quad x = (2) - 5$$

$$\underline{\underline{= -2}} \quad \underline{\underline{= -3}}$$

$$x = \underline{\underline{-2 \text{ or } -3}}$$

$$y = \underline{\underline{3 \text{ or } 2}}$$

(Total for question 1 is 5 marks)

2 Solve the simultaneous equations

$$x^2 + y^2 = 17$$

$$y = x - 3$$

$$x^2 + (x - 3)^2 = 17$$

$$x^2 + (x - 3)(x - 3) = 17$$

$$x^2 + x^2 - 3x - 3x + 9 = 17$$

$$2x^2 - 6x + 9 = 17$$

$$2x^2 - 6x - 8 = 0$$

$$x^2 - 3x - 4 = 0$$

$$(x - 4)(x + 1) = 0$$

$$\underline{\underline{x = 4}} \quad \underline{\underline{x = -1}}$$

$$y = (4) - 3$$

$$\underline{\underline{= 1}}$$

$$y = (-1) - 3$$

$$\underline{\underline{= -4}}$$

$$x = \underline{\underline{4 \text{ or } -1}}$$

$$y = \underline{\underline{1 \text{ or } -4}}$$

(Total for question 2 is 5 marks)

3 Solve the simultaneous equations

$$x^2 + y^2 = 34$$

$$x - y = 2$$

$$x = 2 + y$$

$$(2 + y)^2 + y^2 = 34$$

$$(2 + y)(2 + y) + y^2 = 34$$

$$4 + 2y + 2y + y^2 + y^2 = 34$$

$$2y^2 + 4y + 4 = 34$$

$$2y^2 + 4y - 30 = 0$$

$$y^2 + 2y - 15 = 0$$

$$(y + 5)(y - 3) = 0$$

$$\underline{y = -5} \quad \underline{y = 3}$$

$$\begin{array}{ll} x = 2 + (-5) & x = 2 + (3) \\ = \underline{\underline{-3}} & = \underline{\underline{5}} \end{array}$$

$$x = \underline{\underline{-3}} \text{ or } \underline{\underline{5}}$$

$$y = \underline{\underline{-5}} \text{ or } \underline{\underline{3}}$$

(Total for question 3 is 5 marks)

4 Solve the simultaneous equations

$$x^2 + y^2 = 20$$

$$3x = 2 - y$$

$$3x + y = 2$$

$$y = 2 - 3x$$

$$x^2 + (2 - 3x)^2 = 20$$

$$x^2 + (2 - 3x)(2 - 3x) = 20$$

$$x^2 + 4 - 6x - 6x + 9x^2 = 20$$

$$10x^2 - 12x + 4 = 20$$

$$10x^2 - 12x - 16 = 0$$

$$5x^2 - 6x - 8 = 0$$

$$(5x + 4)(x - 2) = 0$$

$$\underline{\underline{x = -\frac{4}{5}}} \quad \underline{\underline{x = 2}}$$

$$y = 2 - 3\left(-\frac{4}{5}\right) \quad y = 2 - 3(2)$$

$$= 2 + \frac{12}{5}$$

$$= -4$$

$$= \frac{22}{5}$$

$$x = \underline{\underline{-\frac{4}{5} \text{ or } 2}}$$

$$y = \underline{\underline{\frac{22}{5} \text{ or } -4}}$$

(Total for question 4 is 5 marks)

5 Solve the simultaneous equations

$$x^2 + y^2 = 41$$

$$y = 2x - 3$$

$$x^2 + (2x - 3)^2 = 41$$

$$x^2 + (2x - 3)(2x - 3) = 41$$

$$x^2 + 4x^2 - 6x - 6x + 9 = 41$$

$$5x^2 - 12x + 9 = 41$$

$$5x^2 - 12x - 32 = 0$$

$$(5x + 8)(x - 4) = 0$$

$$x = -\frac{8}{5}$$

$$\underline{\underline{x = 4}}$$

$$y = 2\left(-\frac{8}{5}\right) - 3$$

$$y = 2(4) - 3$$

$$= -\frac{16}{5} - 3$$

$$\underline{\underline{= 5}}$$

$$= -\frac{31}{5}$$

$$x = -\frac{8}{5} \text{ or } 4$$

$$y = -\frac{31}{5} \text{ or } 5$$

(Total for question 5 is 5 marks)

6 Solve the simultaneous equations

$$x^2 + y^2 = 20$$

$$2x + y = 3$$

$$y = 3 - 2x$$

$$x^2 + (3 - 2x)^2 = 20$$

$$x^2 + (3 - 2x)(3 - 2x) = 20$$

$$x^2 + 9 - 6x - 6x + 4x^2 = 20$$

$$5x^2 - 12x + 9 = 20$$

$$5x^2 - 12x - 11 = 0$$

This will not factorise.

$$a = 5 \quad b = -12 \quad c = -11$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$= \frac{-(-12) \pm \sqrt{(-12)^2 - 4(5)(-11)}}{2(5)}$$

$$x = \underline{3.11 \text{ (3sf)}} \quad \text{or} \quad \underline{-0.708 \text{ (3sf)}}$$

$$y = 3 - 2(3.11)$$

$$= \underline{\underline{-3.22 \text{ (3sf)}}}$$

$$y = 3 - 2(-0.708)$$

$$= \underline{\underline{4.42 \text{ 3sf}}}$$

$$x = \underline{\underline{3.11 \text{ or } -0.708}}$$

$$y = \underline{\underline{-3.22 \text{ or } 4.42}}$$

(Total for question 6 is 5 marks)

7 Solve the simultaneous equations

$$x^2 + y^2 = 27$$

$$2x - y = 3$$

$$2x = 3 + y$$

$$2x - 3 = y$$

$$x^2 + (2x - 3)^2 = 27$$

$$x^2 + (2x - 3)(2x - 3) = 27$$

$$x^2 + 4x^2 - 6x - 6x + 9 = 27$$

$$5x^2 - 12x + 9 = 27$$

$$5x^2 - 12x - 18 = 0$$

$$a = 5 \quad b = -12 \quad c = -18$$

$$x = \frac{-(-12) \pm \sqrt{(-12)^2 - 4(5)(-18)}}{2(5)}$$

$$= \underline{\underline{3.44}} \text{ (3sf)} \quad \text{or} \quad \underline{\underline{-1.04}} \text{ (3sf)}$$

$$y = 2(\text{Ans}) - 3$$

$$= \underline{\underline{3.89}} \text{ (3sf)}$$

$$y = 2(\text{Ans}) - 3$$

$$= -5.09 \text{ (3sf)}$$

$$x = \underline{\underline{3.44}} \text{ or } \underline{\underline{-1.04}}$$

$$y = \underline{\underline{3.89}} \text{ or } \underline{\underline{-5.09}}$$

(Total for question 7 is 5 marks)

8 Solve algebraically the simultaneous equations

$$x^2 - 3y^2 = 13$$

$$2x + 3y = 4$$

$$2x + 3y = 4$$

$$2x = 4 - 3y$$

$$x = \frac{4 - 3y}{2}$$

$$\left(\frac{4 - 3y}{2}\right)^2 - 3y^2 = 13$$

$$\left(\frac{4 - 3y}{2}\right)\left(\frac{4 - 3y}{2}\right) - 3y^2 = 13$$

$$\frac{16 - 12y - 12y + 9y^2}{4} - 3y^2 = 13$$

$$\frac{16 - 24y + 9y^2}{4} - 3y^2 = 13$$

$$16 - 24y + 9y^2 - 12y^2 = 52$$

$$-3y^2 - 24y + 16 = 52$$

$$-3y^2 - 24y - 36 = 0$$

$$3y^2 + 24y + 36 = 0$$

$$y^2 + 8y + 12 = 0$$

$$(y + 2)(y + 6) = 0$$

$$y = -2 \quad y = -6$$

$$x = \frac{4 - 3(-2)}{2}$$

$$= 5$$

$$x = \frac{4 - 3(-6)}{2}$$

$$= 11$$

$$\underline{x = 5, y = -2 \quad \text{or} \quad x = 11, y = -6}$$

(Total for question is 5 marks)



9 Solve algebraically the simultaneous equations

$$2x^2 - y^2 = 14$$

$$3x + 2y = 3$$

$$3x + 2y = 3$$

$$3x = 3 - 2y$$

$$x = \frac{3 - 2y}{3}$$

$$2\left(\frac{3 - 2y}{3}\right)^2 - y^2 = 14$$

$$2\left(\frac{3 - 2y}{3}\right)\left(\frac{3 - 2y}{3}\right) - y^2 = 14$$

$$2\left(\frac{9 - 6y - 6y + 4y^2}{9}\right) - y^2 = 14$$

$$2\left(\frac{9 - 12y + 4y^2}{9}\right) - y^2 = 14$$

$$\frac{18 - 24y + 8y^2}{9} - y^2 = 14$$

$$18 - 24y + 8y^2 - 9y^2 = 126$$

$$-y^2 - 24y + 18 = 126$$

$$-y^2 - 24y - 108 = 0$$

$$y^2 + 24y + 108 = 0$$

$$(y + 6)(y + 18) = 0$$

$$y = -6 \quad y = -18$$

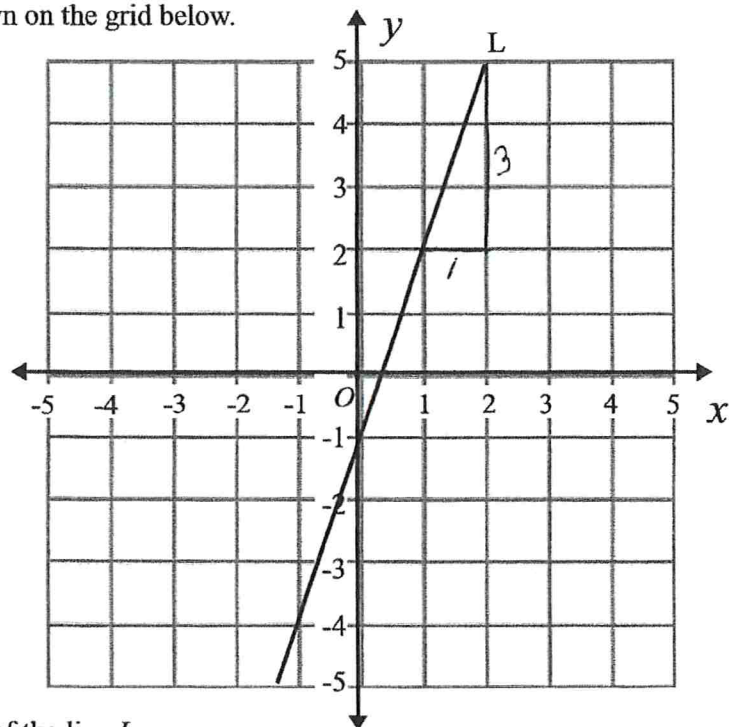
$$x = \frac{3 - 2(-6)}{3}$$
$$= 5$$

$$x = \frac{3 - 2(-18)}{3}$$
$$= 13$$

$$x = 5 \text{ and } y = -6 \text{ or } x = 13 \text{ and } y = -18$$

(Total for question is 5 marks)

- 1 The line  $L$  is drawn on the grid below.

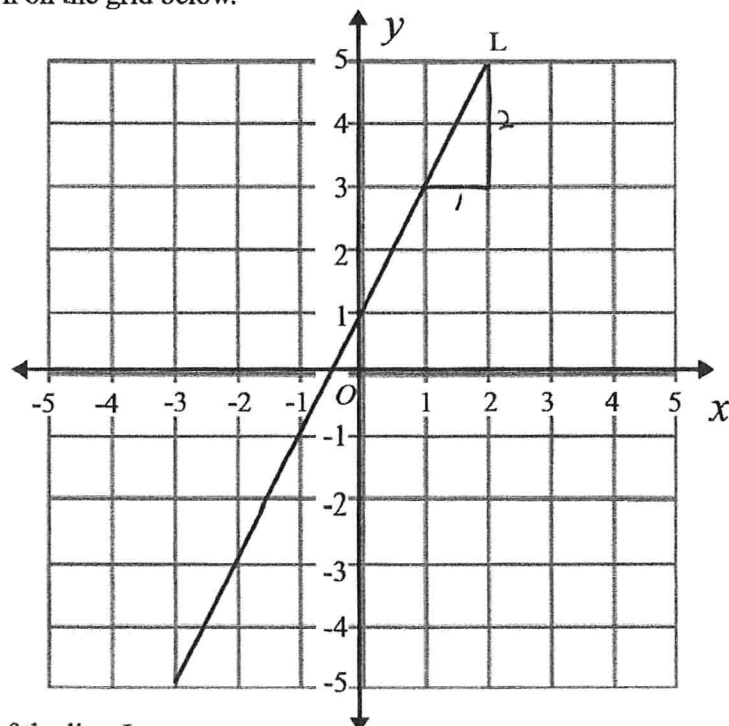


Find the gradient of the line  $L$ .

3

(Total for question 1 is 1 mark)

- 2 The line  $L$  is drawn on the grid below.

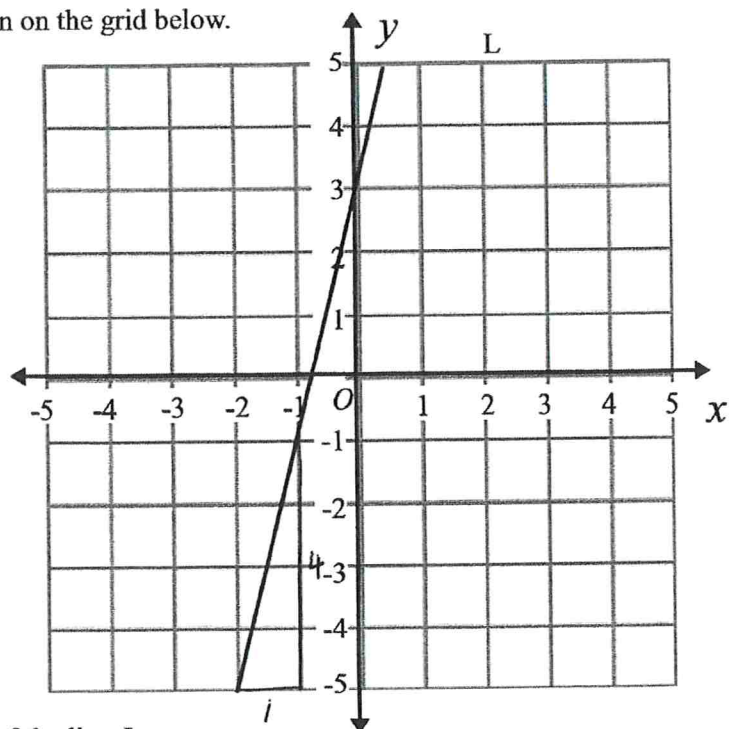


Find the gradient of the line  $L$ .

2

(Total for question 2 is 1 mark)

- 3 The line  $L$  is drawn on the grid below.

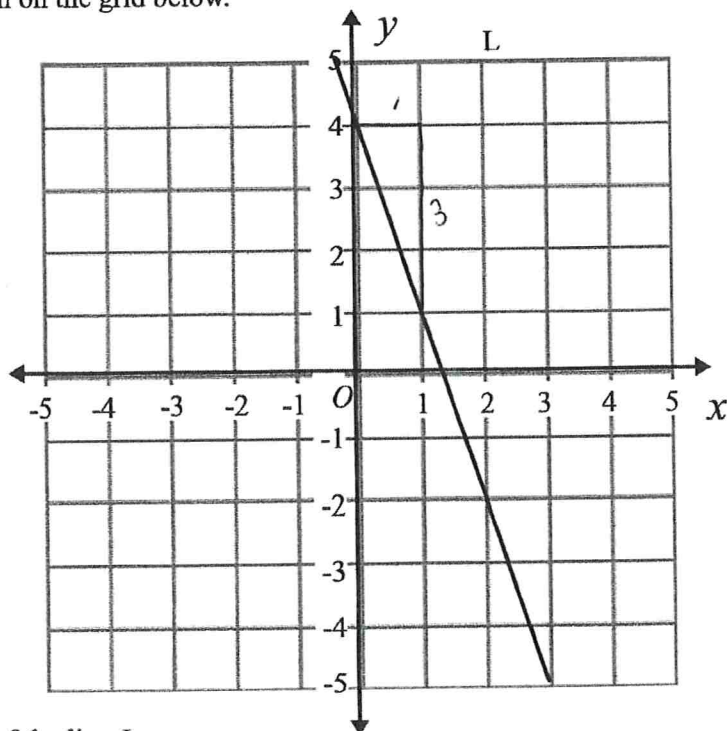


Find the gradient of the line  $L$ .

4

(Total for question 3 is 1 mark)

- 4 The line  $L$  is drawn on the grid below.

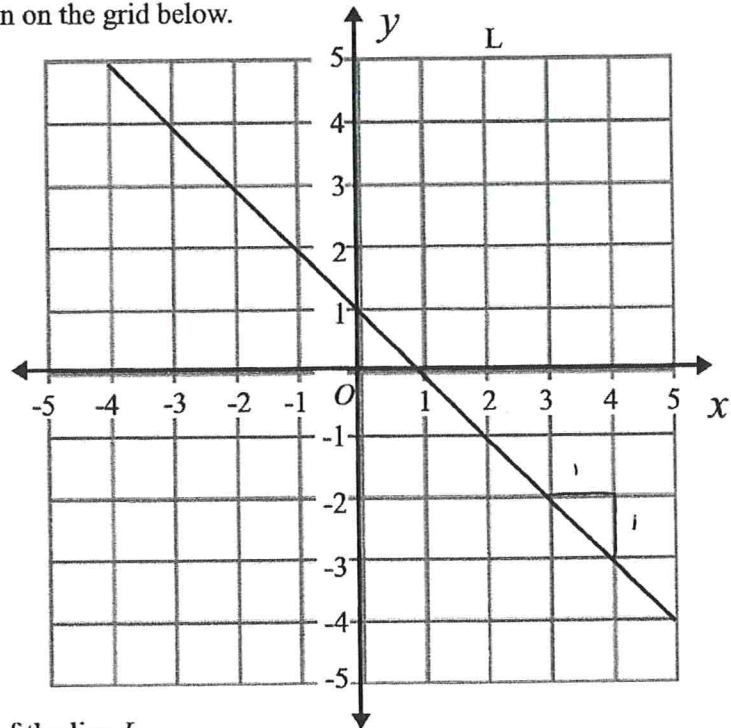


Find the gradient of the line  $L$ .

-3

(Total for question 4 is 1 mark)

- 5 The line  $L$  is drawn on the grid below.

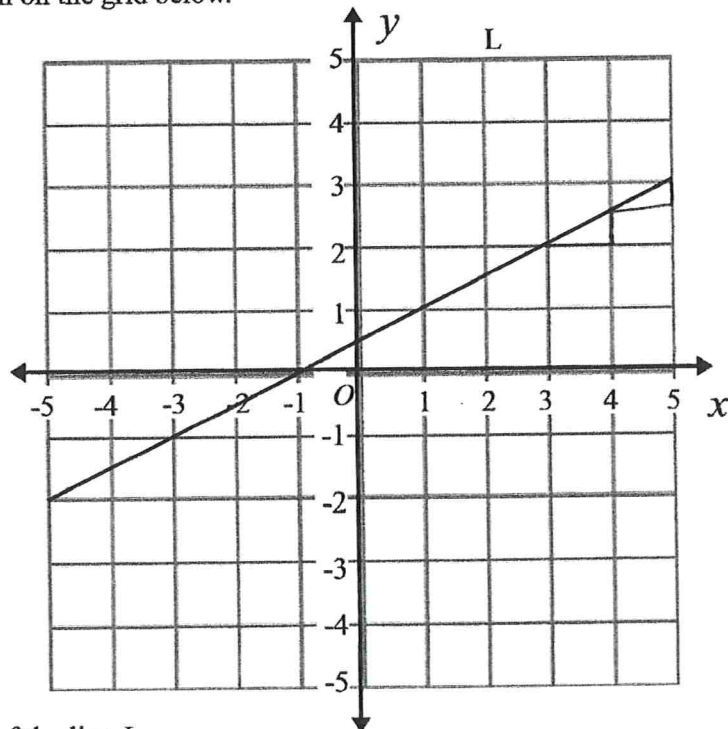


Find the gradient of the line  $L$ .

.....  
-1

(Total for question 5 is 1 mark)

- 6 The line  $L$  is drawn on the grid below.



Find the gradient of the line  $L$ .

.....  
 $\frac{1}{2}$

(Total for question 6 is 1 mark)

- 7 Find the gradient of the line that passes through (2, 1) and (5, 10).  
 $x_1 \ y_1 \ x_2 \ y_2$

$$\begin{aligned} m &= \frac{y_2 - y_1}{x_2 - x_1} \\ &= \frac{10 - 1}{5 - 2} \\ &= \frac{9}{3} \end{aligned}$$

3

(Total for question 7 is 2 marks)

- 8 Find the gradient of the line that passes through (5, 4) and (7, 0).  
 $x_1 \ y_1 \ x_2 \ y_2$

$$\begin{aligned} m &= \frac{0 - 4}{7 - 5} \\ &= \frac{-4}{2} \\ &= -2 \end{aligned}$$

-2

(Total for question 8 is 2 marks)

- 9 Find the gradient of the line that passes through (-3, 4) and (5, 8).  
 $x_1 \ y_1 \ x_2 \ y_2$

$$\begin{aligned} m &= \frac{8 - 4}{5 - -3} \\ &= \frac{4}{8} \\ &= \frac{1}{2} \end{aligned}$$

$\frac{1}{2}$

(Total for question 9 is 2 marks)

- 10 Find the gradient of the line that passes through (3, 7) and (1, 10).

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$= \frac{10 - 7}{1 - 3}$$

$$= \frac{3}{-2}$$

$$= -1.5$$

$$-1.5$$

(Total for question 10 is 2 marks)

- 11 Find the gradient of the line that passes through (1, -1) and (-3, -9).

$$x_1 \quad y_1 \quad x_2 \quad y_2$$

$$m = \frac{-9 - -1}{-3 - 1}$$

$$= \frac{-8}{-4}$$

$$= 2$$

$$2$$

(Total for question 11 is 2 marks)

- 12 Find the gradient of the line that passes through (8, 1) and (3, -3).

$$x_1 \quad y_1 \quad x_2 \quad y_2$$

$$m = \frac{-3 - 1}{3 - 8}$$

$$= \frac{-4}{-5}$$

$$= \frac{4}{5}$$

$$\frac{4}{5}$$

(Total for question 12 is 2 marks)



- 13 Find the gradient of the line that passes through (3, -1) and (-2, 9).

$x_1 \ y_1 \ x_2 \ y_2$

$$\begin{aligned} m &= \frac{9 - -1}{-2 - 3} \\ &= \frac{10}{-5} \\ &= -2 \end{aligned}$$

-2

(Total for question 13 is 2 marks)

- 14 Find the gradient of the line that passes through (-1, -2) and (-3, 10).

$x_1 \ y_1 \ x_2 \ y_2$

$$\begin{aligned} m &= \frac{10 - -2}{-3 - -1} \\ &= \frac{12}{-2} \\ &= -6 \end{aligned}$$

-6

(Total for question 14 is 2 marks)

- 15 Find the gradient of the line that passes through (-3, 4) and (-5, 7).

$x_1 \ y_1 \ x_2 \ y_2$

$$\begin{aligned} m &= \frac{7 - 4}{-5 - -3} \\ &= \frac{3}{-2} \\ &= -1.5 \end{aligned}$$

-1.5

(Total for question 15 is 2 marks)

- 16 The line  $AB$  passes through the points  $A(2, -1)$  and  $(6, k)$ .

The gradient of  $AB$  is 5.

$$x_1 \ y_1 \ x_2 \ y_2$$

Work out the value of  $k$ .

$$5 = \frac{k - -1}{6 - 2}$$

$$5 = \frac{k + 1}{4}$$

$$20 = k + 1$$

$$k = 19$$

$$k = \dots 19 \dots$$

(Total for question 16 is 3 marks)

- 17 The line  $AB$  passes through the points  $A(-3, 4)$  and  $(k, 12)$ .

The gradient of  $AB$  is 4.

$$x_1 \ y_1 \ x_2 \ y_2$$

Work out the value of  $k$ .

$$4 = \frac{12 - 4}{k - -3}$$

$$4 = \frac{8}{k + 3}$$

$$4(k + 3) = 8$$

$$k + 3 = 2$$

$$k = -1$$

$$k = \dots -1 \dots$$

(Total for question 17 is 3 marks)

- 18 The line  $AB$  passes through the points  $A(-2, k)$  and  $(4, 8)$ .

The gradient of  $AB$  is -2.

$$x_1 \ y_1 \ x_2 \ y_2$$

Work out the value of  $k$ .

$$-2 = \frac{8 - k}{4 - -2}$$

$$-2 = \frac{8 - k}{6}$$

$$-12 = 8 - k$$

$$-12 + k = 8$$

$$k = 20$$

$$k = \dots 20 \dots$$

(Total for question 18 is 3 marks)



- 1 Change 120 minutes to hours.

$$\frac{120}{60}$$

..... 2 ..... hours

(Total for question 1 is 1 mark)

- 2 Change 4 hours to minutes.

$$4 \times 60$$

..... 240 ..... minutes

(Total for question 2 is 1 mark)

- 3 Work out the difference, in minutes, between 55 minutes and  $1\frac{3}{4}$  hours.

1 hour 45 mins

$$60 + 45 = \underline{105}$$

$$105 - 55$$

..... 50 ..... minutes

(Total for question 3 is 2 marks)

- 4 Work out the difference, in minutes, between 2 hour 25 minutes and  $1\frac{1}{2}$  hours.

$$2 \times 60 + 25$$

$$120 + 25$$

$$= 145$$

1 hour 30 mins

$$60 + 30$$

$$= 90$$

$$145 - 90$$

..... 55 ..... minutes

(Total for question 4 is 2 marks)

5

Hayley left her home at 10.40 am.

She walked from her home to the shop.  
It took her 14 minutes to walk to the shop.

Hayley was at the shop for 10 minutes.

Then Hayley walked from the shop to her friends house.  
It took Hayley 22 minutes to walk to her friends house.

What time did Hayley arrive at her friends house?

+ 14 mins

10 54

+ 10 mins

11 04

+ 22 mins

11 26

11.26 am

(Total for question 5 is 2 marks)

6

A film starts at 7.45 pm.  
The film lasts 98 minutes.

What time does the film finish?

60 mins + 38 mins

7.45

+ 60 mins

8.45

+ 15 mins

9.00

+ 23 mins

9.23

9.23 pm

(Total for question 6 is 2 marks)

7

Natalie drives from London to Sheffield.

Natalie leaves London at 9.15 am.

Natalie drives for  $2\frac{1}{4}$  hours before stopping for a break.

2 hours 15 mins  
The break lasts for 20 minutes.

Natalie then takes another 85 minutes to reach Sheffield.

What time does Natalie arrive in Sheffield?

11.30

11.50

12.50

13.15

13.15

(Total for question 7 is 2 marks)

[1.15 pm]

8

Here is part of a train timetable.

London St Pancras	0540	0618	0701	0755
Ebbsfleet	0558	-	-	0812
Ashford	0624	0655	-	-
Paris	0917	0947	1017	1117

(a) A train leaves London St Pancras at 0618, how many minutes should it take to reach Paris?

0618 → 0947

0618 → 0918 → 0947

3 hours

29 mins

 $180 + 29 = 209$  ..... 209 ..... minutes  
 (1)

(b) What is the difference, in minutes, between the time it takes for the 0540 train and the 0618 train from London St Pancras to reach Paris?

0540 → 0917

0540 → 0840 → 0917

3 hours

37 mins

3 hours 37 - 3 hours 29

8 minutes

(2)

Georgie lives in Ashford. She has to get to a meeting in Paris for 1030.

(c) What is the time of the latest train she can get from Ashford?

0655

(1)

(Total for question 8 is 4 marks)

Here is part of a bus timetable.

Woolwich	0717	0724	0732	0739	0746
Woolwich Arsenal	0719	0726	0734	0741	0748
Plumstead Station	0725	0732	0740	0747	0754
Plumstead Corner	0730	0737	0745	0752	0759
Upper Wickham Lane	0737	0744	0752	0759	0806
Welling Corner	0743	0750	0758	0805	0813
Bexleyheath	0754	0801	0809	0817	0825
Crayford	0803	0811	0819	0827	0835
Dartford Station	0814	0823	0831	0839	0847
Darent Valley Hospital	0824	0833	0841	0849	0857
Bluewater	0828	0837	0845	0853	0901

- (a) A bus leaves Woolwich at 0724, how many minutes does this bus take to reach Bluewater?

$$\begin{array}{l}
 0724 \rightarrow 0837 \\
 0724 \rightarrow 0824 \rightarrow 0837 \\
 \text{1 hour} \quad 13 \text{ min} \\
 60 + 13 = 73 \text{ minutes} \\
 (1)
 \end{array}$$

Jeff needs to get from Bexleyheath to Bluewater to start work at 9 am.  
 It takes Jeff 12 minutes to walk from his house to the bus stop in Bexleyheath.  
 It takes Jeff 8 minutes to walk from the bus station in Bluewater to his work.

- (b) What is the latest time Jeff can leave his house to get to work on time?

must arrive at Bluewater at 0845

Bexleyheath bus at 0809

- 12 mins

0757

0757 (3)

(Total for question 9 is 4 marks)

7.57 am



- 10 Here is part of a train timetable.

London Marylebone	1410	1440	1510	1540
High Wycombe	1433	-	1534	-
Banbury	1506	1541	1608	1639
Leamington Spa	1524	1559	1626	1657
Warwick Parkway	1530	1606	1631	1705
Solihull	1544	1622	1644	1721
Birmingham Moor Street	1556	1632	1653	1735

- (a) A train leaves London Marylebone at 1440, what time does it arrive in Birmingham Moor Street?

1632

(1)

- (b) How many minutes should the 1410 train take to get from London Marylebone to Birmingham Moor Street?

1410 → 1510 → 1556  
1 hour 46 mins

60 + 46 = 106 ..... 106 minutes  
(1)

Millie goes from Banbury to Birmingham Moor Street on the train.

Millie takes 16 minutes to get from her house to the train station in Banbury.  
She takes 20 minutes to get from Birmingham Moor Street station to her meeting.

Millie needs to get to the meeting by 5 pm.  
Millie leaves her home at 3.15 pm.

- (c) Does Millie get to her meeting by 5pm?  
You must show all your working.

3.15 → 3.31 TRAIN AT 1541 ARRIVES AT 1632  
+16 mins

1632 → 1652  
+20 mins

Yes she arrives at 1652 ..... minutes  
(3)

(Total for question 10 is 5 marks)

- 1 Emma buys a house for £201 500  
She sells the house for £213 590

Calculate the percentage profit Emma makes.

$$\frac{\text{change}}{\text{original}} \times 100$$

$$\frac{213590 - 201500}{201500} \times 100$$

$$= 6\%$$

.....6.....%

(Total for question 1 is 3 marks)

- 2 Mel buys a house for £352 000  
She sells the house for £325 600

Calculate the percentage loss Mel makes.

$$\frac{\text{change}}{\text{original}} \times 100$$

$$\frac{325600 - 352000}{352000} \times 100$$

$$= -7.5\%$$

.....7.5.....%

(Total for question 2 is 3 marks)

- 3 Last year Geri's council tax bill was £1815  
This year she has to pay £1906 for her council tax.  
Work out the percentage increase in her council tax bill.  
Give your answer to 1 decimal place.

$$\frac{1906 - 1815}{1815} \times 100$$

$$5.01377... \%$$

$$\dots\dots\dots 5.0 \dots\dots\dots \%$$

(Total for question 3 is 3 marks)

- 4 Last year Victoria paid £354 for her car insurance  
This year she has to pay £329 for her car insurance.  
Work out the percentage decrease in her car insurance.  
Give your answer to 1 decimal place.

$$\frac{329 - 354}{354} \times 100$$

$$= -7.06214... \%$$

$$\dots\dots\dots 7.1 \dots\dots\dots \%$$

(Total for question 4 is 3 marks)

- 5 In 2000, the world population was 6.1 billion.  
In 2015, the world population was 7.3 billion.

Work out the percentage increase in population.  
Give your answer correct to 1 decimal place.

$$\frac{7.3 - 6.1}{6.1} \times 100$$

$$19.6721... \%$$

$$\dots\dots\dots 19.7 \dots\dots\dots \%$$

(Total for question 5 is 3 marks)

- 6 Banana computers sold 19.3 million computers in 2017.

In 2018, they sold 18.2 million computers.

Work out the percentage decrease in the number of computers sold.

Give your answer to three significant figures.

$$\frac{18.2 - 19.3}{19.3} \times 100$$

$$= -5.69948... \%$$

$$\dots\dots\dots 5.70 \dots\dots\dots \%$$

(Total for question 6 is 3 marks)



- 7 Last year Patrick paid £2534 for his annual train ticket.  
This year he has to pay £2612 for his annual train ticket.

Work out the percentage increase in the cost of his train ticket.  
Give your answer correct to 3 significant figures.

$$\frac{2612 - 2534}{2534} \times 100$$

$$3.078137... \%$$

$$\dots\dots\dots 3.08 \dots\dots\dots \%$$

(Total for question 7 is 3 marks)

- 8 The average house price in London in 2017 was £474902  
The average house price in London in 2018 was £469538

Calculate the percentage change in house prices between 2017 and 2018.  
Give your answer correct to 1 decimal place.

$$\frac{469538 - 474902}{474902} \times 100$$

$$= -1.129496... \%$$

$$\dots\dots\dots -1.1 \dots\dots\dots \%$$

(Total for question 8 is 3 marks)

- 9 Richard buys a car for £13 500  
He sells the car for £9 500

Work out Richard's percentage loss.  
Give your answer correct to three significant figures.

$$\frac{9500 - 13500}{13500} \times 100$$

$$= -29.6296\ldots\%$$

$$\underline{\quad\quad\quad 29.6 \quad\quad\quad} \%$$

(Total for question 9 is 3 marks)

- 10 Lottie buys a pack of 50 cans of lemonade.  
She pays £17 for the cans.

Lottie sells 32 of the cans for 50p each.

$$32 \times 0.5 = 16$$

She sells the remaining cans for 20p each.

$$18 \times 0.2 = 3.6$$

Work out Lottie's percentage profit.

Give your answer correct to three significant figures.

$$\underline{\underline{19.60}}$$

$$\frac{19.60 - 17}{17} \times 100$$

$$= 15.2941\ldots\%$$

$$\underline{\quad\quad\quad 15.3 \quad\quad\quad} \%$$

(Total for question 10 is 3 marks)

- 11 Karen buys a pack of 8 bottles of water.  
The pack costs £1.25

Karen sells all 8 bottles of water for 50p each.

$$8 \times 0.5 = 4$$

Work out Karen's percentage profit.

$$\frac{4 - 1.25}{1.25} \times 100$$

.....220..... %

(Total for question 11 is 3 marks)

- 12 Theo buys 24 packs of crisps.  
He pays £3 for the crisps.

Theo sells each pack of crisps for 50p.

$$24 \times 0.5 = 12$$

Work out Theo's percentage profit.

$$\frac{12 - 3}{3} \times 100$$

.....300..... %

(Total for question 12 is 3 marks)

- 13 Donald buys a pack of 9 chocolate bars.  
The pack costs £2.50

Donald sells all 9 chocolate bars for 45p each.

$$9 \times 0.45 = 4.05$$

Work out Donald's percentage profit.

$$\frac{4.05 - 2.50}{2.50} \times 100$$

..... 6.2 %

(Total for question 13 is 3 marks)

- 14 Alan buys 1.2 kg of sweets. 1200g  
He pays £2.25 for the sweets.

Alan puts the sweets into bags.  
He puts 150g of sweets in each bag.  
He sells each bag of sweets for 30p.

$$\frac{1200}{150} = 8 \text{ bags}$$

Work out Alan's percentage profit.

$$8 \times 0.3 = 2.4$$

$$\frac{2.4 - 2.25}{2.25} \times 100$$

6.6 %

..... 6.6 %  
[or 6.7 / 6.67 %]

(Total for question 14 is 4 marks)

- 1 Jesy invests £8000 for  $n$  years in a savings account.

To find the value,  $V$ , of her investment after  $n$  years she uses the formula:

$$V = 8000 \times (1.025)^n$$

- (a) Write down the annual rate of interest Jesy earns.

..... 2.5% .....  
(1)

- (b) Find the **total amount of interest** Jesy earns in three years.

$$8000 \times 1.025^3 = £8615.13$$

$$8615.13 - 8000$$

£..... 615.13 .....  
(2)

(Total for question 1 is 3 marks)

- 2 Perrie invests £25000 for 3 years in a savings account.  
She gets 2.7% per annum compound interest.

Calculate the **total amount of interest** Perrie will get after 3 years.

$$25000 \times 1.027^3 = 27080.17$$

$$27080.17 - 25000 = £2080.17$$

£..... 2080.17 .....  
(2)

(Total for question 2 is 3 marks)

- 3 Jade bought a house for £350 000.

In the first year the house price increased by 3%

In the second year the house price increased by 2%

In the third year the house price depreciated by 5%

Work out the value of the house at the end of 3 years.

$$350\,000 \times 1.03 \times 1.02 \times 0.95$$

$$= \text{£ } 349\,324.50$$

£ 349 324.50

(Total for question 3 is 3 marks)

- 4 Leigh-Anne invests £2500 for 4 years in a savings account.  
She gets 3% per annum compound interest.

How much money does Leigh-Anne have at the end of 4 years.

$$2500 \times 1.03^4 = \text{£ } 2813.77$$

£ 2813.77

(Total for question 4 is 2 marks)

- 5 Annie invests £9500 for 5 years in a savings account.  
She gets 1.8% per annum compound interest.

How much money does Annie have at the end of 5 years.

$$9500 \times 1.018^5 = £10386.34$$

£.....10386.34.....

(Total for question 5 is 2 marks)

- 6 Greg bought a new car for £18000.  
In the first year the value of the car depreciates by 30%.  
In the second year and the third year the car depreciates by 14%

Work out the value of the car after three years.

$$18000 \times 0.7 \times 0.86^2 = £9318.96$$

£.....9318.96.....

(Total for question 6 is 3 marks)



- 7 Nick bought a new car.  
Each year the car depreciates in value by 12%.

Work out the number of years it takes for the car to half in value.

$$0.88^2 = 0.7744$$

$$0.88^3 = 0.681472$$

$$0.88^4 = 0.59969536$$

$$0.88^5 = 0.5277319168$$

$$0.88^6 = 0.464404868 \quad [\text{less than } 0.5]$$

.....6.....years

(Total for question 7 is 3 marks)

- 8 Fearnie invests £5600 in a savings account.  
She gets 2% per annum compound interest.

After  $n$  years, Fearnie has £6061.62 in her account.  
Work out the value of  $n$ .

$$5600 \times 1.02^3 = \frac{5942.76}{\cancel{6119.27}}$$

$$5600 \times 1.02^4 = 6061.62 \quad \checkmark$$

.....4.....  
(Total for question 8 is 2 marks)



9 Alice is going to invest some money for 5 years.

She can choose from ~~two~~ two options:

Investment A: 2.7% compound interest per annum

Investment B: 2.8% simple interest per annum

Which investment should Alice choose  
You must show your working.

A

$$100 \times 1.027^5 = 114.2$$

Increase of 14.2%

B

$$2.8 \times 5 = 14$$

Increase of 14%

She should choose Investment A

---

(Total for question 9 is 4 marks)

- 10 Matt wants to invest £8000 for three years. He can choose between Bank A and Bank B.

**Bank A**

1.2% compound interest  
per annum

**Bank B**

2% compound interest in  
the first year  
1% compound interest  
for each extra year

Which bank will give Matt the most interest after three years.  
You must show your working.

A

$$\cancel{8000 \times 1.02^3}$$
$$8000 \times 1.012^3$$

$$= £8291.47$$

B

$$8000 \times 1.02 \times 1.01^2$$

$$= £8324.02$$

Bank B

(Total for question 10 is 4 marks)

11 Melvin invests £5000 in an account paying 2.5% compound interest per annum.

Charlie invests £4500 in an account paying 3% compound interest per annum.

Work out the difference between the amount of money Melvin has after 5 years and the amount of money Charlie has after 5 years.

$$\text{Melvin: } 5000 \times 1.025^5 = 5657.04$$

$$\text{Charlie: } 4500 \times 1.03^5 = 5216.73$$

$$5657.04 - 5216.73$$

$$= 440.31$$

£.....440.31.....

(Total for question 11 is 4 marks)

- 1 The value of a house increased by 6%.  
The house then had a value of £265 000

Work out the value of the house before the increase.

$$\begin{aligned} x \times 1.06 &= 265\,000 \\ x &= \frac{265\,000}{1.06} \\ &= 250\,000 \end{aligned}$$

~~OR~~

$$\begin{aligned} 265\,000 &= 106\% \\ \div 106 &\quad \div 106 \\ 2500 &= 1\% \\ \times 100 &\quad \times 100 \\ 250\,000 &= 100\% \end{aligned}$$

£ 250 000

(Total for Question 1 is 2 marks)

- 2 In a sale, the normal price of a book is reduced by 20%.  
The sale price of the book is £4.80

Work out the normal price of the book.

$$\begin{aligned} x \times 0.8 &= 4.80 \\ x &= \frac{4.80}{0.8} \\ &= 6 \end{aligned}$$

£ 6

(Total for Question 2 is 2 marks)

- 3 The value of a litre of petrol increased by 8%.  
A litre of petrol then cost £1.62

Work out the price of a litre of petrol before the increase.

$$\begin{aligned} x \times 1.08 &= 1.62 \\ x &= \frac{1.62}{1.08} \\ &= £1.50 \end{aligned}$$

£ 1.50

(Total for Question 3 is 2 marks)

- 4 In a sale, normal prices are reduced by 25%.  
The normal price of a coat is reduced by £12

Work out the normal price of the coat.

$$12 = 25\%$$

$$\times 4 \quad \times 4$$

$$48 = 100\%$$

£ 48

(Total for Question 4 is 2 marks)

- 5 In a sale, the normal price of a TV is reduced by 20%.  
The sale price of the TV is £660

Work out the normal price of the TV.

$$x \times 0.8 = 660$$

$$x = \frac{660}{0.8}$$

$$= 825$$

£ 825

(Total for Question 5 is 2 marks)

- 6 The cost of a council tax bill increased by 5%.  
The council tax bill increased by £62.

Work out the cost of the council tax bill before the increase

$$62 = 5\%$$

$$\times 20 \quad \times 20$$

$$1240 = 100\%$$

£ 1240

(Total for Question 6 is 2 marks)

- 7 The price of a train season ticket increased by 4%.  
The price of the ticket increased by £152.20

Work out the price of the train ticket before the increase.

$$\begin{array}{rcl} 152.20 & = & 4\% \\ \times 25 & & \times 25 \\ \hline 3805 & = & 100\% \end{array}$$

£ 3805

(Total for Question 7 is 2 marks)

- 8 In a sale, the normal price of a car is reduced by 30%.  
The sale price of the car is £6300

Work out the normal price of the car.

$$\begin{array}{rcl} 6300 & = & 70\% \\ \div 7 & & \div 7 \\ \hline 900 & = & 10\% \\ \times 10 & & \times 10 \\ \hline 9000 & = & 100\% \end{array}$$

£ 9000

(Total for Question 8 is 2 marks)

- 9 In a sale, normal prices are reduced by 15%.  
The normal price of a pen is reduced by £1.20

Work out the normal price of the pen.

$$\begin{array}{rcl} 1.20 & = & 15\% \\ \div 3 & & \div 3 \\ \hline 0.40 & = & 5\% \\ \times 20 & & \times 20 \\ \hline 8 & = & 100\% \end{array}$$

£ 8

(Total for Question 9 is 2 marks)



- 1 Write down the ratio of 350 cm to 25 cm.  
Give your answer in its simplest form.

$$\begin{array}{r} 350 : 25 \\ \div 25 \quad \div 25 \\ 14 : 1 \end{array}$$

$$14 : 1$$

(Total for question 1 is 2 marks)

- 2 Write down the ratio of 220 kg to 5 kg.  
Give your answer in its simplest form.

$$\begin{array}{r} 220 : 5 \\ \div 5 \quad \div 5 \\ 44 : 1 \end{array}$$

$$44 : 1$$

(Total for question 2 is 2 marks)

- 3 Alex has the following coins:



Write down the ratio of the value of Alex's 20p coins to the value of Alex's 50p coins.

$$\begin{array}{r} 40 : 150 \\ 4 : 15 \end{array}$$

$$4 : 15$$

(Total for question 3 is 2 marks)

- 4 (a) Write the ratio 32 : 24 in its simplest form

$$\div 8 \quad \div 8$$

$$4 : 3$$

$$\frac{4 : 3}{(1)}$$

- (b)  $\frac{1}{9}$  of people in a class are left handed.

Write the ratio of left handed people to right handed people

$$\frac{1}{9} : \frac{8}{9}$$

$$1 : 8$$

$$\frac{1 : 8}{(1)}$$

(Total for question 7 is 2 marks)

- 5 (a) Write the ratio 15 : 35 in its simplest form.

$$\div 5 \quad \div 5$$

$$3 : 7$$

$$\frac{3 : 7}{(1)}$$

- (b) There are red shapes and blue shapes in a box,  $\frac{2}{3}$  of the shapes are red.

Write the ratio of red shapes to blue shapes.

$$\frac{2}{3} : \frac{1}{3}$$

$$2 : 1$$

$$\frac{2 : 1}{(1)}$$

(Total for question 9 is 2 marks)



- 6 (a) Write the ratio  $81 : 27$  in its simplest form

$$\div 9 \quad \div 9$$

$$9 : 3$$

$$\div 3 \quad \div 3$$

$$3 : 1$$

$$3 : 1$$

(1)

- (b)  $\frac{3}{8}$  of chocolates in a box are white chocolate, the rest are milk chocolate.

Write the ratio of white chocolates to milk chocolates.

$$\frac{3}{8} : \frac{5}{8}$$

$$3 : 5$$

$$3 : 5$$

(1)

(Total for question 6 is 2 marks)

- 7 (a) Write the ratio  $24 : 72$  in its simplest form.

$$\div 8 \quad \div 8$$

$$3 : 9$$

$$1 : 3$$

$$1 : 3$$

(1)

- (b) In February, it rained on  $\frac{3}{7}$  of days

Write the ratio of the days it rained to the number of days it did not rain.

$$\frac{3}{7} : \frac{4}{7}$$

$$3 : 4$$

$$3 : 4$$

(1)

(Total for question 9 is 2 marks)

- 8 Write the ratio  $7.5 : 2.5$  in the form  $n : 1$

$$\div 2.5 \quad \div 2.5$$

$$3 : 1$$

$$3 : 1$$

(Total for question 8 is 1 mark)

- 9 Write the ratio  $12 : 30$  in the form  $1 : n$

$$6 : 15$$

$$2 : 5$$

$$1 : 2.5$$

$$1 : 2.5$$

(Total for question 9 is 1 mark)

- 10 There are some cubes in a bag.

$\frac{1}{6}$  of the cubes are red.

The rest of the cubes are blue.

Write the ratio of the number of red cubes to the number of blue cubes.

Give your answer in the form  $1 : n$

$$\frac{1}{6} : \frac{5}{6}$$

$$1 : 5$$

$$1 : 5$$

(Total for question 10 is 2 marks)

- 11 There are only blue counters, red counters and yellow counters in a bag.

There are twice as many blue counters as yellow counters.  $B : Y$   
 $2 : 1$

There are three times as many red counters as yellow counters.  $R : Y$   
 $3 : 1$

Write down the ratio of blue counters to red counters to yellow counters.

$$B : R : Y$$

$$2 : 3 : 1$$

---

(Total for question 11 is 2 marks)

- 12 There are only green pens, black pens and red pens in a box.

There are four times as many green pens as black pens.  $4 : 1$

There are twice as many red pens as green pens.  $4 : 8$

Write down the ratio of green pens to black pens to red pens.

$$G : B : R$$

$$4 : 1 : 8$$

$$4 : 1 : 8$$

---

(Total for question 12 is 2 marks)

- 13 Charlotte, Jo and Mike played a game.

Charlotte's scored four times as many points as Jo.  
Mike's scored half as many points as Charlotte.

Write down the ratio of Charlotte's points to Jo's points to Mike's points

$$C : J : M$$
$$4 : 1 : 2$$

$$4 : 1 : 2$$

(Total for question 13 is 2 marks)

- 14 There are 120 people in a school canteen.  
Half of the people in the canteen are in year 11 students. 60

The number of year 11 students in the canteen is three times the number of year 10 students.  
The rest of the people in the canteen are year 9 students.

$$\frac{60}{3} = 20$$

the number of year 9 students : the number of year 10 students =  $n : 1$

Work out the value of  $n$ .

You must show how you get your answer.

$$120 - 60 - 20 = 40 \quad \text{YEAR 9}$$

$$40 : 20$$
$$2 : 1$$

$$n = 2$$

(Total for question 14 is 2 marks)

- 15 In a bag there are blue sweets, red sweets and yellow sweets.

The number of red sweets is three times the number of blue sweets.

The number of yellow sweets is half the number of red sweets.

Write down the ratio of blue sweets to red sweets to yellow sweets.

Give your answer in the form  $a : b : c$  where  $a$ ,  $b$  and  $c$  are whole numbers

$$\begin{array}{l} B : R : Y \\ 1 : 3 : 1.5 \\ 2 \quad 6 : 3 \end{array}$$

$$2 : 6 : 3$$

(Total for question 15 is 2 marks)

- 16 In a bag there are blue sweets, red sweets and yellow sweets.

The number of blue sweets is four times the number of yellow sweets.

The number of red sweets is half the number of yellow sweets.

Find the percentage of sweets in the bag that are yellow.

$$\begin{array}{l} B : R : Y \\ 4 : 0.5 : 1 \\ 8 : 1 : 2 \end{array}$$

$$\text{Yellow } \frac{2}{11}$$

$$\frac{2}{11} \times 100$$

$$\frac{200}{11} \%$$

(Total for question 16 is 2 marks)

$$[18.18\%]$$

- 1 Will and Olly share £80 in the ratio 3 : 2

Work out how much each of them get.

$$\boxed{16} \quad \boxed{16} \quad \boxed{16} : \boxed{16} \quad \boxed{16}$$

$$80 \div 5 = 16$$

$$3 \times 16 = 48$$

$$2 \times 16 = 32$$

Will £ 48

Olly £ 32

(Total for question 1 is 3 marks)

- 2 Molly, Paige and Demi share 42 sweets in the ratio 3 : 2 : 1

Work out the number of sweets that each of them receives.

$$\boxed{7} \quad \boxed{7} \quad \boxed{7} : \boxed{7} \quad \boxed{7} : \boxed{7}$$

$$42 \div 6 = 7$$

$$3 \times 7 = 21$$

$$2 \times 7 = 14$$

$$1 \times 7 = 7$$

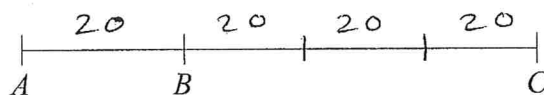
Molly 21 sweets

Paige 14 sweets

Demi 7 sweets

(Total for question 2 is 3 marks)

- 3  $ABC$  is a straight line.



The length of  $BC$  is three times the length of  $AB$ .

$AC = 80$  metres.

Work out the length  $BC$ .  $3:1$   
 $BC:AB$

$$\frac{80}{4} = 20$$

$$3 \times 20 = 60$$

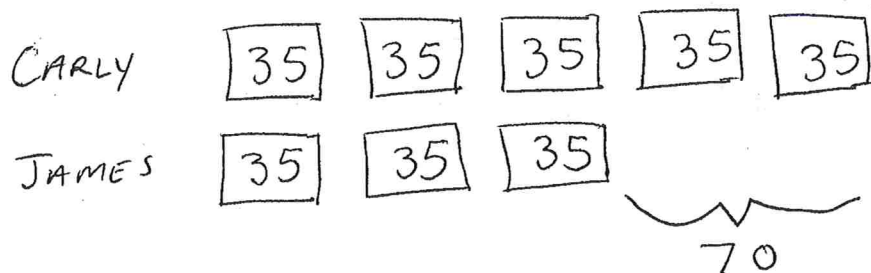
60 metres

(Total for question 3 is 3 marks)



- 4 Carly and James share some money in the ratio 5 : 3  
Carly gets £70 more than James.

Work out how much money James gets.



$$\frac{70}{2} = 35$$

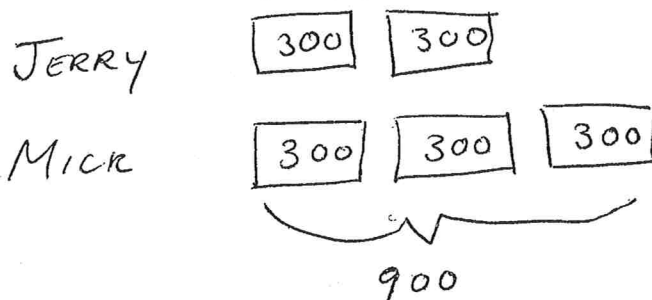
$$3 \times 35$$

£ 105

(Total for question 4 is 3 marks)

- 5 Jerry and Mick share some money in the ratio 2 : 3  
Mick gets £900

Work out how much money Jerry gets.



$$\frac{900}{3} = 300$$

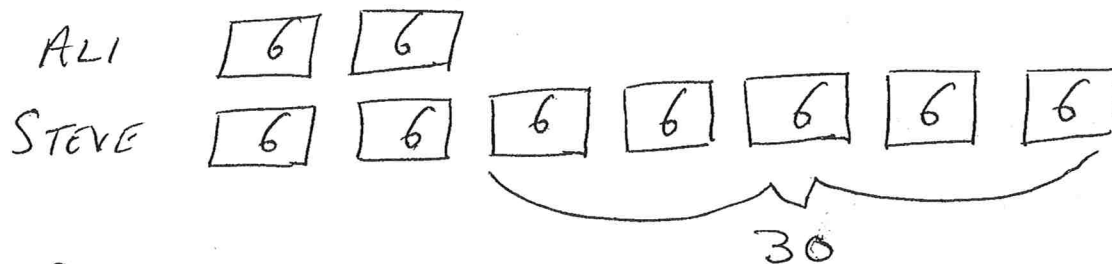
$$2 \times 300$$

£ 600

(Total for question 5 is 3 marks)

- 6 Ali and Steve share some sweets in the ratio 2 : 7  
Ali gets 30 more sweets than Steve.

Work out how many sweets Steve gets.



$$\frac{30}{5} = 6$$

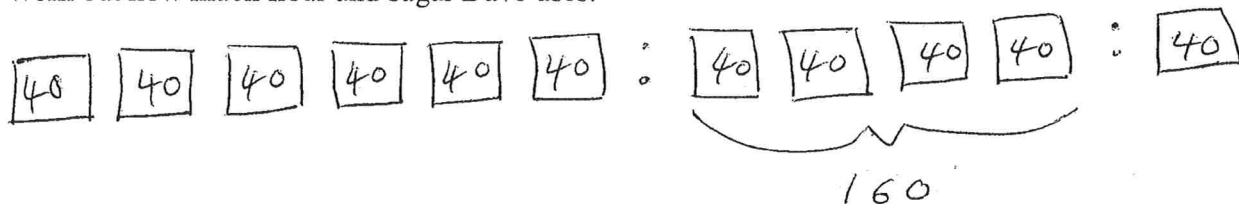
$$6 \times 7 = 42$$

42

(Total for question 6 is 3 marks)

- 7 Dave is making cookies.  
He mixes flour, butter and sugar in the ratio 6 : 4 : 1

Dave uses 160 grams of butter.  
Work out how much flour and sugar Dave uses.



$$\frac{160}{4} = 40$$

$$6 \times 40 \text{ flour } 240 \text{ grams}$$

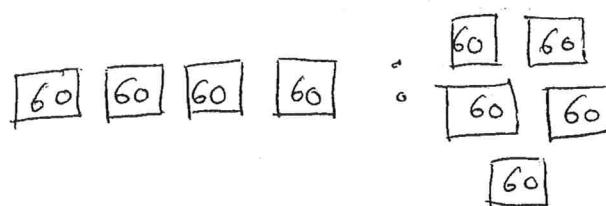
$$1 \times 40 \text{ sugar } 40 \text{ grams}$$

(Total for question 7 is 3 marks)

- 8 Alvin and Simon shared £540 in the ratio 4 : 5

Alvin gave half of his share to Theo.  
Simon gave a tenth of his share to Theo.

What fraction of the £540 did Theo receive?



$$\text{ALVIN } 4 \times 60 = 240$$

$$\text{SIMON } 5 \times 60 = 300$$

$$\frac{540}{9} = 60$$

$$\text{THEO gets } \frac{1}{2} \text{ of } 240 = 120$$

$$\frac{1}{10} \text{ of } 300 = 30$$

$$120 + 30 = 150$$

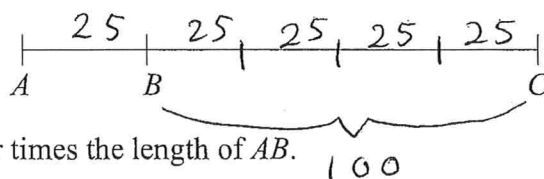
$$\frac{150}{540} = \frac{15}{54}$$

$$= \frac{5}{18}$$

$$\frac{5}{18}$$

(Total for question 8 is 3 marks)

- 9 ABC is a straight line.



The length of BC is four times the length of AB.

BC = 100 metres.

Work out the length AC.

$$\frac{100}{4} = 25$$

$$5 \times 25$$

$$125 \text{ metres}$$

(Total for question 9 is 3 marks)

- 10 Bob is going to make some orange paint.  
He needs to mix red paint, yellow paint and white paint in the ratio 5 : 4 : 1

Bob wants to make 750 ml of orange paint.

Bob has

400 ml of red paint  $400 > 375$   
300 ml of yellow paint  $300 = 300$   
200 ml of white paint  $200 > 75$

Does Bob have enough red paint, yellow paint and white paint to make the orange paint?  
You must show all your working.

RED  $\boxed{75} \boxed{75} \boxed{75} \boxed{75} \boxed{75}$   
YELLOW  $\boxed{75} \boxed{75} \boxed{75} \boxed{75}$   
WHITE  $\boxed{75}$

$$5 \times 75 = 375 \checkmark$$

$$4 \times 75 = 300 \checkmark$$

$$1 \times 75 = 75 \checkmark$$

$$\frac{750}{10} = 75$$

Yes Bob has enough paint

(Total for question 10 is 4 marks)

- 11 Megan is going to make a drink using the instructions below.

Mix 2 parts of fruit juice  
with 5 parts of sparkling water

Megan has 180 ml of fruit juice and 400 ml of sparkling water.

What is the greatest amount of the drink Megan can make?

with 180ml of fruit juice

$\boxed{90} \boxed{90} : \boxed{90} \boxed{90} \boxed{90} \boxed{90} \boxed{90}$   
180

$$5 \times 90 = 450 \text{ ml}$$

(NOT ENOUGH)

$$\frac{180}{2} = 90$$

with 400 ml of sparkling water  $\frac{400}{5} = 80$

$\boxed{80} \boxed{80} : \boxed{80} \boxed{80} \boxed{80} \boxed{80} \boxed{80}$   
160 400

560 ml

(Total for question 11 is 3 marks)

- 12 In a bag there are only red counters, blue counters and white counters.  
A counter is taken at random from the bag.

The table shows the probability of getting a red counter.

Colour	Red	Blue	White
Probability	0.35	0.26	0.39

the number of blue counters : the number of white counters = 2 : 3

Complete the table.

$$1 - 0.35 = 0.65$$

$$\boxed{0.13} \boxed{0.13} : \boxed{0.13} \boxed{0.13} \boxed{0.13}$$

$$\frac{0.65}{5} = 0.13$$

$$2 \times 0.13 = 0.26$$

$$3 \times 0.13 = 0.39$$

(Total for question 12 is 4 marks)

- 13 Al, Tom and Joe share €3000.

The ratio of the amount Al gets to the amount Tom gets is in the ratio 5 : 4

Joe gets 1.5 times the amount Tom gets.

Work out the amount of money that Tom gets.

$$1.5 \times 4 = 6$$

Joe gets 6 parts

$$5 : 4 : 6$$

$$\boxed{200} \boxed{200} \boxed{200} \boxed{200} \boxed{200} : \boxed{200} \boxed{200} \boxed{200} \boxed{200} : \boxed{200} \boxed{200} \boxed{200} \boxed{200} \boxed{200} \boxed{200}$$

$$\frac{3000}{15} = \frac{6000}{30} = 200$$

$$4 \times 200$$

$$€ 800$$

(Total for question 13 is 4 marks)



- 14 Harry and Gary have a total of 300 stickers.  
The ratio of the number of stickers Harry has to the ratio of the number of stickers Gary has is in the ratio 7 : 3

Harry gives Gary some stickers.

The ratio of the number of stickers Harry has to the ratio of the number of stickers Gary has is now in the ratio 8 : 7

Work out how many stickers Harry gives to Gary.

You must show all your working.

$$\boxed{30} \boxed{30} \boxed{30} \boxed{30} \boxed{30} \boxed{30} \boxed{30} : \boxed{30} \boxed{30} \boxed{30}$$

$$\frac{300}{10} = 30$$

$$7 \times 30 = 210$$

$$3 \times 30 = 90$$

$$\boxed{20} \boxed{20} \boxed{20} \boxed{20} \boxed{20} \boxed{20} \boxed{20} \boxed{20} : \boxed{20} \boxed{20} \boxed{20} \boxed{20} \\ \boxed{20} \boxed{20} \boxed{20}$$

$$\frac{300}{15} = 20$$

$$8 \times 20 = 160$$

$$7 \times 20 = 140$$

$$210 - 160 = \underline{\underline{50}}$$

50

(Total for question 14 is 4 marks)

- 15 A shop sells small chocolate bars and large chocolate bars.

There are

small chocolate bars are sold in packs of 4  
large chocolate bars are sold in packs of 9

On one day

the number of packs of : the number of packs of = 5 : 2  
small chocolate bars sold : large chocolate bars sold

A total of 95 chocolate bars were sold.

Work out the number of small chocolate bars sold.

Chocolate bars sold  
S : L  
 $5 \times 4 : 2 \times 9$   
 $20 : 18$   
 $10 : 9$

$\boxed{5} \boxed{5} \boxed{5} \boxed{5} \boxed{5} \boxed{5} \boxed{5} \boxed{5} \boxed{5} \boxed{5} : \boxed{5} \boxed{5} \boxed{5} \boxed{5} \boxed{5} \boxed{5} \boxed{5}$   
19 parts

$$\frac{95}{19} = 5$$

$$10 \times 5 = \underline{\underline{50}}$$

50

(Total for question 15 is 4 marks)



- 1 A machine fills 1000 bottles in 5 hours.

Work out how many hours it would take the machine to fill 1200 bottles.

1000 bottles in 5 hours ↓  
  ÷ 5  
200 bottles in 1 hour ↓  
  ↓  
  x 6  
1200 bottles in 6 hours ↓

6

(Total for question 1 is 2 marks)

- 2 It costs £0.75 to buy 5 bananas.

Work out how much it would cost to buy 7 bananas.

£0.75 for 5 bananas ↓  
  ÷ 5  
£0.15 for 1 banana ↓  
  ↓  
  x 7  
£1.05 for 7 bananas ↓

£1.05

(Total for question 2 is 2 marks)

3 3 tins of beans and 4 tins of tomatoes costs £2.73.

5 tins of beans costs £1.55.

Work out how much one tin of tomatoes costs.

5 tins of beans costs £1.55  
↓ ÷ 5  
1 tin of beans costs £0.31  
↓ × 3  
3 tins of beans costs £0.93

$$2.73 - 0.93 = £1.80$$

£1.80 for 4 tins of tomatoes

$$£1.80 \div 4 = £0.45$$

£0.45

(Total for question 3 is 2 marks)

4 There are 500 sheets in a pack of paper. 500 sheets of paper weigh 2.5kg.

Work out the weight of 50 sheets of paper.

500 sheets weigh 2.5kg  
↓ ÷ 10  
↓

50 sheets weigh 0.25kg

0.25kg

(Total for question 4 is 2 marks)

- 5 It takes 2 painters 4 days to complete a job.

Inverse proportion.  
More painters = Less time.

Work out how many days it would take 1 painter to complete the same job.

2 painters take 4 days

$2 \times 4 = 8$  8 days of work needed.

8

(Total for question 5 is 2 marks)

- 6 It takes 3 machines 2 days to produce a batch of products

Work out how long it would take 1 machine to produce the same batch of products.

$$3 \times 2 = 6$$

6 days of machine work needed

6

(Total for question 6 is 2 marks)

- 7 It takes 3 painters 6 days to complete a job.

Work out how many days it would take 2 painters to complete the same job.

$$3 \times 6 = 18$$

18 days of work needed

$$2 \text{ painters} \quad \frac{18}{2} = 9 \text{ days}$$

9

(Total for question 7 is 2 marks)

- 8 It takes 5 machines 6 hours to produce 1000 DVDs

Work out how long it would take 4 machines to produce 1000 DVDs.

$$5 \times 6 = 30 \text{ machine } \overset{\text{hours}}{\text{days}} \text{ needed}$$

$$\frac{30}{4} = 7.5 \text{ hours}$$

7.5 hours

(Total for question 8 is 2 marks)

9  $x$  is inversely proportional to  $y$ .

$x$  is given by the formula:  $x = \frac{1000}{y}$

Find the value of  $x$  when  $y = 50$

$$x = \frac{1000}{y}$$

$$x = \frac{1000}{50} = 20$$

$$x = \dots 20 \dots$$

(Total for question 9 is 2 marks)

10  $y$  is directly proportional to  $x$ .

$y$  is given by the formula:  $y = 0.4x$

Find the value of  $y$  when  $x = 6$

$$y = 0.4x$$

$$y = 0.4(6)$$

$$y = 2.4$$

$$y = \dots 2.4 \dots$$

(Total for question 10 is 2 marks)

- 11 The weight of a piece of wire ( $w$  grams) is directly proportional to its length ( $l$  cm).

$w$  is given by the formula:  $w = 30l$

Find the length of a wire weighing 75 grams.

$$w = 30l$$
$$75 = 30l$$

$$\frac{75}{30} = l$$

$$l = 2.5$$

$$l = 2.5 \text{ cm}$$

(Total for question 11 is 2 marks)

- 12 The force,  $F$ , between two magnets is inversely proportional to the square of the distance,  $x$  cm, between them.

$F$  is given by the formula:  $F = \frac{36}{x^2}$

Find the Force when two magnets are 3 cm apart.

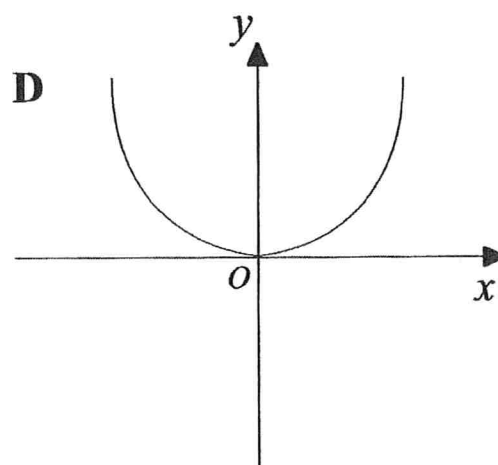
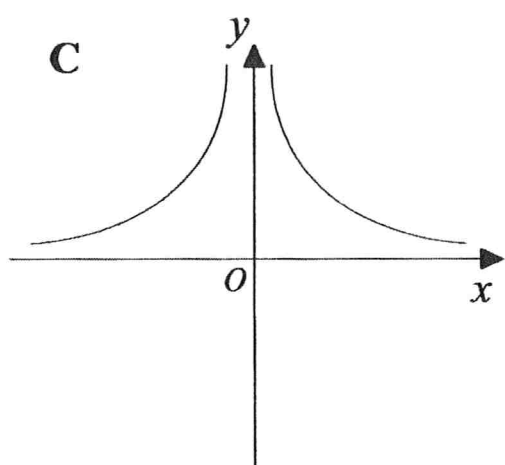
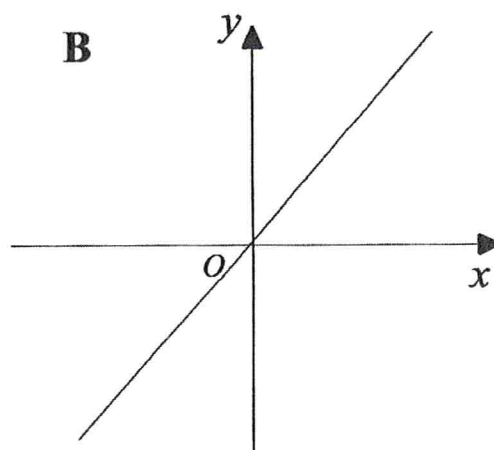
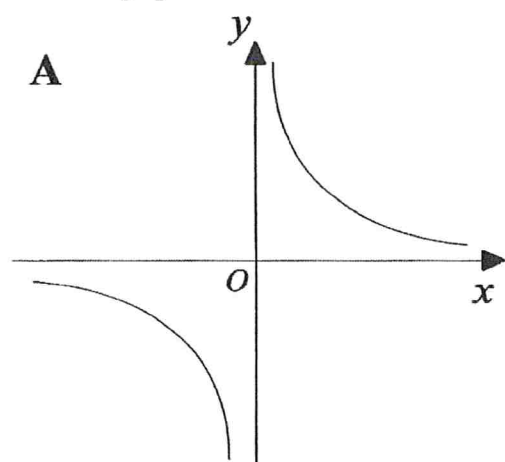
$$F = \frac{36}{x^2}$$
$$= \frac{36}{3^2}$$
$$= \frac{36}{9}$$
$$= 4$$

$$F = 4 \text{ N}$$

(Total for question 12 is 2 marks)



13 Here are four graphs.

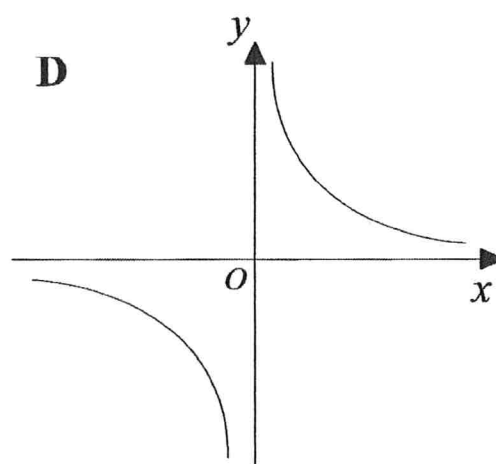
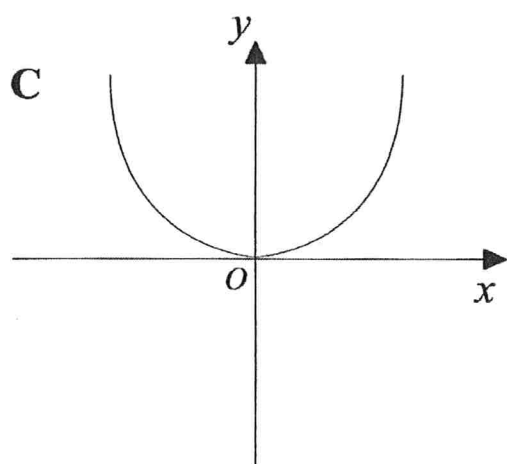
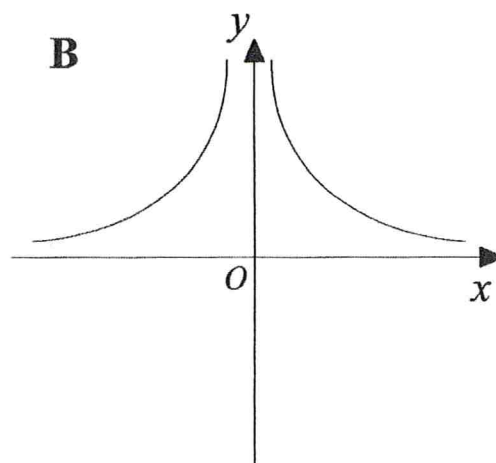
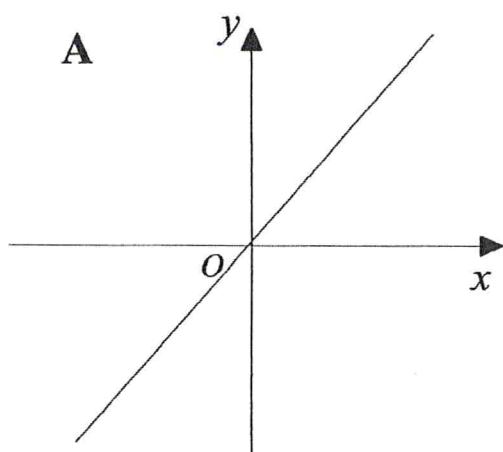


Match each graph with a statement in the table below.

Proportionality relationship	Graph letter
$y$ is directly proportional to $x$	B
$y$ is inversely proportional to $x$	A
$y$ is directly proportional to $x^2$	D
$y$ is inversely proportional to $x^2$	C

(Total for question 13 is 2 marks)

1 Here are four graphs.



Match each graph with a statement in the table below.

**Proportionality relationship**

$y$  is directly proportional to  $x$

$y$  is inversely proportional to  $x$

$y$  is directly proportional to  $x^2$

$y$  is inversely proportional to  $x^2$

**Graph letter**

A

D

C

B

(Total for question 1 is 2 marks)

2  $a$  is directly proportional to  $b$

When  $a = 7$ ,  $b = 28$

Find the value of  $b$  when  $a = 5$

$$a = kb$$
$$7 = k(28)$$

$$k = \frac{7}{28}$$
$$= \frac{1}{4}$$

$$\therefore a = \frac{1}{4}b$$

when  $a = 5$

$$5 = \frac{1}{4}b$$

$$\underline{\underline{b = 20}}$$

$$b = \underline{\underline{20}}$$

(Total for question 2 is 3 marks)

3  $c$  is inversely proportional to  $d$

When  $c = 3$ ,  $d = 8$

Find the value of  $c$  when  $d = 2$

$$c = \frac{k}{d}$$

$$3 = \frac{k}{8}$$

$$k = 24$$

$$\therefore c = \frac{24}{d}$$

when  $d = 2$

$$c = \frac{24}{2}$$

$$= 12$$

$$c = \underline{\underline{12}}$$

(Total for question 3 is 3 marks)

4  $e$  is directly proportional to  $f$

When  $e = 3, f = 36$

Find the value of  $f$  when  $e = 4$

$$e = kf$$

$$3 = k(36)$$

$$k = \frac{3}{36}$$

$$= \frac{1}{12}$$

$$\therefore e = \frac{1}{12}f$$

when  $e = 4$

$$4 = \frac{1}{12}f$$

$$\underline{\underline{f = 48}}$$

$$f = \underline{\underline{48}}$$

(Total for question 4 is 3 marks)

5  $g$  is directly proportional to the square root of  $h$

When  $g = 18, h = 16$

Find the possible values of  $h$  when  $g = 2$

$$g = k\sqrt{h}$$

$$18 = k\sqrt{16}$$

$$18 = k(4)$$

$$k = \frac{18}{4} = \frac{9}{2}$$

$$\therefore g = \frac{9}{2}\sqrt{h}$$

when  $g = 2$

$$2 = \frac{9}{2}\sqrt{h}$$

$$4 = 9\sqrt{h}$$

$$\frac{4}{9} = \sqrt{h}$$

$$h = \frac{16}{81}$$

$$h = \underline{\underline{\frac{16}{81}}}$$

(Total for question 5 is 3 marks)

6  $y$  is inversely proportional to  $x$

When  $y = 15$ ,  $x = 4$

Find the value of  $y$  when  $x = 12$

$$y = \frac{k}{x}$$

$$15 = \frac{k}{4}$$

$$60 = k$$

$$\therefore y = \frac{60}{x}$$

$$\text{when } x = 12 \quad y = \frac{60}{12} = 5$$

$$y = \dots\dots\dots 5$$

(Total for question 6 is 3 marks)

7  $x$  is inversely proportional to the square root of  $y$

When  $x = 12$ ,  $y = 9$

Find the value of  $x$  when  $y = 81$

$$x = \frac{k}{\sqrt{y}}$$

$$12 = \frac{k}{\sqrt{9}}$$

$$12 = \frac{k}{3}$$

$$k = 36$$

$$\therefore x = \frac{36}{\sqrt{y}}$$

$$\text{when } y = 81 \quad x = \frac{36}{\sqrt{81}} = \frac{36}{9} = 4$$

$$x = \dots\dots\dots 4$$

(Total for question 7 is 3 marks)

- 8  $y$  is inversely proportional to the cube of  $x$

When  $y = 250$ ,  $x = 0.2$

Find the value of  $y$  when  $x = 0.5$

$$y = \frac{k}{x^3}$$

$$250 = \frac{k}{(0.2)^3}$$

$$250 = \frac{k}{(1/125)}$$

$$k = 2$$

$$\therefore y = \frac{2}{x^3}$$

when  $x = 0.5$

$$y = \frac{2}{(0.5)^3}$$

$$y = \frac{2}{1/8} = 16$$

$$0.2 = \frac{1}{5}$$

$$(0.2)^3 = \frac{1}{125}$$

$$0.5 = \frac{1}{2}$$

$$0.5^3 = \frac{1}{8}$$

$$y = \dots 16 \dots$$

(Total for question 8 is 3 marks)

- 9  $x$  is directly proportional to the cube of  $y$

When  $x = 32$ ,  $y = 0.4$

Find the value of  $y$  when  $x = 256$

$$x = ky^3$$

$$32 = k(0.4)^3$$

$$32 = \frac{8k}{125}$$

$$k = 500$$

$$\therefore x = 500y^3$$

when  $x = 256$

$$256 = 500y^3$$

$$\frac{256}{500} = y^3$$

$$0.4 = \frac{2}{5}$$

$$0.4^3 = \frac{8}{125}$$

$$y^3 = \frac{64}{125}$$

$$y = \frac{4}{5}$$

$$y = \dots \frac{4}{5} \dots$$

(Total for question 9 is 3 marks)



10 The table shows pairs of values for  $x$  and  $y$

$x$	2	3
$y$	32	72

(i) Tick the correct statement below.

$$y = kx$$

$$32 = 2k$$

$$k = 16$$

and

$$72 = 3k$$

$$k = 24$$

X

$$y = kx^2$$

$$32 = k(4)$$

$$k = 8$$

and

$$72 = k(9)$$

$$k = 8$$

✓

$$y = kx^3$$

$$y \propto x$$
 .....
 
$$y \propto x^2$$
 ..... ✓
 
$$y \propto x^3$$
 .....

(ii) Write a formula for  $y$  in terms of  $x$

$$\underline{\underline{y = 8x^2}}$$

$$y = 8x^2$$

(Total for question 10 is 4 marks)

11 The table shows pairs of values for  $x$  and  $y$

$x$	4	5
$y$	256	500

(i) Tick the correct statement below.

$$y = kx$$

$$256 = k(4)$$

$$k = 64$$

$$500 = k(5)$$

$$k = 100$$

X

$$y = kx^2$$

$$256 = k(16)$$

$$k = 16$$

$$500 = k(25)$$

$$k = 20$$

X

$$y = kx^3$$

$$256 = k(64)$$

$$k = 4$$

$$500 = k(125)$$

$$k = 4$$

✓

$$y \propto x \quad \dots\dots\dots$$

$$y \propto x^2 \quad \dots\dots\dots$$

$$y \propto x^3 \quad \dots\dots\dots \checkmark$$

(ii) Write a formula for  $y$  in terms of  $x$

$$y = 4x^3$$

$$y = 4x^3$$

(Total for question 11 is 4 marks)