



13.1 Direct proportion

Learning objectives:

- To understand the meaning of direct proportion
- To find missing values in problems involving proportion

Keywords	
direct proportion	proportional
scale factor	variable

When you buy petrol you pay a fixed price for each litre. If you buy twice or three times as much, you pay twice or three times as much. This is an example of **direct proportion**.

Two **variables** (such as the number of litres and the price) are in direct proportion if, when you multiply one by a number (such as 2 or 3 or 0.5) you multiply the other by the same number.

Here are some other pairs of variables that are in direct proportion.

- The distance travelled by a car moving at 100 km/hour and the time taken
- The volume of water flowing out of a tap and the time in seconds
- The volume of a fizzy drink and the amount of sweetener in it
- The mass of some loose carrots bought in a shop and the cost in pounds
- The time a light has been on and the cost of the electricity used
- The length of a journey in miles and the length of the same journey in kilometres

Example 1

At a petrol station 15 litres of petrol cost £20.40.

Work out the cost of

- a 30 litres
- **b** 60 litres
- c 5 litres

Answer

It helps to put the numbers in a table.

Petrol (litres)	15	30	60	5
Cost (£)	20.40			

a $30 = 15 \times 2$ The number of litres is multiplied by 2, so the cost is also multiplied by 2.

The cost of 30 litres = £20.40 \times 2 = £40.80.

- **b** $60 = 15 \times 4$ The number of litres is multiplied by 4. The cost of 60 litres = £20.40 × 4 = £81.60.
- **c** $5 = 15 \div 3$ The number of litres is <u>divided</u> by 3. Do the same to the cost.

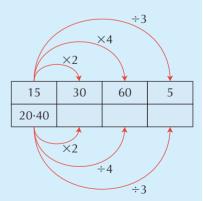
The cost of 5 litres is £20.40 \div 3 = £6.80.

If you multiply or divide the number of litres by any number, you multiply or divide the cost by the same number.

We say that the number of litres and the cost in pounds are directly **proportional**.

Sometimes we leave out the word "directly" and just say they are proportional.

You will learn about another sort of proportion later in this chapter.







Exercise 13A



1 A train is travelling at a constant speed. The distance travelled is proportional to the time taken. In five minutes it travels 13 km. Copy and complete this table.

Time taken (minutes)	5	10	20	30	45
Distance (km)	13				



2 Jacob buys 300 g of carrots and they cost 84 pence.

Work out the cost of

a 600 g of carrotsb 900 g of carrotsc 150 g of carrotsd 100 g of carrots

3 250 ml of cola contains 27 g of sugar.

Work out the amount of sugar in

a 500 ml of cola

b 1 litre of cola

c 2 litres of cola

d 125 ml of cola

4 1.5 kg of flour is enough to make 4 small loaves.

a How much flour is needed to make 16 small loaves?

b How many small loaves can be made from 9 kg of flour?

Five miles is approximately the same as eight kilometres. Copy and complete this table to show equivalent lengths.

miles	5	40	100			
kilometres	8			24	40	200

The perimeter of a circle is called the circumference. The circumference of a circle is proportional to the diameter of the circle. A circle with a diameter of 3.5 m has a circumference of 11 m.

Work out the circumference of a circle with a diameter of

a 7 m

b 10.5 m

c 35 m

d 1.75 m

Water is dripping from a tap at a steady rate. In 15 minutes there are 80 drips.

a Work out the number of drips in one hour.

 ${f b}$ Work out the time taken by 800 drips.

8 In a shop, 100 g of sweets cost 84 pence.

a Work out the cost of

i 300 g of sweets

ii 500 g of sweets

iii 25 g of sweets

b What mass of sweets can you buy for:

i £1.68

ii £8.40

iii 42p?



4

The exchange rate between pounds and US dollars is £41 = \$63. Copy and complete this table.

Pounds	£41	£205		£328	
US dollars	\$63		\$126		\$630



The pressure of a car tyre can be measured in two different units, bar or psi. 2.1 bar is the same as 30 psi. Copy and complete this table to show conversions between the two units.

bar	2.1			8.4	12.6
psi	30	10	20		

- The mass of a steel cable is proportional to its length. Five metres of a particular cable has a mass of 8.2 kg.
 - **a** Work out the mass of 20 metres of the cable.
 - **b** Another cable of the same type has a mass of 49.2 kg. How long is it?
- 12 This table shows the exchange rate between pounds and New Zealand dollars.

Pounds	£50	£150
NZ dollars	\$96	

- **a** Work out the missing value.
- **b** Work out the ratio of the two amounts of pounds.
- **c** Work out the ratio of the two amounts of dollars.



Energy content on food labels is given in two different units, kilocalories (kcal) and kilojoules (kJ). Here is part of a conversion table:

kilocalories	38 kcal	
kilojoules	160 kJ	800 kJ

- a Work out the missing value.
- Show that the ratio of the two amounts of kilojoules is the same as the ratio of the two amounts of kilocalories.



Temperature can be measured in degrees C or degrees F. Here is a table of values.

Degrees C	20	30	50	100
Degrees F	68	86	122	212

Is temperature in degrees C proportional to temperature in degrees F? Give a reason for your answer.

Investigation

This table is from a US website.

It shows the average height and the average mass of a boy at different ages.

Because it is a US website, the heights are in inches and the masses are in pounds.

Age (years)	2	4	6	8
Average height (inches)	31	37	42	45
Average mass (pounds)	28.4	36.0	46.2	57.2

- **a** Is the average height proportional to age? Use numbers from the table to justify your answer.
- **b** Is the average mass proportional to age? Use numbers from the table to justify your answer.
- **c** Is the average mass proportional to the average height? Use numbers from the table to justify your answer.

13.1 Direct proportion



13.2 Graphs and direct proportion

Learning objective:

To represent direct proportion graphically and algebraically

Keywords	
graph	formula

Here is a table to show the relationship between distances measured in miles and in kilometres.

They are in direct proportion.

Distance in miles	20	30	50	60	70	100
Distance in kilometres	32	48	80	96	112	160

We can plot these values on a graph and join them with a line.

You can see two things:

- The points are in a straight line
- The line passes through the origin

A graph of values of two variables in direct proportion always has these properties.

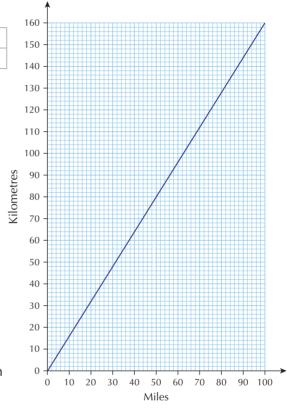
Look at the pairs of values in the table.

Check that
$$20 \times 1.6 = 32$$
 $30 \times 1.6 = 48$ $50 \times 1.6 = 80$ and so on.

If *x* miles is the same as *y* kilometres we can write this formula:

$$y = 1.6x$$

If two variables, x and y, are in direct proportion we can always write a formula y = mx where m is a number.



Example 2

Ribbon is sold by the metre. Lucy buys 6 metres and the cost is £5.04.

- **a** Find a formula for the cost, y pence, of x metres of ribbon.
- $\boldsymbol{b}\,$ Draw a graph to show the cost of different lengths of ribbon.

Answer

a The formula is y = mx and you need to find the number m.

You know that if x is 6 then y is 504.

Notice that y is the cost in pence

$$504 = m \times 6$$

$$m = 504 \div 6 = 84$$

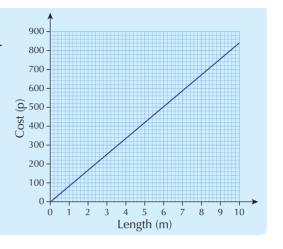
The formula is y = 84x.



b Use the formula to find the costs of different lengths. Multiply the length by 84 to find the cost.Choose some values for the length.

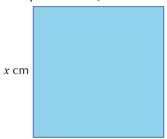
Length (x metres)	1	2	3	5	7	10
Cost (y pence)	84	168	252	420	588	840

Plot the points on graph paper and join them up. The points should be in a straight line. The line should go to the origin.



Exercise 13B

1 The perimeter (y cm) of a square of side x cm is given by the formula y = 4x.



a Complete this table to show values of *x* and *y*.

Side (x cm)	2	5	7	8	10
Perimeter (y cm)					

- **b** Draw a graph to show the values in the table. Label the axes.
- The cost, £y, of x litres of petrol is given by the formula y = 1.3x.
 - **a** Show that 10 litres cost £13.
 - **b** Copy and complete this table.

Petrol (x litres)	10	20	25	30	40
Cost (£y)					

- **c** Draw a graph to show the cost of petrol.
- A 200 ml glass of a fizzy drink contains 20 g of sugar.
 - **a** Copy and complete this table.

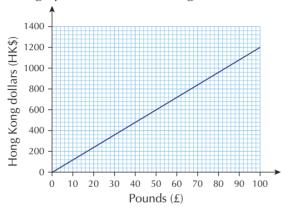
Drink (x ml)	200	100	500	1000
Sugar (y g)	20			

- **b** If x ml of fizzy drink contain y g of sugar, show that y = 0.1x.
- **c** Draw a graph to show the values in the table.

This table shows the price of different masses of potatoes.

Mass (x kg)	0.5	1	1.5	2	3
Price (y pence)		48		96	

- Work out the missing values of y.
- What do you multiply the mass by to find the price?
- Work out a formula for y in terms of x.
- Use the formula to find the cost of 7.5 kg of potatoes.
- Draw a graph to show the cost of potatoes.
- This graph shows the exchange rate between pounds and Hong Kong dollars.



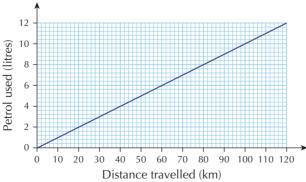
Use the graph to complete this table.

Pounds (£x)	25	50	75	100
Hong Kong dollars (HK\$ <i>y</i>)				

b Work out a formula for *y* in terms of *x*.

Use the formula to change £1270 into Hong Kong dollars.

A car is travelling at 80 km/h. The amount of petrol used for different distances travelled is shown in this graph.



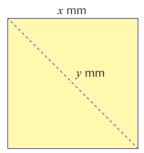
Use the graph to complete this table.

Distance (x km)	30	60	70	85	110
Petrol (y litres)					

- Write a formula for y in terms of x.
- Use your formula to work out the amount of petrol used to travel 430 km.



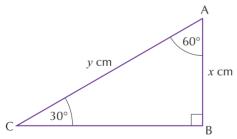
- 7 The speed of a car can be measured in metres per second (m/s) or in kilometres per hour (km/h). 5 m/s is the same as 18 km/h.
 - a Write 10 m/s in km/h.
 - **b** What do you multiply a speed in m/s by to find the speed in km/h?
 - **c** y km/h is the same as x m/s
 - **d** Write down a formula for y in terms of x.
- 8 The lengths of the side and the diagonal of a square are proportional.



a This table shows possible values of *x* and *y*. Fill in the missing values.

Side (x mm)	5	10	15	20	25
Diagonal (y mm)	7				

- **b** Work out a formula for y in terms of x.
- c Use the formula to find the diagonal of a square if the length of the side is
 - i 12 mm
- **ii** 19 mm
- **iii** 31 mm
- 9 The angles of this triangle are 30°, 60° and 90°.



The lengths of AB and AC are proportional.

Here is an incomplete table showing possible values of x and y.

AB (x cm)	4.1	5.2	12.9		
AC (y cm)	8.2			18.8	6.4

- **a** Write down a formula for y in terms of x.
- **b** Work out the missing values in the table.
- **c** Draw your own triangle with angles of 30° , 60° and 90° , like the one in the diagram. Measure x and y and check that they agree with your formula.

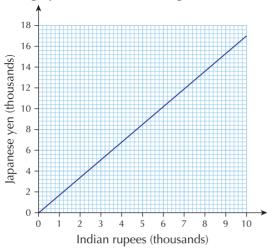






Challenge

This graph shows the exchange rate between two currencies, the Indian rupee and the Japanese yen.



- a Work out a formula connecting the values of the two currencies. Show your method.
- **b** Explain how to use your formula to convert Indian rupees into Japanese yen.
- **c** Could you use your formula to convert Japanese yen into Indian rupees? If so, explain how to do this.

13.3 Inverse proportion



- To understand what is meant by inverse proportion
- To use graphical and algebraic representations of inverse proportion

Keywords	
inverse proportion	formula

A car journey is 120 km.

The time it takes depends on the speed of the car.

If the car travels at 60 km/h the journey will take $120 \div 60 = 2$ hours.

If the car travels at 40 km/h the journey will take $120 \div 40 = 3$ hours.

Here is a table to show the times taken at different speeds.

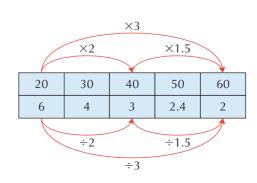
Speed (x km/h)	20	30	40	50	60
Time (y hours)	6	4	3	2.4	2

It you <u>multiply</u> the speed by any number, you <u>divide</u> the time by the same number.

For example,
$$20 \times 2 = 40$$
 and $6 \div 2 = 3$

or
$$40 \times 1.5 = 60$$
 and $3 \div 1.5 = 2$.

x and *y* are in **inverse proportion**.





When two variables are in inverse proportion, if you multiply one by a number you divide the other by the same number.

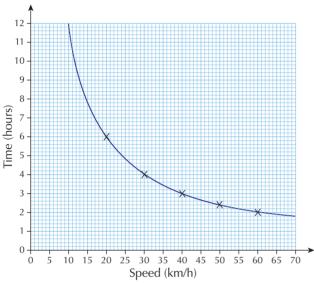
If you multiply the speed by the time then the answer is always 120 because speed \times time = distance.

For example, $20 \times 6 = 120$ or $50 \times 2.4 = 120$.

If the speed is x km/h and the time is y hours, you can write this formula: xy = 120

When x and y are in inverse proportion you can always write a formula xy = k where k is a number.

Here is a graph to show the numbers in the table:



The points are not in a straight line. A smooth curve is drawn through them.

Notice that the curve passes through (10, 12). What does that tell you about a speed and a time? Graphs of inverse proportion are always this shape.

The variables do not have to be x and y. You can use any letters.

Example 3

The area of a rectangular field is 1200 m².

The sides of the field are a metres and b metres long.

Here is a table showing possible sides of the field.

a metres	40	50	
<i>b</i> metres			60

- **a** Find the missing values.
- **b** Work out a formula connecting *a* and *b*.

Answer

a The area of the field is the lengths of the two sides multiplied together.

If
$$a = 40$$
, $40 \times b = 1200 \rightarrow b = 1200 \div 40 = 30$.
If $a = 50$, $50 \times b = 1200 \rightarrow b = 1200 \div 50 = 24$.

If
$$b = 60$$
, $b \times 60 = 1200 \rightarrow b = 1200 \div 60 = 20$.

b The formula is ab = 1200.

In this case the variables, *a* and *b*, are inversely proportional.







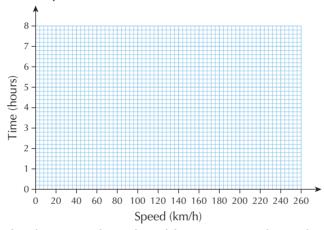


A train is travelling a distance of 600 km.

- a How long does the train take if it travels at 100 km/h?
- **b** If the train travels at 150 km/h, how long will it take?
- **c** Copy and complete this table.

Speed (x km/h)	100	120	150	200	300
Time (y hours)					

- **d** Show that *x* and *y* are inversely proportional.
- **e** Write down a formula connecting *x* and *y*.
- **f** Draw a pair of axes like this.



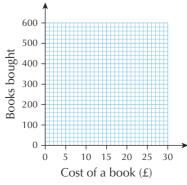
- ${f g}$ Plot the points from the table in part ${f c}$ and join them with a smooth curve.
- 2

A teacher has £1000 to spend on books.

- **a** If books cost £10 each, how many can the teacher buy?
- **b** If books cost £5 each, how many can the teacher buy?
- **c** Copy and complete this table.

Cost of a book (£x)	2	2.50	5	10	20	25
Number bought (y)						

- **d** Show that x and y are inversely proportional.
- **e** Write down a formula connecting *x* and *y*.
- **f** Draw a pair of axes like this.

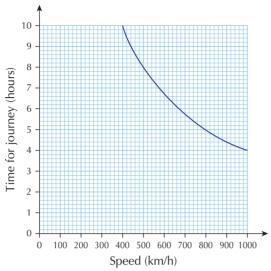


g Draw a graph to show the information in the table.

13 Proportion



3 The graph shows the time taken by a plane to travel between two airports at different speeds.



- a Use the graph to find the time taken if the plane flies at 800 km/h.
- **b** Use the graph the find the speed if the plane takes 4 hours. The time (*y* hours) is inversely proportional to the speed (*x* km/h).
- **c** Use your answers to **a** and **b** to find a formula connecting *x* and *y*.
- 4 Children are measuring the length of a pace and how many paces they take to walk 12 metres.
 - **a** If the length of a pace is 0.5 metres, how many paces are needed to walk 12 metres?
 - **b** Find the missing values in this table.

Length of pace (p metres)	0.5	0.6	1	1.2
Number of paces (n)				

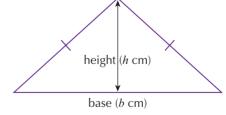
- **c** Show that p and n are inversely proportional.
- **d** Write down a formula connecting p and n.



An isosceles triangle has an area of 100 cm².

The length of the base (b cm) is inversely proportional to the height (h cm).

If the base is 20 cm then the height is 10 cm.



13.3 Inverse proportion

- **a** Write down a formula connecting *b* and *h*.
- **b** Copy and complete this table to show possible values of *b* and *h*.

Base (b cm)	20	16	12	10	8
Height (h cm)	10				

- **c** Draw a graph to show how the height varies with the base.
- **d** Use your graph to find the height if the base is 15 cm.
- **e** Use your formula to check the answer to part **d**.







- Some families want to buy play equipment for their local park. The total cost is £30 000. The families agree to share the cost between them equally.
- **a** If there are 20 families, work out the cost for each family.
- **b** If there are 30 families, work out the cost for each family.
- **c** Copy and complete this table of values.

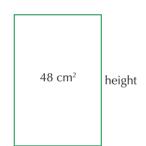
Number of families (n)	10	20	30	40	50	60
Cost for each family (£c)						

- **d** Is the cost for each family inversely proportional to the number of families? Justify your answer.
- **e** Draw a graph to show how the cost varies with the number of families.
- f They decide that each family should not pay more than £800. Use your graph to work out the smallest number of families that are needed.
- **g** Write down a formula connecting n and c and use it to check your answer to part **f**.

Activity

- 1 Draw two different rectangles with an area of 48 cm²
- 2 Copy and complete this table showing possible lengths for the height and base of a rectangle with an area of 48 cm².

Base (x cm)	4	5	6	8	10	12
Height (y cm)						



base

- 3 Draw a graph to show your values.
- 4 Write down a formula to show the connection between *x* and *y*.

5 Use your graph to find the length of the side of a square with an area of 48 cm².

13.4 Comparing direct proportion and inverse proportion

Learning Objective:

To recognise direct and inverse proportion and work out missing values

You have learnt about direct proportion and inverse proportion. Here is a summary.

Direct proportion

x	3	4.5	6	15	20
y	24	36	48	120	160

x and y are directly proportional

If you multiply (or divide) a value of x by a number, you multiply (or divide) y by the same number.

You can always write y = mx where m is a number.

In this example y = 8x.



х	3	4.5	6	15	20
y	24	16	12	4.8	3.6

x and y are inversely proportional

If you multiply a value of *x* by a number, you divide *y* by the same number.

You can always write xy = k where k is a number.

In this example xy = 72.

Check that each pair of numbers does multiply to make 72.

Example 4

Here are the values of two variables, p and q.

p	20	50
q	90	

a Find the missing value if q is directly proportional to p.

b Find the missing value if q is inversely proportional to p.

Answer

a
$$q \div p = 90 \div 20 = 4.5$$
 So $q = 4.5p$
If $p = 50$ then $q = 4.5 \times 50 = 225$

b
$$pq = 20 \times 90 = 1800$$

If
$$pq = 1800$$
 and $p = 50$ then $50 \times q = 1800 \rightarrow q = 1800 \div 50 = 36$

Exercise 13D

- 1 George is walking at a constant speed. In 5 minutes he walks 400 metres.
 - **a** Is the distance travelled (*d* metres) proportional to the time taken (*t* minutes)?
 - **b** Write down a formula for *d* in terms of *t*.
 - ${f c}$ Use the formula to work out how far George walks in 8.5 minutes.
- 2 Anne is doing a sponsored walk of 20 km.
 - **a** If she walks at 5 km/ h how long will it take?
 - **b** If she walks at 8 km/ h how long will it take?
 - **c** Explain why the time taken (*t* hours) is inversely proportional to her walking speed (*w* km/h).
 - **d** Write down a formula connecting t and w.













Here are some tables of values. In each case, say whether they show direct proportion, inverse proportion or neither of these. Give a reason in each case. If the variables are directly or inversely proportional, work out the formula.

a	x	12	17	5	14
	у	36	51	20	42

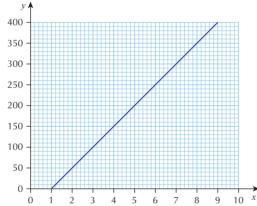
b	c	18	30	12	1.5
	d	5	3	7.5	60

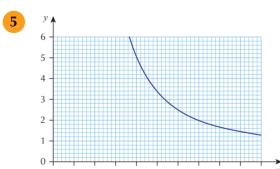
C	f	5.6	9.4	63.8	3.6
	r	75.6	126.9	861.3	48.6

d	и	12	16	14.8	46.25
	w	12	9	10	3.2

MR

How can you tell that this graph does not show direct proportion?

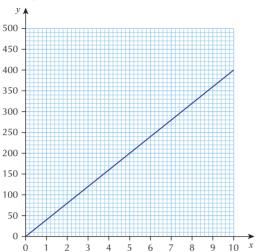




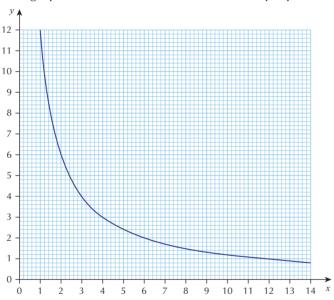
- **a** Two points on this line are (4,) and (7,). Find the missing y coordinates.
- **b** Show that x and y are <u>not</u> in inverse proportion.
- 6 x and y are two variables.
 - **a** They are in direct proportion and when x = 40, y = 10. Work out a formula for y in terms of x.
 - **b** They are in inverse proportion and when x = 40, y = 10. Work out a formula connecting x and y.



7 This graph shows two variables in direct proportion.



- a Write down the coordinates of two points on the line.
- **b** Work out a formula for y in terms of x.
- 8 This graph shows two variables in inverse proportion.



- a Write down the coordinates of three points on the line.
- **b** Work out a formula for *y* in terms of *x*.

Reasoning

The perimeter of a rectangle is 20 cm.

- **a** If one side of the rectangle is 3 cm, show that the other side is 7 cm.
- **b** Work out three other pairs of values for the two sides of the rectangle.
- **c** Draw a graph to show the pairs of values and draw a line through them.
- **d** Are the lengths of the two sides in direct proportion? Justify your answer.
- **e** Are the lengths of the two sides in inverse proportion? Justify your answer.

13.4 Comparing direct proportion and inverse proportion



Ready to progress?

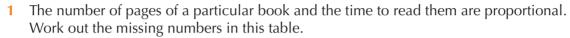


I can decide whether two variables are in direct proportion or inverse proportion



I can find a formula for two variables in direct proportion
I can recognise and draw a graph for two variables in direct proportion
I can find a formula connecting two variables in inverse proportion
I can recognise and draw a graph for two variables in inverse proportion

Review questions



Number of pages	20	40	100
Time to read them (minutes)	17 minutes		

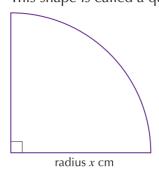
A rectangle where the length is 1.6 times the width is called a "Golden Rectangle". Copy and complete this table to show some possible sizes for a "Golden Rectangle".

Length	5 cm	20 cm	50 cm	1.5 m	4 m
Width					

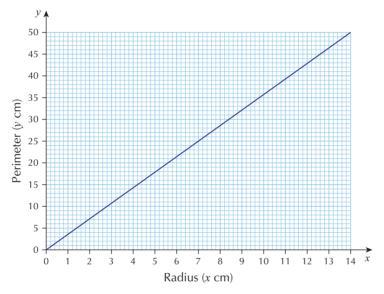
- 3 The mass of five maths text books is 3.48 kg. Work out the mass of
 - a 10 books
- b 20 books
- c 200 books
- 4 The cost of oranges is proportional to the number bought. Eight oranges cost £2.24. Work out the cost of
 - a 16 oranges
- **b** 24 oranges
- c 4 oranges
- 5 The average cost of heating the water for a shower is £0.20.
 - a Work out the cost, in pounds of
 - i 7 showers (one each day for a week) ii 30 showers (one each day for a month)
 - iii 365 showers (one each day for a year)
 - **b** Write down a formula for the cost $(\pm c)$ of n showers.
- 6 The cost of a taxi journey is proportional to the distance travelled.
 - a Work out the missing values in this table.

Distance (x km)	4	8	20	2
Cost (£y)	14			

- b Work out a formula for the cost (£y) of travelling x kilometres.
- **c** Draw a graph to show the values in the table.



This graph shows the perimeter (y cm) of a quadrant of radius x cm.



- **a** Explain why the graph shows that the perimeter of the quadrant is proportional to the radius.
- **b** Find the perimeter of a quadrant of radius 10 cm.
- \mathbf{c} Work out a formula for the perimeter (y cm) of the quadrant in terms of the radius (x cm).
- **d** Use your formula to find the perimeter of a quadrant of radius 43 cm.
- 8 A survey of one hundred 50-year olds shows that 27 of them wear glasses. If the sample in the survey is a fair representation of all 50-year olds, how many out of 2000 do you expect will wear glasses?
- **9** The time taken to complete a rail journey is inversely proportional to the average speed of the train. At a speed of 100 km per hour the journey takes 4.5 hours. Find the missing values in this table.

Speed (km/h)	100	50	150	
Time (hours)	4.5			

- 10 The time to walk to the end of a playing field is inversely proportional to walking speed. Amelia walks at 1.6 m/s and takes 200 seconds.
 - a Lily walks at 0.8 m/s. How long does she take?
 - **b** Emily runs at 4.8 m/s. How long does she take?



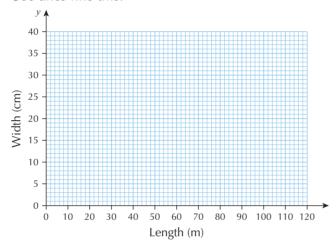




11 Here are the lengths and widths of four rectangles with the same area.

Length (x cm)	120	100	80	60
Width (y cm)	10	12	15	20

- a Show that the length is inversely proportional to the width.
- b The length of a fifth rectangle is 40 cm. Work out the width.
- **c** Work out a formula connecting *x* and *y*.
- **d** Use the dimensions of the five rectangles to draw a graph to show values of *x* and *y*. Use axes like this:



12 A fence is being put along one side of a school playground.



The fence is made from separate panels. The number of panels needed is inversely proportional to the length of each panel.

a Work out the missing numbers in the table.

Length of panel (l m)	1.2	1.5	1.8	2.4	3.0
Number of panels (n)	150	120			

b Work out a formula connecting l and n.

13 Proportion

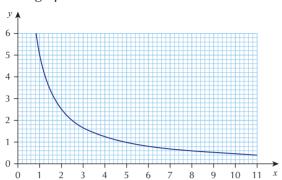
20







13 This graph shows the values of two variables in inverse proportion.



- a Find the missing coordinate for these points on the line:
 - **i** (5,)
- **ii** (10,)
- iii (2,)
- iv (....,1)
- **b** Work out a formula connecting *x* and *y*.
- c Use your formula to find the value of y if x = 25.
- **14** Here is a table of values of r and s.

r	12	48
	8	?

- a If s is directly proportional to r, work out the missing value of s.
- **b** If s is <u>inversely</u> proportional to r, work out the missing value of s.





A Grand Day Out

A youth leader is planning a coach trip for some youth club members.

1. Cost of the coach

The total cost of the coach is £800.

This must be shared equally by the people on the coach.

a Copy and complete this table.

Number of passengers (x)	50	40	32	25	20
Cost for each person (£y)					

- **b** Show that the number of passengers and the cost per person are in inverse proportion.
- **c** Draw a graph to show how the cost per person varies with the number of people.
- 2. Time and distance

On the motorway the coach travels at a constant speed of 90 km/h.

- **a** How far does the coach travel in 30 minutes on the motorway?
- **b** How far does the coach travel in 10 minutes on the motorway?
- c Copy and complete this table.

Time (minutes)	10	20	30	40	50	60
Distance (km)						

- **d** Is the distance proportional to the time? Justify your answer.
- **e** Draw a graph to show the data in the table.
- 3. Speed and time

The time to complete the whole journey is inversely proportional to the average speed.

a Complete this table

Average speed (x km/h)	50	60	75	80	100
Time (y hours)	4.8	4			

- **b** Write down a formula connecting *x* and *y*.
- **c** Draw a graph to show how the time varies with the average speed.



4. Fuel consumption

The amount of fuel the coach uses varies with the distance.

Look at the data in this table. It shows the fuel used when the coach is travelling on the motorway at 90 km/h.

Fuel used (flitres)	46	82	14
Distance travelled (d km)	115	205	35

a Is the relationship between fuel used and distance travelled:

direct proportion inverse proportion neither of these?

b Use your answer to part a to write a formula for *d* in terms of *f*.

The fuel consumption of the coach is measured in litres per kilometre (l/km).

The fuel consumption varies with speed.

Look at the data in this table.

Speed (km/h)	50	60	70
Fuel consumption (I/km)	3.2	2.6	2

c Is the relationship between speed and fuel consumption:

direct proportion

inverse proportion neither of these?

Give a reason for your answer.

