DIRECT AND INVERSE PROPORTION ON GRAPHS
Ratio and Proportion

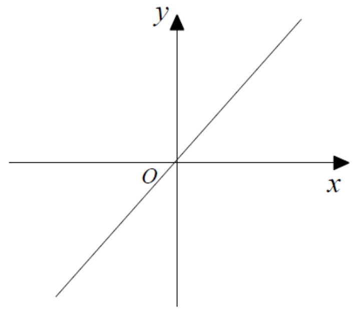
Key Concepts

Variables are **directly proportional** when the **ratio is constant** between the quantities.

Variables are **inversely proportional** when **one quantity increases in proportion to the other decreasing.**

Direct and inverse proportion can also be represented on **graphs**.

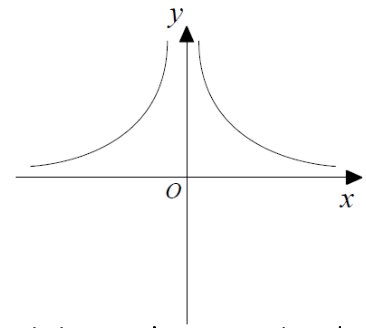
Examples



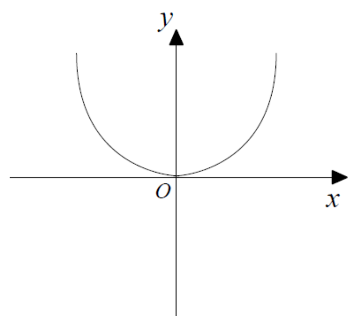
$y \propto x$

y is directly proportional to x

$y \propto \frac{1}{x}$



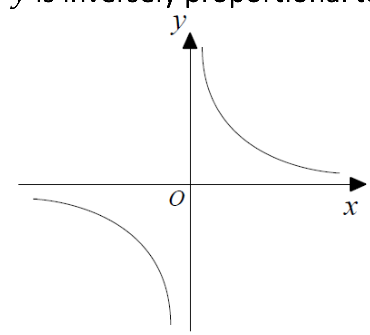
y is inversely proportional to x



$y \propto x^2$

y is directly proportional to x^2

$y \propto \frac{1}{x^2}$



y is inversely proportional to x^2

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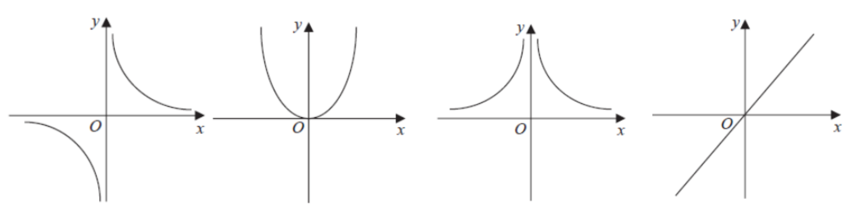
Key Words

Direct
Inverse
Proportion
Graph



Graph A Graph B Graph C Graph D

Match the correct graph to each statement:

Proportionality relationship	Graph letter
y is directly proportional to x	
y is inversely proportional to x	
y is proportional to the square of x	
y is inversely proportional to the square of x	

ANSWERS

DIRECT AND INVERSE PROPORTION USING ALGEBRA

Ratio and Proportion

Key Concepts

Variables are **directly proportional** when the **ratio is constant** between the quantities.

Variables are **inversely proportional** when **one quantity increases in proportion to the other decreasing.**

α is the symbol we use to show that one variable is in proportion to another.

Direct proportion: $y \propto x$

Inverse proportion: $y \propto \frac{1}{x}$

Examples

Direct proportion:

g is directly proportional to the square root of *h*
When *g* = 18, *h* = 16
Find the possible values of *h* when *g* = 2

$$g \propto \sqrt{h}$$
$$g = k\sqrt{h}$$
$$18 = k\sqrt{16}$$
$$18 = 4k$$
$$4.5 = k$$
$$g = 4.5\sqrt{h}$$

$$g = 4.5\sqrt{h}$$
When $g = 2$
$$2 = 4.5\sqrt{h}$$
$$\frac{2}{4.5} = \sqrt{h}$$
$$\left(\frac{4}{9}\right)^2 = h$$
$$\frac{16}{81} = h$$

Inverse proportion:

The time taken, t, for passengers to be checked-in is inversely proportional to the square of the number of staff, s, working.
It takes 30 minutes passengers to be checked-in when 10 staff are working. How many staff are needed for 120 minutes?

$$t \propto \frac{1}{s^2}$$
$$t = \frac{k}{s^2}$$
$$30 = \frac{k}{10^2}$$
$$3000 = k$$
$$t = \frac{3000}{s^2}$$

$$t = \frac{3000}{s^2}$$
$$120 = \frac{3000}{s^2}$$
$$s^2 = \frac{3000}{120}$$
$$s^2 = 25$$
$$s = \sqrt{25}$$
$$s = 5$$

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Key Words

Direct
Inverse
Proportion
Divide
Multiply
Constant

1) *e* is directly proportional to *f*
When $e = 3$, $f = 36$
Find the value of *f* when $e = 4$

2) *x* is inversely proportional to the square root of *y*.
When $x = 12$, $y = 9$
Find the value of *x* when $y = 81$

ANSWERS 1) $f = 48$ 2) $x = 4$

DIRECT AND INVERSE PROPORTION
Ratio and Proportion

Key Concepts

Variables are **directly proportional** when the **ratio is constant** between the quantities.

Variables are **inversely proportional** when **one quantity increases in proportion to the other decreasing.**

Examples

Direct proportion:

Value of A	32	P	56	20	72
Value of B	20	30	35	R	45

Ratio constant: $20 \div 32 = \frac{5}{8}$

From A to B we will multiply by $\frac{5}{8}$.

From B to A we will divide by $\frac{5}{8}$.

$P = 30 \div \frac{5}{8} = 48$

$R = 20 \times \frac{5}{8} = 12.5$

Inverse proportion:

÷5

×2

Value of A	10	20	14	R	28
Value of B	14	P	10	70	5

÷2

×5

P = 7

R = 2

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Key Words

Direct
Inverse
Proportion
Divide
Multiply
Constant

Complete each table:

1) Direct proportion

Value of A	5	P	22
Value of B	9	28.8	Q

2) Inverse proportion

Value of A	4	P	18
Value of B	9	3	Q

ANSWERS 1) P = 16, Q = 39.6 2) P = 12, Q = 2

RATIO AND DIRECT PROPORTION

Ratio and Proportion

Key Concepts

To calculate the **value** for a single item we can use the **unitary method**.

When working with best value in monetary terms we use:

$$Price\ per\ unit = \frac{price}{quantity}$$

In recipe terms we use:

$$Weight\ per\ unit = \frac{weight}{quantity}$$

If 20 apples weigh 600g. How much would 28 apples weigh?

600 ÷ 20 = 30g weight of 1 apple
28 × 30 = **840g**

Box A has 8 fish fingers costing £1.40.
Box B has 20 fish fingers costing £ 3.40.
Which box is the better value?

$$A = \frac{£1.40}{8} = £0.175 \qquad B = \frac{£3.40}{20} = £0.17$$

Therefore Box B is better value as each fish finger costs less.

Examples

The recipe shows the ingredients needed to make 10 Flapjacks.
How much of each will be needed to make 25 flapjacks?

Ingredients for 10 Flapjacks

80 g rolled oats

60 g butter

30 *ml* golden syrup

36 g light brown sugar

Method 1: Unitary

80 ÷ 10 = 8
8 × 25 = **200g**

30 ÷ 10 = 3
3 × 25 = **75g**

60 ÷ 10 = 6
6 × 25 = **150g**

36 ÷ 10 = 3.6
3.6 × 25 = **90g**

Method 2: 5 flapjacks

80 ÷ 2 = 40
40 × 5 = **200g**

30 ÷ 2 = 15
15 × 5 = **75g**

60 ÷ 2 = 30
30 × 5 = **150g**

36 ÷ 2 = 18
18 × 5 = **90g**

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Key Words

Unitary

Best Value

Proportion

Quantity

Ingredients
to make **16** gingerbread men

180 g	flour
40 g	ginger
110 g	butter
30 g	sugar

1) How much will we need to make 24 gingerbread men?

2) Packet A has 10 toilet rolls costing £3.50.
Packet B has 12 toilet rolls costing £3.60.
Which is better value for money?

3) If 15 oranges weigh 300g. What will 25 oranges weigh?

ANSWERS 1) 270g flour, 60g ginger, 165g butter, 45g sugar 2) Packet B 30p per roll 3) 500g