

GCSE Maths – Ratio, Proportion and Rates of Change

Direct and Inverse Proportion

Worksheet

NOTES



SOLUTIONS



This worksheet will show you how to work out different types of direct and inverse proportion questions. Each section contains a **worked example**, a **question with hints** and then **questions for you to work through** on your own.

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Section A

Worked Example

10 apples cost £2.40, how much will it cost to buy 9 apples?

Step 1: Find the cost of one apple

$$2.40 \div 10 = 0.24$$

$$\div 10 \quad \left(\begin{array}{l} 10 \text{ apples : } \pounds 2.40 \\ 1 \text{ apple : } \pounds 0.24 \end{array} \right) \div 10$$

Step 2: Find the cost of 9 apples

$$0.24 \times 9 = 2.16$$

$$\times 9 \quad \left(\begin{array}{l} 1 \text{ apple : } \pounds 0.24 \\ 9 \text{ apples : } \pounds 2.16 \end{array} \right) \times 9$$

9 apples cost £2.16

Guided Example

5 bananas cost £3.60, how much will it cost to buy 7 bananas?

Step 1: Find the cost of one banana

Step 2: Find the cost of 7 bananas



Now it's your turn!

If you get stuck, look back at the worked and guided examples.

1. 6 pens cost £2.16. Calculate the cost of 12 pens.
2. 8 water bottles cost £20. Calculate the cost of 13 water bottles.
3. Maya buys 7 nail polishes for £10.57. Calculate the cost of 15 nail polishes.
4. Raf bought 9 earrings for £9.81. Ayushi bought 7 earrings for £7.42. Who got the better value?



Section B

Worked Example

**A is directly proportional to the square root of B . When $A = 16$, $B = 16$.
Find A when $B = 81$.**

Step 1: Write an equation involving k

$$A \propto \sqrt{B}$$
$$A = k\sqrt{B}$$

Step 2: Substitute the known values into the equation

$$A = k\sqrt{B}$$
$$16 = k\sqrt{16}$$

Step 3: Solve for k

$$16 = k\sqrt{16}$$
$$16 = 4k$$
$$k = 4$$

Step 4: Express A in terms of B

$$A = 4\sqrt{B}$$

Step 5: Find the value for A

$$A = 4\sqrt{81}$$
$$A = 4 \times 9$$
$$A = 36$$



Guided Example

T is directly proportional to the square of U . When $T = 16$, $U = 2$.
Find U when $T = 64$.

Step 1: Write an equation involving k

Step 2: Substitute the known values into the equation

Step 3: Solve for k

Step 4: Express T in terms of U

Step 5: Find the value for U



Now it's your turn!

If you get stuck, look back at the worked and guided examples.

- X is directly proportional to the square of Y . When $X = 50$, $Y = 5$.
Find X when $Y = 3$.

- C is directly proportional to the cube root of D . When $C = 32$, $D = 8$.
Find D when $C = 16$.

- P is directly proportional to the Q . When $P = 14$, $Q = 5$.
Find Q when $P = 6$.

- Lauren is paid £225 for 25 hours of work. Use direct proportion to calculate how much she is paid for 30 hours of work.



Section C

Worked Example

The time taken (t) for customers to be served is inversely proportional to the square root of the number of waiters (w) working. It takes 10 min to be served when there are 4 waiters working. Find t in terms of w .

Step 1: Write an equation involving k .

$$t \propto \frac{1}{\sqrt{w}}$$

$$t = \frac{k}{\sqrt{w}}$$

Step 2: Substitute the known values into the equation

$$t = \frac{k}{\sqrt{w}}$$

$$10 = \frac{k}{\sqrt{4}}$$

Step 3: Solve for k .

$$10 = \frac{k}{\sqrt{4}}$$

$$10 = \frac{k}{2}$$

$$k = 20$$

Step 4: Express t in terms of w

$$t = \frac{20}{\sqrt{w}}$$



Guided Example

T is inversely proportional to the square of U . When $T = 7$, $U = 3$.
Find T when $U = \sqrt{21}$.

Step 1: Write an equation involving k .

Step 2: Substitute the known values into the equation.

Step 3: Solve for k .

Step 4: Express T in terms of U .

Step 5: Find the value for U .



Now it's your turn!

If you get stuck, look back at the worked and guided examples.

9. X is inversely proportional to the square of Y . When $X = 2$, $Y = 5$.
Find X when $Y = \sqrt{10}$.
10. C is inversely proportional to the cube root of D . When $C = 4$, $D = 8$.
Find D when $C = 2$.
11. P is inversely proportional to the Q . When $P = 34$, $Q = 9$. Find Q when $P = 5$
12. The number of days (d) to complete a bedroom renovation is inversely to the square of the number of workers (w). It takes 25 days for 2 workers to complete it. Calculate to the nearest day, how long it would take 10 workers to complete the job.

