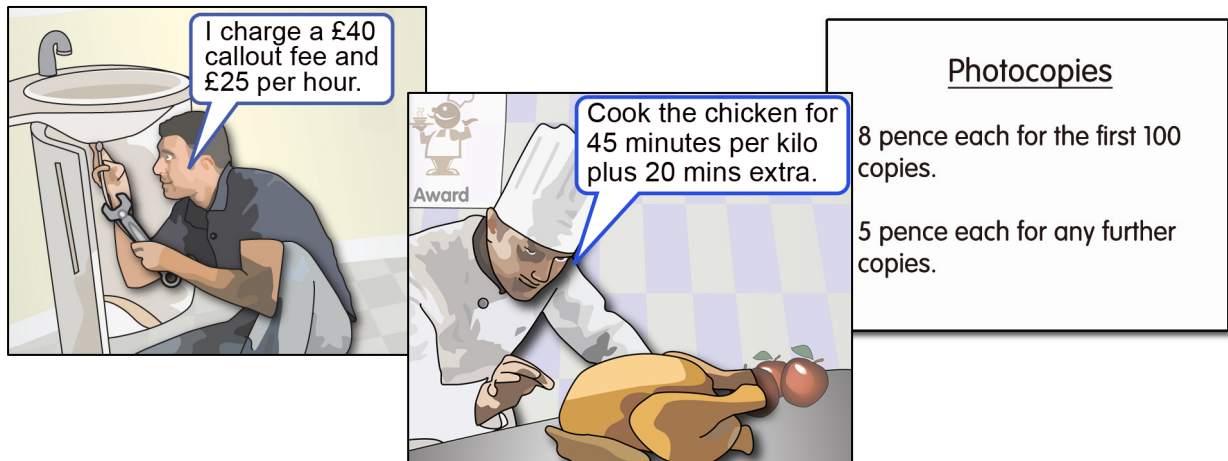


Formulae expressed in words

Introduction

A **formula** is a rule that tells you the relationship between numbers or quantities.

The examples below are all of mathematical formulae expressed in words rather than numbers and symbols.



If you are talking about more than one formula, you can say either **formulas** or **formulae**.

This activity looks at how to work with formulae that are written in words.

You will learn how to:

- translate word formulae into numbers and symbols
- tackle formulae problems step by step.

- You can use a calculator.
- Read the introduction and the 'learn about' examples carefully before you try the practice questions.
- Write down all your working out. If you do not have enough space to do this, ask for extra paper.
- You should show evidence that you have checked your work in your working out.
- You can then give this to your tutor if you are not sure about your answers.

When you have finished, **check your answers** with the ones provided on page 9.

Formulae expressed in words

Learn about simple formulae

When you work with a formula that includes words, you need to:

- break the formula down into steps if needed
- translate each step into numbers and symbols
- work out the answers to each step.

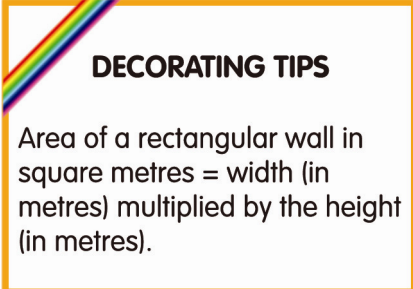
Look at these examples:

Example A

What is the area of a wall that is 3 m high and 5 m wide?

$$5 \text{ m} \times 3 \text{ m} = 15 \text{ m}^2$$

Answer: The wall has an area of 15 m².



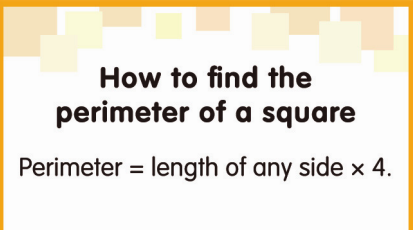
DECORATING TIPS
Area of a rectangular wall in square metres = width (in metres) multiplied by the height (in metres).

Example B

You build a square pond in your garden. The length of one side is 1.5 metres. What is the perimeter of the pond?

$$1.5 \text{ m} \times 4 = 6 \text{ m}$$

Answer: The perimeter of the pond is 6 m.

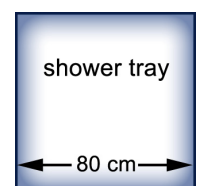


How to find the perimeter of a square
Perimeter = length of any side × 4.

Practice 1

Use the formulae above to help you answer the questions.

- One side of your square vegetable plot is 6 m. You want to enclose the plot with border edging. How much border edging do you need to buy?
- You ask a decorator to paint one wall of your room blue. The wall is 2.3 metres high and 4 metres wide. What is the area of the wall?
- You need to put sealant tape round the edge of a square shower tray. How much tape do you use?



Formulae expressed in words

Learn more about simple formulae

Now look at these further examples.

Example A

How much does it cost for seven A4 photocopies?

$$7 \times 8p = 56p$$

Answer: 7 A4 copies will cost 56p.

QUICK COPY SHOP

A4 photocopies cost 8 pence each for the first 100 copies and then it is 5 pence each for any further copies.

A3 photocopies cost 15 pence each for any number of copies.

Example B

There is a special offer at the Quick Copy Shop: 2p off each A4 photocopy (maximum of 100 copies). What is the cost of 45 A4 copies?

You will need to change the formula before you start to work out the answer.

A4 Photocopies cost 6 pence each for the first 100 copies, and then it is 5 pence each for any further copies.

So the formula becomes:

$$45 \times 6p = 270p \text{ (or } \pounds 2.70)$$

Answer: 45 copies will cost £2.70.

Practice 2

Use the Quick Copy Shop poster to answer the questions.

- a. How much does it cost for 60 A3 photocopies?

- b. You need 90 A4 photocopies. What will this cost?

- c. The Quick Copy shop has had to increase its prices. Each A4 copy now costs 1p more (any amount of copies). How much will it cost for 21 A4 copies?

Formulae expressed in words

Learn about longer formulae

When you work with longer word formulae you need to:

- translate each step into numbers and symbols
- work out the answers to each step
- put the steps in the correct order before working out the final answer.

Example

What is the total preparation time for a rare steak?

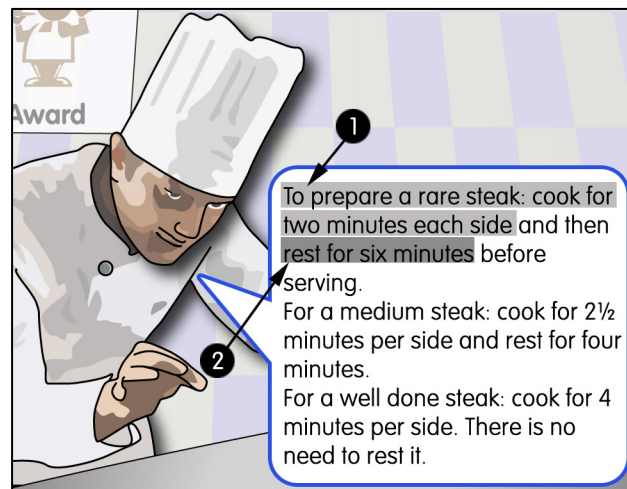
This is a two-step problem.

The steak has two 'sides' so

Step 1 2×2 minutes = 4 minutes
(cooking time)

Step 2 4 minutes + 6 minutes (rest time)
= 10 minutes

Answer: It takes 10 minutes to prepare a rare steak.



Practice 3

Use the chef's formulae above and on page 1 to answer the questions.

- How long does it take to prepare a medium steak?
- You have a small 1-kilogram chicken. How long will it take to cook?

Formulae expressed in words

Learn about longer formulae

In this example, the formula uses words, numbers and symbols. If a formula includes brackets, you must work out the answer to what is in the brackets first.

Example

What is the perimeter of a rectangular room that is 4 m long and 3 m wide?

This is a two-step problem.

Step 1 $4\text{ m} + 3\text{ m} = 7\text{ m}$

Step 2 $2 \times 7\text{ m} = 14\text{ m}$

Answer: The room has a perimeter of 14 m.

How to find the perimeter of a rectangle

$$\text{Perimeter of a rectangle} = 2 \times (\text{length} + \text{width})$$

2

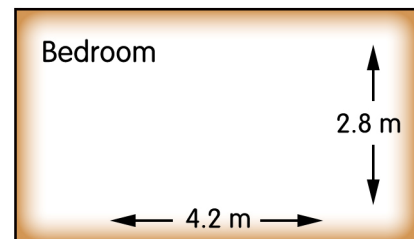
1

Do the work inside the brackets first.

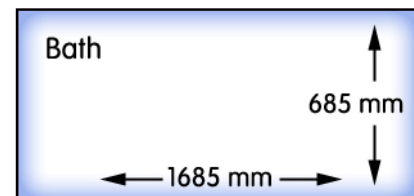
Practice 4

Use the formula above to help you answer these questions.

- a. You want to put a border around the top of your bedroom wall – just below the ceiling. What length of border paper will you need?



- b. You put sealant tape round the edges of a rectangular bath. How much tape do you use? Give your answer in metres.



Formulae expressed in words

Apply your skills

In this section, you will apply what you have learnt to other real-life situations.

Blue Cab rates
06.00 – 19.00 Minimum charge £1.80 Plus 90p per mile
19.00 – 23.00 Minimum charge £2.20 Plus £1.00 per mile
23.00 – 06.00 Minimum charge £2.20 Plus £1.30 per mile



Use the formulae above to answer these questions.

- You hail a cab at 3.30 p.m. for a 5-mile trip. Calculate the fare.
- How much do Blue Cab charge for a 6-mile trip at midnight?
- Calculate the cooking time for a large 3.4kg chicken.
- You have a blocked pipe. The plumber takes 3 hours to fix it. Calculate the cost.

Formulae expressed in words

Check your skills

1. Perimeter of a rectangle = $2 \times (\text{length} + \text{width})$

A rectangle is 8 cm long and 13 cm wide. The perimeter is:

- a. 34 cm
- b. 29 cm
- c. 42 cm
- d. 23 cm

2. Area of a rectangle = $\text{length} \times \text{width}$

A rectangle is 45 cm long and 3 cm wide. The area is:

- a. 48 cm^2
- b. 42 cm^2
- c. 145 cm^2
- d. 135 cm^2

3. Roast beef: cook for 35 minutes per kilogram plus 15 minutes

A 3kg joint of beef will cook in:

- a. 50 minutes
- b. 80 minutes
- c. 120 minutes
- d. 105 minutes

4. Emergency electrician: £50 callout charge plus £42 per hour

The electrician stays for 2 hours. The bill is:

- a. £92
- b. £134
- c. £142
- d. £ 84

5. Bloxford bus company: a child's bus fare is half the adult fare plus 20p

An adult fare to Bloxford is £3.28, so a child's fare to Bloxford is:

- a. £1.84
- b. £1.74
- c. £1.64
- d. £3.08

Formulae expressed in words

Answers

You might have the correct answer but used a different method from the one shown in the answers. Talk to your tutor if you are confused.

Practice 1 (page 2)

- a. $6 \text{ m} \times 4 = 24 \text{ m}$
- b. $4 \text{ m} \times 2.3 \text{ m} = 9.2 \text{ m}^2$
- c. $80 \text{ cm} \times 4 = 320 \text{ cm}$ (or 3.2 m)

Practice 2 (page 3)

- a. $60 \times 15\text{p} = 900\text{p}$ (or £9.00)
- b. $90 \times 8\text{p} = 720\text{p}$ (or £7.20)
- c. $21 \times 9\text{p} = 189\text{p}$ (or £1.89)

Practice 3 (page 4)

- a. $(2\frac{1}{2} \text{ mins} \times 2) + 4 \text{ mins} = 5 \text{ mins} + 4 \text{ mins} = 9 \text{ minutes}$
- b. $(1 \times 45 \text{ mins}) + 20 \text{ mins} = 45 \text{ mins} + 20 \text{ mins} = 65 \text{ minutes}$

Practice 4 (page 5)

- a. $(4.2 \text{ m} + 2.8 \text{ m}) \times 2 = 7 \text{ m} \times 2 = 14 \text{ m}$
- b. $(685 \text{ mm} + 1685 \text{ mm}) \times 2 = 2370 \text{ mm} \times 2 = 4740 \text{ mm} = 4.74 \text{ m}$

Practice 5 (page 6)

- a. $100 \times 8\text{p} = £8.00$
 $200 \times 5\text{p} = £10.00$
 So total cost = £8 + £10 = £18
- b. $(36 \times 15\text{p}) + (100 \times 8\text{p}) + (8 \times 5\text{p}) = 540\text{p} + 800\text{p} + 40\text{p} = 1380\text{p} = £13.80$

Apply your skills (page 7)

- a. $£1.80 + (5 \times 90\text{p}) = £1.80 + £4.50 = £6.30$
- b. $£2.20 + (6 \times £1.30) = £2.20 + £7.80 = £10.00$
- c. $(45 \text{ min} \times 3.4) + 20 \text{ min} = 153 \text{ min} + 20 \text{ min} = 173 \text{ minutes}$
- d. $£40 + (£25 \times 3) = £40 + £75 = £115$

Check your skills (page 8)

- 1. c. $2 \times (8 \text{ cm} + 13\text{cm}) = 2 \times 21 \text{ cm} = 42 \text{ cm}$
- 2. d. $45 \text{ cm} \times 3 \text{ cm} = 135 \text{ cm}^2$
- 3. c. $(3 \times 35 \text{ min}) + 15 \text{ min} = 105 \text{ min} + 15 \text{ min} = 120 \text{ minutes}$ (or 2 hours)
- 4. b. $£50 + (£42 \times 2) = £50 + £84 = £134$
- 5. a. $(£3.28 \div 2) + 20\text{p} = £1.64 + 20\text{p} = £1.84$