

# Introduction

Welcome to Collins *Maths Skills Builder*. This book builds on the concepts and ideas you already know at Key Stage 3 and the maths skills you have gained. It will help you to build skills, ready for GCSE or an equivalent.

There will be new maths skills for you to learn and new topics to master at GCSE. But you will also need to remember and use the skills from Key Stage 3 and learn to apply those skills in a greater variety of ways.

You will learn to:

- apply your knowledge in more complex situations and choose appropriate methods
- communicate mathematically by giving explanations and reasons, using appropriate language
- make connections between different parts of maths.

This book is designed to give you an idea of what that means in practice. The questions are more than just straightforward applications of your maths skills. They should make you think a bit more and gain confidence in tackling problems that are different or unusual in some way.

The questions are divided into six sections that match the Key Stage 3 and Key Stage 4 Programme of Study:

- **Number**
- **Algebra**
- **Ratio, percentage and rates of change**
- **Geometry and measures**
- **Probability**
- **Statistics.**

There is also a seventh section of mixed questions that can be taken from any area of the Programme of Study.

The questions in each section are arranged in approximate order of difficulty. Harder questions at the end of each section are marked with an asterisk (\*). Each section starts with a worked example. The sections are not all the same length: the length is approximately proportional to the amount of material in the Programme of Study.

Good luck! I hope you enjoy tackling these problems in preparation for GCSE.

# 1 Number

## WORKED EXAMPLE

35% of £80 = \_\_\_\_% of £40

Work out the missing number.

## SOLUTION

This is a question about percentages. You should know:

- how to work out a percentage of a quantity
- how to write one quantity as a percentage of another.

There are several ways to answer this question.

### Method 1

$$35\% \text{ of } £80 = 0.35 \times 80 = £28$$

$$\text{So } \_\_\% \text{ of } £40 = £28$$

$$\text{The percentage is } \frac{28}{40} \times 100 = 0.7 \times 100 = 70\%.$$

### Method 2

$$35\% \text{ of } £80 = \_\_\% \text{ of } £40$$

Notice that the amount of money is divided by 2.

That means you multiply the percentage by 2 to get the same answer.

$$35\% \times 2 = 70\%, \text{ as before.}$$

You can use any method you like.

In this example it is easy to check your answer:

$$70\% \text{ of } £40 = 0.7 \times 40 = £28 \text{ This is correct.}$$

## QUESTIONS

1. Zeta has these coins.



She can make different amounts with her coins.

For example,  $17\text{p} = 10\text{p} + 5\text{p} + 2\text{p}$ .

- Show how to make 68p with her coins.
- What is the smallest whole number of pence that Zeta **cannot** make with her coins?

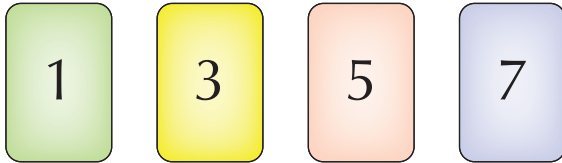
2. This thermometer shows the temperature of a freezer at 13:00.



Between 13:00 and 14:00 the temperature falls by 1.5 degrees.

Between 14:00 and 15:00 the temperature rises 3.7 degrees.

- Work out the temperature at 15:00.
  - Work out the overall change in temperature from 13:00 to 15:00.
3. Here are four number cards.



You can make two-digit numbers with pairs of these cards.

- Write down a multiple of three you can make with two cards.
  - Work out the difference between the largest possible two-digit number and the smallest possible two-digit number.
4. Here are the frequencies for four FM radio stations, as listed in a magazine.

<b>Radio 1</b>	<b>97.6–99.8</b>
<b>Radio 2</b>	<b>88.0–90.2</b>
<b>Radio 3</b>	<b>90.2–92.4</b>
<b>Radio 4</b>	<b>92.4–94.6</b>

Look at this scale.



What station is the arrow pointing at?

5. Justine buys 4 bananas and 5 nectarines.

The bananas cost £1.80.

The total cost is £5.05.

a. What is the price of one banana?

b. How much does each nectarine cost?

6. a. Find a fraction to make this addition correct.

$$\frac{1}{10} + \text{---} = \frac{3}{5}$$

b. Find a fraction to make this subtraction correct.

$$\text{---} - \frac{1}{2} = \frac{1}{5}$$

7. a. Find a multiple of 5 that is also a multiple of 6.

b. Find a factor of 30 that is **not** a factor of 50.

c. Find the sum of all the factors of 28.

d. Find the product of all the factors of 10.

8. Work out the missing number.

$$3.5 + \text{---} = 6.1 - 2.3$$

9. Look at each of the calculations. Put in brackets to make them correct.

a.  $5 + 4 \times 8 - 3 = 25$

b.  $5 + 4 \times 8 - 3 = 45$

c.  $5 + 4 \times 8 - 3 = 69$

10. Look at these five numbers.

34    37    39    40    41

Which of these is **not** the sum of two square numbers? Give a reason for your answer.

11. a. Show that  $\frac{3}{10}$  is more than  $\frac{1}{4}$  but less than  $\frac{1}{3}$ .

b. Find a fraction that is more than  $\frac{2}{3}$  but less than  $\frac{3}{4}$ .

12. Here are five numbers.

-6    5    -4    3    -2

- Put the numbers in order, smallest first.
- What is the largest possible difference between two of these numbers?
- One of the numbers is the sum of the other four. Which one?
- What is the largest possible product of two of these numbers?

13. In 2010 an apartment sells for £167 500.

In 2014 the same apartment sells for £212 400.

- Work out the increase in price.
- Tim says: 'The price increase is more than 25%.'  
Show that this is true.

14.  $A \times B \times 7 = 1001$

$A$  and  $B$  are prime numbers.

Work out the values of  $A$  and  $B$ .

15. Look at these numbers.

31    35    37    39    41    45    49

- Which is a square number?
- Which is a multiple of 13?
- Which are the product of two prime numbers?

16. Look at this advertisement.

**Special deal  
on sofa bed**

Cash price  
**£800**  
or  
Pay **just £149** and  
10 monthly instalments of **£69**



Work out how much you save if you pay the cash price.

17. a. Show that  $\frac{1}{4}$  of 0.6 is the same as  $\frac{3}{4} - 0.6$ .

b. Is  $\frac{1}{5}$  of 0.5 the same as  $\frac{3}{5} - 0.5$ ? Give a reason for your answer.

18. Plant support sticks are available in three lengths.

Length of plant support stick	
Short	30 cm
Medium	60 cm
Long	80 cm

Support sticks are cut from rods 2.50 m long.

- How many short sticks can be cut from one rod?
  - How many long sticks can be cut from one rod?
  - Is it possible to cut a 2.50 m rod into a mixture of sticks of different sizes without any waste? Give a reason for your answer.
19. This question is about the number 28.
- Write 28 as the sum of two prime numbers.
  - Write 28 as the sum of three different prime numbers.
  - Write 28 as the sum of four different prime numbers.
  - Is it possible to write 28 as the sum of five different prime numbers? Give a reason for your answer.
20. Without using a calculator, work out the missing number in each of these calculations.
- $3.4 \times \underline{\quad} = 340$
  - $1000 \times \underline{\quad} = 740$
  - $\underline{\quad} \div 100 = 4.6 \times 10$

21. Plant food is sold in the form of granules.

This is the label on the container.

**Dosage:** Sprinkle 75 g around the base of each plant  
One handful of granules is approximately 30 g.

- How many handfuls are needed for each plant?
- The jar contains one kilogram of granules. How many doses are there in one jar?

22. Bottles of water cost £0.90.

Packs of sandwiches cost £2.60.

Sean buys water and sandwiches and spends £11.40.

How many bottles of water does he buy?

23. A dance group hires a practice room for eight sessions.

The room costs £35 per session.

There are 13 people in the group.

They share the cost of room hire equally among them.

Work out how much each person pays.

24. Mel is paid £1350 per month.

She pays 15% of this in tax.

She pays one-third of it in rent.

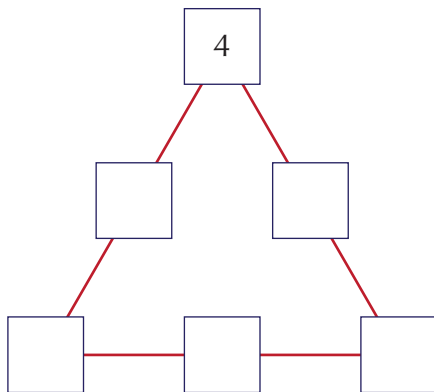
Work out how much Mel has left each month after paying tax and rent.

25. Complete these statements.

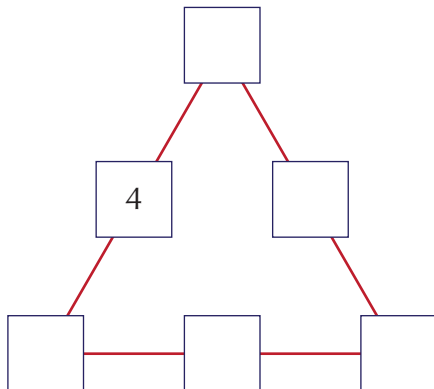
a. 44% of 120 kg = \_\_\_% of 60 kg

b. 15% of £750 = 45% of £\_\_\_\_\_

\*26. a. Put the numbers 5, 6, 7, 8 and 9 in the boxes so that every row has a total of 19.



b. Put the numbers 5, 6, 7, 8 and 9 in the boxes so that every row has the same total.



\*27.  $84 \times 36 = 3024$

Explain how you can use this fact to work out these calculations.

a.  $84 \times 72$

b.  $28 \times 36$

c.  $3024 \div 18$

\*28. The reciprocal of a whole number,  $N$ , is the fraction  $\frac{1}{N}$ .

For example, the reciprocal of 7 is  $\frac{1}{7}$ .

a. Write down the reciprocal of 9.

b. What number has a reciprocal of  $\frac{1}{40}$ ?

c. Multiply the reciprocal of 3 by the reciprocal of 5.

d. Work out half of the reciprocal of 6.


\*29. Textbooks cost £10.90 each.

There is a 10% discount if you buy more than 12.

Work out the cost of 24 books.

\*30.

**Chocolate bars**



£1.69 each  
3 for the price of 2

a. Work out the cost of six chocolate bars.

b. Sally bought some chocolate bars for her friends and she paid £11.83. How many did she buy?

\*31. Here is the start of a sequence of fractions.

$$\frac{1}{3} \quad \frac{2}{5} \quad \frac{3}{7} \quad \frac{4}{9} \quad \frac{5}{11} \quad \frac{6}{13} \quad \dots$$

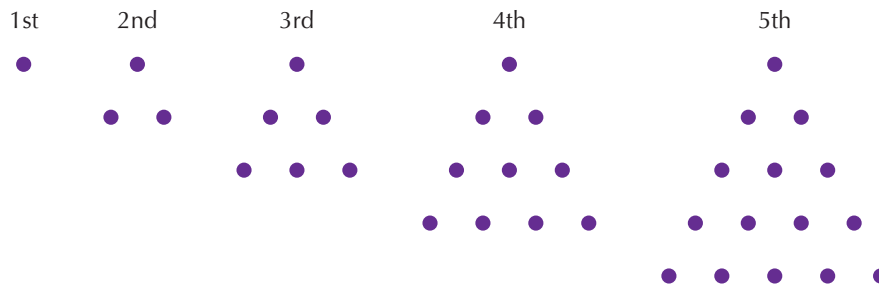
a. Write down the next fraction in the sequence.

b. Write down the second fraction as a decimal.

c. Work out the sum of the first and second fractions. Write your answer as a fraction. Show your working.



\*32. Here is the start of a sequence of patterns.



Serina says: 'The twentieth pattern has an even number of dots.'

Show that this is true.

\*33.  $\sqrt{A} = 4$   
 $\sqrt{B} = 3$

Rose says: 'In that case  $\sqrt{A+B} = 7$ .'

Show that Rose is wrong.

\*34. This is a notice in a bookshop.



Books in the offer cost £4.99, £5.99 or £6.99.

Sam has £25 to spend.

- a. Work out the largest number of books Sam can buy.
- b. What is the largest amount of money Sam can save with the offer?

\*35. Here is the start of a sequence of numbers.

5    17    11    14    ...

To work out the next number in the sequence, add up the last two and divide by 2.

For example,  $(5 + 17) \div 2 = 11$ .

- a. Work out the next three numbers in the sequence.
- b. What can you say about the sequence as you calculate more numbers?

\*36. Here is a list of numbers.

30    31    32    33    34    35    36    37    38

One set of three of these numbers that add up to 100 is  $31 + 33 + 36$ .

Find all the other sets of three of these numbers that add up to 100.