



KING EDWARD VI  
HANDSWORTH GRAMMAR  
SCHOOL FOR BOYS



KING EDWARD VI  
ACADEMY TRUST  
BIRMINGHAM

# Year 7

## 2025 Mathematics 2026

### Unit 2 Booklet

HGS Maths



Tasks



Dr Frost Course



Name: \_\_\_\_\_

Class: \_\_\_\_\_

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# 1 Powers and Roots

# 1.1 Squaring

## Worked Example

- a) Write  $5^2$  as a multiplication and then work it out
- b) Use a calculator to work out  $2.11^2$
- c) Work out the value of  $(-5)^2$
- d) Work out the value of  $-5^2$

## Your Turn

- a) Write  $8^2$  as a multiplication and then work it out
- b) Use a calculator to work out  $31.7^2$
- c) Work out the value of  $(-8)^2$
- d) Work out the value of  $-8^2$

# Fill in the Gaps

We Write...	We Say...			We Calculate...
$3^2$	3 squared	or	3 to the power of 2	$3 \times 3 = 9$
$5^2$		or	5 to the power of 2	
$2^2$	2 squared	or		
	1 squared	or	1 to the power of 2	
$(-4)^2$		or		
		or		$-3 \times -3 = 9$
		or		

## 1.2 Square Roots

## Worked Example

- a) Work out  $\sqrt{25}$
- b) Use a calculator to work out  $\sqrt{4.4521}$

## Your Turn

- a) Work out  $\sqrt{64}$
- b) Use a calculator to work out  $\sqrt{1004.89}$

## 1.3 Cubing

## Worked Example

- a) Write  $4^3$  as a multiplication and then work it out
- b) Use a calculator to work out  $2.11^3$
- c) Work out the value of  $(-4)^3$
- d) Work out the value of  $-4^3$

## Your Turn

- a) Write  $8^3$  as a multiplication and then work it out
- b) Use a calculator to work out  $31.7^3$
- c) Work out the value of  $(-8)^3$
- d) Work out the value of  $-8^3$

# Fill in the Gaps

We Write...	We Say...			We Calculate...
$4^3$	4 cubed	or	4 to the power of 3	$4 \times 4 \times 4 = 64$
$2^3$		or	2 to the power of 3	
$6^3$	6 cubed	or		
	10 cubed	or	10 to the power of 3	
$(-4)^3$		or		
		or		$-3 \times -3 \times -3$ $= -27$
		or		

## 1.4 Cube Roots

## Worked Example

- a) Work out  $\sqrt[3]{64}$
- b) Use a calculator to work out  $\sqrt[3]{9.393931}$
- c) Work out the value of  $\sqrt[3]{-64}$

## Your Turn

- a) Work out  $\sqrt[3]{512}$
- b) Use a calculator to work out  $\sqrt[3]{31855.013}$
- c) Work out the value of  $\sqrt[3]{-512}$

## 1.5 Notation

$7^3$

3 is the power

3 is the index

3 is the exponent

7 is the base

What we write

$8^2$

$8^3$

$8^4$

$8^{16\ 350\ 761.3}$

What we say

“Eight squared”

“Eight cubed”

“Eight to the power four”

“Eight to the power sixteen million  
three hundred and fifty thousand seven  
hundred and sixty one point three”

## 1.6 Powers

## Worked Example

- a) Write  $3^4$  as a multiplication and then work it out
- b) Use a calculator to work out  $2.11^7$
- c) Work out the value of  $(-3)^4$
- d) Work out the value of  $-3^4$

## Your Turn

- a) Write  $2^5$  as a multiplication and then work it out
- b) Use a calculator to work out  $31.7^6$
- c) Work out the value of  $(-2)^5$
- d) Work out the value of  $-2^5$

# Intelligent Practice

<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>10</b>
$2^1 =$	$3^1 =$	$4^1 =$	$5^1 =$	$10^1 =$
$2^2 =$	$3^2 =$	$4^2 =$	$5^2 =$	$10^2 =$
$2^3 =$	$3^3 =$	$4^3 =$	$5^3 =$	$10^3 =$
$2^4 =$	$3^4 =$	$4^4 =$	$5^4 =$	$10^4 =$
$2^5 =$	$3^5 =$	$4^5 =$	$5^5 =$	$10^5 =$
$2^6 =$	$3^6 =$	$4^6 =$	$5^6 =$	$10^6 =$

1. As the power **increases** (moving down the table), how do each of the columns change?
2. As the power **decreases** (moving up the table), how do each of the columns change?
3. What do you notice in the **powers of 5**?
4. What do you notice about the **number of zeroes** in the powers of 10?

# Intelligent Practice

<b>-2</b>	<b>-3</b>	<b>-4</b>	<b>-5</b>	<b>-10</b>
$(-2)^1 =$	$(-3)^1 =$	$(-4)^1 =$	$(-5)^1 =$	$(-10)^1 =$
$(-2)^2 =$	$(-3)^2 =$	$(-4)^2 =$	$(-5)^2 =$	$(-10)^2 =$
$(-2)^3 =$	$(-3)^3 =$	$(-4)^3 =$	$(-5)^3 =$	$(-10)^3 =$
$(-2)^4 =$	$(-3)^4 =$	$(-4)^4 =$	$(-5)^4 =$	$(-10)^4 =$
$(-2)^5 =$	$(-3)^5 =$	$(-4)^5 =$	$(-5)^5 =$	$(-10)^5 =$
$(-2)^6 =$	$(-3)^6 =$	$(-4)^6 =$	$(-5)^6 =$	$(-10)^6 =$

**Generalise... which powers will always give a positive number, and which will always be negative? Why?**

## Fill in the Gaps

We say	We write	We work out	Answer
2 to the power of 4	$2^4$	$2 \times 2 \times 2 \times 2$	
3 to the power of 4		$3 \times 3 \times 3 \times 3$	
	$4^4$		256
5 to the power of 2			
	$6^5$		7776
		$8 \times 8 \times 8 \times 8$	
		$9 \times 9 \times 9$	
	$3^9$		
10 to the power of 2			
2 to the power of 10			

## 1.7 Roots

## Worked Example

a) Work out  $\sqrt[4]{81}$

b) Work out  $\sqrt[6]{64}$

c) Work out  $\sqrt[5]{-243}$

## Your Turn

a) Work out  $\sqrt[5]{32}$

b) Work out  $\sqrt[6]{729}$

c) Work out  $\sqrt[5]{-32}$

## 2 Order of Operations

## 2.1 Commutativity

So far, we have studied three groups of operations.

	<b>Multiplication</b>	<b>Addition</b>	<b>Exponentiation</b>
<b>Operation</b>	$2 \times 3 = 6$ $2 \cdot 3 = 6$	$2 + 3 = 5$	$2^3 = 8$
<b>Inverse Operation</b>	$6 \div 3 = 2$ $\frac{6}{3} = 2$	$5 - 3 = 2$	$\sqrt[3]{8} = 2$

# Commutativity

Which of the operations are commutative?

				Commutative?
Multiplication	Multiplication	$2 \cdot 3 = 6$	$2 \cdot 3 = 3 \cdot 2$	Yes
	Division	$\frac{6}{3} = 2$	$\frac{6}{3} \neq \frac{3}{6}$	No
Addition	Addition	$2 + 3 = 5$	$2 + 3 = 3 + 2$	Yes
	Subtraction	$5 - 3 = 2$	$5 - 3 \neq 3 - 5$	No
Exponentiation	Exponents	$2^3 = 8$	$2^3 \neq 3^2$	No
	Roots	$\sqrt[3]{8} = 2$	$\sqrt[3]{8} \neq \sqrt[8]{3}$	No

Notice how most operations are not commutative.

That means the order you write and work out matters.

It is only multiplication and addition where you can change the order of the inputs and not affect the output.

## Fill in the Gaps

	Calculation	Order Reverse	Commutative?
<b>e.g.</b>	$5 \times 4 = 20$	$4 \times 5 = 20$	Yes
<b>a</b>	$12 \times 3 = 36$	$3 \times 12 =$	
<b>b</b>	$9 \cdot 7 =$		
<b>c</b>	$24 \div 6 = 4$	$6 \div 24 = 0.25$	
<b>d</b>	$\frac{3}{2} =$	$\frac{2}{3} =$	
<b>e</b>	$15 + 19 =$		
<b>f</b>	$20 - 15 = 5$	$15 - 20 = -5$	
<b>g</b>	$6.5 + 1.2 =$		
<b>h</b>	$14 - 8 =$		
<b>i</b>	$5^2 =$	$2^5 =$	
<b>j</b>	$\sqrt[2]{121}$	$\sqrt[121]{2}$	
<b>k</b>	$0.03 - 0.2 =$		
<b>l</b>	$\sqrt[3]{8} =$		
<b>m</b>		$3^4 =$	
<b>n</b>		$123 \cdot 19 =$	

## 2.2 Moving Numbers Around

What happens when we have more than two numbers in a calculation?

Which of these sums are the same?

$$9 + 8 + 25$$

$$25 + 8 + 9$$

$$9 + 25 + 8$$

$$8 + 25 + 9$$

What other sums would be the same?

Which of these differences are the same?

$$30 - 4 - 10$$

$$30 - 10 - 4$$

$$10 - 30 - 4$$

$$4 - 10 - 30$$

Why are the top two the same, but the bottom two different?

## Key Words

summand + summand = sum

multiplier × multiplier = product

same word, you can  
change the order:  
commutative

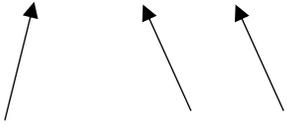
minuend – subtrahend = difference

dividend – divisor = quotient

different words,  
you cannot change  
the order:  
not commutative

# Subtraction

$$12 - 3 - 5$$

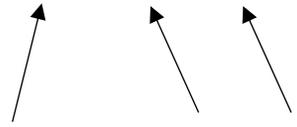


minuend      subtrahends

$$-3 - 5$$

$$-8$$

$$12 - 5 - 3$$



minuend      subtrahends

$$-5 - 3$$

$$-8$$

$$12 - 3 - 5 = 12 - 5 - 3$$

but

$$12 - 3 - 5 \neq 5 - 3 - 12$$

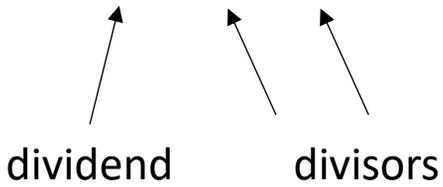
and

$$12 - 3 - 5 \neq 3 - 12 - 5$$

We can subtract in any order. What we can't do is switch a subtrahend with a minuend.

# Division

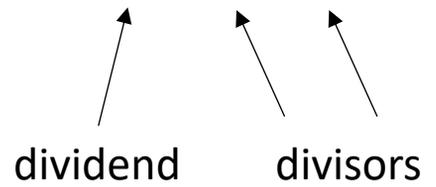
$$24 \div 3 \div 2$$



$$\div 3 \div 2$$

$$\div 6$$

$$24 \div 2 \div 3$$



$$\div 2 \div 3$$

$$\div 6$$

$$24 \div 3 \div 2 = 24 \div 2 \div 3$$

but

$$24 \div 3 \div 2 \neq 2 \div 3 \div 24$$

and

$$24 \div 3 \div 2 \neq 3 \div 24 \div 2$$

We can divide in any order. What we can't do is switch a divisor with a dividend.

# Moving Numbers Around

When you have a mix of addition and subtraction, remember:

<b>Addition</b>	
+	Summands can move anywhere
-	Subtrahends can move as long as they are always behind a subtraction sign

When you have a mix of multiplication and division, remember:

<b>Multiplication</b>	
×	Multipliers can move anywhere
÷	Divisors can move as long as they are always behind a division sign

## Worked Example

Write down as many calculations as you can that are equivalent to these.

- a)  $43 + 189 + 72$
- b)  $11 \times 17 \times 19$
- c)  $360 \div 9 \div 8$
- d)  $34 - 5 - 15.2$

## Your Turn

Write down as many calculations as you can that are equivalent to these.

- a)  $12 \times 23 \times 71$
- b)  $180 \div 10 \div 2$
- c)  $95 - 17 - 51$
- d)  $1.2 + 3.6 + 0.4$

## Worked Example

Write down as many calculations as you can that are equivalent to these.

a)  $43 + 189 - 72 - 121 + 18$

b)  $11 \div 4 \times 16 \times 3 \div 6$

## Your Turn

Write down as many calculations as you can that are equivalent to these.

a)  $2 + 13 - 5 + 11 - 6$

b)  $40 \div 10 \times 3 \div 6 \times 8$

# Notation

Using better notation for  $\times$  and  $\div$  can help us to see this more clearly.

Let's take some questions from the last page.

$$11 \div 4 \times 16 \times 3 \div 6$$

$$= \frac{11 \cdot 16 \cdot 3}{4 \cdot 6} \quad \leftarrow \text{anything multiplied on top, anything divided on bottom}$$

$$= \frac{16 \cdot 3 \cdot 11}{6 \cdot 4} \quad \leftarrow \text{now we can change the order of things}$$

See how it's clearer that dividing by 6 and 4 is the same as dividing by 24.

$$40 \div 10 \times 3 \div 6 \times 8$$

$$= \frac{40 \cdot 3 \cdot 8}{10 \cdot 6} \quad \leftarrow \text{anything multiplied on top, anything divided on bottom}$$

$$= \frac{3 \cdot 8 \cdot 40}{6 \cdot 10} \quad \leftarrow \text{now we can change the order of things}$$

See how it's clearer that dividing by 6 and 10 is the same as dividing by 60.

## 2.3 Mixing the Four Operations

In the last section, every question was either from the multiplication group or the addition group.

	<b>Multiplication</b>	<b>Addition</b>
<b>Operation</b>	×	+
<b>Inverse Operation</b>	÷	−

So, what happens if we have a mix of the multiplication and addition groups in the same calculation?

# Mixing the Four Operations

If there is a mix of multiplication and addition, work out the multiplication first.

When we say “multiplication” we mean the multiplication group: all multiplication and division.

When we say “addition” we mean the addition group: all addition and subtraction.

Multiplication	Multiplication
	Division

This group first!



Addition	Addition
	Subtraction

This group next!



When we solve calculations, we must look for the multiplication group first.

Think of + and – as separators between the multiplication groups.

## Worked Example

Find the value of these calculations.

- a)  $40 \div 8 - 2 \times 5 + 2 \times 11$
- b)  $20 \div 2 \times 3 + 4 \div 8 \times 2$
- c)  $16 \div 4 \times 5 - 2 \times 50 \div 4 + 3 \times 5 \times 2$

## Your Turn

Find the value of these calculations.

- a)  $25 \div 5 - 4 \times 10 + 3 \times 20$
- b)  $50 \div 10 \times 3 + 3 \div 9 \times 6$
- c)  $25 \div 5 \times 2 - 4 \times 10 \div 2 + 3 \times 2 \times 4$

## 2.4 Exponentiation

At the start of this topic, we looked at a third group of operations, which we called exponentiation.

It included exponents and their inverses, roots, which we learnt about in detail in the last unit.

	<b>Exponentiation</b>
<b>Operation</b>	
<b>Inverse Operation</b>	$\sqrt{\quad}$

Where does exponentiation fit into the order of calculating?

# Exponentiation

We have seen that multiplication should be worked out before addition.

Remember how a power comes from repeated multiplication:

$$3^4 = 3 \cdot 3 \cdot 3 \cdot 3$$

This means powers should be worked out before other multiplication.

In fact, all exponentiation should be worked out before other multiplication.

<b>Exponentiation</b>	<b>Exponents</b>
	<b>Roots</b>
<b>Multiplication</b>	<b>Multiplication</b>
	<b>Division</b>
<b>Addition</b>	<b>Addition</b>
	<b>Subtraction</b>

## Worked Example

Find the value of these calculations.

a)  $2^3 + 5$

b)  $15 - \sqrt{81}$

c)  $10 \cdot 4^2$

## Your Turn

Find the value of these calculations.

a)  $5^2 - 11$

b)  $5 + \sqrt[3]{64}$

c)  $2 \cdot \sqrt{49}$

d)  $2 \cdot 6^2$

## Worked Example

Find the value of these calculations.

a)  $3 \times 2^3 + 5 \times 3$

b)  $\frac{66}{2} - \frac{\sqrt{36}}{2} + 2^4$

## Your Turn

Find the value of these calculations.

a)  $\frac{32}{4^2} + 9^2 \cdot 2$

b)  $\frac{\sqrt{144}}{2} + 8^2 - 2 \cdot 5^2$

## 2.5 Brackets

# Breaking the Order

Work out the value of

$$10 + 2 \times 3$$

Of course, the answer is 16, because we multiply before adding.

But what if we *want* to add first?

How can we show that we want to add *before* multiplying?

We have a clever way of showing that we want to break the normal order.

$$(10 + 2) \times 3$$

By putting brackets ( ) around the addition, we mean  
*“break the order, do this first!”*

Work out the new value.

## Worked Example

Find the value of these calculations.

- a)  $3 \cdot 9 + 5$
- b)  $3 \cdot (9 + 5)$
- c)  $15 - 9 \div 3$
- d)  $(15 - 9) \div 3$

## Your Turn

Find the value of these calculations.

- a)  $12 \div 4 + 2$
- b)  $12 \div (4 + 2)$
- c)  $5 + 7 \cdot 2$
- d)  $(5 + 7) \cdot 2$

# The Order of Operations

We now know the order in which we calculate.

This group is repeated multiplication, so we can think of it as “stronger” than multiplication.

This group is repeated addition, so we can think of it as “stronger” than addition.

Exponentiation	Exponents
	Roots
Multiplication	Multiplication
	Division
Addition	Addition
	Subtraction

Brackets break the order, so we must always look at them first.

# The Order of Operations

Brackets break the order.



Addition	Addition
	Subtraction
Exponentiation	Exponents
	Roots
Multiplication	Multiplication
	Division



Multiplication	Multiplication
	Division
Exponentiation	Exponents
	Roots
Addition	Addition
	Subtraction



# Multiplying a Bracket

We have seen questions that look like this:  $2 \times (5 + 3)$   
which can also be written easily like this:  $2 \cdot (5 + 3)$

these  
all  
mean  
the  
same  
thing

We normally don't even write the dot:  $2(5 + 3)$

There is no symbol between the 2 and the bracket.

No symbol still means 'multiply'.

We know that multiplication is commutative, so these two calculations have the same answer:

$$2 \cdot (5 + 3) \text{ and } (5 + 3) \cdot 2$$

When we remove the multiplication symbol, we always write the number in front of the bracket.

$$2(5 + 3) \text{ not } (5 + 3)2$$

The main reason for this is to avoid confusion with exponents:

$$(5 + 3)^2$$

## Worked Example

Find the value of these calculations.

a)  $3(9 + 5)$

b)  $(15 - 9)3$

## Your Turn

Find the value of these calculations.

a)  $12(4 + 2)$

b)  $(5 + 7)2$

# Hidden Brackets

Many calculations use hidden brackets.

Here is a division calculation:  $(6 + 4) \div 2$

We can write it like this:  $\frac{(6+4)}{2}$

We don't need to write the brackets:  $\frac{6+4}{2}$

The long bar under the  $6 + 4$  tells us there's a hidden bracket.

Be careful, though. It's different to this  $\frac{6}{2} + 4$  and this  $6 + \frac{4}{2}$

Many calculations use hidden brackets.

Here is a root calculation:  $\sqrt{(4 + 5)}$

We don't need to write the brackets:  $\sqrt{4 + 5}$

The long bar over the  $4 + 5$  tells us there's a hidden bracket.

Be careful, though. It's different to this  $\sqrt{4} + 5$ .

Many calculations use hidden brackets.

Here is an exponent calculation:  $2^{(3+1)}$

We don't need to write the brackets:  $2^{3+1}$

The addition is clearly in the exponent, which tells us there's a hidden bracket.

Be careful, though. It's different to this  $2^3 + 1$ .

## Worked Example

Find the value of these calculations.

a)  $\sqrt{25} \times \frac{4+14}{2}$

b)  $\sqrt{25 \times 4} + \frac{14}{2}$

## Your Turn

Find the value of these calculations.

a)  $\sqrt{4} \times \frac{9+15}{3}$

b)  $\sqrt{4 \times 9} + \frac{15}{3}$

## Worked Example

Insert brackets to make the following calculations true:

a)  $8 + 4 \times 5 - 2 = 20$

b)  $8 + 4 \times 5 - 2 = 58$

c)  $8 + 4 \times 5 - 2 = 26$

d)  $8 + 4 \times 5 - 2 = 36$

## Your Turn

Insert brackets to make the following calculations true:

a)  $7 + 3 \times 5 - 1 = 49$

b)  $7 + 3 \times 5 - 1 = 40$

c)  $7 + 3 \times 5 - 1 = 19$

d)  $7 + 3 \times 5 - 1 = 21$

## Worked Example

Fill in the missing operations:  
 $46 \square 8 \square 5 = 6$

## Your Turn

Fill in the missing operations:  
 $18 \square 2 \square 5 = 14$

# 3 Introduction to Algebra

## 3.1 Forming Expressions

## Worked Example

Write an algebraic expression for each of the following:

3 more than  $a$

5 less than  $a$

$b$  multiplied by  $a$

$b$  multiplied by  $a$  then squared

## Your Turn

Write an algebraic expression for each of the following:

3 less than  $a$

$a$  more than 5

$b$  divided by  $a$

$b$  divided by  $a$  then squared

## Worked Example

- a) Adam is  $x$  years old. Lucy is 15 years older than Adam. Write down an expression, in terms of  $x$ , for Lucy's age.
- b) Ahmed is  $z$  years old. Libby is 3 times as old as Ahmed. John is 19 years older than Libby. Write down an expression, in terms of  $z$ , for John's age.
- c) Alfred has  $x$  stickers. Lottie has 11 less stickers than Alfred. John has 5 times as many stickers as Lottie. Write down an expression, in terms of  $x$ , for the number of stickers John has.

## Your Turn

- a) Albert is  $z$  years old. Laura is 3 times as old as Albert. Write down an expression, in terms of  $z$ , for Laura's age.
- b) Adam has  $y$  cards. Latika has twice as many cards as Adam. Jack has 10 less cards than Latika. Write down an expression, in terms of  $y$ , for the number of cards Jack has.
- c) Alfie is  $z$  years old. Lottie is 15 years younger than Alfie. John is 3 times as old as Lottie. Write down an expression, in terms of  $z$ , for John's age.

## Worked Example

- a) Lyna buys one eraser and one doughnut. The eraser costs  $e$  pounds and the doughnut costs  $d$  pounds. The total cost is  $T$  pounds. Write down a formula for  $T$  in terms of  $e$  and  $d$ .
- b) Omar buys 9 books at  $\pounds b$  and 7 pens at  $\pounds p$ . The total cost is  $T$  pounds. Write down a formula for  $T$  in terms of  $b$  and  $p$ .
- c) The following rule is used to work out the total cost, in pounds, of hiring a taxi. Total cost =  $\pounds 3.34$  for each kilometre plus fixed cost of  $\pounds 2.90$ . The total cost of hiring the taxi for  $k$  kilometres is  $\pounds T$ . Write down a formula for  $T$  in terms of  $k$ .

## Your Turn

- a) Niko buys one crayon and one toffee. The crayon costs  $c$  pounds and the toffee costs  $t$  pounds. The total cost is  $T$  pounds. Write down a formula for  $T$  in terms of  $c$  and  $t$ .
- b) Aarav buys 9 scarfs at  $\pounds s$  and 6 doughnuts at  $\pounds d$ . The total cost is  $T$  pounds. Write down a formula for  $T$  in terms of  $s$  and  $d$ .
- c) The following rule is used to work out the total cost, in pounds, of hiring a taxi. Total cost =  $\pounds 2.12$  for each kilometre plus fixed cost of  $\pounds 1.90$ . The total cost of hiring the taxi for  $k$  kilometres is  $\pounds T$ . Write down a formula for  $T$  in terms of  $k$ .

## 3.2 Conventions and Definitions

The conventions include:

- We tend to use single lowercase letters for variables, either using the English alphabet or using the Greek alphabet.
- An algebraic  $x$  is written using two back-to-back  $c$ 's. Do NOT write it as a  $\times$  symbol.
- Do NOT include the multiplication sign, for example  $3 \times p = 3p$
- Write division as fractions, for example  $3 \div p = \frac{3}{p}$
- Write numbers first in products, for example  $p \times 3 = 3p$
- Write letters in products in alphabetical order, for example  $4 \times q \times r \times p = 4pqr$
- $1x$  is written simply as  $x$

The definitions include:

- **Variable** is a letter used to represent an unknown number.
- **Coefficient** is the number in front of a variable.
- **Constant** is a number that cannot change its value.
- **Term** is either a constant, a variable or a constant multiplied by a variable.
- **Expression** is terms and operators (+ and -) grouped together.

## Worked Example

Write down the following for the expression:

$$2x - 4y - 9$$

Variables:

Coefficient of  $x$ :

Coefficient of  $y$ :

Constant:

Terms:

## Your Turn

Write down the following for the expression:

$$-2a + 4b + 9$$

Variables:

Coefficient of  $a$ :

Coefficient of  $b$ :

Constant:

Terms:

## Worked Example

Write down the following for the expression:

$$2x^2 - 4xy - 9$$

Variables:

Coefficient of  $x^2$ :

Coefficient of  $xy$ :

Constant:

Terms:

## Your Turn

Write down the following for the expression:

$$-2ab + 4b^2 + 9$$

Variables:

Coefficient of  $ab$ :

Coefficient of  $b^2$ :

Constant:

Terms:

## 3.3 Collecting Like Terms without Powers

# Fluency Practice

$3p$	$p$	Like	Unlike
$x^2$	$3x^2$	Like	Unlike
$x^2$	$2x$	Like	Unlike
$-3\sqrt{x}$	$27\sqrt{x}$	Like	Unlike
$7a$	$7b$	Like	Unlike

$3a$	$3a$	Like	Unlike
$a$	$2a$	Like	Unlike
$2a$	$2A$	Like	Unlike
$-3a$	$2a$	Like	Unlike
$4a$	$4b$	Like	Unlike
$3a$	$3a^2$	Like	Unlike
$2a^2$	$7a^2$	Like	Unlike
$-3a^2$	$7a^2$	Like	Unlike
$2a^2$	$2a^{-2}$	Like	Unlike
$2^a$	$a^2$	Like	Unlike
$x$	$\sqrt{x}$	Like	Unlike
$1$	$2$	Like	Unlike

## Worked Example

Simplify:

a)  $4p + 2p + 3p$

b)  $6y - 3y - 4y$

c)  $4q - 3q - 3q - 4q + 3q$

## Your Turn

Simplify:

a)  $5r + 6r + 7r$

b)  $3x - x - 4x$

c)  $4z + 5z - 5z - 3z - 2z$

## Worked Example

Simplify:

a)  $6p + 9p + 4q + 7p$

b)  $-7x + 5y - y - 6x$

## Your Turn

Simplify:

a)  $3q + q + 6p + 4p$

b)  $-p - 7p + 7p + 6q$

## 3.4 Collecting Like Terms with Powers

## Worked Example

Simplify:

a)  $y^4 + y^2 + 3y^4 - 4q^4$

b)  $5p^4 - 2x^4 - x^4 + 4x^4$

c)  $5xy - x^2 + 9xy^2 + 10x^2 - xy^2$

## Your Turn

Simplify:

a)  $3z^4 + 3z^4 + 3z^3 + p^4$

b)  $p^2 - 4z^3 - 5z^2 + 3z^3$

c)  $7a^2 + 6a - 4a^2b - 3a^2b - 4a^2$

## 3.5 Algebraic Notation

## Worked Example

Explain what the following mean:

$$7x$$

$$xy$$

$$xy^2$$

$$(xy)^2$$

## Your Turn

Explain what the following mean:

$$7a$$

$$ab$$

$$ab^2$$

$$(ab)^2$$

## 3.6 Multiplying Terms without Powers

## Worked Example

Simplify:

a)  $x \times x \times x \times x \times x$

b)  $6 \times 4b$

c)  $9r^3t \times 7$

d)  $2p \times 8y$

e)  $8z \times -7z$

## Your Turn

Simplify:

a)  $y \times y \times y \times y$

b)  $6a \times 3$

c)  $4cs^3 \times 8$

d)  $4x \times 4y$

e)  $-3z \times -2z$

## 3.7 Multiplying Terms with Powers

## Worked Example

Simplify:

a)  $8x^4y^7 \times x^2y^4$

b)  $7x^8y^3 \times 4x^8y^6$

## Your Turn

Simplify:

a)  $x^8y \times 8x^5y^2$

b)  $8x^2y^4 \times 6x^2y^6$

## 3.8 Dividing Terms without Powers

## Worked Example

Simplify:

a)  $\frac{6x}{3}$

b)  $\frac{48xy^2}{2}$

c)  $\frac{9xyz}{y}$

d)  $\frac{42abc}{3c}$

e)  $\frac{-27pr^2}{-3p}$

## Your Turn

Simplify:

a)  $\frac{8y}{2}$

b)  $\frac{33xyz}{11}$

c)  $\frac{36y^2z}{z}$

d)  $\frac{40p^2r}{5r}$

e)  $\frac{-32vw^2}{4v}$

## 3.9 Dividing Terms with Powers

## Worked Example

Simplify:

a)  $\frac{x^6y^6}{x^4y^4}$

b)  $\frac{10x^8y^5}{5xy^3}$

## Your Turn

Simplify:

a)  $\frac{x^6y^8}{x^2y^3}$

b)  $\frac{9x^5y^5}{3x^3y}$

## 3.10 Substitution

## Worked Example

a) Calculate  $\frac{14}{y} + y^2$  when  $y = 7$

b) Work out  $\frac{4z+1}{4}$  when  $z = 6$

## Your Turn

a) Calculate  $y^2 + 3y$  when  $y = 2$

b) Work out  $\frac{2z-1}{4}$  when  $z = 1$

## Worked Example

a) Evaluate  $p^2 + 4q$  when  $p = 6$  and  $q = 7$

b) Work out  $(2p + q)^2$  when  $p = 8$  and  $q = 10$

## Your Turn

a) Evaluate  $x^2 - 2y$  when  $x = 10$  and  $y = 1$

b) Work out  $(4x + 3y)^2$  when  $x = 1$  and  $y = 3$

## Worked Example

- a) Evaluate  $a^2 + \frac{-12}{b}$  when  
 $a = -3$  and  $b = -6$
- b) Work out  $p^2 - 2q$  when  
 $p = -2$  and  $q = -6$
- c) Work out the value of  $\frac{x+9}{y+7}$  when  
 $x = -2$  and  $y = -8$

## Your Turn

- a) Evaluate  $\frac{-32}{x} + y^2$  when  
 $x = -8$  and  $y = -9$
- b) Work out  $p^2 - 4q$  when  
 $p = -8$  and  $q = -2$
- c) Work out the value of  $\frac{5p}{q+14}$  when  
 $p = -18$  and  $q = -5$