Lesson 1 Objectives

In this lesson you should learn how to use symbols in different ways and begin to distinguish their different roles.

You should understand that letters and symbols have different meanings in different contexts.

You should know what the letters in roles such as these

$$3x + 12 = 21$$
$$V = IR + 9$$
$$Y = 3x + 12$$

represent, and you should know the special names given to them in these circumstances.

There are also extension pieces to help stretch your knowledge.

In the following **equations**, the letters represent particular values. They are called **unknowns**.

Can you find the values of each letter?

$2a = 12$

$2b + 4 = 18$

$3c + 5 = 29$

$4d + 3 = 47$

$6e - 2 = 16$

$12f - 9 = 39$

Challenge

Can you solve the following equations?

$8x + 2 = 4x + 14$

$5x + 4 = 2x + 31$

$6x - 2 = 2x + 18$

A **formula** can have several **variable** quantities that relate to each other.

The following formula tells us how the Centigrade and Fahrenheit scales are related.

If we know a temperature in Centigrade, we can find the equivalent temperature in Fahrenheit using the formula

$$F = \frac{9C}{5} + 32$$

Can you find the equivalent Fahrenheit temperatures to the following:

1. 0^oC
2. 5^oC
3. 10^oC
4. 100^oC
5. -15^oC

Challenge

Can you write a formula that will turn a Fahrenheit temperature into a Centigrade temperature?

A **function** can turn an inputted value into an output by using a **rule**.

Use the following functions to find the y-value for each given x-value.

1. $y = 3x - 4$, when $x = 8$
2. $y = 5x + 6$, when $x = 13$
3. $y = 6x - 18$, when $x = 2$
4. $y = 2x + 3$, when $x = -4$

Challenge

Each of these functions can be expressed as graphs. Can you plot the graphs of the above functions?

Plenary

$$2x + 5 = 29$$

In this _____, the x letter represents a particular value. It is called an _____.

$$V = 8R + 52$$

In this _____, the letters are known as _____ quantities.

$$Y = 4x + 12$$

This is an example of a _____. By following a _____, an inputted _____ can give an output _____.

THINK!!

Do you feel you have met the objectives of this lesson?

Lesson 2 Objectives

In this lesson you should learn how to use index notation to represent products.

You should understand the terminology that is used when talking about indices, such as square, cube or power.

You should be able to use index notation for numbers as well as algebraic expressions.

You will learn how to use some of the laws of indices in simple cases.

What is 4 squared?

Why?

Why do we call this "Squared"?

What is 4 cubed?

Why?

Why do we call this "Cubed"?

"5 squared" can be written 5^2 and this means 5 x 5
"5 cubed" can be written 5^3 and this means 5 x 5 x 5

The small numbers are called **powers**.

By writing the meaning out in full, find the value of these powers:

a) 2^2
b) 3^3
c) 4^4
d) 3^5
e) 7^2
f) 6^3
g) 5^1
h) 3^5
i) 6^4
j) 9^3

Using algebra, "n squared" can be written n^2, and means n x n

IMPORTANT: This is not the same as 2n, which means 2 x n. Example; 5 x 5 does not equal 2 x 5 !!!

"n cubed" can be written n^3, and means n x n x n.

Write out these expressions in full:

1) p^3
2) z^6
3) r^4
4) y^5
5) h^9

Write these expressions using powers:

1) n x n x n x n
2) p x p x p x p x p x p
3) b x b x b
4) a x a x a x a x a x a x a
5) k x k x k x k x k

Your teacher has just shown you how to simplify expressions such as:

$2x^2 + 3x^2$ $n^2 \times n^3$ $p^3 \div p^2$

Remember the rules, and simplify the following:

1) $3y^4 + 6y^4$

2) $8p^7 + 17p^7$

3) $12a^3 - 5a^3$

4) $9k^8 - 21k^8$

5) $w^2 \times w^3$

6) $b^7 \times b^{13}$

7) $j^6 \times j^7$

8) $m^{12} \div m^4$

9) $n^{19} \div n^{15}$

10) $b^8 \div b^5$

11) $2m^2 \times 3m^3$

12) $4n^4 \times 6n^2$

13) $14p^{10} \div 7p^4$

14) $20a^{15} \div 5a^{10}$

Lesson 3 Objective

In this lesson you should learn how to simplify linear expressions by collecting like terms.

Remember that n x n can be written n^2
Now n + n can be written 2n.

Write these in short form:

1) p + p + p + p
2) b + b + b + b + b
3) y + y + y
4) s + s + s + s + s + s

Make the following expressions simpler by adding or subtracting like terms:

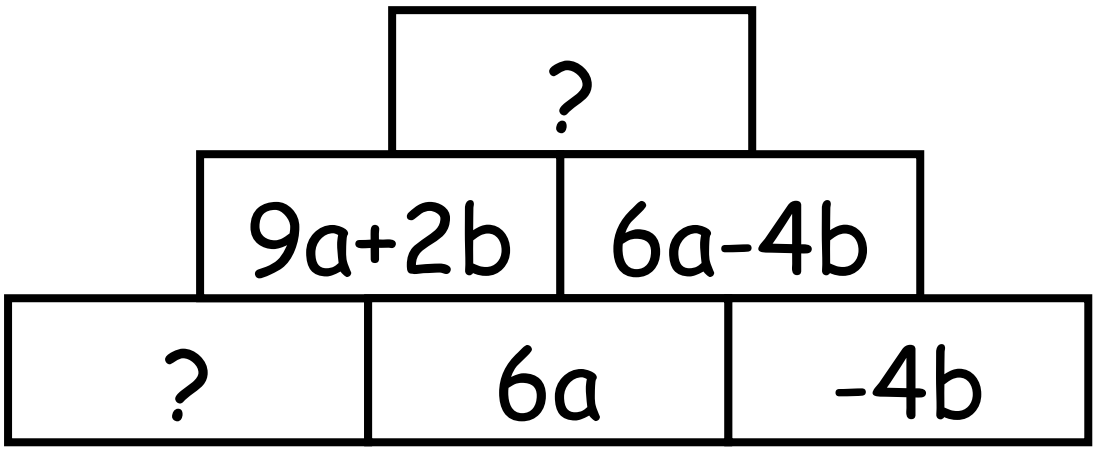
1) 2m + 3m
2) 8p – 5p
3) 6f + 3f + 12f
4) 15n + 8n – 12n

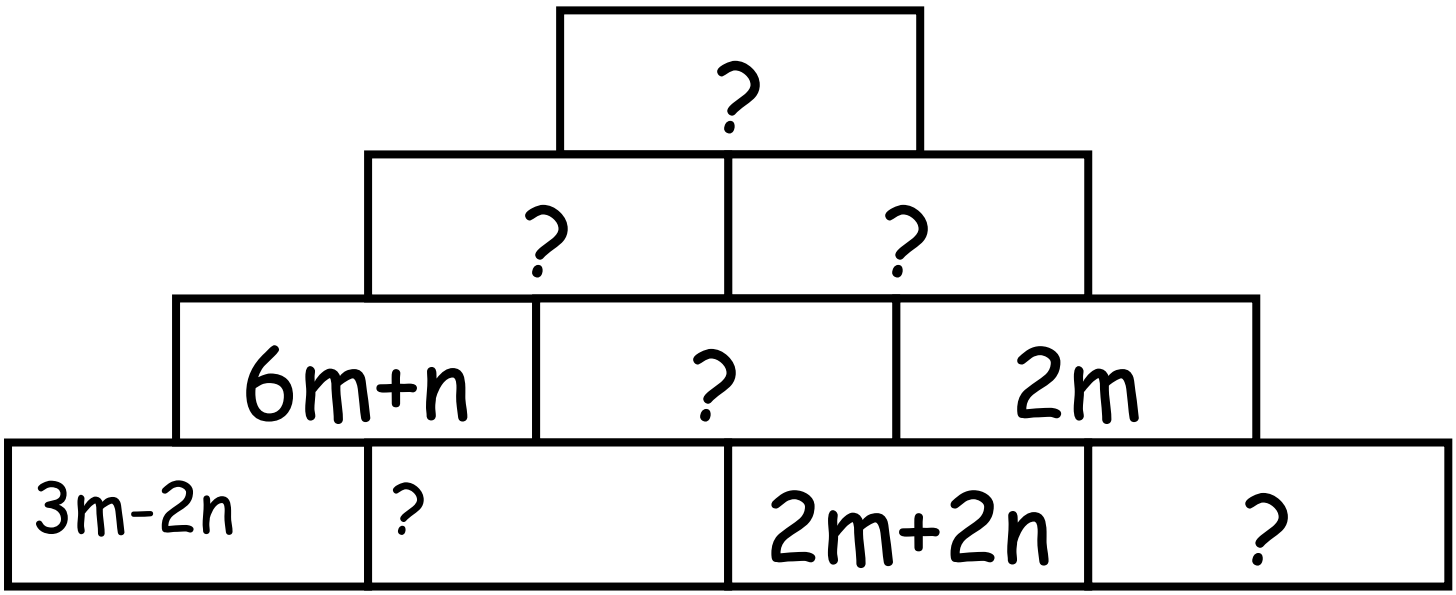
Choose a route through the grid and simplify the expression that your path gives. Take as many different paths as you can

a	b	c	-b	c
c	-c	b	-d	a
-d	b	a	a	b
b	d	-a	c	a
-c	b	b	-a	d

2t	3s	3u	-4r	3u
-3r	u	2r	s	r
2u	-2s	3u	-t	2t
3s	2r	-4t	2r	3s
r	-2u	3s	-t	u

The number in each cell is made by adding the numbers in the two cells beneath it.
Fill in the missing expressions.
Write each expression as simply as possible.





Lesson 4 Objectives

In this lesson you should learn how to multiply a single **term** over a bracket.

You should understand the application of the **distributive law** to arithmetic calculations.

You should learn how to use the **distributive law** for multiplication over addition and over subtraction.

You may learn to **factorise** simple linear expressions.

The Distributive Law

A calculation such as 5 x 46 can be re-written

5 x 46 = 5(40 + 6) = 5 x 40 + 5 x 6
or
5 x 46 = 5(50 – 4) = 5 x 50 – 5 x 4

This is known as the **Distributive Law**, and is probably how some of you do calculations mentally.

Use the distributive law to work out:

a) 4 x 16
b) 8 x 34
c) 7 x 68
d) 5 x 53
e) 9 x 67
f) 6 x 43
g) 8 x 96
h) 4 x 326

Write your solutions in full.

The Distributive Law is also true when we are using algebra.

Example

$a(b + c) = ab + ac$ (remember ab means a x b)

or

$f(g - h) = fg - fh$

Use the Distributive Law to re-write the following (this is sometimes called expanding brackets):

1) $2(b + 4)$
2) $3(m + 8)$
3) $9(h + 5)$
4) $a(d + b)$
5) $4(k - 6)$
6) $12(p - 8)$
7) $6(10 - m)$
8) $14(8 + y)$
9) $g(k - d)$
10) $r(s + m + p)$

Challenge

Can you write down the simpler form of these expressions (this is sometimes called factorising)?

11) $2a + 2b$
12) $2a + 6$
13) $4m + 12$
14) $8p - 24$
15) $3a + 6b$
16) $rv - rp$

Lesson 5 Objectives

In this lesson you should learn how to substitute positive and negative numbers in to linear expressions.

You should be able to substitute positive integers into simple expressions involving powers.

Find the value of the following expressions when m = 3.

1) $4m + 5$
2) $9m + 23$
3) $15m - 26$
4) $m^2 + 10$

Find the value of the following expressions when a = 2, b = 4 and c = 0

5) $a + b$
6) $7a - 3b$
7) $8ab$
8) abc
9) $ab + b$
10) $4b - 2a$
11) b/a
12) $6(a + b)$
13) $12a(b - 10)$
14) $a - 6b$
15) $c(7a + 12b)$

If p = 4, what is the value of $2p^2$?

Remember BODMAS tells us that the power must be taken care of first.

$2p^2 = 2 \times 4^2$

$= 2 \times 16$

$= 32$

If w = 3, y = 4, n = 2 and r = 0, find the value of the following expressions:

1) $2w^2$
2) $w + y + n + r$
3) wyr
4) $wyrn$
5) $4y^2$
6) $2n^3$
7) $3w^2 + 12$
8) $7(w + y + n)$
9) yn^2
10) $(yn)^2$

If b = 2.5, find the value of the following expressions:

11) $4b$
12) $6b + 13$
13) $4(b - 1)$
14) $8b^2$

If g = 4 and h = -3, find the value of the following expressions:

15) $\frac{2g+4}{g}$

16) $\frac{8h}{h+1}$