

# Algebra: the basics

## Expressions and substitution into formulae

Expressions – you need to read the statement and create an expression.

Nine add a number  $x$        $9 + x$   
Fourteen take a number  $p$        $14 - p$   
Seven less than a number  $t$        $t - 7$

The cost of a badger is  $b$  pence.  
A racoon is 5 pence more expensive than a badger and a beaver three times as expensive as a badger.  
a) cost of a racoon?  $b + 5$   
b) cost of a beaver?  $3(b + 5)$   
c) cost of a racoon and 8 badgers?  
 $b + 5 + 8b = 9b + 5$

## Expand brackets and collect terms

$$7x(x + 2)$$

	$x$	$+2$
$7x$	$7x^2$	$14x$

$$= 7x^2 + 14x$$

$$3(a + 4) + 4(a + 2)$$
$$3a + 12 + 4a + 8$$
$$= 7a + 20$$

$$a^2 + a^2 + a^2 \equiv 3a^2$$

## Expand & Simplify...

$$5(x + 3) + 6(x - 4)$$
$$5x + 15 + 6x - 24$$
$$11x - 9$$

$$x + 4y + 6x + 2y \equiv 7x + 6y$$

$$3x + y - 2x + 4y \equiv x + 5y$$

Remember  
 $4(2x + 1) = 8x + 4$   
not  $8x + 1$

$$5n(n + 3)$$
$$= 5n^2 + 15n$$

$$-4(2x - 3)$$
$$= -8x + 12$$

## Substitution – replace values first and the complete calculations

1. Evaluate  $2x^3 - x^2 + y$  for  $x = -3$ ,  $y = 2$

$$2x^3 - x^2 + y = 2(-3)^3 - (-3)^2 + 2$$

Replace each  $x$  with  $-3$ , each  $y$  with  $2$ .  
Perform the indicated operations.

$$= 2(-27) - (9) + (2)$$
$$= -54 - 9 + 2$$
$$= -61$$

If  $a = -3$  and  $b = 2$ ,  
find  $y$

$$y = 2(2a + b)^2$$
$$y = 2(2 \times -3 + 2)^2$$
$$y = 2(-4)^2$$
$$y = 2 \times 16$$
$$y = 32$$

If  $a = 3$ ,  $b = 2$  and  $c = -2$  find  $2ab + 4c$        $2 \times 3 \times 2 + 4 \times -2 = 12 + -8 = 4$

Factorising - Take out the highest common factor. There must be no common factor in the brackets

$16gh + 28gf$	$4g(4h + 7f)$
$21w^2z - 77wx$	$7w(3wz - 11x)$

Factorising into a single bracket  
 $3x^2 + 9x^3 + 12x^4$   
 $= 3x^2(1 + 3x + 4x^2)$

Remember  $x^2 + x^2 = 2x^2$

## Simplifying

$$x \times x = x^2$$

$$3x \times 2y = 6xy$$
$$5a^2 \times 6a^{-4} = 30a^{-2}$$
$$a^2 + 4a^2 - 2a^2 = 3a^2$$

Remember the power does not change when you are adding and subtracting

a.  $\frac{7^8}{7^4} = 7^4$

b.  $\frac{a^{12}}{a^7} = a^5$

c.  $\frac{a^3 \times a^4}{a^2} = a^5$

$$5x \times y = 5xy$$
$$ab \times a = a^2b$$

When you times add powers. When you divide you take powers

Remember a negative x negative = positive

Factorise  
 $20x^2 + 16xy$   
 $= 4x(5x + 4y)$

Factorise  
 $x^3y^2 + xy$   
 $= xy(x^2y + 1)$

$$a^2 + 4a$$
$$= a(a + 4)$$

Factorise  $ab + 2a = a(b + 2)$

Factorise  
 $4a + 20$   
 $= 4(a + 5)$

Factorise  
 $4a - 20$   
 $= 4(a - 5)$

Divide '4a' out of each term

$$12a^2 - 4a =$$
$$= 4a(3a - 1)$$

Make sure you use the Hegarty clips below – make notes

Simplify  $(t^3)^2 = t^6$

Identity  $3a + 2a \equiv 5a$

Expression  $3t^3 + 2t^2$

Equation  $3x(x + 5) = 42$

Formula  $C = \pi r$

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