Maths – 9 Higher: Autumn term 1

1 Number – Indices and Standard Form

Index number laws

Basic rules:

1) $a^m \times a^n = a^{m+n}$
2) $a^m \div a^n = a^{m-n}$
3) $(a^m)^n = a^{mn}$
4) $a^0 = 1$

In general: $x^{-n} = \frac{1}{x^n}$

Solve the equations

(a) $3^x = 81$ We know that $3^4 = 81$, so $x = 4$.

(b) $5^x = \frac{1}{25}$ We know that $5^{-2} = \frac{1}{5^2} = \frac{1}{25}$, so $x = -2$.

Standard form

$1,600 = 1.6 \times 10^3$. The decimal point moves 3 places from A to B.

$0.000\,032 = 3.2 \times 10^{-5}$. The decimal point moves 5 places from A to B.

Notice: In large numbers the power of 10 is positive.
In small numbers the power of 10 is negative.

2 Algebra – Algebraic Fractions

Rewrite the following as single fractions:

(a) $\frac{x}{3} + \frac{x}{3} = \frac{2x}{3}$

(b) $\frac{1}{2}y - \frac{1}{9}y = \frac{y}{2} - \frac{y}{9} = \frac{9y}{18} - \frac{2y}{18} = \frac{7y}{18}$

(c) $\frac{3}{5} \times \frac{t}{4} = \frac{3t}{20}$

(d) $\frac{x}{5} \div \frac{x}{4} = \frac{x}{5} \times \frac{4}{x} = \frac{4x}{5x} = \frac{4}{5}$.

In part (b) $\frac{1}{2}y$ is written as $\frac{y}{2}$ and $\frac{1}{9}y$ is written as $\frac{y}{9}$.
The fractions $\frac{y}{2}$ and $\frac{y}{9}$ are easier to work with.

Equations with fractions

(a) $\frac{2x}{3} = 5$
$2x = 15$ [Multiply by 3]
$x = \frac{15}{2}$ [Divide by 2]
$x = 7\frac{1}{2}$

(b) $\frac{4}{x} = -2$
$4 = -2x$ [Multiply by x]
$\frac{4}{-2} = x$ [Divide by -2]
$-2 = x$

3 Algebra – Changing the Subject

The method for changing the subject of a formula is generally the same as the method for solving an equation. The examples below are written side by side to make comparison easy.

(a) Solve the equation

$3(x-1) = 5$
$3x - 3 = 5$ [Multiply out the brackets]
$3x = 5 + 3$ [Get the x term on its own]
$x = 8/3$ [Divide by the coefficient of x]

(b) Make x the subject of the formula

$a(x-b) = t$
$ax - ab = t$
$ax = t + ab$
$x = \frac{t+ab}{a}$

Formulae involving fractions

(a) Make x the subject.

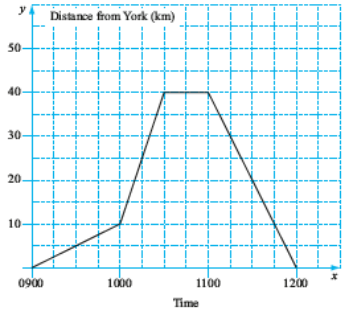
(i) $\frac{m}{x} = e$
$m = ex$ [Multiply both sides by x.]
$\frac{m}{e} = x$ [Divide both sides by e.]

(b) Make p the subject

$\frac{h}{p-t} = a$
$h = a(p-t)$
$h = ap - at$
$h + at = ap$
$\frac{h+at}{a} = p$

4 Shape – Travel Graphs

Travel graphs plot **time** (x-axis) against **distance from start** (y-axis). They often show a round journey which finishes back at the start. Horizontal lines represent no movement; elsewhere, the steeper the gradient of a line the faster the movement it represents.



You will often use the speed formula alongside these graphs: **Speed= Distance ÷ Time**

Remember to be careful with time. Example: 2 hrs 30 mins = 2.5 hours not 2.3 hrs.

hegartymaths

1	2	3	4
102 - 108	159, 172	280 - 283	874, 875