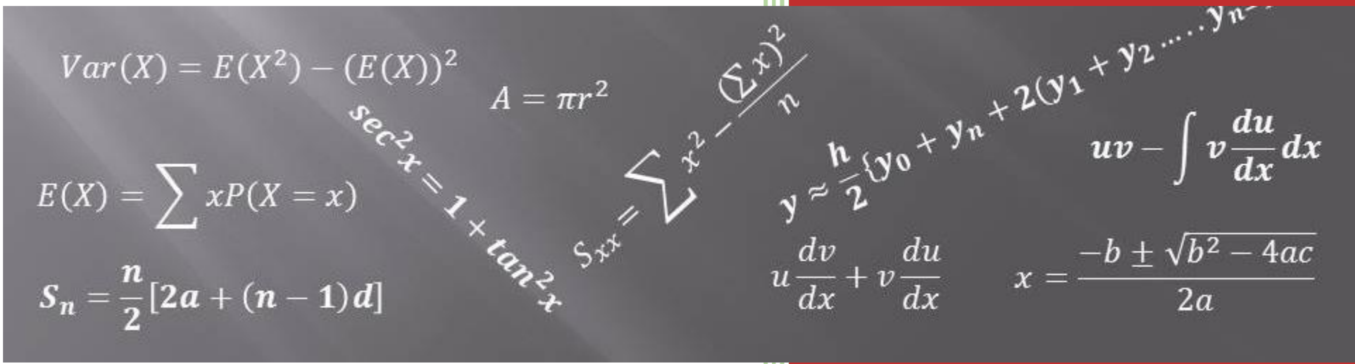
MathsGeeks

'Everything You Need to Know'
A Level – Edexcel – C1



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Simple Algebra: $x^{-1} = \frac{1}{x}$ $\quad x^{\frac{1}{n}} = \sqrt[n]{x}$ $\quad e.g\ \ 8^{\frac{4}{3}} = (\sqrt[3]{8})^4 = 2^4$ $\quad x^a(x^b) = x^{a+b}$

To simplify fractions in the form $\frac{a+\sqrt{b}}{c+\sqrt{d}}$ multiple by $\frac{c-\sqrt{d}}{c-\sqrt{d}}$ to remove the surd from the bottom e.g.

$\frac{2-\sqrt{5}}{7+\sqrt{5}} \times \frac{7-\sqrt{5}}{7-\sqrt{5}}$ giving $\frac{14-2\sqrt{5}-7\sqrt{5}+5}{7-5} = \frac{19-9\sqrt{5}}{2}$.

Differentiation: Use $\frac{dy}{dx} = \ nx^{n-1}$ e.g. if $y = x^{\frac{3}{2}}\ then\ \frac{dy}{dx} = \frac{3}{2}x^{\frac{1}{2}}$.

Note $\frac{dy}{dx}$ can be written as $f'(x)$ and $\frac{d^2y}{dx^2}$ means differentiate twice.

To solve more complicated differentiation make sure you expand out all the terms first and bring any terms in the denominator up to the numerator. e.g. $y = \frac{2}{x}(\frac{1}{x} + 3x^3)$ then expanding out $y = \frac{2}{x^2} + 3x^2$ therefore $y = 2x^{-2} + 3x^2$ and $\frac{dy}{dx} = 2.(-2)x^{-3} + 3.(2)x = -4x^{-3} + 6x$.

Integration: Use $\int y\,dx = \frac{1}{n+1}x^{n+1}\ + C$ e.g. if $y = x^{\frac{5}{2}}\ \ then\ \int x^{\frac{5}{2}}\,dx = \frac{1}{7/2}x^{\frac{7}{2}} + C = \frac{2}{7}x^{\frac{7}{2}} + C$
WHEN YOU INTEGRATE ALWAYS INCLUDE A CONSTANT. Similarly expand out and bring any denominators up to the numerator before you integrate.

Arithmetic Sequence: Use formula books for equations, where a is the first term and d is the difference between two terms.

Any term = $u_n = a + (n-1)d$ and Sum to n terms = $S_n = \frac{n}{2}[2a + (n-1)d]$ and carefully substitute in a and d.

For questions like $\sum_{r=1}^{4} a_r$ work out a_1, a_2, a_3, a_4 separately and then add together.

Learn proof of $S_n = \frac{n}{2}[2a + (n-1)d]$. First write out S_n

(1) $S_n = a + (a+d) + (a+2d) + \cdots \ldots\ldots + (L-d) + L$ where L is the last term. Then write in reverse order.

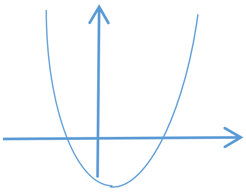
(2) $S_n = L + (L-d) + (L-2d) + \cdots \ldots \ldots + (a+d) + a$. Add together (1) and (2) you get

$2S_n = (a+L) + (a+L) + (a+L) + \cdots \ldots\ldots (a+L)$. Therefore

$S_n = \frac{n}{2}(a+L)$ but L is the nth term of the series to $L = a + (n-1)d$ and therefore

$$S_n = \frac{n}{2}[2a + (n-1)d]$$

Inequalities: For quadratics solve as if equal to zero and then plot the curve. E.g. $2x^2 - 5x - 12 < 0$ then $(2x+3)(x-4) < 0$ therefore the critical values are $x = -\frac{3}{2}$ or $x = 4$. Plot is approximately as follows. This function is clearly < 0 between the critical values and so $-\frac{3}{2} < x < 4$.



Simultaneous Equations: Find one equation in terms of one unknown and sub this into the second one. e.g. Given $y = x - 2$ and $2x^2 - xy = 8$ subst y into second equation and simplify i.e. $2x^2 - x(x-2) = 8$ so $2x^2 - x^2 + 2x - 8 = 0$ and $x^2 + 2x - 8 = 0$ then $(x-2)(x+4) = 0$ and $x = 2$ or $x = -4$. Do not forget to then substitute back in for y i.e. When $x = 2, y = 0$ and when $x = -4, y = -6$.

Roots of Quadratic: If $ax^2 + bx + c = 0$.
1) $b^2 - 4ac > 0$ there are two distinct real roots
2) $b^2 - 4ac = 0$ there are two equal roots
3) $b^2 - 4ac < 0$ there are NO real roots

Graph Transformations

x-transformations:	y-transformations:
$f(x) \to f(x+3)$ translate the graph left by 3.	$f(x) \to f(x) + 2$ translate the graph up 2.
$f(x) \to f(x/3)$ scale the graph by a factor 3 in the x direction.	$f(x) \to 2f(x)$ scale the graph by a factor 2 in the y direction
$f(x) \to -f(x)$ reflect the graph in the x axis	$f(x) \to f(-x)$ reflect the graph in the y axis

Curves/Points/Tangents/Normals

Gradient of the tangent is $\frac{dy}{dx}$ and substitute into $y = mx + c$ find c but substituting the known point on the line. If you are asked for normal then $\frac{dy}{dx} = -\frac{1}{m}$.

The length of a line between two points $d = \sqrt{((x_2 - x_1)^2 + (y_2 - y_1)^2)}$.
If you have two points the the gradient m can be found by $m = \frac{y_2 - y_1}{x_2 - x_1}$.

Don't forget that the area of a triangle = $\frac{1}{2}(base \ \times height)$.

Sketching Cubic Curves The general shape of cubic curves are shown below where the roots are where the curve crosses the x axis. Don't' forget to also work out where the curve crosses the y axis by putting in $x = 0$. If there is a double root the curve turns at this point.