

The Knowledge Self-Check

Discriminant and how it determines the number of roots of a quadratic

$b^2 - 4ac$, if >0 then 2 distinct real roots, $=0$ then one repeated real root, <0 no real roots

Quadratic formula

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

The factor theorem

$(x-a)$ is a factor of $f(x)$ if and only if $f(a)=0$

Sine rule, cosine rule and area of a triangle

$$\frac{\sin A}{a} = \frac{\sin B}{b}, a^2 = b^2 + c^2 - 2bc \cos A, \text{Area} = \frac{1}{2}ab \sin C$$

Equation of a circle

Circle with centre (a,b) and radius r : $(x-a)^2 + (y-b)^2 = r^2$

Graphs of sin, cos and tan

Check on Desmos

Special values of sin, cos and tan

Check with your calculator – should know for $0^\circ, 30^\circ, 45^\circ, 60^\circ, 90^\circ$

Trigonometric identity for $\tan \theta$, the “Pythagorean” identity, and the two that derive from this

$$\tan \theta = \frac{\sin \theta}{\cos \theta}, \sin^2 \theta + \cos^2 \theta = 1, \tan^2 \theta + 1 = \sec^2 \theta, 1 + \cot^2 \theta = \operatorname{cosec}^2 \theta$$

Laws of logarithms

$$\log A + \log B = \log(AB), \log A - \log B = \log\left(\frac{A}{B}\right), \log A^n = n \log A$$

Graphs of $y = x^2$, $y = x^3$, $y = \frac{1}{x}$, $y = \sqrt{x}$, $y = a^x$, $y = \log_a x$

Check with Desmos

How to determine the nature of stationary points from $\frac{d^2y}{dx^2}$

If >0 then local min, <0 then local max, $=0$ need to check gradient either side

Definitions of concave upwards and concave downwards

Concave upwards means $\frac{d^2y}{dx^2} > 0$, concave downwards means $\frac{d^2y}{dx^2} < 0$

Derivatives of $y = x^n$ and $y = e^{kx}$

Function	Differentiated
$y = x^n$	$\frac{dy}{dx} = nx^{n-1}$
$y = e^{kx}$	$\frac{dy}{dx} = ke^{kx}$

Graph transformations $y = f(x) + a$, $y = f(x + a)$, $y = af(x)$, $y = f(ax)$, $y = -f(x)$, $y = f(-x)$

Translation by $\begin{pmatrix} 0 \\ a \end{pmatrix}$, translation by $\begin{pmatrix} -a \\ 0 \end{pmatrix}$, stretch parallel to y-axis by sf a , stretch parallel to x-

axis by sf $\frac{1}{a}$, reflection in x-axis, reflection in y-axis