Edexcel Further Maths AS-level

Further Pure 1

Formula Sheet

Provided in formula book	Not provided in formula book

Vectors

Scalar product	$\boldsymbol{a}\cdot\boldsymbol{b} = \lvert\boldsymbol{a}\rvert\lvert\boldsymbol{b}\rvert\cos\theta$
Vector product	$\boldsymbol{a}\times\boldsymbol{b} = \lvert\boldsymbol{a}\rvert\lvert\boldsymbol{b}\rvert\sin\theta\ \hat{n}$ $= (a_2b_3 - a_3b_2)\boldsymbol{i} + (a_3b_1 - a_1b_3)\boldsymbol{j} + (a_1b_2 - a_2b_1)\boldsymbol{k}$ $= \begin{vmatrix} \boldsymbol{i} & \boldsymbol{j} & \boldsymbol{k} \\ a_1 & a_2 & a_3 \\ b_1 & b_2 & b_3 \end{vmatrix}$

Scalar triple product	$\boldsymbol{a}\cdot(\boldsymbol{b}\times\boldsymbol{c}) = a_1(b_2c_3 - b_3c_2) + a_2(b_3c_1 - b_1c_3) + a_3(b_1c_2 - b_2c_1)$	$= \begin{vmatrix} a_1 & a_2 & a_3 \\ b_1 & b_2 & b_3 \\ c_1 & c_2 & c_3 \end{vmatrix}$

Area of a general triangle ABC	$= \frac{1}{2}\lvert\overrightarrow{AB}\times\overrightarrow{AC}\rvert$
Area of a general parallelogram $ABCD$	$= \lvert\overrightarrow{AB}\times\overrightarrow{AD}\rvert$

Volume of parallelepiped	$V = \lvert\boldsymbol{a}\cdot(\boldsymbol{b}\times\boldsymbol{c})\rvert$
Volume of a tetrahedron	$V = \frac{1}{6}\lvert\boldsymbol{a}\cdot(\boldsymbol{b}\times\boldsymbol{c})\rvert$

Conic Sections

Parametric equation of a curve	$x = p(t), y = q(t)$

Parabola

Cartesian equation of a parabola	$y^2 = 4ax$
Parametric equations of a parabola	$x = at^2, y = 2at, t \in \mathbb{R}$
Focus, S, of a parabola	$S = (a, 0)$
Directrix of a parabola	$x + a = 0$
Equation of the tangent to the general parabola	$ty = x + at^2$
Equation of the normal to the general parabola	$y + tx = 2at + at^3$

Hyperbola

Cartesian equation of a rectangular hyperbola	$xy = c^2$
Parametric equation of a rectangular hyperbola	$x = ct, y = \frac{c}{t}, t \in \mathbb{R}, t \neq 0$
Equation of the tangent to the general rectangular hyperbola	$x + t^2y = 2ct$
Equation of the normal to the general rectangular hyperbola	$t^3x - ty = c(t^4 - 1)$

The t-formulae

When $t = \tan\frac{\theta}{2}$:	$\sin\theta = \frac{2t}{1+t^2}$	$\cos\theta = \frac{1-t^2}{1+t^2}$	$\tan\theta = \frac{2t}{1-t^2}$

Numerical methods

Euler's method for approximating solutions for first-order differential equations	$\left(\frac{dy}{dx}\right)_0 \approx \frac{y_1 - y_0}{h}$ $y_{r+1} \approx y_r + h\left(\frac{dy}{dx}\right)_r, r = 0,1,2,\ldots$
Euler's method for approximating solutions for second-order differential equations	$\left(\frac{d^2y}{dx^2}\right)_0 \approx \frac{y_1 - 2y_0 + y_{-1}}{h^2}$ $y_{r+1} \approx 2y_r - y_{r-1} + h^2\left(\frac{d^2y}{dx^2}\right)_r, r = 0,1,2,\ldots$