

Further Calculus - Essential Skills Exam Practice

FORMULAE LIST

Circle:

The equation $x^2 + y^2 + 2gx + 2fy + c = 0$ represents a circle centre $(-g, -f)$ and radius $\sqrt{g^2 + f^2 - c}$.

The equation $(x - a)^2 + (y - b)^2 = r^2$ represents a circle centre (a, b) and radius r .

Scalar Product:

$\mathbf{a} \cdot \mathbf{b} = |\mathbf{a}| |\mathbf{b}| \cos \theta$, where θ is the angle between \mathbf{a} and \mathbf{b}

or $\mathbf{a} \cdot \mathbf{b} = a_1 b_1 + a_2 b_2 + a_3 b_3$ where $\mathbf{a} = \begin{pmatrix} a_1 \\ a_2 \\ a_3 \end{pmatrix}$ and $\mathbf{b} = \begin{pmatrix} b_1 \\ b_2 \\ b_3 \end{pmatrix}$.

Trigonometric formulae:

$$\sin(A \pm B) = \sin A \cos B \pm \cos A \sin B$$

$$\cos(A \pm B) = \cos A \cos B \mp \sin A \sin B$$

$$\sin 2A = 2 \sin A \cos A$$

$$\cos 2A = \cos^2 A - \sin^2 A$$

$$= 2 \cos^2 A - 1$$

$$= 1 - 2 \sin^2 A$$

Table of standard derivatives:

| $f(x)$ | $f'(x)$ |
|-----------|--------------|
| $\sin ax$ | $a \cos ax$ |
| $\cos ax$ | $-a \sin ax$ |

Table of standard integrals:

| $f(x)$ | $\int f(x) dx$ |
|-----------|----------------------------|
| $\sin ax$ | $-\frac{1}{a} \cos ax + c$ |
| $\cos ax$ | $\frac{1}{a} \sin ax + c$ |

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1. Find $\int \frac{4}{(2x-3)^3} dx$
2. $f(x) = \sqrt{(2x-1)^3}$ find $f'(5)$.
3. If $f(x) = \cos^3 x$ find the exact value of $f'(\frac{\pi}{6})$.
4. (a) Show that $(\sin x + \cos x)^2 = 1 + \sin 2x$.
(b) Hence, find $\int (\sin x + \cos x)^2 dx$.
5. If $y = 2\sin(2x - \frac{\pi}{3})$, find $\frac{dy}{dx}$.