

## 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  $\theta$  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  $\frac{dy}{dx}$ .

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## Answers

1	$-\frac{1}{(2x-3)^2} + c$
2	9
3	$-\frac{9}{8}$
4	(a) <i>proof</i> (b) $x = -\frac{1}{2}\cos 2x + c$
5	$4\cos\left(2x - \frac{\pi}{3}\right)$

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