

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:

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

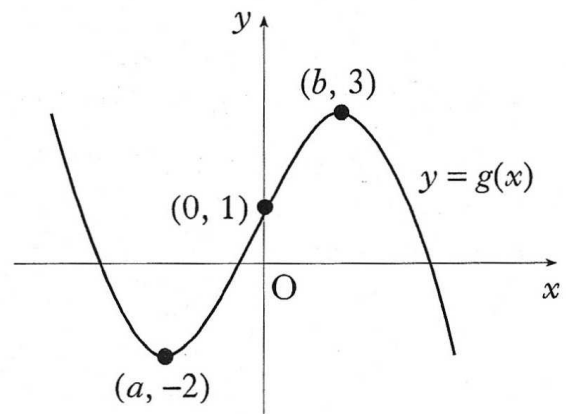
1. The point A has coordinates (7, 4). The straight lines with equations $x + 3y + 1 = 0$ and $2x + 5y = 0$ intersect at B.
- (a) Find the gradient of AB. 3
- (b) Hence show that AB is perpendicular to only one of these two lines. 5

2. $f(x) = x^3 - x^2 - 5x - 3$.
- (a) (i) Show that $(x + 1)$ is a factor of $f(x)$.
(ii) Hence or otherwise factorise $f(x)$ fully. 5
- (b) One of the turning points of the graph of $y = f(x)$ lies on the x -axis. Write down the coordinates of this turning point. 1

3. Find all the values of x in the interval $0 \leq x \leq 2\pi$ for which $\tan^2(x) = 3$. 4

4. The diagram shows the graph of $y = g(x)$.

- (a) Sketch the graph of $y = -g(x)$. 2
- (b) On the same diagram, sketch the graph of $y = 3 - g(x)$. 2



5. A, B and C have coordinates $(-3, 4, 7)$, $(-1, 8, 3)$ and $(0, 10, 1)$ respectively.
- (a) Show that A, B and C are collinear. 3
- (b) Find the coordinates of D such that $\vec{AD} = 4\vec{AB}$. 2

6. Given that $y = 3\sin(x) + \cos(2x)$, find $\frac{dy}{dx}$. 3

7. Find $\int_0^2 \sqrt{4x+1} dx$.

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8. (a) Write $x^2 - 10x + 27$ in the form $(x + b)^2 + c$.

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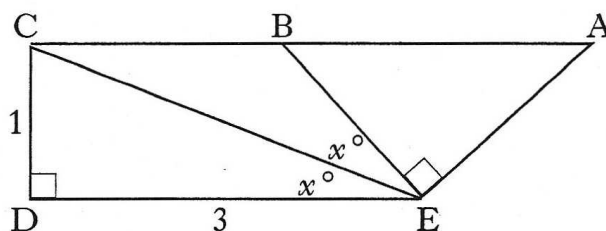
(b) Hence show that the function $g(x) = \frac{1}{3}x^3 - 5x^2 + 27x - 2$ is always increasing.

4

9. Solve the equation $\log_2(x + 1) - 2\log_2(3) = 3$.

4

10. In the diagram
 angle DEC = angle CEB = x° and
 angle CDE = angle BEA = 90° .
 CD = 1 unit; DE = 3 units.
 By writing angle DEA in terms
 of x° , find the exact value of
 $\cos(\hat{D}EA)$.



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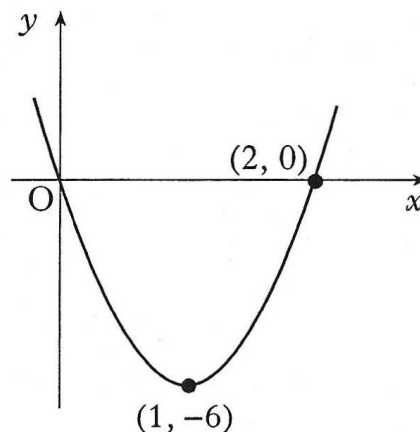
11. The diagram shows a parabola passing through the points (0, 0), (1, -6) and (2, 0).

(a) The equation of the parabola is of the form $y = ax(x - b)$.

Find the values of a and b .

(b) This parabola is the graph of $y = f'(x)$.

Given that $f(1) = 4$, find the formula for $f(x)$.



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