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: \(a \cdot b = |a||b|\cos \theta\), where \(\theta\) is the angle between \(a\) and \(b\)
or \(a \cdot b = a_1b_1 + a_2b_2 + a_3b_3\) where \(a = \begin{pmatrix} a_1 \\ a_2 \\ a_3 \end{pmatrix}\) and \(b = \begin{pmatrix} b_1 \\ b_2 \\ b_3 \end{pmatrix}\).

Trigonometric formulae:
\[
\begin{align*}
\sin (A \pm B) &= \sin A \cos B \pm \cos A \sin B \\
\cos (A \pm B) &= \cos A \cos B \mp \sin A \sin B \\
\sin 2A &= 2 \sin A \cos A \\
\cos 2A &= \cos^2 A - \sin^2 A \\
&= 2 \cos^2 A - 1 \\
&= 1 - 2 \sin^2 A
\end{align*}
\]

Table of standard derivatives:

<table>
<thead>
<tr>
<th>(f(x))</th>
<th>(f'(x))</th>
</tr>
</thead>
<tbody>
<tr>
<td>(\sin ax)</td>
<td>(a \cos ax)</td>
</tr>
<tr>
<td>(\cos ax)</td>
<td>(-a \sin ax)</td>
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</tbody>
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<th>(f(x))</th>
<th>(\int f(x)dx)</th>
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<tr>
<td>(\sin ax)</td>
<td>(-\frac{1}{a} \cos ax + c)</td>
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<td>(\cos ax)</td>
<td>(\frac{1}{a} \sin ax + c)</td>
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</table>
Essential Skills 14

The skills in this series of worksheets appear frequently.

These are the GIFTS you must take to succeed

Synthetic Division

1. Show that \((x - 1)\) is a factor of \(x^3 + 4x^2 - x - 4\) and factorise fully.
2. Show that \((x + 2)\) is a factor of \(x^3 + 2x^2 - 4x - 8\) and factorise fully.
3. Show that \((x + 1)\) is a factor of \(x^3 - 7x - 6\) and factorise fully.
4. Show that \((x - 1)\) is a factor of \(x^3 - 2x^2 - 11x + 12\) and factorise fully.
5. Show that \((x + 3)\) is a factor of \(x^3 + 6x^2 + 11x + 6\) and factorise fully.
6. Show that \((x - 2)\) is a factor of \(2x^3 - 3x^2 - 3x + 2\) and factorise fully.
7. Show that \((x + 1)\) is a factor of \(x^3 - x^2 - 5x - 3\) and factorise fully.
8. Show that \(x = -1\) is a root of \(2x^3 + 7x^2 + 2x - 3 = 0\) and find the other roots.
9. Show that \(x = 1\) is a root of \(3x^3 + x^2 - 3x - 1 = 0\) and find the other roots.
10. Show that \(x = 2\) is a root of \(x^3 - x^2 - 8x + 12 = 0\) and find the other roots.

APPLYING QUESTIONS

1. \((x - 1)\) is a factor of \(2x^3 + px^2 + 2x - 15\).
   Calculate \(p\) and factorise fully.

2. Find the coordinates of the points of intersection of \(f(x) = x^3 + 4x^2 - 32x + 30\)
   and \(g(x) = 5x - 2x^2\)