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 $\mathbf{a} \cdot \mathbf{b} = a_1b_1 + a_2b_2 + a_3b_3$ 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:

<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>
</tr>
</tbody>
</table>

Table of standard integrals:

<table>
<thead>
<tr>
<th>$f(x)$</th>
<th>$\int f(x)dx$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\sin ax$</td>
<td>$-\frac{1}{a} \cos ax + c$</td>
</tr>
<tr>
<td>$\cos ax$</td>
<td>$\frac{1}{a} \sin ax + c$</td>
</tr>
</tbody>
</table>
Essential Skills 4

The skills in this series of worksheets appear frequently.

These are the GIFTS you must take to succeed

Tangent to a Curve (Non Calculator)

Find the equation of the tangent to the curve at the given point:

1. \( y = 3x^2 - 4; x = 2 \)
2. \( y = 6x - x^3; x = -2 \)

3. \( y = 4\sqrt{x}; x = 9 \)
4. \( f(x) = x^3 - 4x + 3; x = -1 \)

5. \( y = x^3 - 2x + 5; x = 2 \)
6. \( y = 5x^3 - 12x; x = 1 \)

7. \( f(x) = (x - 3)^2; x = 4 \)
8. \( y = x^2(2x - 1); x = -1 \)

9. \( y = 2\sqrt{x}; x = 25 \)
10. \( y = 3 - \frac{2}{x}; x = -2 \)

**APPLYING QUESTION**

The tangent to the curve \( y = x^3 - 3x^2 + x \) makes an angle of 45° with the positive direction of the \( x - axis \).

Establish the co-ordinates of point \( A \).