DERIVATIVE AND THE TANGENT

1. Find the equation to the curve $y = 3x^4 + 2x^3 - x^2 + 7x - 4$ at the point where $x = 2$.

2. Find the equation of the tangent to the curve $y = x^2 + \frac{2}{x} + 4$ at the point $P(-1,3)$.

3. A tangent to the curve $y = 2x^2$ is parallel to the line $4x - y - 3 = 0$. What is the equation of this tangent?

4. At the point $(2,3)$ on the curve $y = px^2 + qx + 7$, the tangent is inclined at $135°$ to the positive $x-$ axis. Find the values of p and q.

5. Differentiate the following with respect to x:

   (i) $\frac{\sqrt{x}+x}{x^2}$ (ii) $\frac{7}{\sqrt[4]{x^3}}$ (iii) $(10\text{-}9x)^8$

   (iv) $\frac{1}{x^2-2x+2}$ (v) $5x^2(\sqrt{4x+9}$ (vi) $\frac{7x+3}{5x-2}$

6. Find the point A on the curve $y = (2x+5)^6$ where the line $y = 12x + 25$ is a tangent.

7. (a) If $y = \frac{x^2}{x+1}$, show that $\frac{dy}{dx} = \frac{x^2+2x}{(x+1)^2}$.

   (b) Hence find the equation of the tangent to the curve $y = \frac{x^2}{(x+1)^2}$ at the point $\left(1, \frac{1}{2}\right)$.

   (c) Find the acute angle that this tangent makes with the $x-$ axis. (Give your answer correct to the nearest degree.

8. Evaluate the following limits:

   (i) $\lim_{x\to 0} \frac{x^2+x}{x}$ (ii) $\lim_{x\to 2} \frac{3x^2-x-10}{x-2}$ (iii) $\lim_{x\to\infty} \frac{4x^2-6x+5}{3x^2+8x}$

9. Differentiate by first principles:

   (i) $y = 3x^2$ (ii) $f(x) = 2x^2 - 3x + 1$ (iii) $f(x) = \frac{1}{x}$

ANSWERS:

1. $y = 123x - 176$ **2.** $y = -4x + 1$ **3.** $y = 4x - 2$ **4.** $p = 2,\ q = -9$ **5.** (i) $\frac{-3}{2\sqrt{x^5}} - \frac{1}{x^2}$

(ii) $\frac{-21}{4\sqrt[4]{x^7}}$ (iii) $-72((10-9x)^7$ (iv) $\frac{2-2x}{(x^2-2x+2)^2}$ (v) $10x\sqrt{4x+9} + \frac{10x^2}{\sqrt{4x+9}}$

(vi) $\frac{-29}{(5x-2)^2}$ 6. $A(-2,1)$ 7. (b) $y = \frac{3}{4}x - \frac{1}{4}$ (c) $\theta = 37°$ **8.** (i) 1 (ii) 11

(iii) $\frac{4}{3}$ **9.** (i) $6x$ (ii) $4x-3$ (iii) $\frac{-1}{x^2}$