

1. Find the derived function when $f(x)$ equals
 - a. x^3
 - b. x^{-4}
 - c. $x^{-1/4}$
 - d. $\frac{(x^3)^2}{x}$
 - e. $x^{-3} \times x^6$
 - f. $(3x)^3$

2. Find $\frac{dy}{dx}$ when y equals
 - a. $-4x^3$
 - b. $-3x + (4x^2)^3$
 - c. $x^2 - 6x - 4$
 - d. $\frac{3}{x} + 5x^2$
 - e. $4x^3 + 2x^{-2}$
 - f. $\frac{1}{x}(x^3 - 3x)$

3. Find the derivative of
 - a. $2x^3 - 5x$
 - b. $3x(x + x^4)$
 - c. $x^6 \div x^{-2}$
 - d. $\frac{(2x^3)^2}{3x^{-1}}$
 - e. $(x + 2)(2x - 3)$
 - f. $-1/(2x)^2$

4. Use standard results to differentiate
 - a. $2x^2 + 3x - x^{-1}$
 - b. $\frac{2}{x^3} + \frac{3}{x}$
 - c. $(x^2 - 1)^2$
 - d. $3(x + 5)x$
 - e. $\sqrt{x}(x + 4)$
 - f. $3x(3 - \sqrt{x})^2$

5. Given that $f(x) = 3x^2 - 6x + 1$
 - a. Find the gradient of $y = f(x)$ at the point $(-1, 0)$
 - b. Find the coordinates of the point on the graph of $y = f(x)$ where the gradient is 6.
 - c. Find the gradient of $y = f(x)$ and the co-ordinates at the points where the curve meets the line $y = x - 3$.
 - d. Find the turning point of $f(x)$.
 - e. Find the equation of the tangent at $x = 2$

6. Given that $f(x) = 2x^3 - 3x^{-1} + 5$, find
 - a. $f'(x)$
 - b. $f''(x)$

7. Given that $y = 2x^2 + \frac{1}{x}$
 - a. Find $\frac{dy}{dx}$ at $(1, 3)$
 - b. Find $\frac{d^2y}{dx^2}$ when $y = 1$
 - c. Using differentiation, find the turning point of $f(x)$.
 - d. Find the equation of the normal at $x = 1$.

8. Given that $f(x) = 3\sqrt{x} + 1$
 - a. Find the value of the function $f(x)$ when $x = 4$
 - b. Find the equation of the tangent l_1 when $x = 4$
 - c. Find the equation of the normal l_2 when $x = 1$
 - d. Find the value of x where l_1 and l_2 intersect.

9. Find the gradient of each curve
 - a. $y = 5(x - 1)$
 - b. $y = (x - 2)^2$
 - c. $y = x^3 - 3x^2 + 8$
 - d. $y = -2x^2 + 3x^{-2}$
 - e. $y = (2x - 3)(x + 5)$
 - f. $y = (4\sqrt{x})^{1/2} - 3x^2$

10. Find the coordinates of the points on the curve with the equation $y = x^3 - 3x$ at which the gradient of the curve is 3.

11. Water is poured into a vase such that the depth, h cm, of the water in the vase after t seconds is given by $h = kt^{1/3}$, where k is a constant. Given that when $t = 1$, the depth of the water in the vase is increasing at the rate of 3 cm per second,
 - a. find the value of k ,
 - b. find the rate at which h is increasing when $t = 8$.