

D Michaelmas Differentiation I

1. Find $\frac{dy}{dx}$ for the following curves:

(a) $y = x^2 - 2x + 3.$

$$\frac{dy}{dx} = 2x - 2$$

(b) $y = -2x^2 - 3x + 7.$

(c) $y = x^3 + 5x^2 + x - 1.$

$$\frac{dy}{dx} = 3x^2 + 10x + 1$$

(d) $y = -2x^3 - 4x^2 + 7x - 1.$

(e) $y = \frac{3}{x} - 5.$

$$\frac{dy}{dx} = -3x^{-2}$$

(f) $y = 2x^4 - \pi x - \frac{5}{x^2}.$

$$\frac{dy}{dx} = 8x^3 - \pi + 10x^{-3}$$

(g) $y = 6\sqrt{x} + \frac{2}{\sqrt{x}}.$

(h) $y = \frac{2}{x}.$

(i) $y = \frac{1}{2x}.$

(j) $y = (x + 2)(2x - 3).$

(k) $y = (x - 3)^2(2x + 1).$

(l) $y = (x - 5)^2(2x - 3)^2.$

(m) $y = \frac{x+1}{x^2}.$

2. Find the gradient of $y = x^2 + x - 1$ when $x = 3.$

3. Find the gradient of $y = 3x^2 - 4x + 3$ when $x = -2.$

4. Find the gradient of $y = x^3 + 2x^2 + \frac{x}{2}$ when $x = 2.$

5. Find the gradient of $y = 2x^3 - x^2 - 2x + 1$ when $x = -1.$

6. Find the gradient of $y = 3 - \frac{2}{x}$ when $x = 3.$

7. Find the equation of the tangent to $y = x^2 - 4x + 1$ when $x = 1.$

$$y = -2x$$

8. Find the equation of the tangent to $y = 2x^2 + 3x - 2$ when $x = 2.$

9. Find the equation of the tangent to $y = -3x^2 + 5x - 1$ when $x = -1.$

10. Find the equation of the tangent to $y = x^3 + x^2 - 2x$ when $x = \frac{1}{2}.$

11. Find the equation of the tangent to $y = x^3 - x^2 + 2x - 1$ when $x = -2.$

$$y = 18x + 19$$

12. Find the equation of the tangent to $y = \frac{5}{x}$ when $x = 2.$

$$y = -\frac{5}{4}x + 5$$

13. Find the equation of the tangent to $y = \sqrt{x}$ when $x = 9.$

14. Find the equation of the tangent to $y = x + \frac{1}{x}$ when $x = \frac{1}{2}.$

15. Find the equation of the tangent to $y = 2x^2 + 3x - 1$ when $x = k.$