

## Differentiation III

Patrons are reminded that  $\frac{dy}{dx}$  is the gradient. Also, if a curve passes through a point, then the  $x$  and  $y$  values of the point fit into the equation of the curve.

1. A curve is given by  $y = ax^2 + 2x - 1$ . When  $x = 1$ ,  $\frac{dy}{dx} = 12$ . Find  $a$ .  $a = 5$
2. A curve is given by  $y = 8x^3 + ax + 1$ . When  $x = -1$ ,  $\frac{dy}{dx} = 23$ . Find  $a$ .  $a = -1$
3. A curve is given by  $y = ax^2 + ax + 1$ . When  $x = 4$ ,  $\frac{dy}{dx} = 27$ . Find  $a$ .  $a = 3$
4. A curve is given by  $y = ax^2 + bx + 4$ . It passes through the point  $(1, 5)$ . At that point the curve has gradient 4. Find  $a$  and  $b$ .  $a = 3, b = -2$
5. A curve is given by  $y = mx^2 + 3x + n$ . It passes through the point  $(1, 1)$ . At that point the curve has gradient 7. Find  $m$  and  $n$ .  $m = 2, n = -4$
6. A curve is given by  $y = ax^2 + ax + b$ . It passes through the point  $(1, 10)$ . At that point the curve has gradient 9. Find  $a$  and  $b$ .  $a = 3, b = 4$
7. A curve is given by  $y = x^3 + ax + b$ . It passes through the point  $(2, 14)$ . At that point the curve has gradient 15. Find  $a$  and  $b$ .  $a = 3, b = 0$
8. A curve is given by  $y = x^3 + ax^2 + bx + 2$ . It passes through the point  $(-1, 12)$ . At that point the curve has gradient  $-13$ . Find  $a$  and  $b$ .  $a = 5, b = -6$
9. A curve is given by  $y = ax^4 + bx + 1$ . It passes through the point  $(2, 23)$ . At that point the curve has gradient 35. Find  $a$  and  $b$ .  $a = 1, b = 3$
10. A curve is given by  $y = 2x^3 + ax$ , where  $a$  is a constant. The value of  $\frac{dy}{dx}$  when  $x = 2$  is twice the value of  $\frac{dy}{dx}$  when  $x = -1$ . Work out the value of  $a$ .  $a = 12$
11. A curve is given by  $y = x^2 + kx$ , where  $k$  is a constant. The value of  $\frac{dy}{dx}$  when  $x = 6$  is three times the value of  $\frac{dy}{dx}$  when  $x = 0$ . Work out the value of  $k$ .  $k = 6$
12. A curve is given by  $y = mx^2 + 4x + 3$ , where  $m$  is a constant. The value of  $\frac{dy}{dx}$  when  $x = 8$  is three times the value of  $\frac{dy}{dx}$  when  $x = 2$ . Work out the value of  $m$ .  $m = 2$
13. A curve is given by  $y = 4x^2 + ax$ , where  $a$  is a constant. The value of  $\frac{dy}{dx}$  when  $x = 4$  is five times the value of  $\frac{dy}{dx}$  when  $x = 1$ . Work out the value of  $a$ .  $a = -2$
14. A curve is given by  $y = 5x^3 + kx$ , where  $k$  is a constant. The value of  $\frac{dy}{dx}$  when  $x = 2$  is seven times the value of  $\frac{dy}{dx}$  when  $x = 0$ . Work out the value of  $k$ .  $k = 10$
15. A curve is given by  $y = 4\sqrt{x} + ax$ , where  $a$  is a constant. The value of  $\frac{dy}{dx}$  when  $x = \frac{1}{16}$  is three times the value of  $\frac{dy}{dx}$  when  $x = 1$ . Work out the value of  $a$ .  $a = 1$