

Name: _____

GCSE Further Maths

Differentiation



Corbettmaths

Ensure you have: Pencil, Pen, Calculator

Guidance

1. Read each question carefully before you begin answering it.
2. Check your answers seem right.
3. Always show your workings

Revision for this topic

www.corbettmaths.com/gcse-further-maths

1. $y = 7x^2$

Work out $\frac{dy}{dx}$

$$y = 7x^2$$

$$\frac{dy}{dx} = 14x$$

$$14x$$

(2)

2. $y = 3x^3 - 8x$

Work out $\frac{dy}{dx}$

$$y = 3x^3 - 8x$$

$$\frac{dy}{dx} = 9x^2 - 8$$

$$9x^2 - 8$$

(2)

3. $y = 8x^3 + x - 4$

Work out $\frac{dy}{dx}$

$$y = 8x^3 + x - 4$$

$$\frac{dy}{dx} = 24x^2 + 1$$

$$24x^2 + 1$$

(3)

4. $y = x^7 - 3x^6$

$$y = x^7 - 3x^6$$

Work out $\frac{dy}{dx}$

$$\frac{dy}{dx} = 7x^6 - 18x^5$$

$$7x^6 - 18x^5$$

(3)

5. $y = (x + 4)(x + 2)$

$$y = x^2 + 6x + 8$$

Work out $\frac{dy}{dx}$

$$\frac{dy}{dx} = 2x + 6$$

$$2x + 6$$

(3)

6. $y = 5x^2 - 3x + 7$

Find the value of $\frac{dy}{dx}$ when $x = 1$

$$y = 5x^2 - 3x + 7$$

$$\frac{dy}{dx} = 10x - 3$$

when $x = 1$

$$\frac{dy}{dx} = 10 - 3 = 7$$

$$7$$

(3)

7. $y = x^3(x - 4)$

Work out $\frac{dy}{dx}$

$$y = x^4 - 4x^3$$

$$\frac{dy}{dx} = 4x^3 - 12x^2$$

$$\frac{4x^3 - 12x^2}{\dots\dots\dots} \quad (3)$$

8. $y = (3x - 2)^2$

Work out $\frac{dy}{dx}$

$$y = (3x - 2)(3x - 2)$$

$$y = 9x^2 - 12x + 4$$

$$\frac{dy}{dx} = 18x - 12$$

$$\frac{18x - 12}{\dots\dots\dots} \quad (3)$$

9. $y = \frac{x^9}{3} + \frac{x^4}{4}$

Work out $\frac{dy}{dx}$

$$y = \frac{1}{3}x^9 + \frac{1}{4}x^4$$

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

$$\frac{3x^8 + x^3}{\dots\dots\dots} \quad (3)$$

10. $y = x^3 + 4x^2 + 2$

When $x = -2$, show that the value of $\frac{dy}{dx}$ is -4

$$\frac{dy}{dx} = 3x^2 + 8x$$

when $x = -2$

$$\frac{dy}{dx} = 3(-2)^2 + 8(-2)$$

$$\frac{dy}{dx} = 12 - 16$$

$$\frac{dy}{dx} = -4 \quad \checkmark$$

(3)

11. $y = (1 - 2x)(3 - x)$

Work out $\frac{dy}{dx}$

$$y = 3 - x - 6x + 2x^2$$

$$y = 3 - 7x + 2x^2$$

$$\frac{dy}{dx} = -7 + 4x$$

$$= 4x - 7$$

$$\frac{dy}{dx} = \frac{4x - 7}{\dots\dots\dots}$$

(3)

12. $y = (x^4 - 3)^2$

Work out $\frac{dy}{dx}$

$$y = (x^4 - 3)(x^4 - 3)$$

$$y = x^8 - 3x^4 - 3x^4 + 9$$

$$y = x^8 - 6x^4 + 9$$

$$\frac{dy}{dx} = 8x^7 - 24x^3$$

$$8x^7 - 24x^3$$

(4)

13.. $y = \frac{3}{x^2}$

$$y = 3x^{-2}$$

$$\frac{dy}{dx} = -6x^{-3}$$

$$= -\frac{6}{x^3}$$

$$-\frac{6}{x^3}$$

(2)

14. $y = \frac{3x^3(x^2 - 4x)}{x}$

$$y = \frac{3x^5 - 12x^4}{x}$$

$$y = 3x^4 - 12x^3$$

Work out $\frac{dy}{dx}$

$$\frac{dy}{dx} = 12x^3 - 36x^2$$

$$\frac{12x^3 - 36x^2}{\dots\dots\dots}$$

(4)

15. $y = \frac{4x(x^3 - 2x)}{x^2}$

$$y = \frac{4x^4 - 8x^2}{x^2}$$

$$y = 4x^2 - 8$$

Work out $\frac{dy}{dx}$

$$\frac{dy}{dx} = 8x$$

.....

(3)

16. $y = 9x^4 - \frac{4}{x^3}$

Work out $\frac{dy}{dx}$

$$y = 9x^4 - 4x^{-3}$$

$$\frac{dy}{dx} = 36x^3 + 12x^{-4}$$

$$\frac{dy}{dx} = 36x^3 + \frac{12}{x^4}$$

$$36x^3 + \frac{12}{x^4}$$

(3)

17. $y = \frac{3}{5}x^{10} + 3x^6$

Work out $\frac{dy}{dx}$

$$y = \frac{3}{5}x^{10} + 3x^6$$

$$\frac{dy}{dx} = 6x^9 + 18x^5$$

$$6x^9 + 18x^5$$

(3)

18. $y = \frac{1}{4}x^3 + \frac{3}{x^2} - 10x$

$$y = \frac{1}{4}x^3 + 3x^{-2} - 10x$$

Work out $\frac{dy}{dx}$

$$\frac{dy}{dx} = \frac{3}{4}x^2 - 6x^{-3} - 10$$

$$\frac{dy}{dx} = \frac{3}{4}x^2 - \frac{6}{x^3} - 10$$

$$\frac{3}{4}x^2 - \frac{6}{x^3} - 10$$

(3)

19. $y = \frac{1}{5}x^8 - \frac{2}{x^3} + 4$

$$y = \frac{1}{5}x^8 - 2x^{-3} + 4$$

Work out $\frac{dy}{dx}$

$$\frac{dy}{dx} = \frac{8}{5}x^7 + 6x^{-4}$$

$$= \frac{8}{5}x^7 + \frac{6}{x^4}$$

$$\frac{8}{5}x^7 + \frac{6}{x^4}$$

(3)

20. $y = 12x^3 + \frac{5}{6x^2} + x$

Work out $\frac{dy}{dx}$

$$y = 12x^3 + \frac{5}{6}x^{-2} + x$$

$$\frac{dy}{dx} = 36x^2 - \frac{5}{3}x^{-3} + 1$$

$$\frac{dy}{dx} = 36x^2 - \frac{5}{3x^3} + 1$$

$$\frac{36x^2 - \frac{5}{3x^3} + 1}{\dots\dots\dots}$$

(3)

21. $y = \frac{3}{10}x^4 - x^2 + \frac{1}{2x^6}$

Work out $\frac{dy}{dx}$

$$y = \frac{3}{10}x^4 - x^2 + \frac{1}{2}x^{-6}$$

$$\frac{dy}{dx} = \frac{6}{5}x^3 - 2x - 3x^{-7}$$

$$\frac{dy}{dx} = \frac{6}{5}x^3 - 2x - \frac{3}{x^7}$$

$$\frac{6}{5}x^3 - 2x - \frac{3}{x^7}$$

.....

(3)

22. $y = 3x^2 + 5x - 1$

Work out the value of x when $\frac{dy}{dx} = 32$

$$\frac{dy}{dx} = 6x + 5$$

$$32 = 6x + 5$$

$$27 = 6x$$

$$x = 4.5$$

$$x = 4.5$$

(3)

23. $y = x^3 + 1$

Work out the possible values of x when $\frac{dy}{dx} = 12$

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

$$12 = 3x^2$$

$$4 = x^2$$

$$x = \pm 2$$

$$x = 2 \text{ or } x = -2$$

(3)

24. $y = 4x^2 + px$ where p is a constant

The value of $\frac{dy}{dx}$ when $x = 3$ is five times the value of $\frac{dy}{dx}$ when $x = -1$

Work out the value of p

$$\frac{dy}{dx} = 8x + p$$

when $x = 3$

$$\frac{dy}{dx} = 24 + p$$

when $x = -1$

$$\frac{dy}{dx} = -8 + p$$

$$5(-8 + p) = 24 + p$$

$$-40 + 5p = 24 + p$$

$$4p = 64$$

$$p = 16$$

$$\frac{16}{(5)}$$

25. $y = \frac{3x^4 + 8x}{2x}$

Work out the possible values of x when $\frac{dy}{dx} = 882$

$$y = \frac{3}{2}x^3 + 4$$

$$\frac{dy}{dx} = \frac{9}{2}x^2$$

$$\frac{9}{2}x^2 = 882$$

$$x^2 = 196$$

$$x = \pm 14$$

$$x = \pm 14$$

$$x = \frac{14 \text{ or } x = -14}{(5)}$$