

10.7 Answers

A-Level Pure Mathematics, Year 1 Additional Mathematics Coordinate Geometry

10.7.1 Solution to 10.4 Making Use of The Key Idea (Teaching Video)

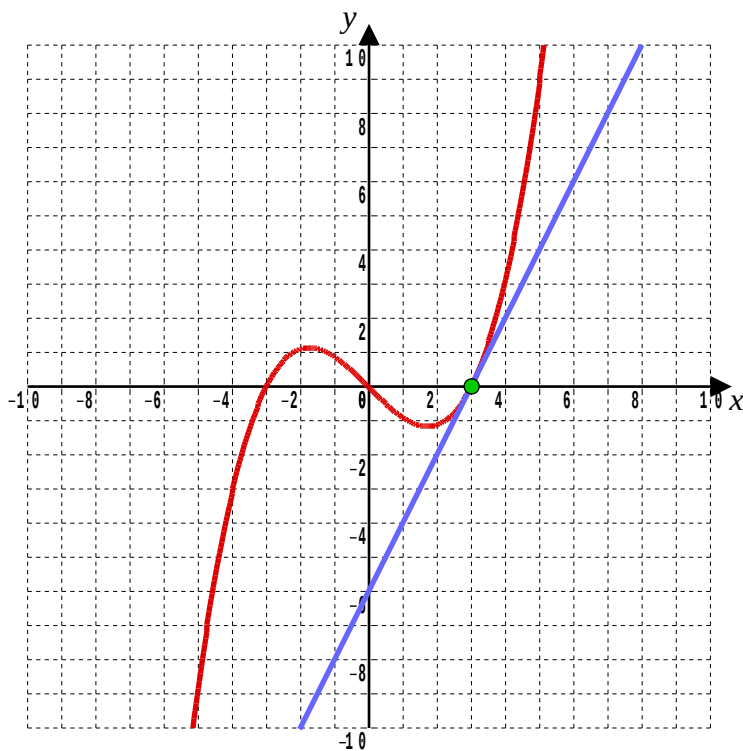
$$\begin{aligned}y &= \frac{x^3}{9} - x + 0 \\ \Rightarrow \frac{dy}{dx} &= \frac{3x^2}{9} - 1 \\ &= \frac{x^2}{3} - 1 \\ \therefore \left. \frac{dy}{dx} \right|_{x=3} &= \frac{3^2}{3} - 1 \\ &= 2\end{aligned}$$

$\therefore$ The tangent is the straight line with gradient 2 through (3, 0)

$$y = mx + c$$

$$0 = 2 \times 3 + c \Rightarrow c = -6$$

The equation of the tangent is, $y = 2x - 6$



[6 marks]

10.7.2 Solutions to 10.6 Exercise

Answer 1

$$y = 4x^8 - 3x^5 \quad \Rightarrow \quad \frac{dy}{dx} = 32x^7 - 15x^4$$

[2 marks]

Answer 2

$$y = 16x^{0.4} \quad \Rightarrow \quad \frac{dy}{dx} = 6x^{-0.6}$$

[2 marks]

Answer 3

$$y = 7 + \frac{1}{2}x^6 \quad \Rightarrow \quad \frac{dy}{dx} = 3x^5$$

[2 marks]

Answer 4

$$y = 0.2x^9 + 0.1x \quad \Rightarrow \quad \frac{dy}{dx} = 1.8x^8 + 0.1$$

[2 marks]

Answer 5

$$y = x^{-5} \quad \Rightarrow \quad \frac{dy}{dx} = -5x^{-6}$$

[2 marks]

Answer 6

$$\begin{aligned} y &= (3x + 8)(2x + 1) \\ &= 6x^2 + 19x + 8 \end{aligned} \quad \Rightarrow \quad \frac{dy}{dx} = 12x + 19$$

[3 marks]

Answer 7

$$y = \frac{x^3}{9} + 4 \quad \Rightarrow \quad \frac{dy}{dx} = \frac{x^2}{3}$$

[2 marks]

Answer 8

$$\begin{aligned} y &= \frac{12}{x^2} \\ &= 12x^{-2} \end{aligned} \quad \Rightarrow \quad \begin{aligned} \frac{dy}{dx} &= -24x^{-3} \\ &= -\frac{24}{x^3} \end{aligned}$$

[2 marks]

Answer 9

$$y = x^3 + 4 \Rightarrow \frac{dy}{dx} = 3x^2 \text{ and so when } x = 1, \frac{dy}{dx} = 3$$

[3 marks]

Answer 10

$$y = 0.1x^5 \Rightarrow \frac{dy}{dx} = 0.5x^4 \text{ and so when } x = 2, \frac{dy}{dx} = 8$$

[2 marks]

Answer 11

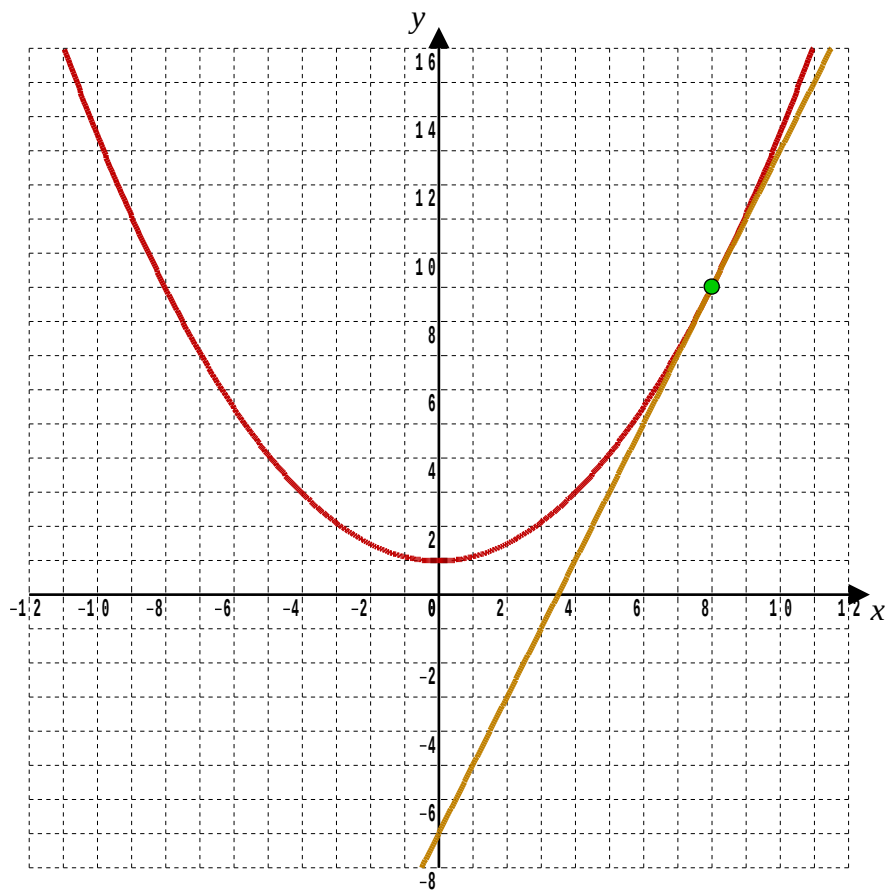
$$y = \frac{x^2}{8} + 1 \Rightarrow \frac{dy}{dx} = \frac{x}{4} \text{ and so when } x = 8, \frac{dy}{dx} = 2$$

$$y = mx + c$$

$$9 = 2 \times 8 + c \Rightarrow c = -7$$

$\therefore$ The equation of the tangent is $y = 2x - 7$

[4 marks]



[2 marks]

Answer 12

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

$$\begin{aligned} \text{when } x = 3, \frac{dy}{dx} &= 27 - 6 - 2 \\ &= 19 \end{aligned}$$

$$y = mx + c$$

$$9 = 19 \times 3 + c \Rightarrow c = -48$$

Equation of the tangent is $y = 19x - 48$

[5 marks]

Answer 13

$$y = x^3 - 3x + 4 \Rightarrow \frac{dy}{dx} = 3x^2 - 3$$

$$\text{when } x = 2, \frac{dy}{dx} = 9$$

$$y = mx + c$$

$$6 = 9 \times 2 + c \Rightarrow c = -12$$

Equation of the tangent is $y = 9x - 12$

[4 marks]

Answer 14

(i)

$$f(x) = \frac{x^3 - x + 8}{16x}, \quad x > 0$$

$$= \frac{x^3}{16x} - \frac{x}{16x} + \frac{8}{16x}$$

$$= \frac{x^2}{16} - \frac{1}{16} + \frac{x^{-1}}{2}$$

$$\therefore A = \frac{1}{16}, B = -\frac{1}{16} \text{ and } C = \frac{1}{2}$$

[4 marks]

(ii)

$$f'(x) = \frac{2x}{16} - \frac{x^{-2}}{2}$$

$$= \frac{x}{8} - \frac{1}{2x^2}$$

[2 marks]

(iii) When $x = 8$, $f(8) = \frac{8^3 - 8 + 8}{16 \times 8} = \frac{8 \times 8 \times 8}{2 \times 8 \times 8} = 4$

$\therefore (8, 4)$ is the point at which the tangent to the curve is wanted

$$\begin{aligned} \text{When } x = 8, f'(8) &= \frac{8}{8} - \frac{1}{2 \times 8 \times 8} \\ &= 1 - \frac{1}{128} = \frac{127}{128} \end{aligned}$$

$$y = mx + c$$

$$4 = \frac{127}{128} \times 8 + c$$

$$4 = \frac{127}{16} + c$$

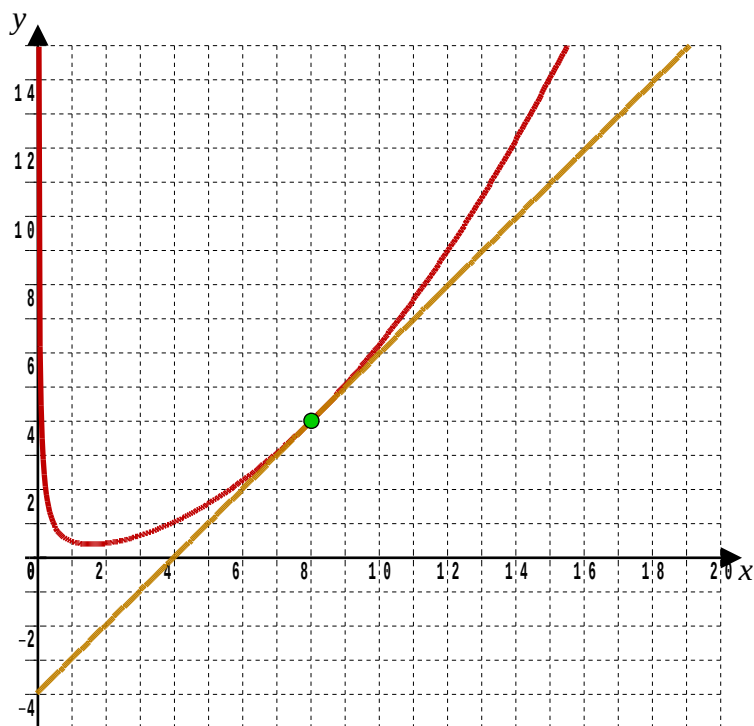
$$c = 4 - \frac{127}{16} = -\frac{63}{16}$$

$$\text{Equation of tangent is } y = \frac{127}{128}x - \frac{63}{16}$$

(This is very close to being $y = x - 4$)

[4 marks]

(iv)



[3 marks]

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