

# Derivative - Product rule - Answers

For questions 1 – 5, Use the product rule of derivative to find the derivative of the following functions.

1.  $y = \sqrt[3]{x^2} \left( \frac{2}{x} - x^3 \right) \quad \frac{dy}{dx} = -\frac{2}{3}x^{-\frac{4}{3}} - \frac{11}{3}x^{\frac{8}{3}}$

2.  $f(t) = (4t^2 - t)(t^3 - 8t^2 + 12) \quad f'(t) = 20t^4 - 132t^3 + 24t^2 + 96t - 12$

3.  $g(z) = (1 + 2z + 3z^2)(5z + 8z^2 - z^3) \quad g'(z) = -15z^4 + 88z^3 + 90z^2 + 36z + 5$

4.  $g(z) = z^2 \left( \frac{2}{z^2} + \frac{5}{z^3} \right) \quad g'(z) = -\frac{5}{z^2}$

5.  $h(y) = (1 + \sqrt{y^3}) \left( \frac{1}{y^3} - 2\sqrt[3]{y} \right) \quad h'(y) = -\frac{3}{y^4} - \frac{3}{2\sqrt{y^5}} - \frac{2}{3\sqrt[3]{y^2}} - \frac{11}{6\sqrt[6]{y^5}}$

For questions 6 – 11 find the gradient of the tangent to: (give answers to 3 significant figures if not exact)

6.  $f(x) = x^4 (1 - 3x)^2$  at  $x = 1$  **28**

7.  $f(x) = x \tan x$  at  $x = \pi$  **3.21**

8.  $f(x) = x^2 e^{-x}$  at  $x = 2$  **0**

9.  $f(x) = 2x^6 (1 + x)^5$  at  $x = -1$  **20**

10.  $f(x) = x^3 \sqrt{4 - x}$  at  $x = 3$  **13.5**

11. Find the equation of the tangent line to  $f(x) = (8 - x^3)(1 + x + x^2)$  at  $x = -2$   **$y = 12$**

12. Find the equation of the tangent line to  $f(x) = (1 + 12\sqrt{x})(4 - x^2)$  at  $x = 9$

13. Find the  $x$ -coordinates of any point on  $y = (1 - x^3)e^{2x}$  where the tangent is horizontal.  **$y = -820x + 4531$**

