# Derivative – Second derivative - Answers

For questions 1 – 6 Find the first two derivatives for each function.

1. $h(t) = 3t^7 - 6t^4 + 8t^3 - 12t + 18$

$h'(t) = 21t^6 - 24t^3 + 24t^2 - 12$

$h''(t) = 126t^5 - 72t^2 + 48t$

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

$V'(x) = 3x^2 - 2x^3 + 1$

$V''(x) = 6x - 2$

3. $f(x) = 4\sqrt[5]{x^3} - \frac{1}{8x^2} - \sqrt{x}$

$f'(x) = \frac{12}{5}x^{-\frac{2}{5}} + \frac{1}{4}x^{-3} - \frac{1}{2}x^{-\frac{1}{2}}$

$f''(x) = -\frac{24}{25}x^{-\frac{7}{5}} - \frac{3}{4}x^{-4} - \frac{1}{4}x^{-\frac{3}{2}}$

4. $f(w) = 7\sin\left(\frac{w}{3}\right) + \cos(1 - 2w)$

$f'(w) = \frac{7}{3}\cos\left(\frac{w}{3}\right) + 2\sin(1 - 2w)$

$f''(w) = -\frac{7}{9}\sin\left(\frac{w}{3}\right) - 4\cos(1 - 2w)$

5. $y = e^{-5z} + 8\ln(2z^4)$

$\frac{dy}{dz} = -5e^{-5z} + 32z^{-1}$

$\frac{d^2y}{dz^2} = 25e^{-5z} - 32z^{-2}$

6. $R(t) = 3t^2 + 8t^{\frac{1}{2}} + e^t$

$R'(t) = 6t + 4t^{-\frac{1}{2}} + e^t$

$R''(t) = 12t - 2t^{-\frac{3}{2}} + e^t$

For questions 7 – 10 determine the second derivative of the given function.

7. $g(x) = \sin(2x^3 - 9x)$

$g''(x) = 12x\cos(2x^3 - 9x) - (6x^2 - 9)^2 \sin(2x^3 - 9x)$

8. $z = \ln(7 - x^3)$

$$\frac{d^2z}{dx^2} = \frac{-42x - 3x^4}{(7 - x^3)^2}$$

9. $$Q(v) = \frac{2}{(6 + 2v - v^2)^4}$$

$Q''(v) = 16(6 + 2v - v^2)^{-5} + 40(2 - 2v)^2 (6 + 2v - v^2)^{-6}$

10. $H(t) = \cos^2(7t)$

$H''(t) = 98\sin^2(7t) - 98\cos^2(7t)$

For questions 11 – 12 find the exact value of the second derivative for these functions at the given value of $x$

11. $f(x) = \tan(x)$, at $x = \frac{\pi}{3}$ $8\sqrt{3}$

12. $f(x) = x\sin(x)$ at $x = 0$ 2