

Second Derivatives

1. $f(x) = 2x^3 - 3x^2 + 7x - 12$

$$f'(x) = 6x^2 - 6x + 7$$

$$f''(x) = 12x - 6 = 6(2x - 1) \quad \boxed{= 0 \text{ at } x = 1/2}$$

2. $f(x) = x^4 + 5x^3 - 2x^2 + x + 1$

$$f'(x) = 4x^3 + 15x^2 - 4x + 1$$

$$f''(x) = 12x^2 + 30x - 4 = 2(6x^2 + 15x - 2)$$

3. $f(x) = x \sin x$

$$f'(x) = \sin x + x \cos x$$

$$f''(x) = \cos x + (\cos x - x \sin x) = 2 \cos x - x \sin x$$

4. $f(x) = e^{x^2}$

$$f'(x) = 2x e^x$$

$$f''(x) = 2e^{x^2} + 2x[e^x \cdot 2x] = 2e^{x^2} + 4x^2 e^{x^2} \\ = 2(1 + 2x^2)e^{x^2}$$

5. $f(x) = \frac{x+1}{x-1}$

$$f'(x) = \frac{(x-1)[1] - (x+1)[1]}{(x-1)^2} = \frac{-2}{(x-1)^2} = -2(x-1)^{-2}$$

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

