

I. Find the value of the 1st derivative at the given point, using the rules for derivatives.

(1) $f(x) = 2x^3 - 5; x = 3$ $f'(5) = 54$

(2) $f(x) = x^2 \sin(x); x = \pi/3$ $f'\left(\frac{\pi}{3}\right) = \frac{\pi^2}{18} + \frac{\sqrt{3}\pi}{3}$

(3) $f(x) = \frac{x - x^3}{4x^2}; x = -7$ $f'(-7) = -48/196$

(4) $f(x) = 5x^{-3} + 2x^2; x = -2$ $f'(-2) = -143/16$

(5) $f(x) = x^2 e^{2x}; x = 3$ $f'(3) = 24e^6$

(6) $f(x) = e^x \sin(x); x = 0.2\pi$ $f'(0.2\pi) \approx 2.619$

(7) $f(x) = \frac{\cos(x)}{x^3 - 2x}; x = 0$ $f'(0) \Rightarrow \infty$

II. Determine whether the function has a maximum or minimum. If so, state where and find the extremum value of the function at that point.

(8) $f(x) = 5x^4 + 2x^2$ $x = 0; f''(0) = 4 \Rightarrow \text{min}$

(9) $f(x) = -4x^2 + 3$ $x = 0; f''(0) = -8 \Rightarrow \text{max}$

(10) $f(x) = \frac{1+x^3}{x}$ $x = \sqrt[3]{0.25}; f''(\sqrt[3]{0.25}) = 12 \Rightarrow \text{min}$

(11) $f(x) = 2 - 3x + 10x^2$ $x = 0.15; f''(0.15) = 20 \Rightarrow \text{min}$

(12) $f(x) = 2\sin(x)$ $x = \pm(n+1/2)\pi, n = 0, 1, 2, \dots; f''(\pm\pi/2) = \mp 2 \Rightarrow \text{max, min, etc.}$

(13) $f(x) = 4\cos(x)$ $x = \pm n\pi, n = 0, 1, 2, \dots; f''(0) = -4 \Rightarrow \text{max}$
 $f''(\pm\pi) = 4 \Rightarrow \text{min, etc.}$

(14) $f(x) = \frac{2}{x^2 + 1}$ $x = 0; f''(0) = -4 \Rightarrow \text{max}$