

Extreme Values of Functions

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For each problem, find the x-coordinates of all critical points and find the open intervals where the function is increasing and decreasing.

1) $f(x) = (-6x + 24)^{\frac{1}{2}}$

2) $f(x) = -2\cot(x); [-\pi, \pi]$

3) $f(x) = -x^2 - 8x - 13$

4) $f(x) = -2\sin(2x); [-\pi, \pi]$

5) $f(x) = -(4x - 16)^{\frac{2}{3}}$

6) $f(x) = -\frac{x^2}{2x + 4}$

7) $f(x) = -(6x + 18)^{\frac{1}{3}}$

8) $f(x) = \frac{x^2}{3x - 6}$

For each problem, find all points of absolute minima and maxima on the given interval.

9) $y = 2\cot(2x); [-\frac{\pi}{4}, \frac{\pi}{4}]$

10) $y = \frac{5}{x^2 + 5}; [-2, 1]$

11) $y = 2x^2 - 12x + 16; [1, 3]$

12) $y = -(2x + 6)^{\frac{2}{3}}; (-5, -1)$

13) $y = \frac{3}{x^2 + 3}; (-6, 0]$

14) $y = x^3 - 2x^2 - 3; (-\infty, \infty)$

15) $y = -(7x - 42)^{\frac{1}{3}}; [2, 5]$

For each problem, find all points of relative minima and maxima.

16) $y = -x^3 + 4x^2 - 6$

17) $y = -(6x + 36)^{\frac{2}{3}}$

18) $y = -2\csc(x); [-\pi, \pi]$

19) $y = \frac{1}{x^2 - 1}$

20) $y = \cos(2x); [-\pi, \pi]$

21) $y = 2x^2 + 12x + 14$

Answers to Extreme Values of Functions

- 1) Critical point at: $x = 4$
Increasing: No intervals exist. Decreasing: $(-\infty, 4)$
- 2) No critical points exist.
Increasing: $(-\pi, 0), (0, \pi)$ Decreasing: No intervals exist.
- 3) Critical point at: $x = -4$
Increasing: $(-\infty, -4)$ Decreasing: $(-4, \infty)$
- 4) Critical points at: $x = -\frac{3\pi}{4}, -\frac{\pi}{4}, \frac{\pi}{4}, \frac{3\pi}{4}$
Increasing: $(-\frac{3\pi}{4}, -\frac{\pi}{4}), (\frac{\pi}{4}, \frac{3\pi}{4})$ Decreasing: $(-\pi, -\frac{3\pi}{4}), (-\frac{\pi}{4}, \frac{\pi}{4}), (\frac{3\pi}{4}, \pi)$
- 5) Critical point at: $x = 4$
Increasing: $(-\infty, 4)$ Decreasing: $(4, \infty)$
- 6) Critical points at: $x = -4, 0$
Increasing: $(-4, -2), (-2, 0)$ Decreasing: $(-\infty, -4), (0, \infty)$
- 7) Critical point at: $x = -3$
Increasing: No intervals exist. Decreasing: $(-\infty, \infty)$
- 8) Critical points at: $x = 0, 4$
Increasing: $(-\infty, 0), (4, \infty)$ Decreasing: $(0, 2), (2, 4)$
- 9) No absolute minima.
No absolute maxima.
- 10) Absolute minimum: $(-2, \frac{5}{9})$
Absolute maximum: $(0, 1)$
- 11) Absolute minimum: $(3, -2)$
Absolute maximum: $(1, 6)$
- 12) No absolute minima.
Absolute maximum: $(-3, 0)$
- 13) No absolute minima.
Absolute maximum: $(0, 1)$
- 14) No absolute minima.
No absolute maxima.
- 15) Absolute minimum: $(5, \sqrt[3]{7})$
Absolute maximum: $(2, \sqrt[3]{28})$
- 16) Relative minimum: $(0, -6)$
Relative maximum: $(\frac{8}{3}, \frac{94}{27})$
- 17) No relative minima.
Relative maximum: $(-6, 0)$
- 18) Relative minimum: $(-\frac{\pi}{2}, 2)$
Relative maximum: $(\frac{\pi}{2}, -2)$
- 19) No relative minima.
Relative maximum: $(0, -1)$
- 20) Relative minima: $(-\frac{\pi}{2}, -1), (\frac{\pi}{2}, -1)$
Relative maxima: $(-\pi, 1), (0, 1), (\pi, 1)$
- 21) Relative minimum: $(-3, -4)$
No relative maxima.