

Practice 1st Deriv Test. (Same as SWOK m3)

• Determine the intervals where $f(x)$ is increasing and decreasing. Classify & locate local extrema.

1. $f(x) = 2x^3 + x^2 - 20x + 1$ 2. $f(x) = 4x^3 - 3x^4$ 3. $f(x) = x^{4/3} + 4x^{1/3}$

4. $f(x) = x^{2/3}(8-x)$ 5. $f(x) = x\sqrt{x^2-9}$ 6. $f(x) = \cos x - \sin x$ $[0, 2\pi]$

7. $f(x) = 2\cos x + \sin 2x$ $[0, 2\pi]$ 8. $f(x) = \sqrt{x^2+4}$

9. $f(x) = \frac{\sqrt{x-3}}{x^2}$

10. $f(x) = \cot^2 x + 2\cot x$ $[\pi/6, 5\pi/6]$
(Find local extrema only)

11. $f(x) = \frac{1}{2}x + \cos x$ $[-2\pi, 2\pi]$
(Find local extrema only)
x-values only

Sketch the graph of a differentiable function that satisfies the given conditions.

12. $f(0) = 3$; $f(-2) = f(2) = -4$; $f'(0)$ DNE; $f'(-2) = f'(2) = 0$;
 $f'(x) > 0$ if $-2 < x < 0$ or $x > 2$; $f'(x) < 0$ if $x < -2$ or $0 < x < 2$

13. $f(3) = 5$; $f(5) = 0$; $f'(5)$ is undefined; $f'(3) = 0$; $f'(x) > 0$
on $(-\infty, 3) \cup (5, \infty)$; $f'(x) < 0$ on $(3, 5)$.

14. $f(0) = 3$; $f(-2) = f(2) = -4$; $f'(-2) = f'(0) = f'(2) = 0$;
 $f'(x) > 0$ if $-2 < x < 0$ or $x > 2$; $f'(x) < 0$ if $x < -2$ or $0 < x < 2$.

Ans.

1. $f(x) \uparrow (-\infty, -2) \cup (\frac{5}{3}, \infty) \downarrow (-2, \frac{5}{3})$ L.max $(-2, 29)$ L.min $(\frac{5}{3}, -\frac{548}{27})$
2. $\uparrow (-\infty, 0) \cup (0, 1) \downarrow (1, \infty)$ L.max $(1, 1)$ No min
3. $\uparrow (-1, 0) \cup (0, \infty) \downarrow (-\infty, -1)$ $(-1, -3)$ L.min No L.max
4. CN: $\frac{16}{5}, 0 \downarrow (-\infty, 0) \cup (\frac{16}{5}, \infty) \uparrow (0, \frac{16}{5})$ L.min $(0, 0)$ L.max $(\frac{16}{5}, \approx 9.42)$
5. CN: $\pm 3 \uparrow (-\infty, -3) \cup (3, \infty)$ No ^{local} extrema
6. CN: $\frac{3\pi}{4}, \frac{7\pi}{4} \downarrow (0, \frac{3\pi}{4}) \cup (\frac{7\pi}{4}, 2\pi) \uparrow (\frac{3\pi}{4}, \frac{7\pi}{4})$ L.min $(\frac{3\pi}{4}, -\sqrt{2})$ L.max $(\frac{7\pi}{4}, \sqrt{2})$
7. CN: $\frac{\pi}{6}, \frac{5\pi}{6}, \frac{3\pi}{2} \uparrow (0, \frac{\pi}{6}) \cup (\frac{5\pi}{6}, \frac{3\pi}{2}) \cup (\frac{3\pi}{2}, 2\pi) \downarrow (\frac{\pi}{6}, \frac{5\pi}{6})$ L.max $(\frac{\pi}{6}, \frac{3\sqrt{3}}{2})$
min $(\frac{5\pi}{6}, -\frac{3\sqrt{3}}{2})$
8. CN: $0 \downarrow (-\infty, 0) \uparrow (0, \infty)$ L.min $(0, 2)$
9. CN: $4, 3 \uparrow (3, 4) \downarrow (4, \infty)$ L.max $(4, \frac{1}{16})$
10. CN: $\frac{3\pi}{4}$ L.min $(\frac{3\pi}{4}, -1)$
11. CN: $-\frac{11\pi}{6}, -\frac{7\pi}{6}, \frac{\pi}{6}, \frac{5\pi}{6}$ L.min $\odot x = -\frac{7\pi}{6}, \frac{5\pi}{6}$ L.max $\odot x = -\frac{11\pi}{6}, \frac{\pi}{6}$