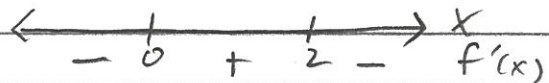


BC @ 201 Lesson 2. HW Solutions

AB Q203. Lesson 2. HW. Solutions.

1. $f(x) = -2x^3 + 6x^2 - 3$

$f'(x) = -6x^2 + 12x = 6x(2-x) = 0 \quad x = 0, 2$



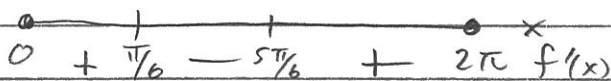
a) f is decreasing on $(-\infty, 0] \cup [2, \infty)$ because $f'(x) < 0$
on $(-\infty, 0) \cup (2, \infty)$

b) f has a local min at $x=0$ b/c $f'(x)$ goes from neg^{ative} to pos^{itive} at $x=0$.
 f has a local max at $x=2$ b/c $f'(x)$ goes from pos^{itive} to neg^{ative} at $x=2$.

c) $f(0) = -3$ is the local min
 $f(2) = 5$ is the local max

2. $f(x) = x + 2 \cos(x) \quad [0, 2\pi]$

$f'(x) = 1 - 2 \sin x = 0 \rightarrow \sin x = 1/2 \quad x = \pi/6, 5\pi/6$



a) f is increasing on $[0, \pi/6] \cup [5\pi/6, 2\pi]$

b/c $f'(x) > 0$ on $(0, \pi/6) \cup (5\pi/6, 2\pi)$ *Bracket or () about 0 and 2π

b) f has a local max at $x = \pi/6$ b/c $f'(x)$ goes from pos^{itive} to neg^{ative} at $x = \pi/6$
 f has a local min at $x = 5\pi/6$ b/c $f'(x)$ goes from neg^{ative} to pos^{itive} at $x = 5\pi/6$

c) $f(0)$ is a local min (increases away from start point)
 $f(2\pi)$ is a local max (increases to end point)
"endpoint analysis"

d) $f(0) = 2$ $2\pi + 2$ is the absolute max and
 $f(2\pi) = 2\pi + 2$ $5\pi/6 - \sqrt{3}$ is the absolute min by
 $f(\pi/6) = \pi/6 + \sqrt{3}$ the closed interval test.
 $f(5\pi/6) = 5\pi/6 - \sqrt{3}$

4. a. Graph

b. $f'(x) = 0$ at $x = -0.507, x = 0.494$

c. f is increasing on $(-1, -0.507] \cup [0.494, 1)$
because $f'(x) > 0$ on $(-1, -0.507) \cup (0.494, 1)$

d. f has a local max at $x = -0.507$
because $f'(x)$ goes from positive to negative at $x = -0.507$

5. a. Graph

b. $f'(x) = 0$ at $x = -1.794, 1.794$

c. f is increasing on $[-1.794, 1.794]$ b/c
 $f'(x) > 0$ on $(-1.794, 1.794)$

d. f has a local max at $x = 1.794$ b/c
 $f'(x)$ goes from positive to negative at 1.794

6. a. Graph

b. $f'(x) = 0$ at $x = -1.253, 0, 1.253$

c. f is increasing on $[-2, -1.253] \cup [0, 1.253]$
b/c $f'(x) > 0$ on $(-2, -1.253) \cup (0, 1.253)$

d. f has a local min at $x = 0$ b/c
 $f'(x)$ goes from negative to positive at $x = 0$

f has a local min at $x = -2$ b/c f increases away from $f(-2)$

f has a local min at $x = 2$ b/c f decreases to $f(2)$

1990 ABS

(a) $f(x) = 0$

$$\sin^2 x - \sin x = 0$$

$$\sin x (\sin x - 1) = 0 \rightarrow x = 0, \pi, \frac{\pi}{2}$$

$$\sin x = 0 \text{ or } \sin x = 1$$

(b) $f'(x) = 2\sin x \cos x - \cos x = 0$

$$\cos x (2\sin x - 1) = 0 \rightarrow x = \frac{\pi}{2}, \frac{3\pi}{2}, \frac{\pi}{6}, \frac{5\pi}{6}$$

$$\cos x = 0 \text{ or } \sin x = \frac{1}{2}$$

f is increasing on $[\frac{\pi}{6}, \frac{\pi}{2}] \cup [\frac{5\pi}{6}, \frac{3\pi}{2}]$

b/c $f'(x) > 0$ on $(\frac{\pi}{6}, \frac{\pi}{2}) \cup (\frac{5\pi}{6}, \frac{3\pi}{2})$.

(c) interior critical pts: $x = \frac{\pi}{2}, \frac{\pi}{6}, \frac{5\pi}{6}$
endpoint critical pts: $x = 0, \frac{3\pi}{2}$

$$f(0) = 0 - 0 = 0$$

$$f(\frac{\pi}{6}) = (\frac{1}{2})^2 - \frac{1}{2} = -\frac{1}{4}$$

$$f(\frac{\pi}{2}) = 1 - 1 = 0$$

$$f(\frac{5\pi}{6}) = (\frac{1}{2})^2 - \frac{1}{2} = -\frac{1}{4}$$

$$f(\frac{3\pi}{2}) = 1 + 1 = 2$$

The absolute max is $\boxed{2}$

The absolute min is $\boxed{-\frac{1}{4}}$

Lesson 2 HW (additional Solutions)

3. $f(x) = x\sqrt{x^2 - 9}$ $D: (-\infty, -3] \cup [3, \infty)$

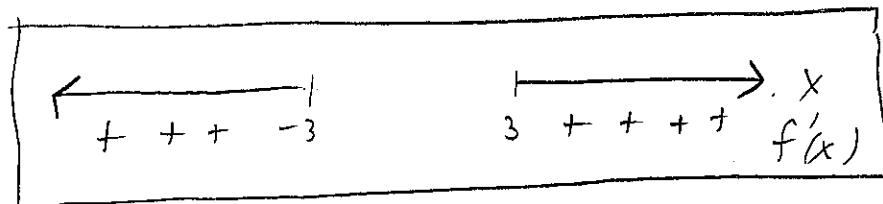
$$f'(x) = x \cdot \frac{1}{2}(x^2 - 9)^{-\frac{1}{2}} \cdot 2x + \sqrt{x^2 - 9}$$

$$= \frac{x^2}{\sqrt{x^2 - 9}} + \sqrt{x^2 - 9} = \frac{x^2}{\sqrt{x^2 - 9}} + \frac{x^2 - 9}{\sqrt{x^2 - 9}}$$

$$= \frac{2x^2 - 9}{\sqrt{x^2 - 9}}$$

$$f'(x) = 0 \quad x = \pm \frac{3}{\sqrt{2}} \rightarrow \text{out of domain}$$

$$f'(x) \text{ DNE when } x = \pm 3$$



f is never decreasing because $f'(x)$ is never negative.

f has a local max at $x = -3$ b/c f increases up to $f(-3)$.

f has a local min at $x = 3$ b/c f increases away from $f(3)$.