

## The First Derivative Test

## HW 3-5

Determine the intervals where  $f(x)$  is increasing and decreasing and locate all local and/or absolute extrema.

$$1) f(x) = 2x^3 + x^2 - 20x + 1, [-4, 3] \quad 2) f(x) = 4x^3 - 3x^4$$

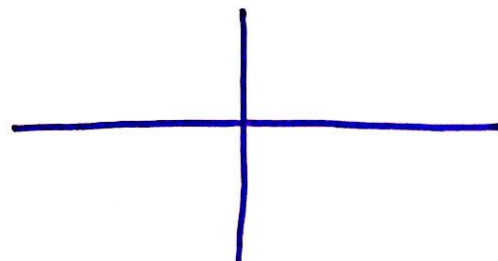
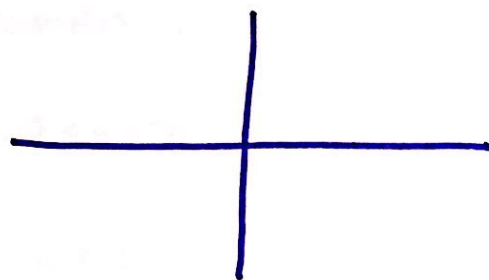
$$3) f(x) = x\sqrt{x^2 - 9}, [-5, 5]$$

$$4) f(x) = \cos x - \sin x, [0, 2\pi]$$

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

$$5) f(3) = 5, f(5) = 0, f'(5) \text{ is undefined, } f'(3) = 0, f'(x) > 0 \text{ if } x < 3 \text{ or } x > 5, f'(x) < 0 \text{ if } 3 < x < 5$$

$$6) f(3) = 5, f(5) = 0, f'(3) = f'(5) = 0, f'(x) > 0 \text{ if } x < 3 \text{ or } x > 5, f'(x) < 0 \text{ if } 3 < x < 5.$$



7) Find the  $x$ -value where the function  $y = -x^2 + 5x - 6$  will have an absolute maximum.

8) Find where the function  $y = \frac{1}{3}x^3 + x^2$  has a relative minimum.

9) Is there a relative minimum or maximum for  $f(x) = \frac{1}{4}x^4 - \frac{4}{3}x^3 - \frac{3}{2}x^2 + 18x$  at  $x = 3$ ? Justify using calculus.

10) For  $f(x) = x^3 + 12x - 24$ , is the function...

- a) increasing for  $x < -2$ , decreasing for  $-2 < x < 2$ , increasing for  $x > 2$
- b) decreasing for  $x < 0$ , increasing for  $x > 0$
- c) increasing for all  $x$
- d) decreasing for all  $x$
- e) decreasing for  $x < -2$ , increasing for  $-2 < x < 2$ , decreasing for  $x > 2$ .