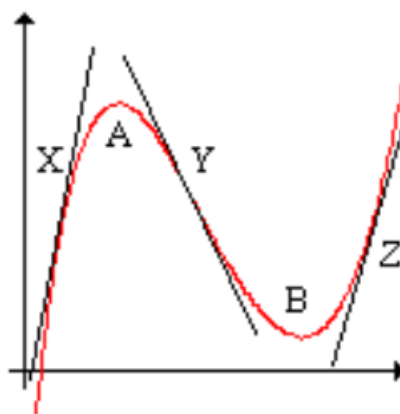


Do now as a warm-up:

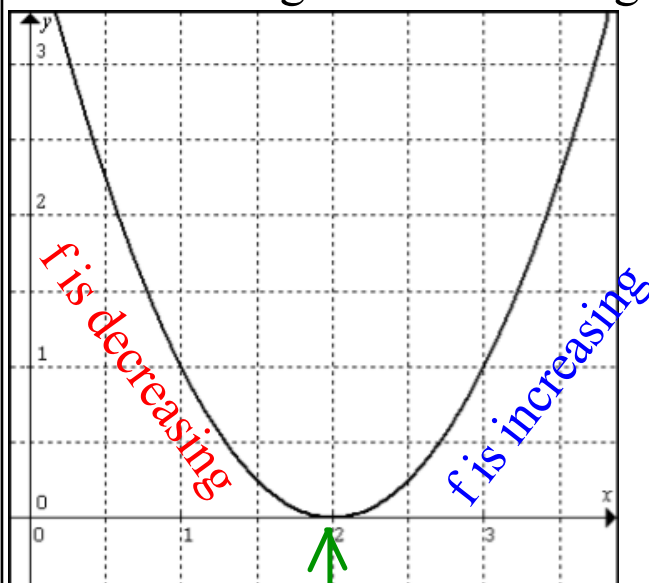
1. Classify point A and point B as either a local maximum or a local minimum.



2. Classify the slope at points X, Y, and Z as either positive or negative.

3. Devise a verbal rule that relates slope along a curve to the position of local extrema.

3.3 Increasing and Decreasing Functions



$$f'(x) < 0$$

$$f'(c) = 0$$

$$f'(x) > 0$$

Informal Defn. If, for each pair of points on an interval, the left point is lower than the right point, the function is increasing on the interval and if the right point is lower, the function is decreasing on an interval.

Formal Defn. A function is increasing on an interval if for any numbers $x_1 < x_2$ then $f(x_1) < f(x_2)$ and the function is decreasing on an interval when $f(x_1) > f(x_2)$.

Thm. Test for increasing or decreasing functions

Let f be continuous on $[a,b]$ and differentiable on (a,b) .

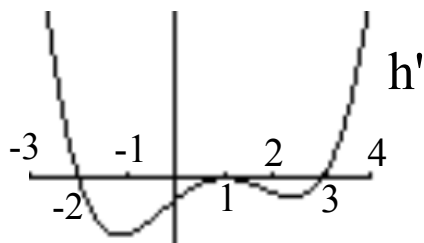
1. If $f'(x) > 0 \quad \forall x \in (a,b)$ then f is increasing on $[a,b]$.
2. If $f'(x) < 0 \quad \forall x \in (a,b)$ then f is decreasing on $[a,b]$.
3. If $f'(x) = 0 \quad \forall x \in (a,b)$ then f is constant on $[a,b]$.

ex. Determine where the function is increasing or decreasing if $f(x) = -x^3 + 12x + 25$

ex. At what x values does f have extrema and on what intervals is f increasing or decreasing if

$$f'(x) = (x - 5)(x + 3)(x - 3)$$

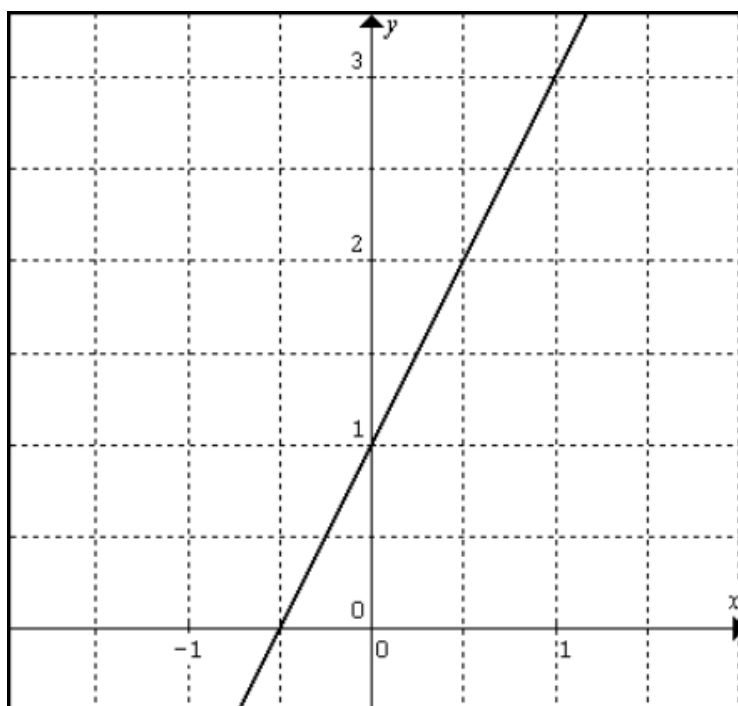
ex. The function h is defined on $(-3,4)$ and the graph below is the graph of h' . Find the x coordinates of all relative maxima of h .



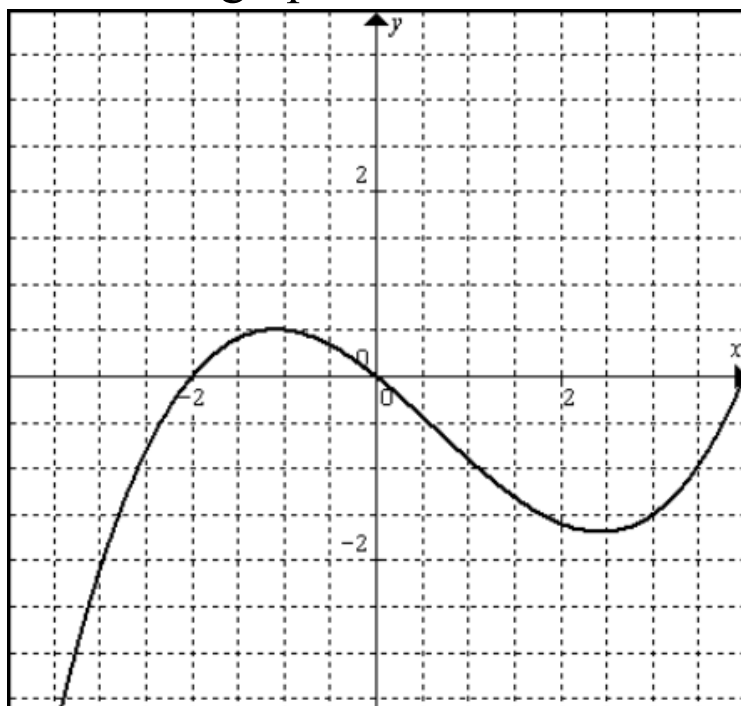
ex. The graph of h' is shown below. For what values of x is h increasing?



ex. This is the graph of f . Sketch the graph of f' .

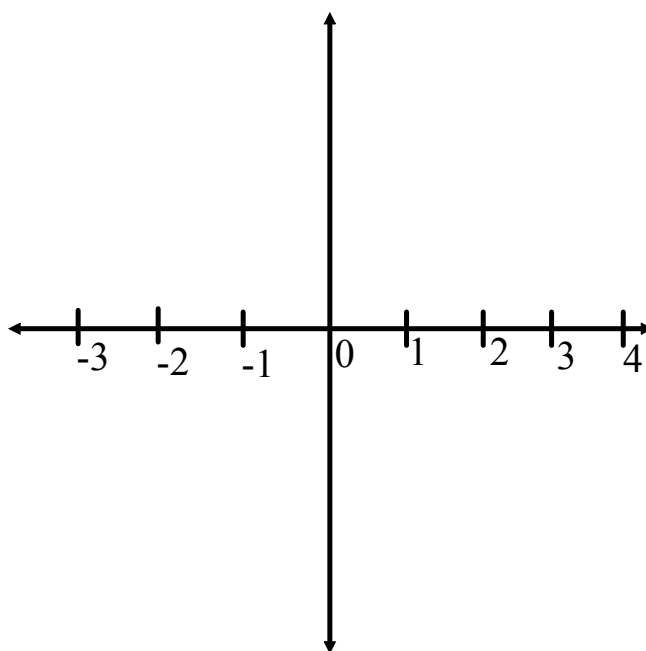


ex. This is the graph of f . Sketch the graph of f' .



ex. Sketch the graph of a function whose derivative satisfies the following properties:

x	$(-\infty, -1)$	-1	$(-1, 1)$	1	$(1, 3)$	3	$(3, \infty)$
$f'(x)$	Positive	0	Negative	0	Negative	0	Positive



ex. If g is a diff 'ble function such that $g(x) < 0$ for all real numbers x . Find the x coordinate of all relative maxima and relative minima of the function f if $f'(x) = (x^2 - 4)g(x)$

ex. Find the highest and lowest points on the curve

$$x^2 + y^2 + xy = 12$$

ex. Use the first derivative to show that

$f(x) = x^4 - 4x + 2$ has at most 2 real roots.

info about solution

more info