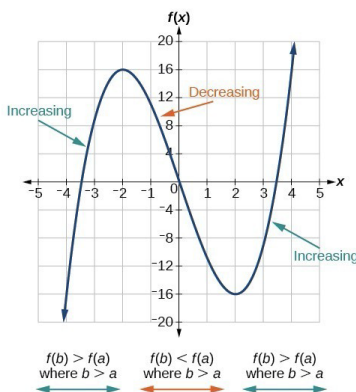


Increasing and Decreasing Functions & the First Derivative Test**Definitions**

1. A function f is _____ on an interval if for any two numbers a, b in the interval,
 $b > a$ implies _____
2. A function f is _____ on an interval if for any two numbers a, b in the interval,
 $b > a$ implies _____

Test for Increasing and Decreasing Functions

1. If $f'(x) > 0$ for all x in (a, b) , then f is _____ on $[a, b]$
2. If $f'(x) < 0$ for all x in (a, b) , then f is _____ on $[a, b]$
3. If $f'(x) = 0$ for all x in (a, b) , then f is _____ on $[a, b]$

First Derivative Test:

Let c be a critical number of a function f that is continuous on an open interval (a, b) where $a < c < b$.

If f is differentiable on the interval, except possibly at c , then $(c, f(c))$ can be classified as follows:

1. If $f'(x)$ _____ from _____ to _____ at $x = c$,
then $(c, f(c))$ is a _____
2. If $f'(x)$ _____ from _____ to _____ at $x = c$,
then $(c, f(c))$ is a _____

Find the intervals where f is increasing and decreasing, identify all points that are relative maximum and minimum points, and justify your answers. Use your results to sketch the graph.

1. $f(x) = \frac{1}{3}x^3 - x^2 - 3x + 2$

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

3. $f(x) = \frac{x^2}{2x - 1}$

4. Let g be the function defined by $g(x) = x^4 + 4x^3$. How many relative extrema does g have?

5. The function $s(t) = t^2 - 7t + 10$ describes the motion of a particle along a line.

(a) Find the velocity function of the particle at any time $t > 0$.

(b) Identify the time interval(s) in which the particle is moving in a positive direction. Justify.

(c) Identify the time interval(s) in which the particle is moving in a negative direction. Justify.

(d) Identify the time(s) at which the particle changes direction. Justify.

AP Style Practice

6. The function $y = g(x)$ is differentiable and decreasing for all real numbers. On what intervals is the function $y = g(x^3 - 6x^2)$ increasing?

7. Let f be the function given by $f(x) = 3 - 2x$. If g is a function with derivative given by $g'(x) = f(x)f'(x)(x - 3)$, on what intervals is g increasing?

8. What are all values of x for which the function f defined by $f(x) = (x^2 - 3)e^{-x}$ is increasing?

x	-4	-3	-2	-1	0	1	2	3	4
$g'(x)$	2	3	0	-3	-2	-1	0	3	2

9. The derivative g' of a function g is continuous and has exactly two zeros. Selected values of g' are given in the table above. If the domain of g is the set of all real numbers, then g is decreasing on what intervals?