# Function Analysis Notes
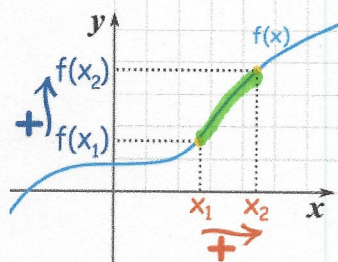
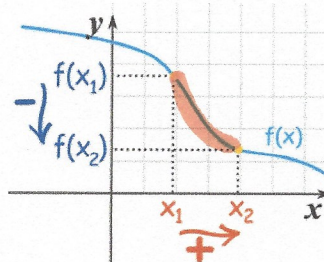## Increasing and Decreasing

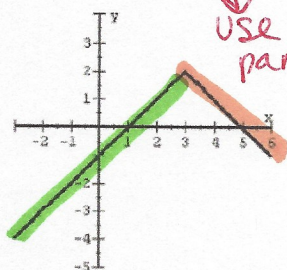| A function is "increasing" when the **y-values** increase as the **x-values** increases: | A function is "increasing" when the **y-values** decrease as the **x-values** increases: |
|---|---|
|  |  |
| (More simply, as you look at the graph from left to right, the graph goes <u>up</u>.) | (More simply, as you look at the graph from left to right, the graph goes <u>down</u>.) |

*When stating the open intervals on which a function is increasing or decreasing do NOT include turning points or endpoints.
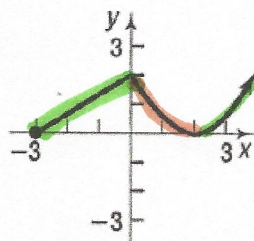
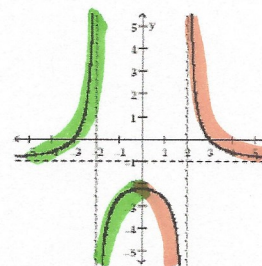Ex 1) Determine the open intervals on which the graph is increasing and decreasing.

use parentheses

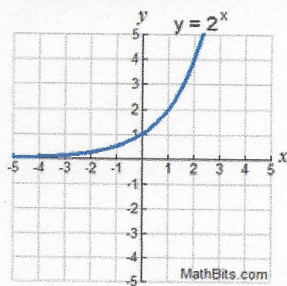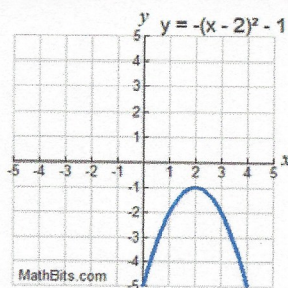| a) | b) | c) |
|---|---|---|
|  |  |  |
| inc: $(-\infty, 3)$ <br> dec: $(3, \infty)$ | inc: $(-3, 0) \cup (2, \infty)$ <br> dec: $(0, 2)$ | inc: $(-\infty, -2) \cup (-2, 0)$ <br> dec: $(0, 2) \cup (2, \infty)$ |

## Positive and Negative

The "positive" regions of a function are those intervals where the function is <u>above the</u> <u>x-axis</u>. Simply, it is where the y-values are positive (not zero).

The "negative" regions of a function are those intervals where the function is <u>below the</u> <u>x-axis</u>. Simply, it is where the y-values are negative (not zero).
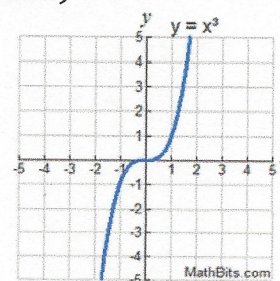
| Some functions are positive over their entire domain (All y-values above the x-axis.) | Some functions are negative over their entire domain. (All y-values below the x-axis.) | Some functions have both positive and negative regions. (y-values are above and below the x-axis) |
|---|---|---|
|  |  |  |

*When stating the open intervals on which a function is positive or negative do NOT include zeros.

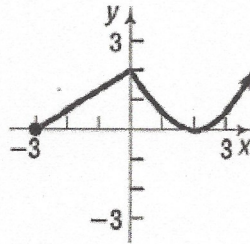Ex 2) Determine the open intervals on which the graph is positive and negative.
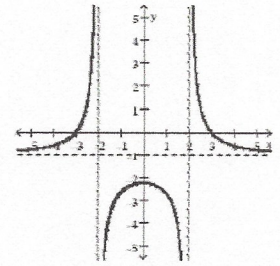
a)
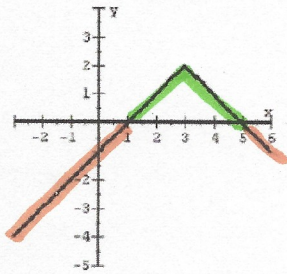


$+: (-\infty, 1) \cup (5, \infty)$

$-: (1, 5)$
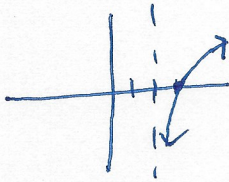
b)



$+: (-3, 2) \cup (2, \infty)$

$-: $ never

c)



$+: (-3, -2) \cup (2, 3)$

$-: (-\infty, -3) \cup (-2, 2) \cup (3, \infty)$

Ex 3) Sketch the function. Then determine the open intervals on which the function is increasing, decreasing, positive and negative.
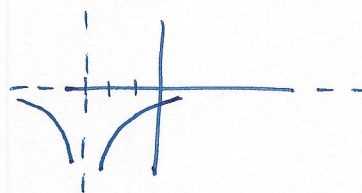
a) $y = \ln(x-2)$



inc: $(2, \infty)$
dec: never
$+: (3, \infty)$
$-: (2, 3)$

b) $y = \dfrac{-1}{(x+3)^2}$



inc: $(-3, \infty)$
dec: $(-\infty, -3)$
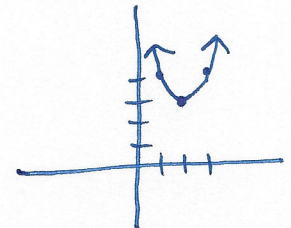$+: $ never
$-: (-\infty, -3) \cup (-3, \infty)$

c) $y = x^2 - 4x + 7$

vertex: $x = \dfrac{4}{2(1)} = 2$

$y = (2)^2 - 4(2) + 7 = 3$



inc: $(2, \infty)$
dec: $(-\infty, 2)$
$+: (-\infty, \infty)$
$-: $ never