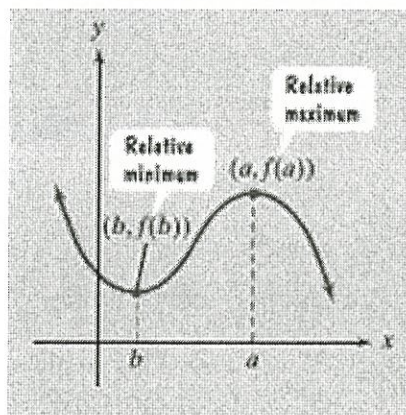


Notes 1.3 – More on Functions and Their Graphs

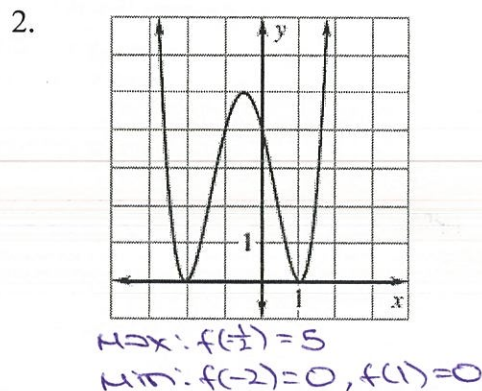
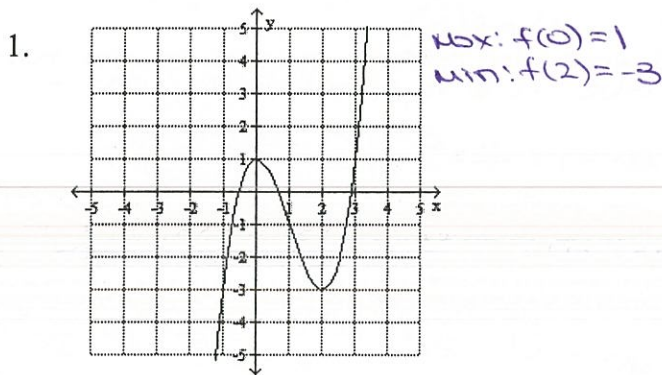
Relative Maxima and Relative Minima:

- Relative Max: function value  $f(c)$  of  $f$  if there exists an open interval containing  $c$  such that  $f(c) \geq f(x)$  for all  $x \neq c$  in the open interval
- Relative Min:  $f(b)$  of  $f$  if there exists an open interval containing  $b$  such that  $f(b) \leq f(x)$  for all  $x \neq b$  in the open interval

TYPE OUT

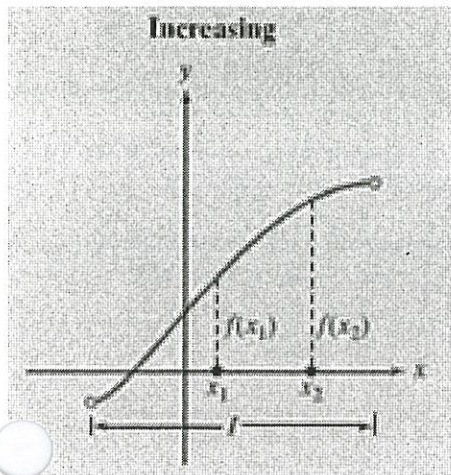


Ex: State the relative maximum and/or minimum



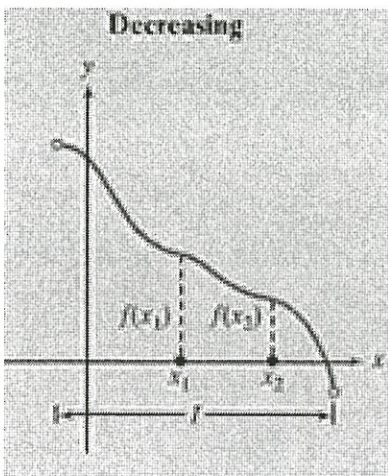
Increasing, Decreasing, and Constant Functions:

Increasing



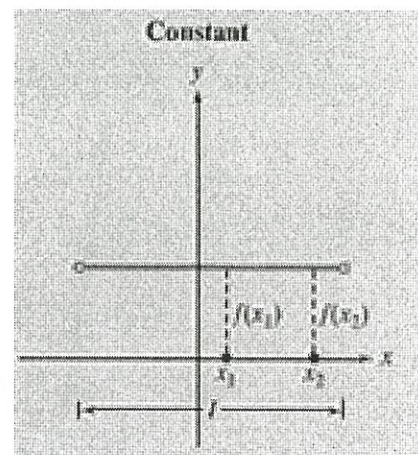
Increasing on open interval if  $f(x_1) < f(x_2)$  whenever  $x_1 < x_2$  for any  $x_1$  and  $x_2$  in the interval

Decreasing



Decreasing on open interval if  $f(x_1) > f(x_2)$  whenever  $x_1 < x_2$  for any  $x_1$  and  $x_2$  in the interval

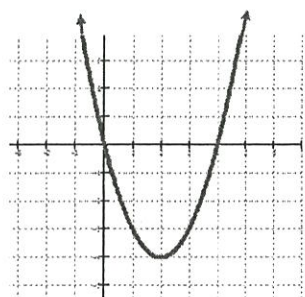
Constant



constant on open interval if  $f(x_1) = f(x_2)$  for any  $x_1$  and  $x_2$  in the interval

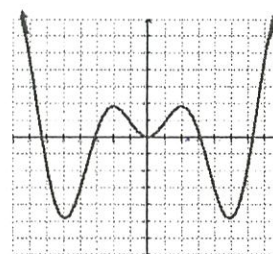
Ex: State the intervals on which each given function is increasing, decreasing, or constant

1.



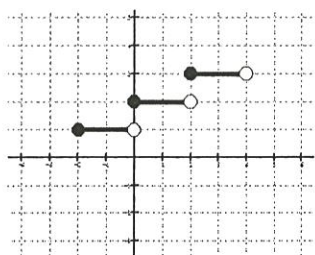
Inc:  $(2, \infty)$   
Dec:  $(-\infty, 2)$

2.



Inc:  $(-5, -2)$   
 $(0, 2)$   $(5, \infty)$   
Dec:  $(-\infty, -5)$   $(-2, 0)$   
 $(3, 5)$

3.



constant:  $[-2, 0)$   $[0, 2)$   $[2, 4)$   
Inc:  $(-\infty, \infty)$

**Even and Odd Functions:**

- ▶ Even Function if  $f(-x) = f(x)$ 
  - Right side of the equation of an even function does not change if  $x$  is replaced with  $-x$
- ▶ Odd function if  $f(-x) = -f(x)$ 
  - Every term on the right side of the equation of an odd function changes its sign if  $x$  is replaced with  $-x$

Ex: Determine whether each of the following functions is even, odd or neither.

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

$$f(-x) = (-x)^3 - 6(-x)$$

$$= -x^3 + 6x$$

$$f(-x) = -f(x)$$

ODD

2.  $g(x) = x^4 - 2x^2$

$$g(-x) = (-x)^4 - 2(-x)^2$$

$$= x^4 - 2x^2$$

$$f(-x) = f(x)$$

EVEN

3.  $h(x) = x^2 + 2x + 1$

$$h(-x) = (-x)^2 + 2(-x) + 1$$

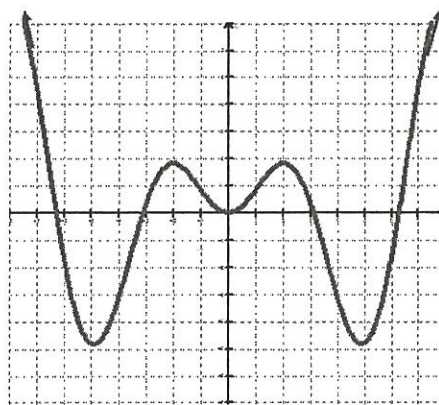
$$= x^2 - 2x + 1$$

$$h(-x) \neq h(x)$$

$$h(-x) \neq -h(x)$$

Neither

4.



EVEN

- \* Even Functions symmetric with respect to y-axis
- \* Odd Functions symmetric with respect to origin