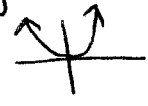
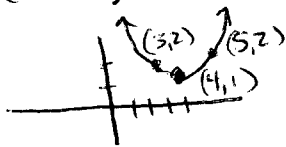
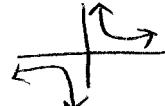


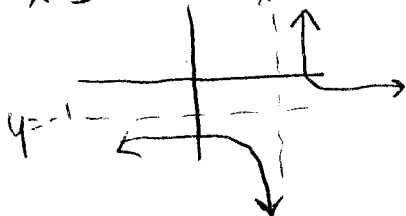
Section 3.4 - Techniques of Graphing

- 2a) $y = f(x+2) + 3$ K left by 2 then up by 3
 b) $y = f(x+3) + 2$ B left by 3, then up by 2
 c) $y = f(x-2) + 3$ J right by 2, then up by 3
 d) $y = f(x-2) - 3$ L right by 2, then down by 3
 e) $y = f(x+2) - 3$ A left by 2, down by 3
 f) $y = f(x-3) + 2$ C right by 3, up by 2
 g) $y = f(x-3) - 2$ E right by 3, down by 2
 h) $y = f(x+3) - 2$ D left by 3, down by 2
 i) $y = -f(x+2)$ H left by 2, reflect about horizontal axis
 j) $y = -f(x-2)$ G right by 2, reflect horizontal axis
 k) $y = f(2-x) = f(-x+2)$ I left 2 units, reflect vertical axis
 l) $y = f(-x) + 2$ F reflect vertical axis then up by 2.

8. $y = (x-4)^2 + 1$ basic is $y = x^2$  shift right by 2, then up 1



18. $y = \frac{1}{x-3} - 1$ basic is $y = \frac{1}{x}$  right by 3, down by 1

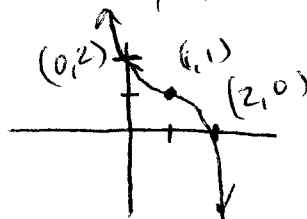


20. $y = -(x-1)^3 + 1$

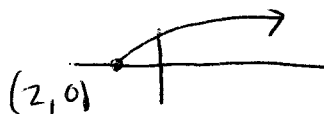
basic is $y = x^3$



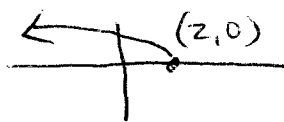
shift left by 1, reflect over horizontal axis, then up one



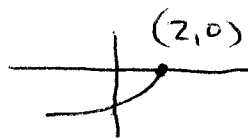
24. A. $y = \sqrt{x+2}$



B. $y = \sqrt{2-x} = \sqrt{-x+2}$

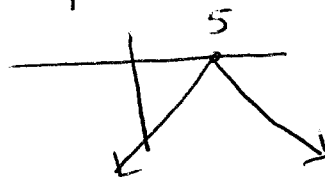


C. $y = -\sqrt{2-x} = -\sqrt{-x+2}$



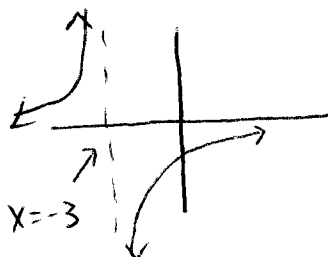
27. $y = f(5-x) = |5-x| = |-x+5|$

$f(x) = |x|$



33. $y = -F(x+3) = -\frac{1}{x+3}$

$F(x) = \frac{1}{x}$

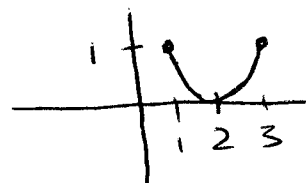


37. $y = 1 - g(x-2) = 1 - \sqrt{1-(x-2)^2}$

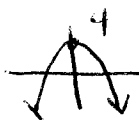
$g(x) = \sqrt{1-x^2}$



right by 2
reflect horizontal
axis
up one



42. $f(x) = 4 - x^2$



A. $y = x^2 - 4 = -f(x)$ reflects over horizontal axis



B. $y = 1 - x^2 = f(x) - 3$ shifts down by 3



46. $f(x) = -x^3 + 3x^2 - 3x + 1 = -(x-1)^3$



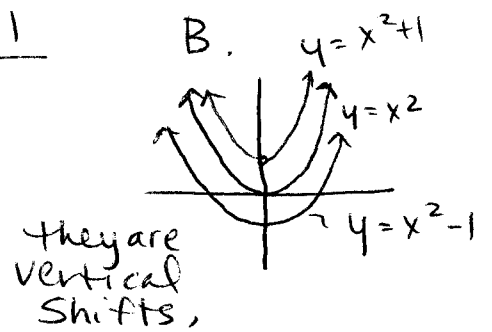
A. $y = -x^3 + 3x^2 - 3x - 1 = f(x) - 2$

B. $y = x^3 + 3x^2 + 3x + 1 = (x+1)^3 = -f(x+2)$

C. $y = x^3 - 3x^2 + 3x - 1 = -f(x)$

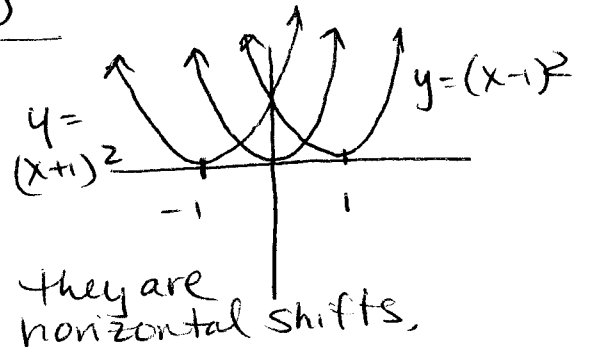
47.A.

x	x^2	$x^2 - 1$	$x^2 + 1$
0	0	-1	1
± 1	1	0	2
± 2	4	3	5
± 3	9	8	10



48.

x	x^2	$(x-1)^2$	$(x+1)^2$
0	0	1	1
1	1	0	4
2	4	1	9
3	9	4	16
-1	1	4	0
-2	4	9	1
-3	9	16	4



54. $y = \sqrt{x}$ $y = \sqrt{-x-2} = \sqrt{-(x+2)}$

reflect vertical axis
then shift to left
2 units

58. a) $y = f(x-3)$ $(a+3, b)$ e. $y = f(-x)$ $(-a, b)$
 b) $y = f(x) - 3$ $(a, b-3)$ f. $y = -f(-x)$ $(-a, -b)$
 c) $y = f(x-3) - 3$ $(a+3, b-3)$ g. $y = f(3-x) = f(-x+3)$ $(-a+3, b)$
 d) $y = -f(x) \Rightarrow (a, -b)$ h. $y = -f(3-x) + 1$ $(-a+3, -b+1)$

60. A. when a function is symmetric to the vertical or y-axis then points $(x, f(x))$ and $(-x, f(-x))$ are on graph and $f(x) = f(-x)$

Bi $f(-x) = (-x)^2 = x^2 = f(x)$

ii $f(-x) = 2(-x)^4 - 6 = 2x^4 - 6 = f(x)$

iii $f(-x) = 3(-x)^6 - \frac{4}{(-x)^2} + 1 = 3x^6 - \frac{4}{x^2} + 1 = f(x)$

$$61. A. f(-x) = -f(x) \Rightarrow f(x) = -f(-x)$$

which means when (x, y) is on graph so is $(-x, -y)$

$$B. i \left. \begin{array}{l} f(x) = x^3 \\ f(-x) = (-x)^3 \\ -f(x) = -x^3 \end{array} \right\} \text{ Same}$$

$$ii) \left. \begin{array}{l} f(x) = -2x^5 + 4x^3 - x \\ f(-x) = -2(-x)^5 + 4(-x)^3 - (-x) \\ \quad = 2x^5 - 4x^3 + x \\ -f(x) = -(-2x^5 + 4x^3 - x) = 2x^5 - 4x^3 + x \end{array} \right\}$$

$$iii) f(x) = \frac{|x|}{x+x^7} \quad f(-x) = \frac{|-x|}{-x+(-x)^7} = \frac{|x|}{-(x+x^7)} = -\frac{|x|}{x+x^7}$$

$$-f(x) = -\frac{|x|}{x+x^7}$$

$$62. a) f(x) = \frac{1-x^2}{2+x^2} \quad f(-x) = \frac{1-(-x)^2}{2+(-x)^2} = \frac{1-x^2}{2+x^2}$$

Since $f(x) = f(-x)$ function is even

$$b) g(x) = \frac{x-x^3}{2x+x^3} \quad g(-x) = \frac{-x-(-x)^3}{2(-x)+(-x)^3} = \frac{-(x-x^3)}{-(2x+x^3)} =$$

$$\frac{x-x^3}{2x+x^3} \text{ so } g(x) \text{ is even.}$$

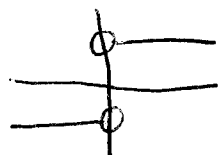
$$d) F(x) = (x^2+x)^2 \quad F(-x) = ((-x)^2+(-x))^2 = (x^2-x)^2 \\ = x^2+2x^3+x^2 \quad = x^2-2x^3+x^2 \\ -F(x) = -(x^2+x)^2 = -x^2-2x^3-x^2$$

So neither.

$$e) h(x) = (x^2+x) \quad h(-x) = (-x)^2+(-x) = x^2-x \\ -h(x) = -(x^2+x) = -x^2-x$$

So neither.

$$e). G(x) = \begin{cases} 1 & x > 0 \\ 0 & x = 0 \\ -1 & x < 0 \end{cases}$$



odd function