

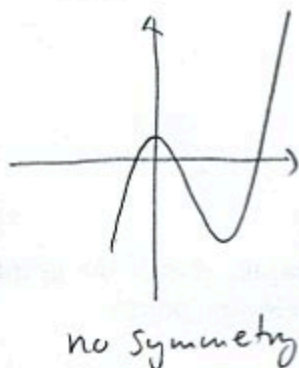
1. (21pts) For the following functions:

a) determine algebraically whether they are odd, even, or neither

b) use the calculator to draw their graphs here and verify your conclusions by stating symmetry.

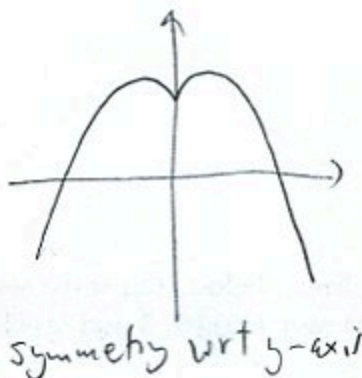
$$f(x) = x^3 - 4x^2 + 1$$

$$\begin{aligned} f(-x) &= (-x)^3 - 4(-x)^2 + 1 \\ &= -x^3 - 4x^2 + 1 \\ &\neq f(x), \neq -f(x) \\ &\text{neither} \end{aligned}$$



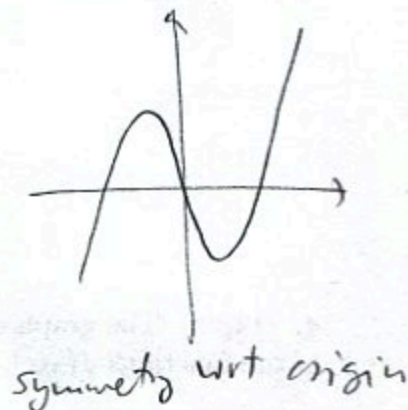
$$g(x) = -x^2 + 5|x| + 4$$

$$\begin{aligned} g(-x) &= -(-x)^2 + 5|-x| + 4 \\ &= -x^2 + 5|x| + 4 \\ &= g(x) \\ &\text{even function} \end{aligned}$$



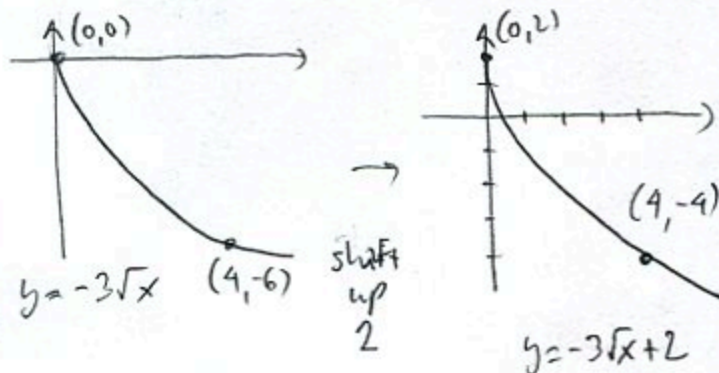
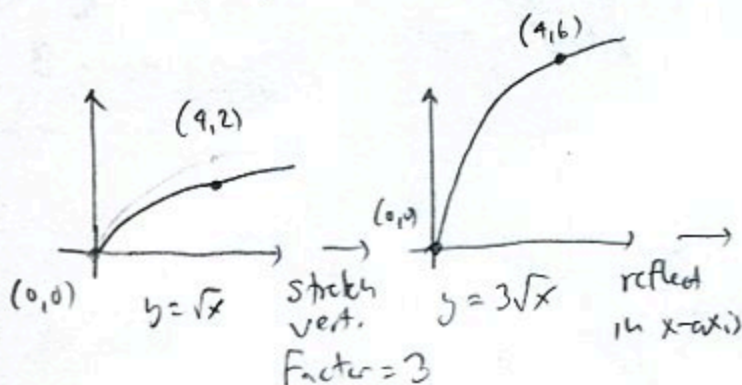
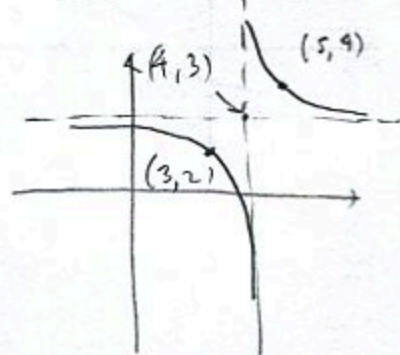
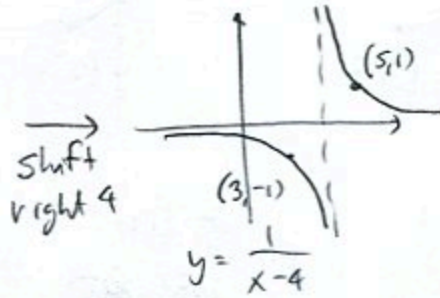
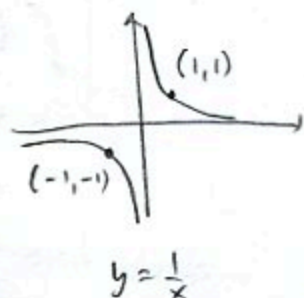
$$h(x) = x^3 - 15x$$

$$\begin{aligned} h(-x) &= (-x)^3 - 15(-x) \\ &= -x^3 + 15x = -(x^3 - 15x) \\ &= -h(x) \text{ odd function} \end{aligned}$$



2. (16pts) Draw the graphs of $f(x) = \frac{1}{x-4} + 3$ and $g(x) = -3\sqrt{x} + 2$ using transformations.

Explain how you transform graphs of basic functions in order to get the graphs of f and g . Indicate at least two points on each graph.



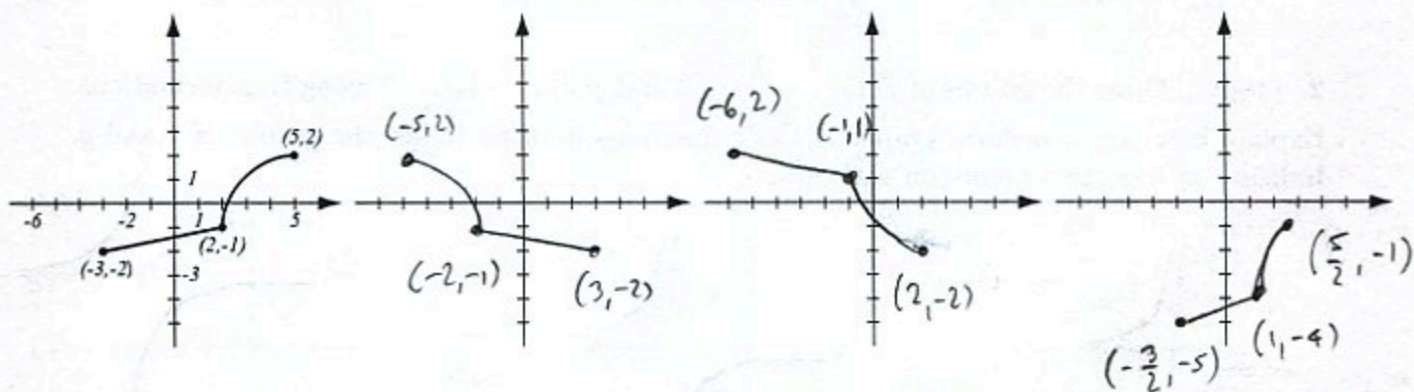
3. (10pts) Write the equation for the function whose graph has the following characteristics:
- shape of $y = x^2$, shifted right 2 units
 - shape of $y = |x|$, stretched vertically by factor 4, then reflected about the x -axis
 - shape of $y = x^3$, shifted left 2 units, then reflected about the y -axis, then stretched horizontally by factor 3.

$$a) y = x^2 \rightarrow y = (x-2)^2$$

$$b) y = |x| \rightarrow y = 4|x| \rightarrow y = -4|x|$$

$$c) y = x^3 \rightarrow y = (x+2)^3 \rightarrow y = (-x+2)^3 \rightarrow y = \left(-\frac{1}{3}x+2\right)^3$$

4. (13pts) The graph of $f(x)$ is drawn below. On three separate graphs, sketch the graphs of the functions $f(-x)$, $-f(x+3)$ and $f(2x) - 3$ and label all the relevant points.



$f(-x)$
reflect
in y -axis

$-f(x+3)$
shift left 3
reflect in x -axis

stretch horizontally,
factor = $\frac{1}{2}$
shift down 3