

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.

$$f(x) = x^5 - 7x^3 + 4x$$

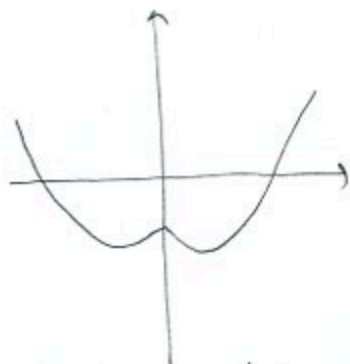
$$\begin{aligned} f(-x) &= (-x)^5 - 7(-x)^3 + 4(-x) \\ &= -x^5 - 7(-x^3) - 4x \\ &= -x^5 + 7x^3 - 4x \\ &= -f(x), \text{ so odd} \end{aligned}$$



symm. wrt.
origin

$$g(x) = x^2 - 5|x| - 7$$

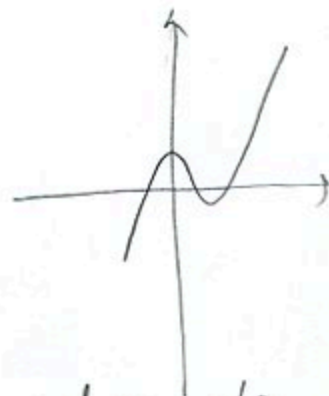
$$\begin{aligned} g(-x) &= (-x)^2 - 5|-x| - 7 \\ &= x^2 - 5|x| - 7 \\ &= g(x), \text{ so even} \end{aligned}$$



symm. wrt.
y-axis

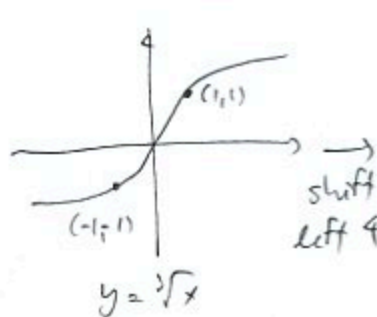
$$h(x) = x^3 - 3x^2 + 2$$

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

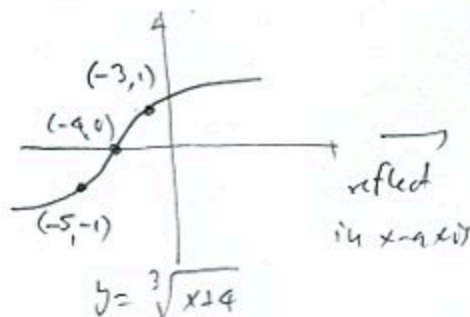


not symmetric
wrt origin or y-axis

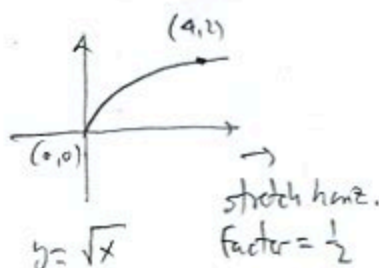
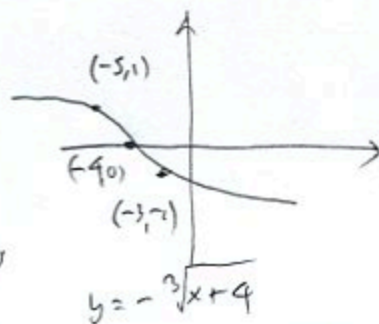
2. (16pts) Using transformations, draw the graphs of $f(x) = -\sqrt[3]{x+4}$ and $g(x) = 5 + \sqrt{-2x}$. Explain how you transform graphs of basic functions in order to get the graphs of f and g . Indicate at least two points on each graph.



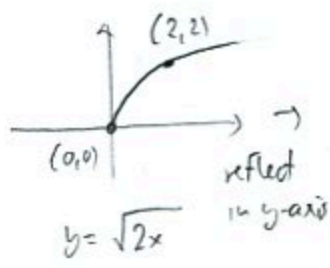
shift
left 4



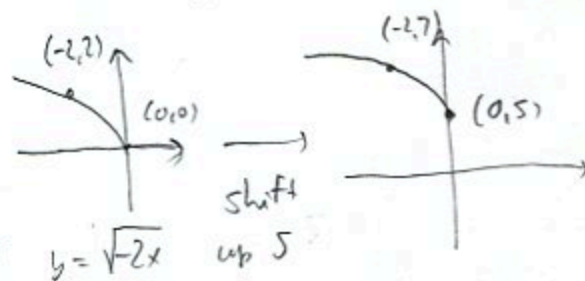
reflected
in x-axis



stretch horiz.
factor = 1/2



reflected
in y-axis



shift
up 5

3. (10pts) Write the equation for the function whose graph has the following characteristics:

a) shape of $y = |x|$, shifted up 2 units

b) shape of $y = \frac{1}{x}$ stretched vertically by factor 3, then shifted right 4 units

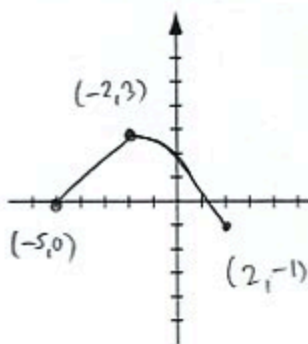
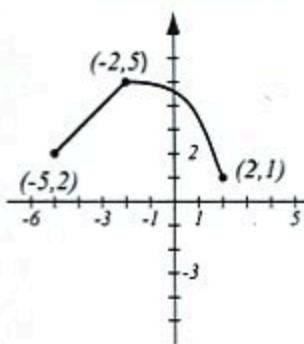
c) shape of $y = x^3$, stretched horizontally by factor 4, then reflected about the y -axis, then shifted left 1 unit.

a) $y = |x| + 2$

b) $y = \frac{1}{x} \mapsto y = 3 \cdot \frac{1}{x} \mapsto y = 3 \cdot \frac{1}{x-4}, y = \frac{3}{x-4}$

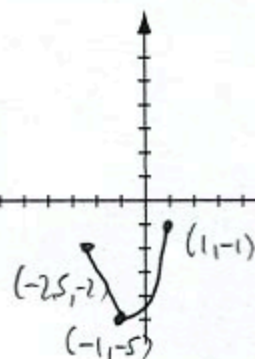
c) $y = x^3 \mapsto y = \left(\frac{1}{4}x\right)^3 \mapsto y = \left(\frac{1}{4}(-x)\right)^3 \mapsto y = \left(-\frac{1}{4}(x+1)\right)^3 = \left(-\frac{1}{4}x\right)^3$

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



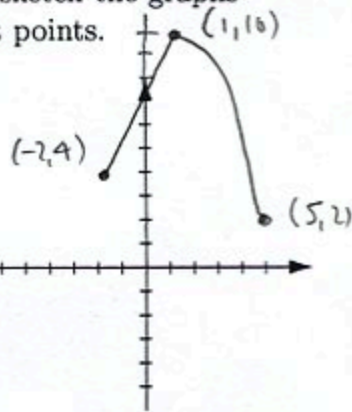
$f(x) - 2$

shift
down 2



$-f(2x)$

stretch horizontally,
factor = $\frac{1}{2}$
reflect in x -axis



$2f(x-3)$

shift right 3
stretch vertically,
factor = 2