

Math 113
Group Quiz 10 Solutions

① (40 pt) $g(x) = x^2$

a) $g_1(x) = 2g(x) = 2x^2$ ← stretch vertically by a factor of 2

$f(x) = g_1(x-7)$ ← shift to the right 7 units

$= 2g(x-7)$ [5]

$= 2(x-7)^2$ [5]

b) $f(x) = g(2x-5)$

$= g(2x+5)$ [5]

$= (2x+5)^2$ [5]

shrink horizontally by factor of $1/2$
shift to the left 5 units

c) $f(x) = g(-x) - 4$ [5]

reflect across y-axis
shift down 4 units

$= (-x)^2 - 4$

$= x^2 - 4$ [5]

d) $f(x) = -g(x) + 1$ [5]

reflect across x-axis
shift up by 1 unit

$= -x^2 + 1$ [5]

② a) let $f(x) = \sqrt{x}$

[10]

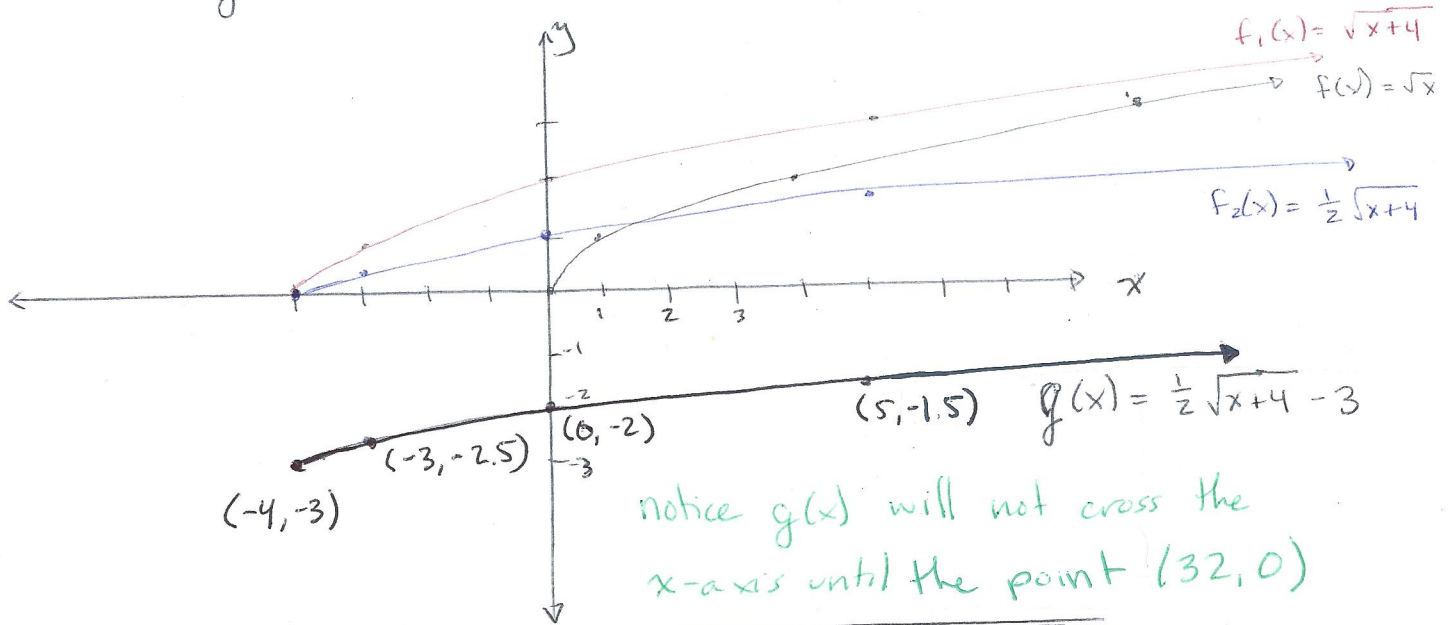
$f_1(x) = \sqrt{x+4} = f(x+4)$

left 4 units

$f_2(x) = \frac{1}{2}\sqrt{x+4} = \frac{1}{2}f_1(x)$

vertical shrink by factor of $\frac{1}{2}$

$g(x) = \frac{1}{2}\sqrt{x+4} - 3 = f_2(x) - 3$ down 3 units



b) let $f(x) = x^2$

[10]

$f_1(x) = (x-1)^2 = f(x-1)$

right 1 unit.

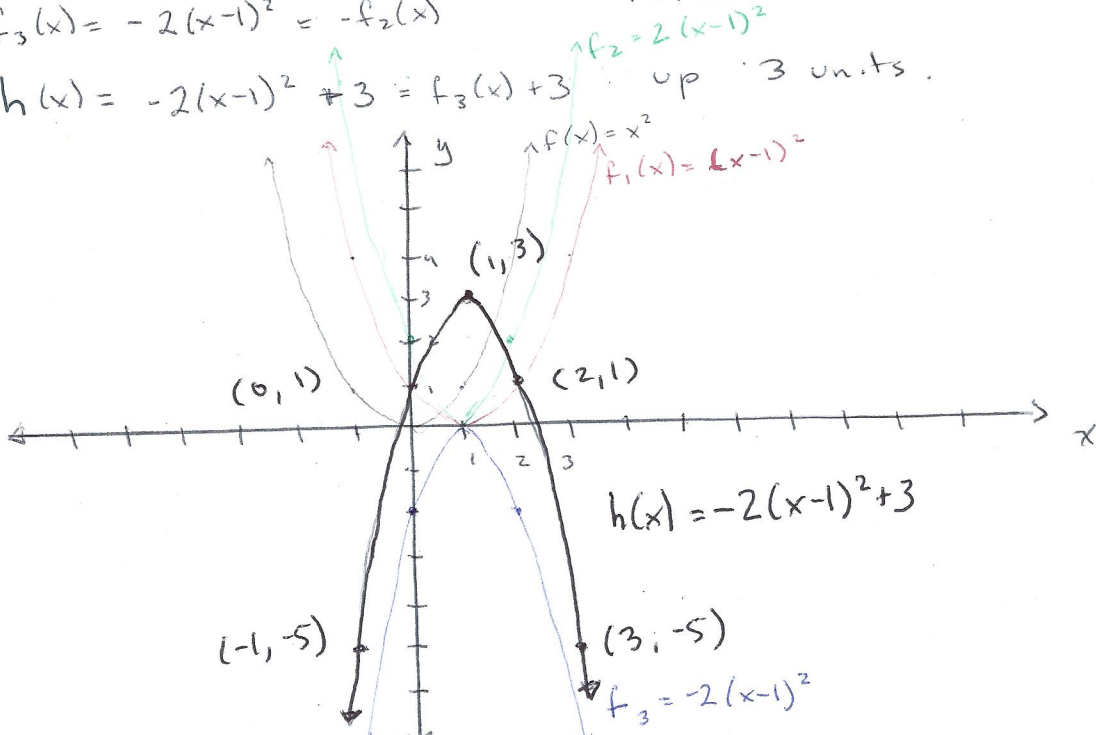
$f_2(x) = 2(x-1)^2 = 2f_1(x)$

stretch vertically by factor of 2.

$f_3(x) = -2(x-1)^2 = -f_2(x)$

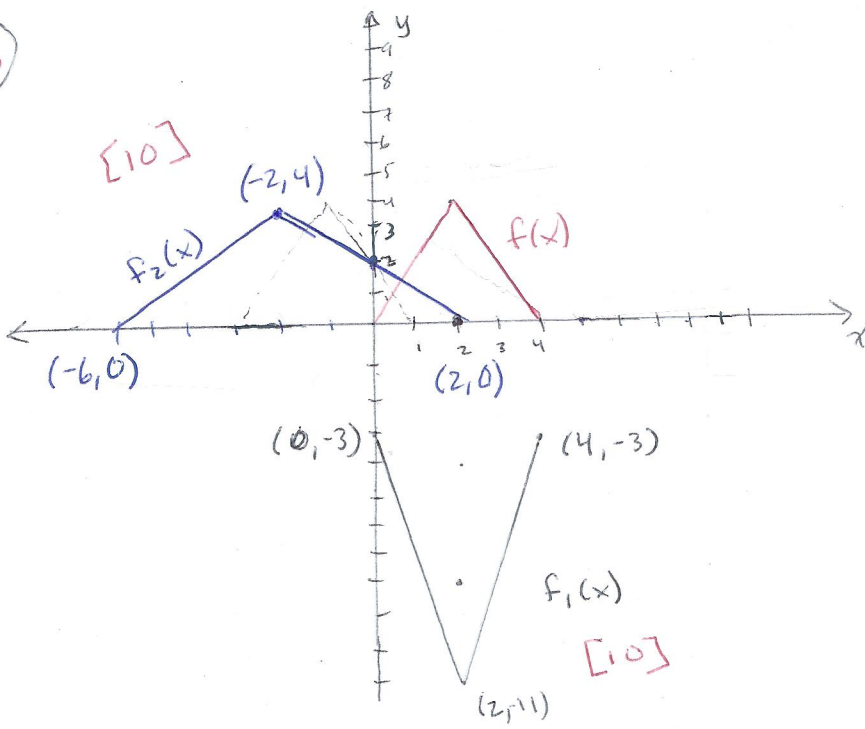
reflect across x-axis.

$h(x) = -2(x-1)^2 + 3 = f_3(x) + 3$ up 3 units.



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3



a) $f_1(x) = -2f(x) - 3$
 reflect x-axis
 vertical stretch factor of 2
 down 3

b) $f_2(x) = f\left(\frac{1}{2}x + 3\right)$
 horizontal stretch by factor of 2
 left 3
 [do this 1st]

one way to check if you did it right is to plug in your new x values at the vertices.

eg $f_1(0) = -2f(0) - 3$
 $= -2 \cdot 0 - 3 = -3$ ✓
 $f_1(2) = -2f(2) - 3$
 $= -2 \cdot 4 - 3$
 $= -8 - 3 = -11$ ✓
 $f_1(4) = -2f(4) - 3$
 $= -2 \cdot 0 - 3$
 $= -3$ ✓

$f_2(-6) = f\left(\frac{1}{2} \cdot -6 + 3\right)$
 $= f(-3 + 3)$
 $= f(0) = 0$ ✓
 $f_2(-2) = f\left(\frac{1}{2} \cdot -2 + 3\right)$
 $= f(-1 + 3)$
 $= f(2) = 4$ ✓
 $f_2(2) = f\left(\frac{1}{2} \cdot 2 + 3\right)$
 $= f(1 + 3)$
 $= f(4) = 0$ ✓

④ a) $f(x) = x^5 + x$

$$f(-x) = (-x)^5 + (-x)$$

$$= -1 \cdot x^5 + -1 \cdot x$$

$$= -1 \cdot (x^5 + x)$$

$$= -1 \cdot f(x)$$

$\Rightarrow f$ is odd

b) $f(x) = x^2 + x$

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

$$= x^2 - x \neq x^2 + x = f(x) \text{ not even}$$

$$\neq -1(x^2 + x) = -f(x) \text{ not odd.}$$

$\Rightarrow f$ is neither even, nor odd