Math 111, Wed, 4/13

Q's on 1.3, 1.4

Checkpoint 3 (1.3 + 1.4)

Q's on 1.5

Finish section 1.5

(Review completing the square)

Mission 2 due at the beginning of class on monday

Completing the square to put a parabola in vertex form

$f(x) = \underbrace{x^2 + 4x} + 3$

$a = 1$

$= x^2 + 4x + 2^2 + 3 - 4$

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

$\boxed{\begin{array}{l} y = a(x-h)^2 + k \\ \text{vertex form} \end{array}}$

$\left(\frac{b}{2}\right)^2$

$\left(\frac{1}{2}b\right)^2$

82. $f(x) = \underbrace{-2x^2 - 12x} - 13$

$a = -2$ factor it out

$-2(x^2 + 6x + 3^2) - 13 + 18$

$-2(x+3)^2 + 5$

Q's 1.4

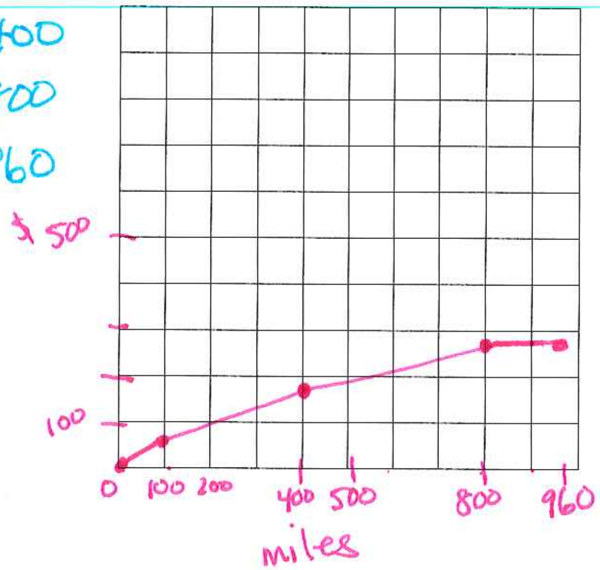
53.

$y = \frac{1}{2}x + 0$ \$.50/mile $0 \le x \le 100$

$y = .4(x-100) + 50$ \$.40/mile $100 \le x \le 400$

$y = .25(x-400) + 170$ \$.25/mile $400 < x \le 800$

— $800 < x \le 960$



x	y
0	\$0
100	\$50

x	y
100	50
400	170

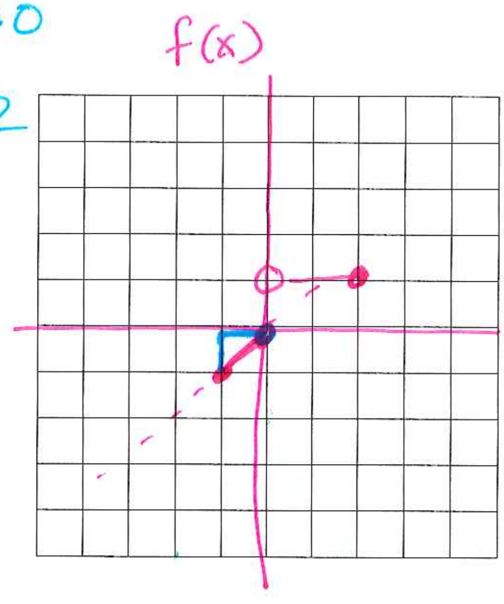
x	y
400	170
800	270

\$50

$.4(400) + 50$

42.

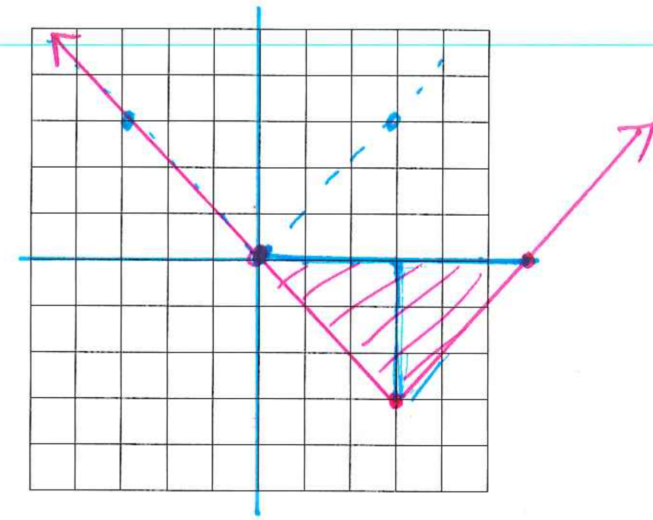
$$f(x) = \begin{cases} x, & \text{if } -1 \le x \le 0 \\ 1 & \text{if } 0 < x \le 2 \end{cases}$$



1.5

83. $f(x) = |x-3| - 3$

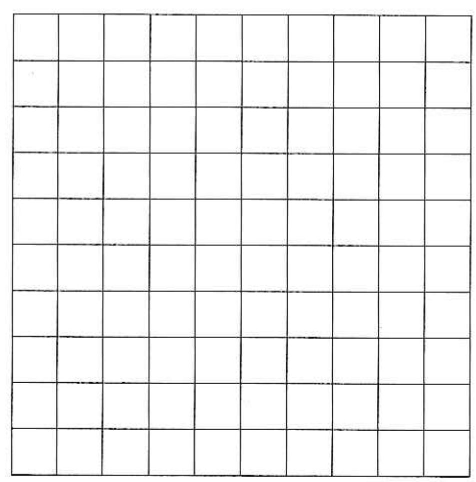
① right 3
② down 3



b. $A = \frac{1}{2} b \cdot h$

$= \frac{1}{2}(6 \cdot 3)$

$= 9$ square units



Example 9. The point $(4, 12)$ is on the graph of $y = f(x)$. Determine the point on the graph of...

(a) $y = f(x+2) - 1$

(4,12)
shift left 2 (2,12)
shift down 1 (2,11)

(d) $y = f\left(\frac{1}{3}x\right)$

(4,12)
horizontal stretch by 3 (12,12)

(b) $y = 5f(x)$

(4,12)
vertical stretch by 5 (4,60)
y-values multiplied by 5

(e) $y = f(-x) - 5$

(4,12)
horizontal flip (-4,12)
down 5 (-4,7)

(c) $y = -f(x-5) + 4$

(4,12)
vertical flip (4,-12)
Right 5 (9,-12)
up 4 (9,-8)

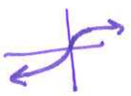
(f) $y = 2f(4(x+1)) - 3$

(4,12) x2
vertical stretch by 2 (4,24)
Horizontal compression by $\frac{1}{4}$ (1,24)
Left 1 (0,24)
Down 3 (0,21)

Example 10. For the function below, identify the original (or "basic") function and explain how the graph is a transformation of the graph of the original function. State all steps to this transformation in an appropriate order.

(a) $g(x) = 8\sqrt[3]{-4x}$

Original function : $\sqrt[3]{x}$

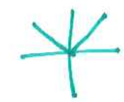


① $A=8$ vertical stretch by 8

② $B=-4$ Horizontal flip (negative) and Horizontal compression by $\frac{1}{4}$

(b) $h(x) = -|2x+6|$ $= -|2(x+3)|$

Original function $|x|$



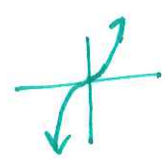
① $A=-1$ vertical flip

② $B=2$ Horizontal compression by $\frac{1}{2}$

③ $h=3$ shift left by 3

(c) $j(x) = \frac{2}{3}(5(x-1))^3 + 4$

Original Function: x^3



① $A=\frac{2}{3}$ vertical compression by $\frac{2}{3}$

② $B=5$ Horizontal compression by $\frac{1}{5}$

③ $h=1$ Shift right 1

④ $K=4$ shift up 4

Example 11. Let $g(x) = -(x-6)^2 - 3$.

(a) Identify the original (or "basic") function and explain how the graph of $y = g(x)$ is a transformation of the original function. State all steps to this transformation in an appropriate order.

Basic function : x^2

① $A = -1$ Flip vertically

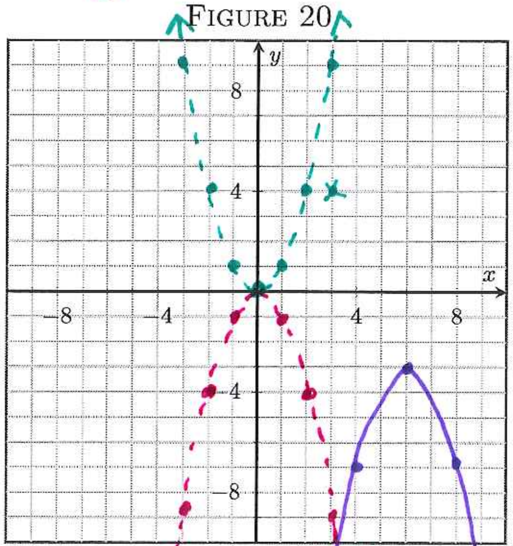
② $h = 6$ Right 6

③ $k = -3$ Down 3

(b) Compare the graph of $y = g(x)$ to the graph of $y = x^2$ after it has been shifted right 6 units, shifted down 3 units and THEN reflected about the x-axis.

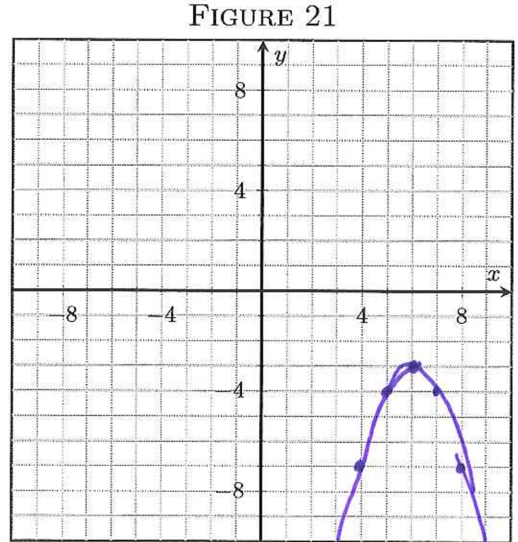
$y=x^2$

FIGURE 20



Final Answer

FIGURE 21



Example 12. Let $g(x) = \frac{1}{2}(x+5)^3 + 4$. Identify the original function and explain how the graph of $y = g(x)$ is a transformation of the graph of the original function. Then sketch a graph of $y = g(x)$ in Figure 22.

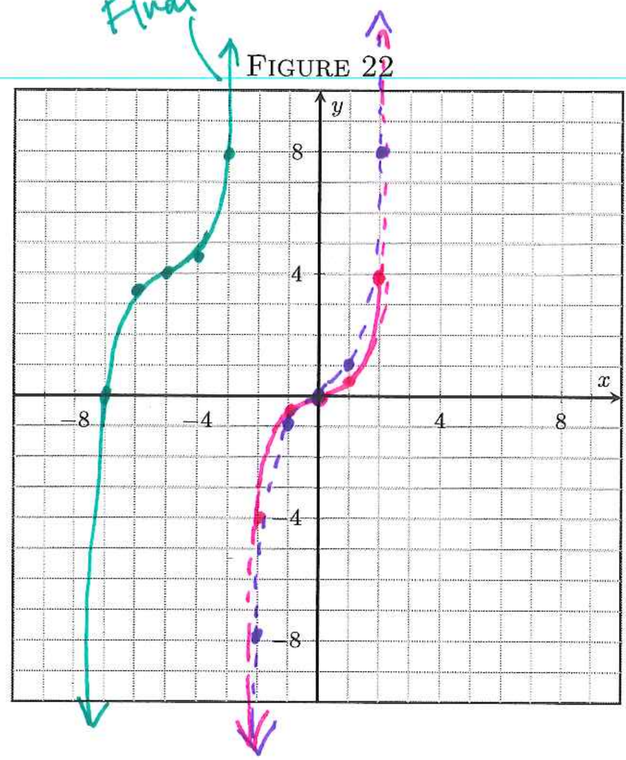
Basic Function : x^3

① vertical compression by $\frac{1}{2}$

② Left 5

③ Up 4

FIGURE 22



$\boxed{g(x) = \left|\frac{1}{2}(x-6)\right| - 1}$

Example 13. Let $g(x) = \left|\frac{1}{2}x - 3\right| - 1$. Identify the original function and explain how the graph of $y = g(x)$ is a transformation of the graph of the original function. Then sketch a graph of $y = g(x)$ in Figure 23.

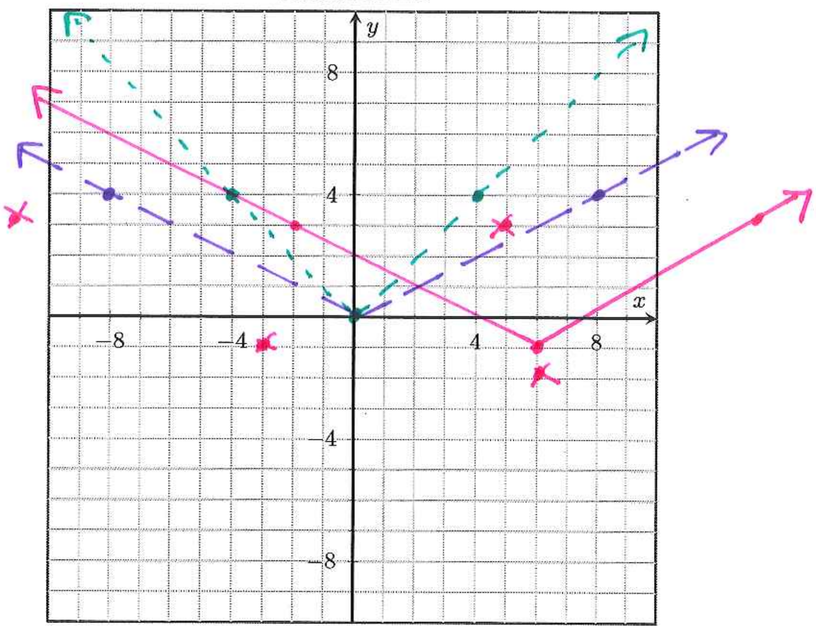
Basic Function $|x|$

① Horizontal Stretch by 2

② ~~Left 3~~ Right 6

③ Down 1

FIGURE 23



Example 14. Let $g(x) = \sqrt{-(x+3)} + 2$. Identify the original function and explain how the graph of $y = g(x)$ is a transformation of the graph of the original function. Then sketch a graph of $y = g(x)$ in Figure 24.

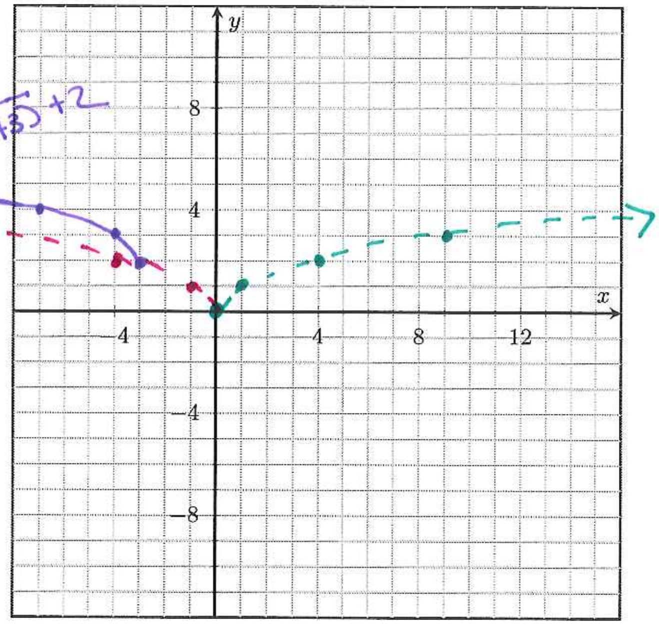
Original Function $\sqrt{x}$

① $B = -1$ Horizontal flip

② Left 3
Up 2

FIGURE 24

Final $g(x) = \sqrt{-(x+3)} + 2$



Example 15. Let $g(x) = -f(2(x+4)) + 3$. The original function $y = f(x)$ is shown in Figure 25. Explain how the graph of $y = g(x)$ is a transformation of the graph of the original function. Then sketch a graph of $y = g(x)$ in Figure 25.

① $A = -1$
vertical flip

② $B = 2$
Horizontal compression by $\frac{1}{2}$

③ Left 4
up 3

FIGURE 25

Final