Math 126
Exam 3
Spring 2015

Name Key

Show All Work

1) If $f(x) = 3x - x^2$ what is $f(x-1)$?

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

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

$= 3x - 3 - x^2 + 2x - 1 \quad = -x^2 + 5x - 4$

2) If $f(x) = \frac{x-3}{x-4}$

a) What is the domain of f(x)

$\{x \mid x \neq 4\}$ or $(-\infty, 4) \cup (4, \infty)$

b) What are its x and y intercepts?

if $x = 0$ $\quad y = \frac{3}{4}$ $\quad \rightarrow \quad (0, \frac{3}{4})$

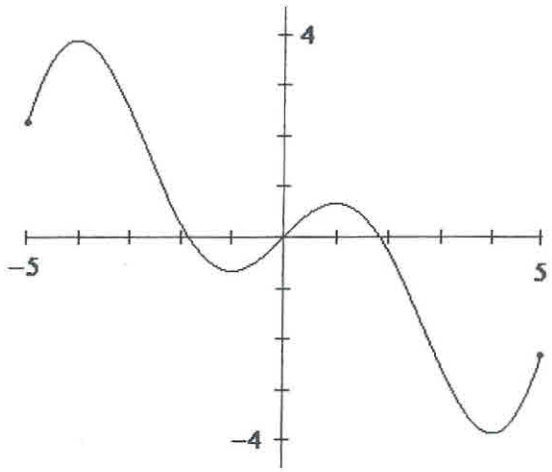
if $y = 0$ $\quad 0 = x - 3$

$3 = x \quad (3, 0)$

c) If f(x) even, odd, both or neither?

$f(-x) = \frac{-x-3}{-x-4} = \frac{-1(x+3)}{-1(x+4)} = \frac{x+3}{x+4}$ $\neq f(x)$, $\neq -f(x)$ $\rightarrow$ NEITHER

3) Given the graph of $g(x)$ on the right.



a) What kind of symmetry does it have?

ODD; ABOUT THE ORIGIN

b) On what intervals is it decreasing?

$(-4, -1) \cup (1, 4)$

c) List the x coordinate(s) of the local maximum(s).

$x = -4$, $x = 1$

d) What is the domain of g(x).

$[-5, 5]$

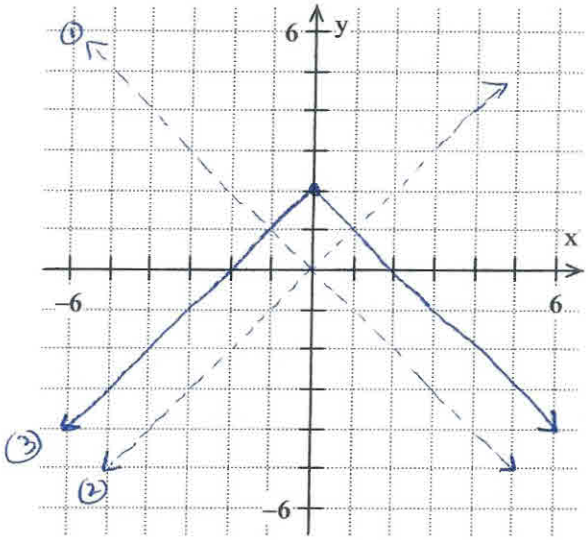
4) Graph the following functions using the techniques of shifting, compressing, stretching, and/or reflecting. Start with the graph of the basic function and show all stages.

a) $f(x) = -|x| + 2$

① $y = |x|$ — ✓

② $y = -|x|$ → upside down

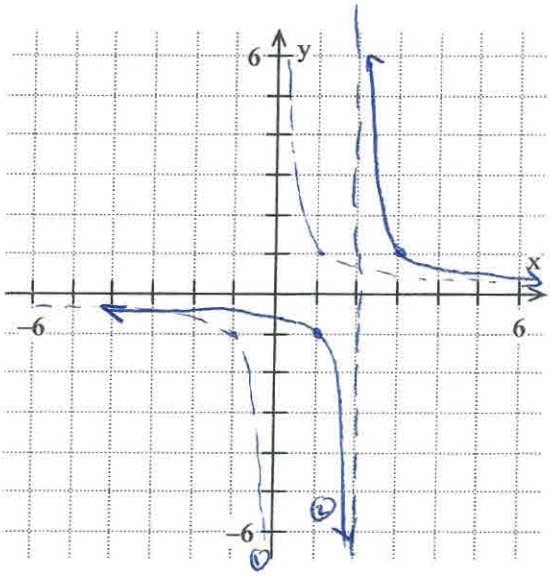
③ $y = -|x| + 2$ → up 2



b) $g(x) = \frac{1}{x-2}$

① $y = \frac{1}{x}$

② $y = \frac{1}{x-2}$ right 2



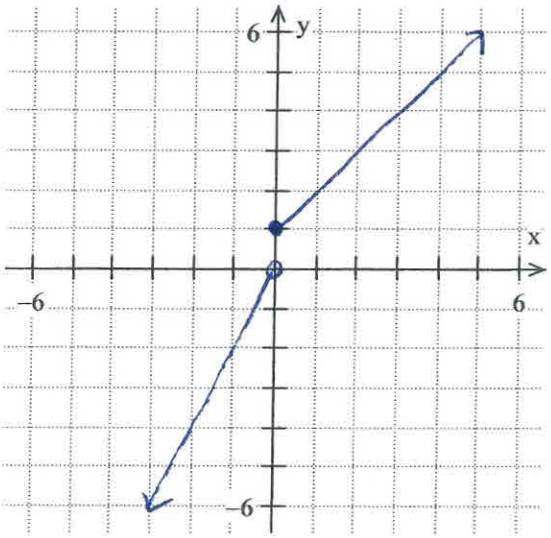
5) Graph $f(x) = \begin{cases} 2x & \text{if } x < 0 \\ x+1 & \text{if } x \geq 0 \end{cases}$

left of y axis

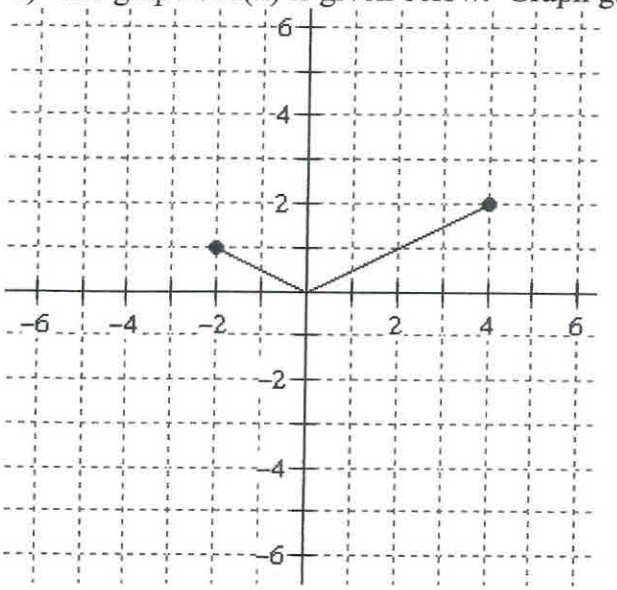
slope 2 intercept 0

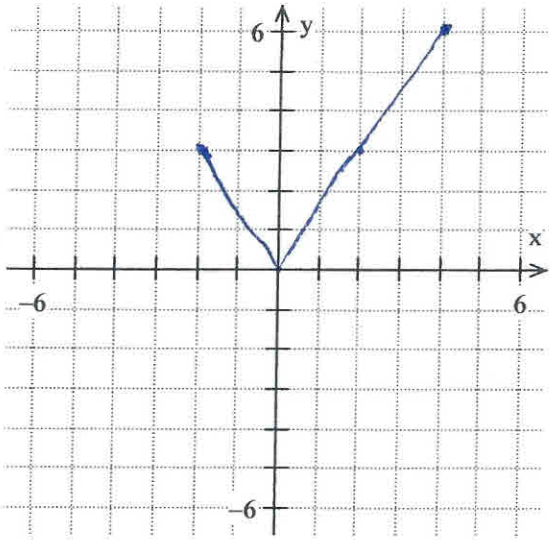
right of y axis

slope 1, y-intercept 1



6) The graph of f(x) is given below. Graph $g(x) = 3f(x)$ Vertical stretch by 3





7) If $f(x) = \frac{1}{x}$ and $g(x) = \frac{1}{x-4}$

a) Find f ∘ g and its domain

$f(g(x)) = f\left(\frac{1}{x-4}\right) = \frac{1}{\frac{1}{x-4}} = x-4$

domain $x-4 \neq 0$, $x \neq 4$ → $D = \{x \mid x \neq 4\}$

$D = (-\infty, 4) \cup (4, \infty)$

b) Find g ∘ f and its domain.

$g(f(x)) = g\left(\frac{1}{x}\right) = \frac{1}{\frac{1}{x} - 4}$

Domain $x \neq 0$, $\frac{1}{x} \neq 4$ → $x \neq 0$, $x \neq \frac{1}{4}$ → $(-\infty, 0) \cup \left(0, \frac{1}{4}\right) \cup \left(\frac{1}{4}, \infty\right)$

c) Find $g^{-1}(x)$

Switch

$x = \frac{1}{y-4}$

Solve for y

$x(y-4) = 1$

$xy - 4x = 1$

$xy = 1 + 4x$

$y = \frac{1+4x}{x}$

$g^{-1}(x) = \frac{1+4x}{x}$

$g^{-1}(x) = \frac{1}{x} + 4$

} Both acceptable

8) Put the quadratic function below in standard form and graph. Find the vertex and intercepts, if any.

$f(x) = x^2 + 6x + 5$

$f(x) = x^2 + 6x + 9 - 9 + 5$

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

Vertex $(-3, -4)$

INTERCEPTS

if $x = 0$ $y = 5$ $(0, 5)$

if $y = 0$ $(x+3)^2 - 4 = 0$

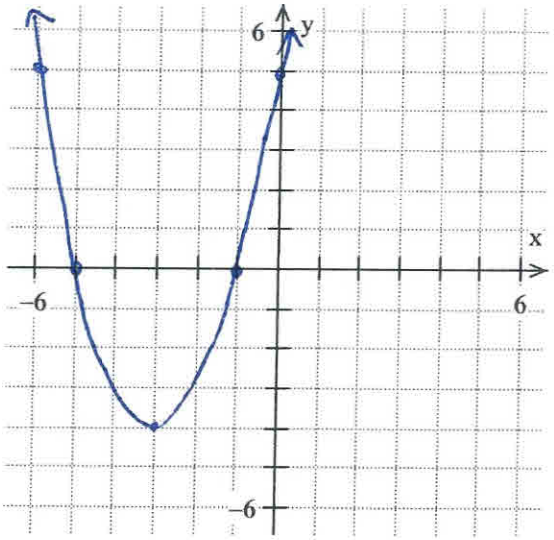
$(x+3)^2 = 4$

$x + 3 = \pm 2$

$x = -3 \pm 2$

$x = -1, -5$

$(-1, 0), (-5, 0)$



9) The weekly profit from selling x Thingamajigs is given by $P(x) = 800x - 20x^2$

$= -20x^2 + 800x$

a) How many Thingamajigs must the company sell to maximize profit?

Vertex at $x = \frac{-b}{2a} = \frac{-800}{2(-20)} = 20$

20 Thingamajigs

b) What is the maximum profit?

$k = f(20) = 800(20) - 20(20)^2$

$= 16{,}000 - 8000$

$= 8000$

PROFIT $8000