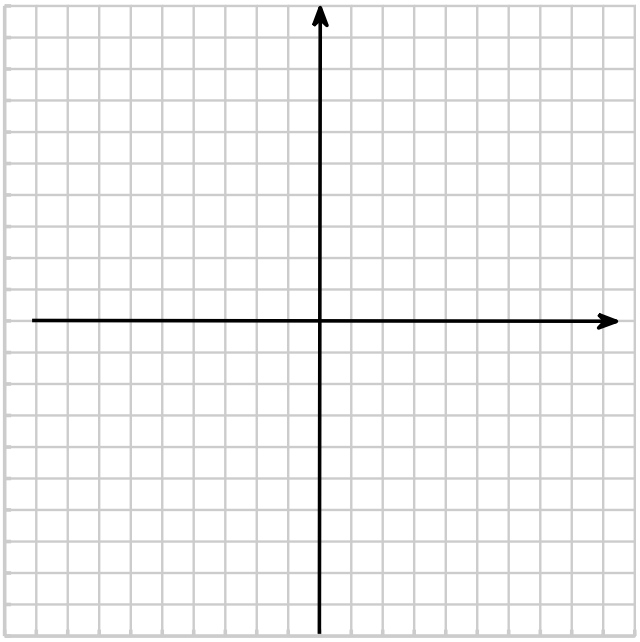
Math 176
Exam 1
Professor Busken **Name:** _____

Directions: You may not use a calculator. The use of any other electronic devices are strictly prohibited. Show your work on ALL of the questions. Scratch paper is not allowed. You will not be allowed to leave to use the restroom.

1. (5 points) Find an equation of the line that is tangent to the circle $x^2 + y^2 = 25$ at the point $(x, y) = (3, 4)$.



2. (5 points) Suppose $f(x) = \begin{cases} 4 - 3x & \text{if } x < 0 \\ 5x & \text{if } 0 \leq x \leq 2 \\ (x-5)^2 & \text{if } x > 2 \end{cases}$. Evaluate the piecewise defined function at the values indicated below.

(a) $f(-5)$ (a) _____

(b) $f(0)$ (b) _____

(c) $f(1)$ (c) _____

(d) $f(2)$ (d) _____

(e) $f(5)$ (e) _____

3. (5 points) Let $g(x) = \dfrac{3}{1-x}$. Find a simplified form for the difference quotient $\dfrac{g(a+h)-g(a)}{h}$, where $h \neq 0$.

3. _____

4. (3 points) Find the domain of $f(x) = \dfrac{2}{\sqrt{x+13}}$. Express the domain set using interval notation.

4. _____

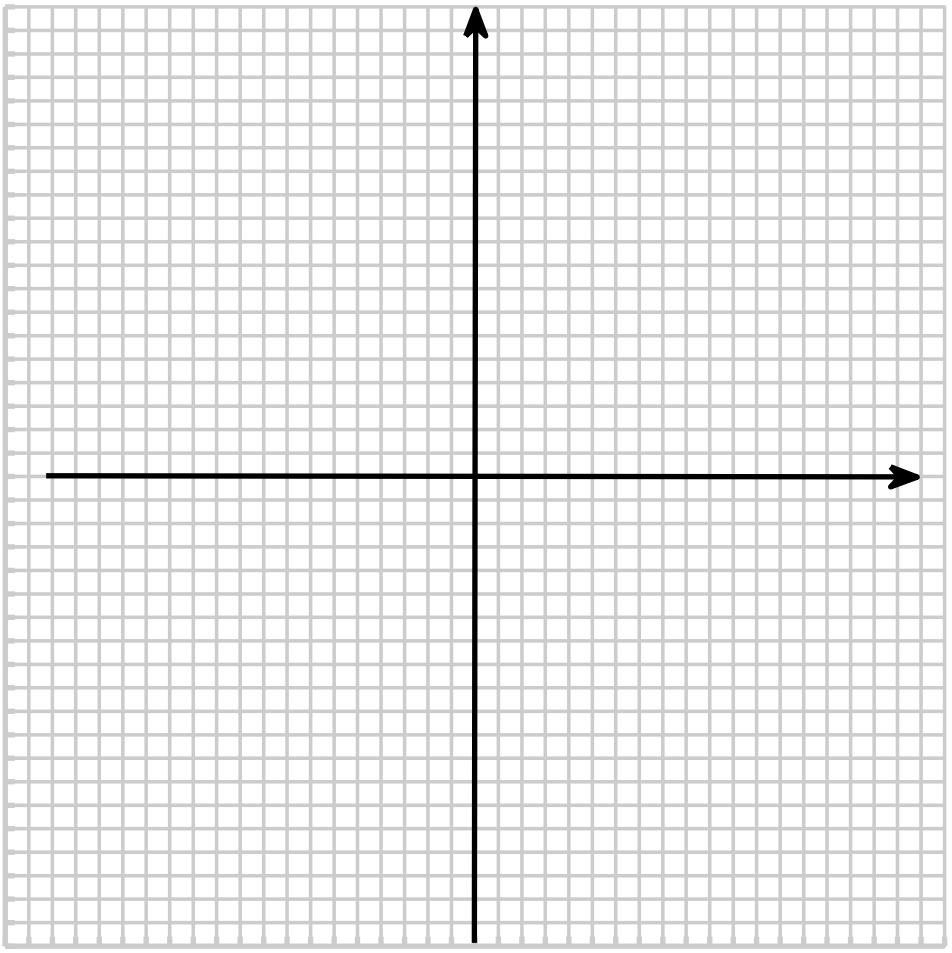
5. (3 points) Find the domain of $f(x) = \sqrt[3]{x-13}$. Express the domain set using interval notation.

5. _____

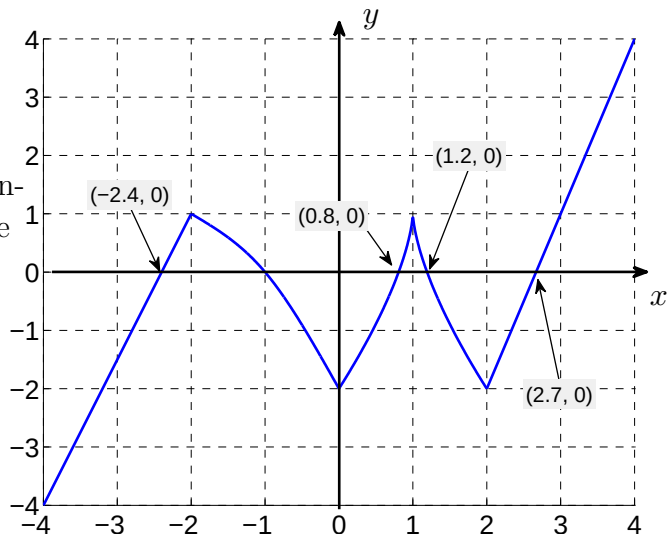
6. (4 points) Suppose $f(t) = 3t + t^2$ Find the average value of f over time interval $[5, 10]$.

6. _____

7. (5 points) Sketch the graph of $f(x) = \left\{ \begin{array}{ll} -3x & \text{if } x < 0 \\ \sqrt{16 - x^2} & \text{if } 0 \leq x < 4 \\ (x-4)^2 & \text{if } x \geq 4 \end{array} \right\}$.



8. (10 points) The graph of a function f is given. **Assume the entire graph of f is shown in the figure.**



(a) Find all ***local*** maximum and minimum values of the function and the value of x at which each occurs.

(b) State the x intervals for which $f(x) > 0$.

(c) State the x intervals for which $f(x) < 0$.

(d) Find the x intervals on which the function is ***increasing***.

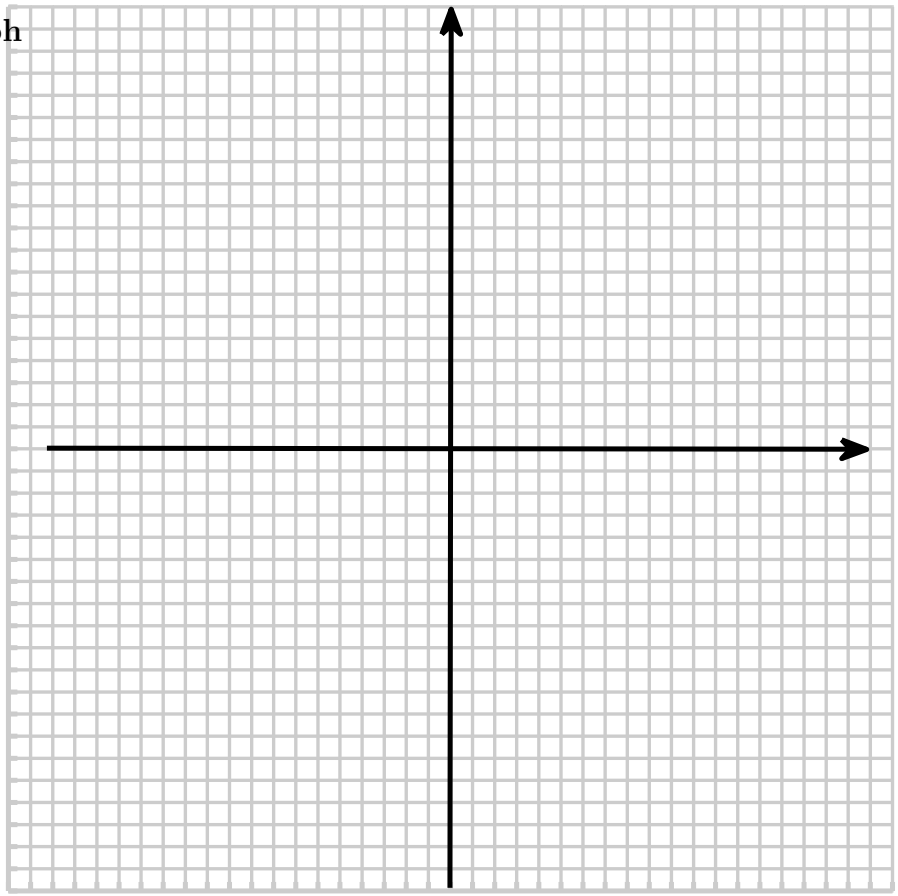
(e) Find the x intervals on which the function is ***decreasing***.

(f) Find $f(4)$. (f) _____

(g) Find $f(-1)$. (g) _____

9. (5 points) **Use the graph of $f(x) = \sqrt{x}$ to sketch the graph of the given function.**

$h(x) = -3\sqrt{x-4}+1$



10. (2 points) What interval represents the domain of h? 10. _____

11. (2 points) What interval represents the range of h? 11. _____

12. (5 points) This is a ***Matching question*** associated with the theory on graphical translations of functions. Suppose $f(x) = x^3$. Relative to the graph of $f(x)$ the graphs of the following functions have been changed in what way?

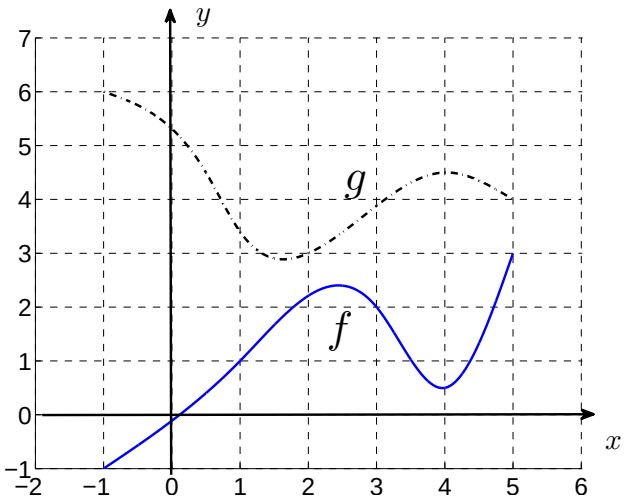
_____	$g(x) = x^3 + 5$	a.) shifted 5 units left
_____	$g(x) = (x+5)^3$	b.) reflected about the x axis
_____	$g(x) = -2 \cdot x^3$	c.) shifted 5 units down
_____	$g(x) = (x-5)^3$	d.) shifted 5 units right
_____	$g(x) = x^3 - 5$	e.) shifted 5 units vertically up

13. (6 points) **Use the graph to find the indicated functional values.**

(a) $(f+g)(5)$

(b) $(f \circ g)(-1)$

(c) $\frac{f}{g}(3)$



14. (6 points) Suppose $f(x) = \sqrt{25 - x^2}$ and $g(x) = \sqrt{2 + x}$. Find $f + g$ and f/g, AND THEIR DOMAINS.

15. (2 points) Suppose f is an invertible function and suppose that $f(2) = -5$. Find $(f(2))^{-1}$

16. (2 points) Suppose f is an invertible function and suppose that $f(3) = 5$. Find $(f^{-1}(5))^{-1}$

17. (5 points) Find $f^{-1}(x)$ if $f(x) = \dfrac{1+3x}{5-2x}$.

17. _____

18. (5 points) Suppose $f(x) = \dfrac{2x}{1-x}$ and $g(x) = 2+7x$. Find $f \circ g$ and its domain.

18. _____

19. (5 points) Write $f(x) = 3x^2 + 6x + 1$ in standard (vertex) form.

19. _____

20. (8 points) Use this equation to answer parts a through h: $y = -(x+2)^2 + 4$

(a) Determine whether the parabola has a maximum or a minimum and give the value.

(a) _____

(b) Find the vertex (and plot it on the graph below).

(b) _____

(c) What is the equation that represents the axis of symmetry (and draw it on the graph).

(c) _____

(d) Find a second point (and plot it on the graph).

(d) _____

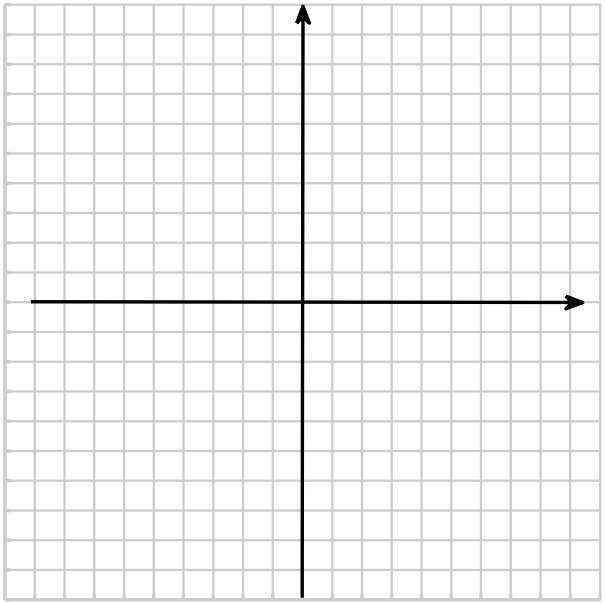
(e) Use symmetry to find a third point (and plot it on the graph)

(e) _____

(f) Find the x-intercepts

(f) _____

(g) Sketch the parabola



(h) What interval represents the range of the function? (h) _____