By providing my signature below I acknowledge that I abide by the University's academic honesty policy. This is my work, and I did not get any help from anyone else during the exam:

Name (sign): _____   Name (print): _____

Student Number: _____

Instructor's Name: _____   Class Time: _____

- If you need extra space use the last page.

- Please show your work. **An unjustified answer may receive little or no credit.**

- If you make use of a theorem to justify a conclusion then state the theorem used by name.

- Your work must be **neat**. If I can't read it (or can't find it), I can't grade it.

- The total number of possible points that is assigned for each problem is shown here. The number of points for each subproblem is shown within the exam.

- Please turn off your mobile phone.

- A calculator is not necessary, but numerical answers should be given in a form that can be directly entered into a calculator.

- Common identities:

$$\cos(\alpha + \beta) = \cos(\alpha)\cos(\beta) - \sin(\alpha)\sin(\beta),$$
$$\sin(\alpha + \beta) = \sin(\alpha)\cos(\beta) + \cos(\alpha)\sin(\beta).$$

Problem Number	Points Possible	Points Made
1	0	
2	15	
3	15	
4	15	
5	14	
6	14	
7	15	
8	12	
Total:	100	

1. [2 Bonus] Common Knowledge: Why are car races on oval tracks in the United States run so the cars turn left?
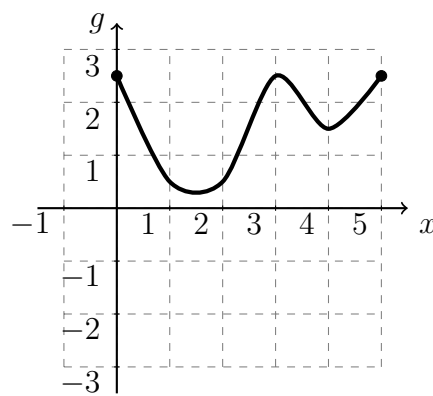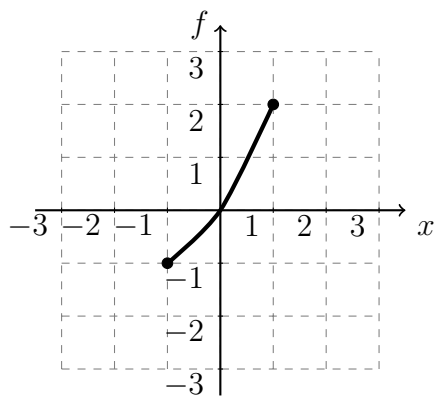
2. Determine all of the values of x for each question below that satisfy the given equation. If no values of x satisfy the equation provide a brief justification as to how you arrived at your conclusion.

——————   (a) [5 pts] $\dfrac{1}{x+1} = \dfrac{3}{x-5}$.

(b) [5 pts] $\sqrt{2x+1} = 8$.

——————

(c) [5 pts] $\sqrt{2x-3} = 3x + 1$

——————

3. The graphs of two relationships, f, and g, are shown below. Each of the questions below refer to these relationships.

(a) [5 pts] Determine the intervals where the relationship f is increasing and the intervals where the relationship is decreasing. (Make a rough estimate if you are not sure of the x values.)

(b) [5 pts] Determine the intervals where the relationship g is increasing and the intervals where the relationship is decreasing. (Make a rough estimate if you are not sure of the x values.)

(c) [5 pts] Determine the domain of the relationship $g(f(x))$.

4. The questions below refer to the quadratic function

$$s(x) \;=\; 8x^2 - 6x + 7.$$
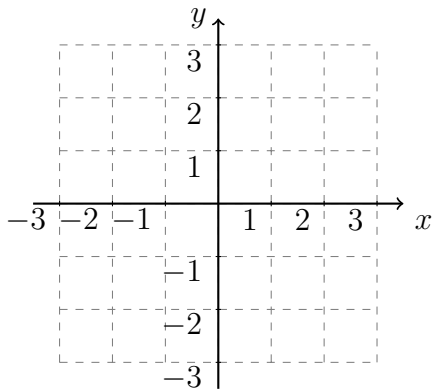
_____ (a) [5 pts] Determine the vertex of the function.

(b) [5 pts] Does the vertex represent a minimum or a maximum? (Justify your answer.)

_____

(c) [5 pts] Determine the maximum of the function on the interval $[1, 3]$. (Briefly explain why your choice is the maximum.)

_____

Points earned: _____
out of a possible 15 points

5. The questions below refer to the following graph of a function, $q(x)$.
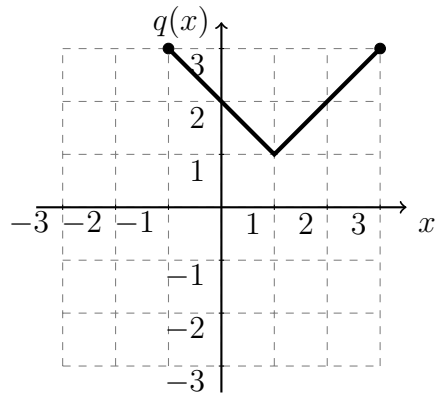
_____ (a) [7 pts] use the axes below to sketch a graph of the function $-q(x+2)+3$.

_____ (b) [7 pts] Determine the coordinate, (x, y), of the minimum of the function $3q(x-4)-5$.

6. A function, $q(x)$, is linear on the interval $1 \leq x \leq 4$ and goes through the coordinates $(1, 3)$ and $(4, 1)$. It is also linear on the interval $5 \leq x \leq 7$ with a slope of 2 and includes the coordinate $(6, 0)$.

   (a) [7 pts] Express the function as a piecewise defined function.

   (b) [7 pts] Determine the average rate of change of $q(x)$ from $x = 2$ to $x = 5.5$.

7. A factory can produce 1,200 bearings an hour and starts with 100 bearings in its inventory at the start of the day. It can also produce 7 hubs per hour and starts with no hubs in its inventory. Each hub requires 64 bearings for a full assembly.

_____ (a) [7 pts] Determine the functions that provide the number of bearings and the number of hubs available at any time, t in hours, after the start of the day.

(b) [8 pts] At what time of the day will there be exactly enough bearings to create assemblies for all the available hubs?

_____

8. [12 pts] Farmer Bob has made a solemn promise that this will be the year he beats Farmer Alice at the county fair. To beat her he will need to build two turkey pens out of 105 meters of special fencing. The first pen will be a square, and the second pen will be a rectangle in which the height is three times its width. What dimensions should Farmer Bob to finally surpass Farmer Alice?

Extra space for work. **Do not detach this page.** If you want us to consider the work on this page you should print your name, instructor and class meeting time below.

Name (print): _____ Instructor (print): _____ Time: _____