

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: _____

Problem Number	Points Possible	Points Made
1	15	
2	10	
3	15	
4	12	
5	7	
6	6	
7	15	
8	10	
9	10	
Total:	100	

- 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:

$$\begin{aligned}\cos(\alpha + \beta) &= \cos(\alpha)\cos(\beta) - \sin(\alpha)\sin(\beta), \\ \sin(\alpha + \beta) &= \sin(\alpha)\cos(\beta) + \cos(\alpha)\sin(\beta).\end{aligned}$$

1. Determine all of the values of x for each question below that satisfy the given equation.

(a) [5 pts] $3x + 1 = 8x - 10$

(b) [5 pts] $4x^2 = 4x + 1$

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

2. [10 pts] Determine the domain of the function

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

3. The formula for a quadratic function is given by

$$Q(x) = x^2 - 10x + 38.$$

_____ (a) [5 pts] Does the function have a local minimum or a local maximum value? Briefly explain the rationale for your answer.

_____ (b) [5 pts] Determine the minimum/maximum value of the function, $Q(x)$.

_____ (c) [5 pts] Determine the x and y -intercepts of the graph of the function. If the function does not have an x or y -intercept briefly justify your conclusion.

4. Answer each of the questions below, and the function referred to is defined by

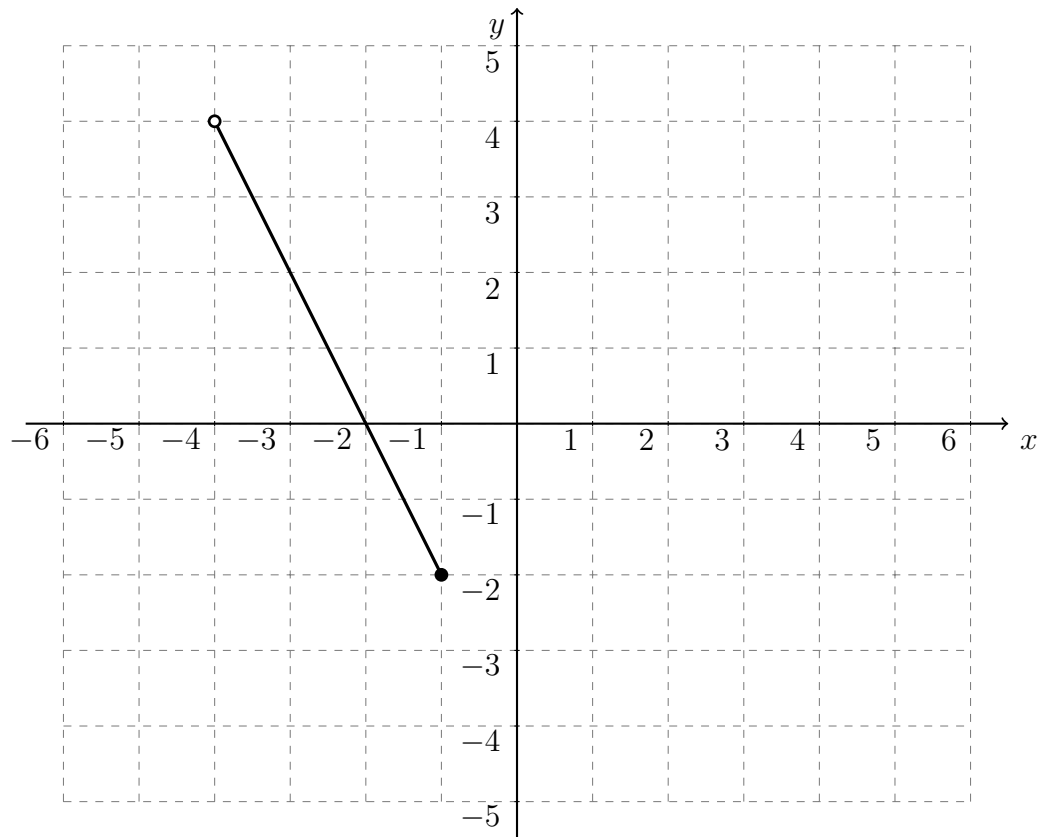
$$\text{Alice}(x) = \begin{cases} -5x + 2 & x < 2, \\ -x^2 + 8x - 9, & x \geq 2. \end{cases}$$

(a) [6 pts] Determine the average rate of change of the function from $x = -2$ to $x = 2$.

(b) [6 pts] Determine the values of x in the domain where the function is increasing.

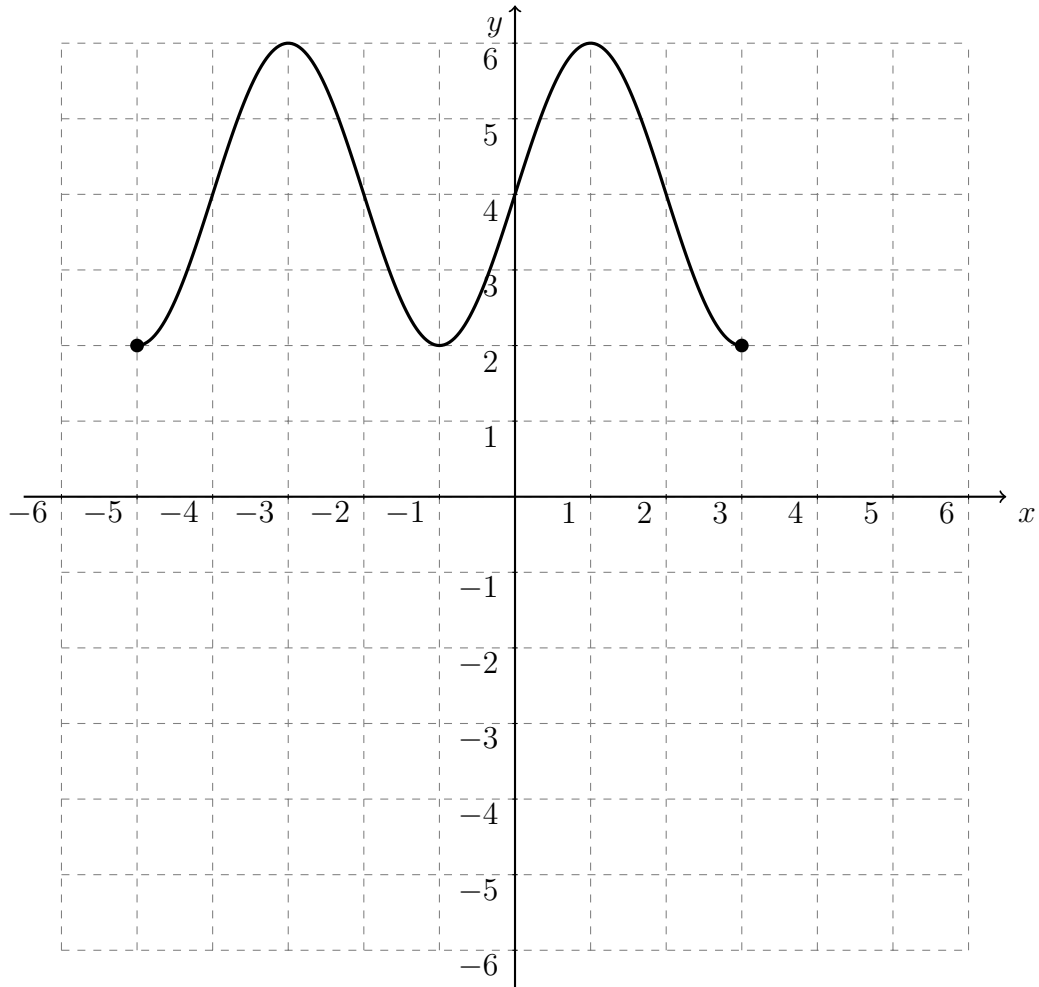
5. [7 pts] A line has a slope of 30. If the change in the y values between two points is 120 what is the corresponding change in the x values?
- _____

6. [6 pts] Part of the graph of a function, $q(x)$, is shown in the plot below. The graph for positive values of x is missing.



The function is an even function, and the graph only includes the negative values of x in the plot above. Sketch the rest of the missing parts of the graph of the function on the axes above.

7. The graph of a function, f , is given in the plot below.



_____ (a) [7 pts] Determine the domain and range of the function, f .

(b) [8 pts] Add a sketch of the graph of $g(x) = f(x - 2) - 5$ to the plot above using a solid line. Clearly label the function.

8. [10 pts] The Madison Rambler leaves the Chicago train station at 8:00am. The train consumes 2,500 gallons of fuel every 500 miles. When it leaves the station it has 4,000 gallons of fuel in its storage tanks. Determine the volume of fuel in the train's storage tanks as a function of the distance it has traveled from Chicago. Determine the domain of the function.

9. [10 pts] A new street is planned, and it will be in the shape of a giant “U” on a hillside. Because of the grade, the two north/south legs will cost \$50 per foot, and the east/west road connecting the ends of the other roads will cost \$30 per foot. A total of \$125,000 has been allocated for road construction. What road lengths should be used to maximize the area between the roads?

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: _____