

Math 120 A, B Winter 2017

Final Exam

March 11, 2017

Name: _____

Student ID no. : _____

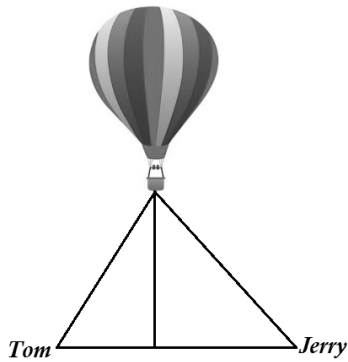
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Section: _____

1	10	
2	10	
3	10	
4	10	
5	10	
6	10	
7	10	
Total	70	

- Complete all seven questions.
- Show all work for full credit.
- The only calculator you may use during this exam is a TI-30XIIs. All other electronic devices are not allowed, and should be turned off and put away for the duration of the exam.
- You should keep at least four decimal digits throughout all calculations. Bases in exponential expressions should be kept as precise as possible.
- If you use a trial-and-error or guess-and-check method when an algebraic method is available, you will not receive full credit.
- You may use one hand-written 8.5 by 11 inch page of notes. Write your name on your notesheet and turn it in with your exam.
- You have 2 hours and 50 minutes to complete the exam.

1. Tom and Jerry are standing 2,000 feet apart on a straight, horizontal road. They observe a hot-air balloon between them directly above the road. The angle of elevation from Tom is 62° and from Jerry is 48° . Find the height of the balloon to the nearest foot.



2. You are selling tickets to a concert, and you need to decide on the ticket price.

From past experience, you know that the number of tickets you sell is a linear function of the ticket price.

If you set the ticket price to be \$10, then you will sell 292 tickets.

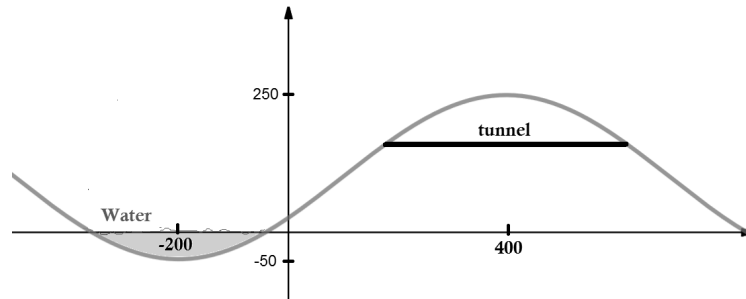
If you set the ticket price to be \$15, then you will sell 240 tickets.

The *revenue* is the amount of money you make from the sale of the tickets.

(a) What ticket prices would result in a revenue of \$2700 ?

(b) What should the ticket price be to maximize the revenue?

3. You are tasked to build a tunnel through the Sine Hill, so-called because it has a sinusoidal cross section (see figure). The valley to the left is filled with water to a maximum depth of 50 m, and the top of the hill is 250 m above the water level. You set up a coordinate system with the x -axis at water level and the y -axis 200 m to the right of the deepest part of the water, as shown. The top of the hill has x -coordinate $x = 400$ m.



- a) Write a sinusoidal function expressing y in terms of x for the points on the surface of the hill, in the above coordinate system.

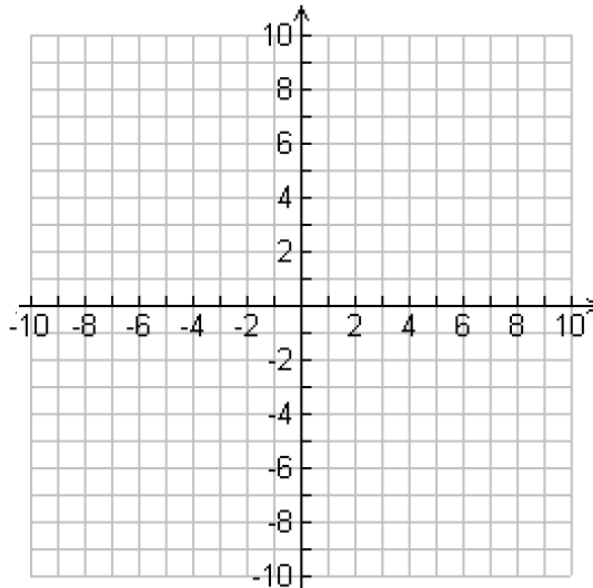
- b) If your tunnel is to be dug horizontally through the hill, at a height of 150 m above the water level, how long will it be? Round your answer to the nearest meter.

4. Let A and B be two constants, and consider the functions:

$$f(x) = \sqrt{16 - x^2}$$

$$g(x) = -2f(Ax + B) + 3$$

(a) On the graph below, draw the graph of $f(x)$, and determine its domain and range.



Domain of f _____

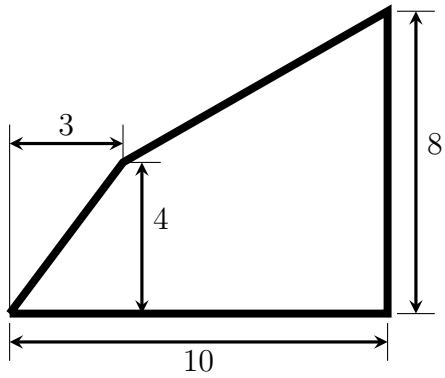
Range of f _____

(b) What is the range of $g(x)$?

(c) For what values of A and B will the domain of $g(x)$ be $-1 \leq x \leq 3$?

5. You have a pizza shaped as shown in the figure below (dimensions are in centimeters). You are going to make a vertical cut through the pizza. The cut will be located a distance of x centimeters from the leftmost corner of the pizza.

Express the area of the pizza to the left of the cut as a multipart function of x .



6. City X and City Y are growing exponentially.

City X had a population of 4000 in the year 1960 and a population of 7000 in the year 2000.

The population of City Y doubles every 24 years.

The populations of City X and City Y will be equal in the year 2020.

When will the population of City Y be twice that of City X?

Express your answer in years after the year 2000.

7. Paula and Jing are running around a circular track. They start running at the same time. Paula starts from the northernmost point and runs clockwise at 2 radians per minute. Jing starts from the westernmost point of the track and runs counterclockwise. Jing and Paula pass each other after they have been running for 1.4 minutes.

(a) What is Jing's angular speed?

(b) Suppose the radius of the track is 140 meters. What is the straight-line distance between Jing and Paula after they have been running for 11.3 minutes?