

Math 120 A Spring 2017
Final Exam
June 3, 2017

Name: _____

Student ID no. : _____

Signature: _____

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.
- 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, two-sided, 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 170 minutes to complete this exam.

1. The radiation level measured on earth from a certain star is a sinusoidal function of time. At 2:30 AM today, the radiation was at its maximum, 22. The level then decreased to its minimum of 3 at 5:30 AM today.

(a) Determine the sinusoidal function that gives the radiation level t hours after midnight last night.

(b) Starting from midnight last night, how long will it be until the level has been above 16 for a total of exactly 5 hours?

2. Alex and Charlie start running around a circular track at the same time. The track has a radius of 160 meters. Alex starts at the westernmost point and runs counterclockwise, taking 200 seconds to run one lap.

Charlie runs clockwise at 3 meters per second and passes Alex for the first time after they have been running for 25 seconds.

- (a) From when he begins running, how long does it take Charlie to reach the northernmost point of the track?

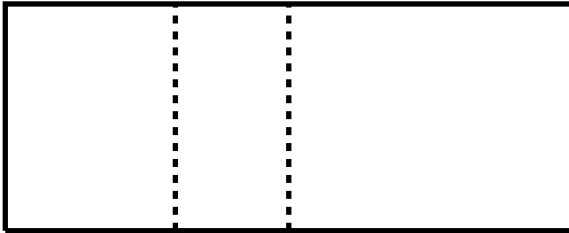
- (b) How many meters north or south of his starting point is Charlie after he has been running for 1200 seconds? Specify the number of meters, and whether Charlie is north or south of his starting point.

3. You are trying to determine the height of a building whose base is on a level plane on which you stand. You are at the base of a vertical pole that you are able to climb. From the base of the pole, you measure the angle to the top of the building to be 30° . You climb a certain distance up the pole and measure again: the angle is now 28° . After climbing 10 feet further up the pole, you measure once more, and find the angle is 27° .

How tall is the building?

4. You are making a rectangular enclosure with fencing. The fencing costs 5 dollars per foot. Also, you want to make two partitions, each parallel to the same side of the rectangle (which will separate the enclosure into three sections). The partitions will be made with special fencing material which costs 8 dollars per foot.

For example, the enclosure might look like this, with the regular fencing shown as the solid line, and the special fencing as the dashed lines.



You have a budget of 1000 dollars. What should the dimensions of the enclosure be to maximize its area?

5. Alex and Bah are walking in the xy -plane. They start walking at the same time from different points, and walk at constant speeds without ever changing direction.

Alex starts from the point $(10, 6)$ and heads directly toward the point $(-4, -3)$, reaching it in 8 seconds.

Bah starts from the point $(-8, 7)$ and passes through the point where Alex crosses the x -axis 1.5 seconds after Alex passes that point.

How long has Bah been walking when Bah cross the y -axis?

6. (a) Let $f(x) = |x + 5|$ and $g(x) = \frac{1}{2}x - 3$. Write the multipart rule for $g(f(g(x)))$.

(b) Let $h(x) = 7 + \frac{3x + 1}{2x - 5}$. Find $h^{-1}(x)$.

7. The Circular Forest is a region in the xy -plane represented by the circle

$$x^2 - 18x + y^2 + 5y = 108.75$$

with units in kilometers (so, for example, the point $(2, 3)$ is 2 kilometers east and 3 kilometers north of the origin).

Charlie is camped 4 kilometers due north of the center of the forest. He then hikes from there 1 km due east. He then turns and walks due south until leaving the forest.

At what point does Charlie leave the forest?