

Math 120 - Autumn 2008
Final Exam
December 6, 2008

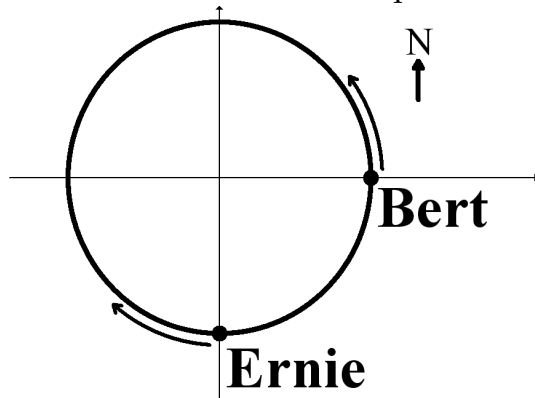
Name: _____ Student ID no. : _____

Signature: _____ Section: _____

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

- Complete all questions.
- You may use a scientific calculator during this examination. NO GRAPHING CALCULATORS. All other electronic devices are not allowed, and must be turned off for the duration of the exam.
- If you use a trial-and-error or guess-and-check method, or read a numerical solution from a graph on your calculator 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.
- Show all work for full credit.
- You have 180 minutes to complete the exam.

1. Bert and Ernie start running around a circular track at the same time. Bert starts at the easternmost point and runs counter-clockwise completing one lap in 50 seconds. Ernie starts at the southernmost point and runs clockwise completing one lap in 60 seconds.



- (a) Give the first time, in seconds, when Bert and Ernie meet.
- (b) If Bert is running at 5 ft/sec, then how far (in a straight line) is Ernie from his starting point after 100 seconds?

2. Fred's height is a **linear-to-linear rational function** of his age.

When Fred is born ($x=0$ years old), his height is 21 inches.

On first birthday, his height is 30 inches.

At age 10, his height is 55 inches.

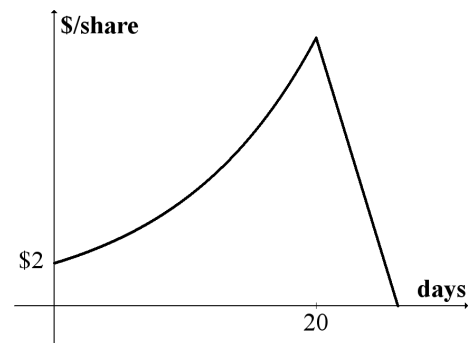
As Fred gets older and older his height approaches, but does not exceed, a particular value.

What height is Fred approaching?

3. You own stock in a company. The day you buy the stock, $x = 0$, the value is 2 dollars per share. After 10 days, the value of the stock is 5 dollars per share.
- (a) If the value of the stock per share is an exponential function of time, how long does it take the stock to quadruple in value?

- (b) After 20 days, the stock stops growing exponentially and starts to decrease at a constant (linear) rate. By day 25, the value of the stock has decreased to 2.5 dollars per share. This situation is illustrated below.

When will the value of the stock be zero?



- (c) Give a multipart rule for the value of the stock as a function of the number of days.

4. A particular radar buoy off the coast can detect any ship within a radius of 10 miles. Erik is in his sailboat located at 3 miles north and 13 miles west of the buoy. Erik sails due east at a constant speed of 8 miles per hour. After 45 minute, he turns due south and continues sailing at the same constant speed.

How long (in hours) is Erik within the radar region?

5. The temperature in a certain cave is a **sinusoidal function of time**. When you first enter the cave, you set up a thermometer to record the temperature. After 19.5 hours, the temperature in the cave is at its maximum: 35 degrees Celsius. The temperature then dropped, reaching the minimum temperature of 25 degrees Celsius 36.5 hours after you entered the cave.

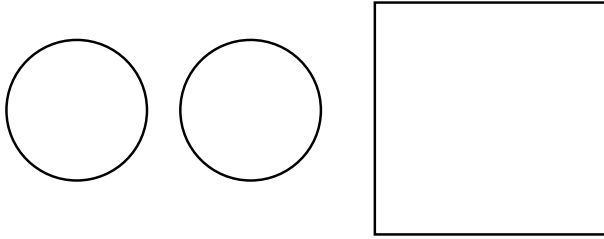
During the first 90 hours after you enter the cave, how much time will the temperature in the cave be above 31 degrees Celsius?

6. Sven is going for a run. He starts 60 meters due WEST of Juan and heads directly toward a point 45 meters EAST and 80 meters NORTH of Juan. Sven runs at a constant 3 meters per second. Juan does not move.

(a) Express the distance between Sven and Juan as a function of the time, t , in seconds that Sven has been running.

(b) Determine all times, t , when Sven and Juan are 50 meters apart.

7. You have 100 inches of wire. You want to use the wire to create two identical circles and a square. The result might look like this:



- (a) What should the radius of the circles be so that the total combined area of the circles and square is as **small** as possible?

- (b) What should the radius of the circles be so that the total combined area of the circles and square is as **large** as possible?