Math 120U
Final Exam

Name:_____

Problem 1		16
Problem 2		7
Problem 3		9
Problem 4		8
Problem 5		20
Extra Credit		5
Total		60

Read this:
- Do not cheat.
- To receive full credit, make sure you show all your work in a neat and orderly fashion.
- You're allowed to use one handwritten 8½ x 11 sheet of notes.
- The number of points each item is worth is marked. Take that into account if you're running out of time.
- If you need scratch paper, use the back of the previous page and indicate where to look.
- Place a box around your answer to each question.
- Raise your hand if you have a question.

1.[16 pts] Uncle Norm starts a candy bar store, Norm's Nutty Nougat Nest. He notes that if he spends 500 dollars on advertising, he sells 1,000 Nutty Nougat Bars. If he spends no money on ads, he sells 500 bars. Let x be the number of dollars Uncle Norm spends on advertising **in hundreds**.

(a) [3 pts] Find a linear model $B_L(x)$ for the number of bars he sells as a function of x.

(b) [2 pts] According to this linear model, how much should Uncle Norm spend to sell 2,500 bars

(c) [3 pts] Find a quadratic model $B_Q(x)$ for the number of bars he sells, assuming the vertex is at x =0.

(d) [2 pts] According to this quadratic model, how much should Uncle Norm spend to sell 2,500 bars?

(e) [3 pts] Find an exponential model $B_E(x)$ for the number of bars he sells as a function of x.

(f) [3 pts] According to this exponential model, how much should Uncle Norm spend to sell 2,500 bars?

2. [7 pts] Find the coordinates of the point P.
The slope of the line is m= –3/2, and the
center of the circle is at (-2, 2).

(–2,2)

P

m=–3/2
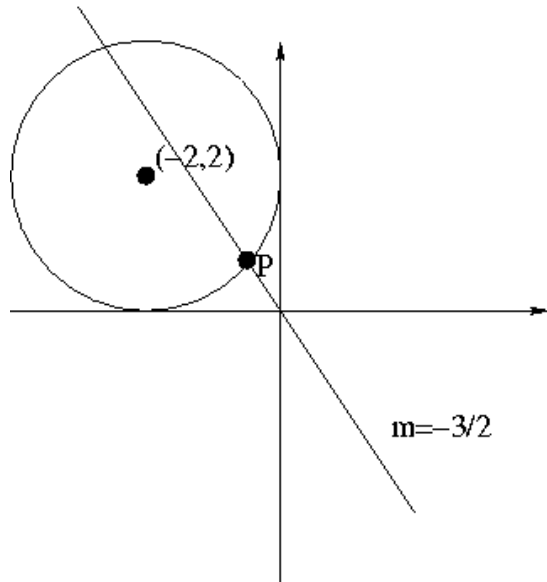
3. [9 pts, 3 each] Write the (a) and (b) in standard exponential form ($y = A_0 b^x$).

(a) $y = 2^{-3x+3}$

(b) $y = 4^x \left(\dfrac{e^x}{4} \right)^2$

(c) Write $y = \dfrac{2^x}{3^x}$ in the form $y = Ce^{kx}$.

4. (a) [1 pt] What condition is necessary for a function, f(x), to have an inverse?

(b) [4 pts] Find the inverse of $f(x) = \dfrac{2x-1}{3-4x}$.

(c) [3 pts] Find $f(f^{-1}(x))$. Show your work.

5. [20 pts] Allie and Bjorn are on a circular track of radius 10 yards. At t = 0, they're both standing in the same place at $\pi/6$ off the horizontal, as shown. For this part of the problem, don't worry about multipart functions, step functions or any of that rot.

(a) [3 pts] If (0,0) is at the north-most part of the circle, what are their coordinates (x, y) at t = 0? (Note: The solution to part (a) is needed for the rest of the problem. If you can't get part (a), assume that the solution to part (a) is (x,y) = (6,8) for the rest of the parts.)

(0,0)

Allie

$\pi/6$
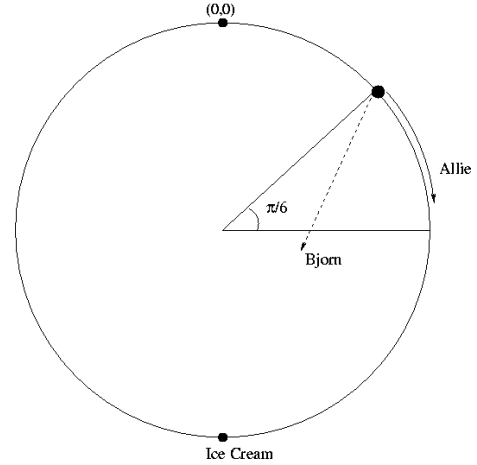
Bjorn

Ice Cream

(b) [4 pts] At t=0, a bowl of ice cream is dropped on the south most point of the track. At that time, Bjorn starts running in a straight line towards the ice cream at a speed of $\sqrt{3}$ yd/sec. Allie simultaneously takes off running **clockwise** around the track at a linear speed of $\dfrac{5\pi}{6}$ yd/sec. Who reaches the bowl of ice cream first? Show all your work.
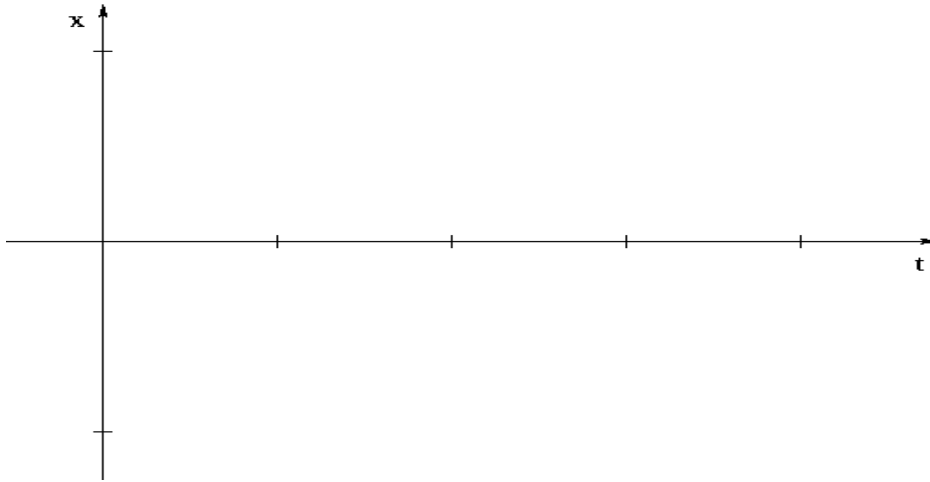
(c) [5 pts] Find equations $(x_A(t), y_A(t))$ for Allie's position after t seconds.
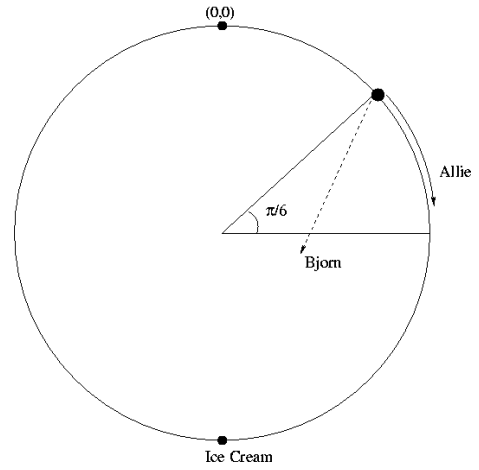
(d) [5 pts] Find parametric equations $(x_B(t), y_B(t))$ for Bjorn's position after t seconds.
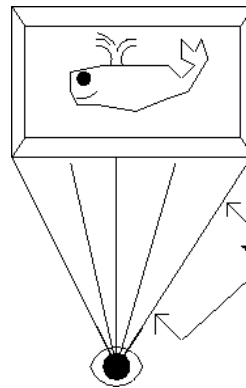
(e) [3 pts] Graph $x_A(t)$ on the graph below. Make the domain one full period. Clearly mark on the graph when Allie first gets to the spot with the ice cream.

Extra Credit [5 pts] Background: In our class we've dealt with Euclidean geometry. There are other forms of geometry. Projective geometry, for example, starts with Euclidean geometry and identifies all lines going through the origin as a "point." This is how your eye sees the world: Your eye "looks" in a certain direction, and anything in a straight line coming out of your eye is what your eye considers a "point." Artists call this *perspective* and use it to draw objects that should be farther away smaller. For example, if an artist wants to draw two lions, but wants one to be farther away, she'll draw the farther-away lion smaller, just like it would look in real life. **Problem:** Assume an artist wants to draw a picture of a 100 foot wide whale at 300 feet from the onlooker. She figures the picture will be viewed from 2 feet away. How wide should she draw the whale?