Math 120A
Summer, 2001
Final 1

Date: Aug 16, 2001 Name _____

- There are 5 problems of 10 points each, for a total of 50 points.
- You may use two $8\frac{1}{2}'' \times 11''$ one-sided pages (or one sheet written on both sides) of your own handwritten notes (no photocopied or printed material). You should also have a clear plastic rular.
- *Show your work:* If your work demonstrates that you had the right idea, you might get partial credit even if your answer is wrong. On the other hand, if your answer is not justified by your work, you might lose points even if your answer is correct. If you need more room, continue your work on the back of the page.
- Leave your answers in exact form (for example, $\sqrt{2}$ rather than 1.414213562...). If you do give decimal answers, round your answers to two (2) decimal places, unless otherwise specified. Calculators are not allowed.
- If any particular question appears to be 'tough' move on to the next. Do not waste time over one single problem.
- If you have a question, raise your hand and Kelly or I will come to your seat.
- Good luck!

For grader's use only

Problem	Points
1	
2	
3	
4	
5	
Total	

1. Warming up: (5 x 2 points)

   (a) Express $45°38'29''$ as a decimal of degree.

   (b) Express $68.3295°$ in degree/minute/second units.

   (c) Evaluate $\cos(450°)$

   (d) Evaluate $\sin(-\frac{7\pi}{3})$

   (e) Solve for x: $(17 + x)e^2 = \ln(39)$

2. In LPs, the 'lead in groove' and the 'exit groove' are 6 in and 1 in respectively from the center. Where as in CDs, the laser is $\frac{3}{4}$ in and 2 in from the center at the beginning and at the end respectively. LPs rotate at a constant angular speed of $33\frac{1}{3}$ RPM but the laser (for CDs) move at a constant linear speed of 2835 in/min.

   (a) What is the maximum linear speed of the needle while playing a LP? (3 points)

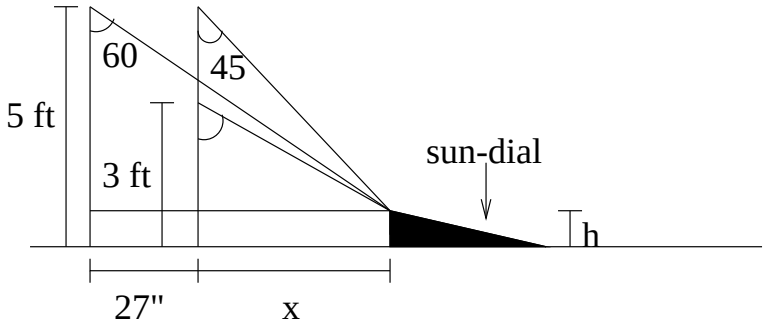
   (b) What is the minimum angular speed of the laser while playing a CD? (2 points)

   (c) Is it possible that a LP needle and a laser for CD will have the same angular speed? Same linear speed? (2 points)

   (d) What is the position of the LP needle when its rotating at half the linear speed of the laser? (3 points)

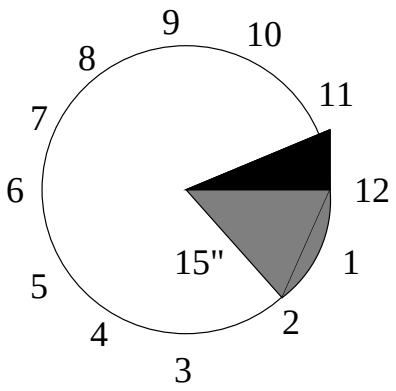
3. As Jim was walking to the sun-dial he noticed that the angle 60°. As he moved 27 in closer, the angle became 45°. Then he sat down. His height is 5 ft while standing and 3 ft when he sat.

(a) What is the height h of the sun-dial? [**Hint:** Get two equations involving h, x and trig functions and then solve.] (5 points)



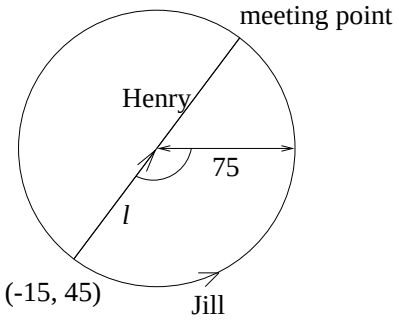
(b) What is the angle θ when he sat down? (3 points)

(c) Find the area of the shaded part of the sun-dial at 2 pm? (2 points)



4. Jill and Henry decided to jog together. In the field as Henry was jogging at 5 ft/sec along the line l with slope $\frac{4}{3}$ and Jill was running along a circle of radius 75 ft. They started from the same point at the same time and met when Jill had completed half way along the circle. Assume horizontal-vertical coordinate axes.

   (a) Find parametric equations for Henry's position at time t (in sec). (4 points)



   (b) How long does it take them to meet? What is Jill's angular speed? [**Hint:** Find the distance Henry jogged.] (2 points)

   (c) Find parametric equations for Jill's position at time t (in sec). [**Note:** You have to find the center of the circle and the angle θ.] (4 points)

5. (a) Ba-140 has a half life of 13 *days*. If you have 6 *gm* of this element, how much will be left 26 *days* later? (2 points)

(b) How much will be there t *days* later (i.e. fit an exponential model)? (3 points)

(c) A fossilized tree has 4 *gm* of C-14 (in 2000 AD). Researchers estimated that when it was alive in 9480 BC, it had 16 *gm* of C-14. Fit an exponential model to this data of radio-active decay? (3 points)

(d) What is the half life of C-14 (i.e. when does it become $\frac{1}{2}$ *gm* if we start with 1 *gm*)? (2 points)