

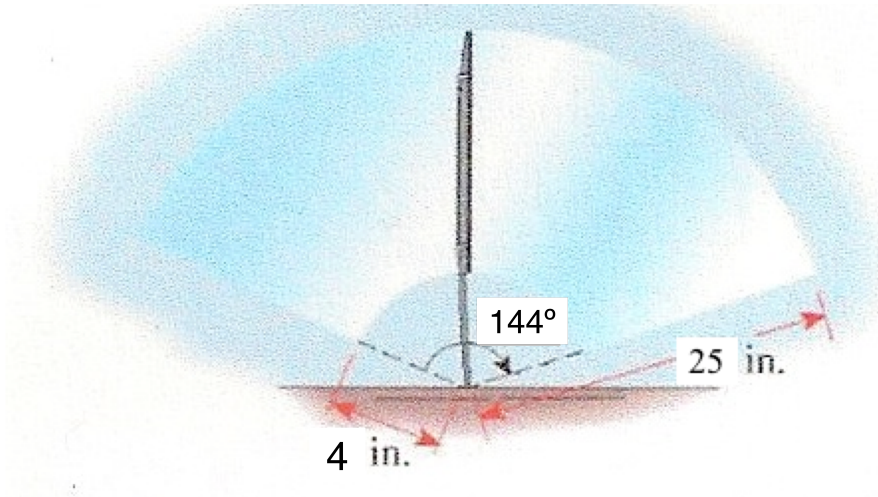
Math 4
Exam 3

Justify your answers!

- 1) Show work that demonstrates how you arrived at an answer.
- 2) If you use a formula, show the formula and then show what numbers are substituted into the formula.

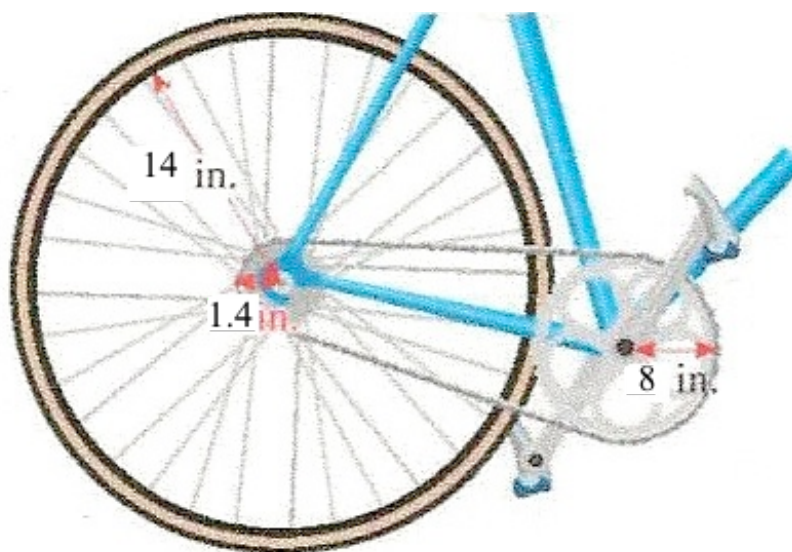
All work, including graphs, should be handwritten. No graphing calculator print outs. Reduce all fractions. When a problem specifies “no decimals”, radicals should be left as simplified radicals and π should left as π . Be sure to include units for word problems.

1. The outer end of a windshield wiper blade is 25 inches from the pivot point attached to the car. The inner end is 4 inches from the pivot point. While in operation, the wiper sweeps through an angle of 144° . Find the area swept by the blade. Give an exact expression for the area in terms of a single simplified fraction and π , and an approximation rounded to the nearest square inch. (10 pts.)



2. When reading a CD-Rom disk **2.8 centimeters** from its center, the drive motor of a disk player rotates the disk at a rotational speed of **726 rpm**. As the reader eye changes its distance from the center, the rotational speed must also change so that the disk player always reads data at the same linear speed, regardless of how far the reader eye is from the center. How fast must the drive motor rotate the disk (in rpm) when reading the disk **5.2 centimeters** from the center? Show computation steps with appropriate units. Round your final result to the nearest **hundredth**. (10 pts.)

3. The toothed cogs of a bicycle are called sprockets. The rear sprocket is attached to the rear wheel. The front sprocket is attached to the pedals. Answer questions given below for a bicycle with the following sprocket and wheel sizes. Show computation steps with appropriate units. **Rear sprocket radius: 1.4 inches. Front sprocket radius: 8 inches. Rear wheel radius: 14 inches.**
- How many times will the rear sprocket rotate for one rotation of the front sprocket? (5 pts.)
 - Determine the angular speed of the rear sprocket when the rotational speed of the front sprocket is 35 revolutions per minute (rpm). (5 pts.)
 - How fast, in revolutions per minute, must a cyclist pedal to propel the bicycle to 25 miles per hour? 1 mile = 5280 feet. Round to the nearest hundredth. (12 pts.)



4. The terminal side a central angle θ in standard position is in Quadrant 2 and parallel to the line shown below.

$$8x + 3y = 5$$

Draw a circle with central angle θ showing the terminal side and the point, expressed as an ordered pair, where the terminal side intersects the circle. Use the coordinates of this point to determine the exact values of all six trigonometric functions of θ . **No decimals. (16 pts.)**

5. Let θ be an angle in standard position. Let $P = (9, -7)$ be a point on the terminal side of θ . Draw a circle with central angle θ containing point P. Use it to find the exact values of all six trigonometric functions of θ . **No decimals. (12 pts.)**
6. Draw a circle with a central angle θ in standard position satisfying the values of the given trigonometric functions. Label the point, expressed as an ordered pair, where the terminal side intersects the circle. Use these coordinates to determine the values of the other five trigonometric functions based on your circle. **No decimals. (15 pts. each)**

a) $\sec \theta = -\frac{13}{6} \qquad \cot \theta < 0$

b) $\tan \theta = \frac{11}{8} \qquad \csc \theta < 0$

7. For each problem a), b), and c) listed below, complete the given list of tasks. Justify your answers. **(25 pts. for each problem)**
- 1) State the period.
 - 2) State the phase shift.
 - 3) State the amplitude.
 - 4) Sketch the graph for **two periods**. When graphing, subdivide and label the x-axis where maximums, minimums, and x-intercepts, occur. Show work to justify how you obtained these x-values. Label the y-axis where values of a maximum or minimum occur. **No decimals.**

a)

$$f(x) = 3 \cos \left(3x + \frac{\pi}{4} \right)$$

b)

$$f(x) = 2 \sin \left(-\frac{1}{2}x + \frac{\pi}{3} \right)$$

c)

$$f(x) = \cos \left(\frac{1}{3}x - \frac{\pi}{6} \right)$$