Name________________________ Banner_______________

Spring 2008 Quiz #2 Solutions Precalculus

Clear your desk of everything but this quiz, a writing utensil (pen or pencil), and your student I.D. (I may verify your enrollment in this class if I don't recognize you). Do **NOT** use a calculator or formula/"cheat" sheet of any kind. Do not talk or look around the room.

Show your work. An answer without a solution receives no credit. Use proper notation. Think before you write or give up. Write on this paper only. Separate the pages and use the backsides for your scratchwork and to cover your work from the eyes of cheaters. Identify what scratchwork goes to which problem. Scratchwork is not a solution. Use your scratchwork to write a complete solution to each problem in the appropriate space provided. Box your answer at the end of your solution. Write legibly and make your arguments clear.

Please ask for clarification if a problem is illegible or ambiguous or if you suspect a typo. Do easy problems first. Check your work. Use the entire class time.

Do not leave this room with this quiz or a copy of any part of this quiz. Do not tell other students about any of the contents of this quiz as it can give them an unfair advantage (which is the same as an unfair disadvantage for you because it drives your grade down compared to the class average).

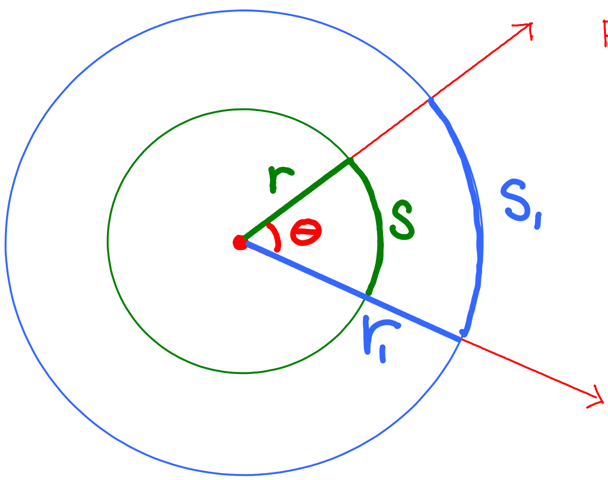
Your grade will be available in webCT as soon as the grader enters it, which should be within a week or so.

#1) Explain, in your own words, using gramatically correct sentences, the difference between units of radians and units of degrees, other than the obvious fact that $\theta^\circ \neq \theta$ radians. What are the possible advantages or disadvantages to using one unit or the other?
Hint: What was the possible motivation behind the definitions of each unit?

Each type of unit is defined in an effort to relate to the "size" of an angle. Any "relation", as the term itself suggests, requires two or more things to be compared. In this case, one of "things" is the "size" of an angle and the other "thing" must be something that we already understand but somehow has a relation to the idea of the "size" of an angle. It is through this relation that we can relate to the "size" of an angle and start to build deeper intuition when working with angles.

Degrees are defined on the basis that we all know what a "revolution" is. At the time of the creation of the unit of degrees, the people who conceived of these units used a base 60 number system. So, just as we like numbers that divide 10, like 2 or 5, and multiples of 10, especially multiples made from the numbers that divide 10, like $2 \cdot 10 = 20$ and $5 \cdot 10 = 50$ just because we use base 10, the creators of the unit of degrees chose $360 = 6 \cdot 60$ to be the number of degrees in a revolution. Thus, knowledge of a revolution equates to knowledge of degrees through the relation provided in the definition of a degree which was provided by the arbitrary choice of $360^\circ = 1$ rev.

Radians are defined on the basis that for any given central angle (an angle with circle of any radius drawn around it with the center of the circle corresponding to the vertex of the angle) the ratio of the arc length subtended by the angle on the circle to the radius of the circle is constant in value.



For any given central angle, denoted by θ in the diagram, the ratio of the arclength subtended by the angle, denoted by s and s_1 for each of the circles in the diagram, to the radius of the circle is a constant:

$$\frac{s}{r} = \frac{s_1}{r_1} = \text{constant}$$

This ratio is unique for a given angle and therefore serves as a basis for a definition of a unit of measure for angles.

This unit of measure is called the radian.

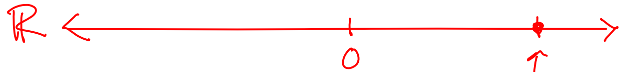
Thus,

$$\theta = \frac{s}{r} \text{ radians}$$

There were no parameters open for arbitraration as there was in the definition of the degree. They could have chosen any number of degrees to be equal to one revolution. This distinction provides radians with the advantage that most mathematical formulas involving angles attain their most simple form when angles are expressed in units of radians. This is due to the fact that radians are a more "natural" unit being based on an intrinsic property of angles themselves and the fact that radians are a "dimension-less unit" since a ratio of a length to a length can be expressed as a pure number and a number by itself has dimension zero, as opposed to a length that has units of dimension one or an area that has units of dimension two.

$$\frac{s\ \cancel{\text{units of length}}}{r\ \cancel{\text{units of length}}} = \frac{s}{r} = \text{number}$$

"The Real Number Line"



A number can be represented by a "point" on the "number line".
A point is zero dimensional.

We'll soon see another benefit of using radians when we learn about trigonometric functions, which take angles as their input. Since an angle in radians is just a pure number, we can forget that the number was in reference to the measure of an angle at all. This will allow us to generalize a trigonometric function to be like any other function that simply converts one number, call it x if you like, into another number which you can call y if you like.

#2) Given that there are A molecules in a mole of molecules, and there are B atoms in each molecule, answer the following questions.

a) In terms of A, B, and C, how many atoms are there in C moles of molecules?

$$C \text{ moles of molecules} = C \text{ moles of molecules} \cdot 1$$

$$= C\ \cancel{\text{moles of molecules}} \left(\frac{A\ \cancel{\text{molecules}}}{1\ \cancel{\text{mole of molecules}}}\right)\left(\frac{B \text{ atoms}}{1\ \cancel{\text{molecule}}}\right)$$

$$= CAB \text{ atoms} = \boxed{ABC \text{ atoms} = C \text{ moles of molecules}}$$

b) In terms of A, B, and D, how many moles of molecules can you get from D atoms?

$$D \text{ atoms} = D\ \cancel{\text{atoms}} \left(\frac{1\ \cancel{\text{molecule}}}{B\ \cancel{\text{atoms}}}\right)\left(\frac{1 \text{ mole of molecules}}{A\ \cancel{\text{molecules}}}\right)$$

$$= \boxed{\frac{D}{AB} \text{ moles of molecules} = D \text{ atoms}}$$