ORMATYC - Aleks session notes

Tuesday, March 22, 2011

10:21 AM

Link to these notes:
http://tinyurl.com/AleksAtORMATYC

Individualized Skills Review with Aleks prep

After teaching calculus a few times, I gradually became frustrated by the range of preparation levels represented by the students in my pre-calculus or calculus courses. I was spending too much time reviewing pre-reqs and polishing algebra skills to be able to properly treat the important concepts in the course! With Aleks prep products, my students can work at their own individual level and pace to brush up their skills or even to overcome steeper deficits in readiness. Meanwhile, I recover both my patience and some class time to use treating the wonderful conceptual ideas from these courses. In this session we will introduce Aleks and talk about the experience that I and my students have had using the Aleks prep products.

What is Aleks? Assessment and Learning in Knowledge Spaces
http://www.aleks.com/about_aleks/publications_kst

Mathematical Psychology:

a combinatorial structure describing the possible states of knowledge of a human learner.[1] To form a knowledge space, one models a domain of knowledge as a set of concepts, and a feasible state of knowledge as a subset of that set containing the concepts known or knowable by some individual. Typically, not all subsets are feasible, due to prerequisite relations among the concepts. The knowledge space is the family of all the feasible subsets. Knowledge spaces were introduced in 1985 by Jean-Paul Doignon and Jean-Claude Falmagne[2] and have since been studied by many other researchers.[3] They also form the basis for two computerized tutoring systems, RATH and ALEKS.[4]

Student View:
Login Name: **GUEST256035**
Password: **BENCHKEY**

How did I use it?

What happened?

How did the students feel?

"But what do you do in class while they are working on Aleks on their own?"

Implicit proposition: Students need to be to use algebra effectively with several families of functions before they are able to learn calculus.

I disagree with this proposition, and to some degree what this proposition implies about what a calculus course is about.

For even the best entering students, their grasp of the conceptual issues of calculus is typically minimal. That means if we engage the students in discussions and activities which allow them to interact with these concepts, the playing field will be much more level.

This works in Pre-calculus too, since student thinking about the function concept, even for linear functions, is typically weak.

Example of conceptual activities:

GoodQuestions for Calculus and Peer-learning
http://www.math.cornell.edu/~GoodQuestions/

4. [**P**] Given two infinite decimals $a = .3939393939...$ and $b = .67766777666...$, their sum $a + b$

   (a) is not defined because the sum of a rational and irrational number is not defined.
   (b) is not a number because not all infinite decimals are real numbers.
   (c) can be defined precisely by using successively better approximations
   (d) is not a real number because the pattern may not be predictable indefinitely.

5. [**D**] You decide to estimate e^2 by squaring longer decimal approximations of $e = 2.71828\dots$.

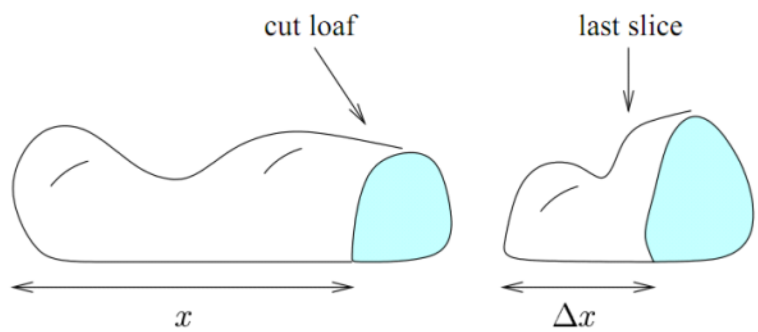
   (a) This is a good idea because e is a rational number.
   (b) This is a good idea because $y = x^2$ is a continuous function.
   (c) This is a bad idea because e is irrational.
   (d) This is a good idea because $y = e^x$ is a continuous function.

Other ideas: Roanoke college method:

But this is an area of increasing need, as well, for more and ***tested*** active learning strategies to help move more synthesis of knowledge into the classroom space

Developing a physical intuition for the concepts of calculus.

7. [**D**] When you slice a loaf of bread, you change its volume. Let x be the length of the loaf from one end to the place where you cut off the last slice. Let $V(x)$ be the volume of the loaf of length x (see figure). For each x, $\frac{dV}{dx}$ is



(a) the volume of a slice of bread

(b) the area of the cut surface of the loaf where the last slice was removed

(c) the volume of the last slice divided by the thickness of the slice.

Not just for calculus!

3. [**P**] Imagine that there is a rope around the equator of the earth. Add a 20 meter segment of rope to it. The new rope is held in a circular shape centered about the earth. Then the following can walk beneath the rope without touching it:

(a) an amoeba

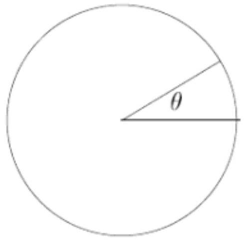
(b) an ant

(c) I (the student)

(d) all of the above

Lead ins for the loaf of bread:

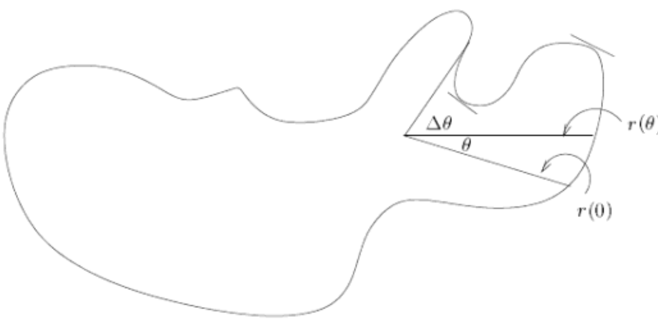
4. **[Q]** Suppose you cut a slice of pizza from a circular pizza of radius r, as shown.



As you change the size of the angle θ, you change the area of the slice, $A = \frac{1}{2}r^2\theta$. Then $A' =$

(a) $\frac{1}{2}r^2$
(b) $r\theta + \frac{1}{2}r^2\frac{d\theta}{dr}$
(c) $r\frac{d\theta}{dr}$
(d) $r\frac{dr}{d\theta}\theta + \frac{1}{2}r^2$, and $\frac{dr}{d\theta}$ is not 0.

5. **[D]** Suppose you cut a slice of pizza from an amoeba shaped pizza, as shown.



As you change the size of the angle θ, you change the area of the slice. Then $A'(\theta)$ is

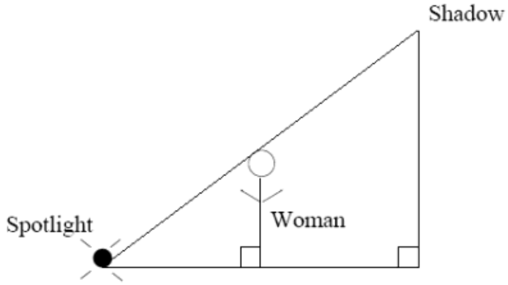
(a) Not enough information. You need an explicit function for the area
(b) $\frac{1}{2}(r(\theta))^2$
(c) $\frac{1}{2}(r(\theta))^2 + r(\theta)\frac{dr}{d\theta}\theta$

8. **[P]** If you divide the volume of the rind of a thin-skinned orange by the thickness of the rind you get a good estimate for

(I) The surface area of the original orange
(II) The surface area of the edible part
(III) The change in the volume of the orange
(IV) The square of the radius of the orange

(a) I and II
(b) III
(c) I only
(d) IV

5. **[P]** A spotlight installed in the ground shines on a wall. A woman stands between the light and the wall casting a shadow on the wall. How are the rate at which she walks away from the light and rate at which her shadow grows related?



(a) One is a constant multiple of the other.

(b) They are equal.

(c) It depends also on how close the woman is to the pole.

6. **[P]** Gravel is poured into a canonical pile. The rate at which gravel is added to the pile is

(a) $\frac{dV}{dt}$

(b) $\frac{dr}{dt}$

(c) $\frac{dV}{dr}$

(d) none of the above

1. **[Q]** $\frac{d}{dx}(e^7)$ equals

(a) $7e^6$

(b) e^7

(c) 0

1. **[Q]** **True** or **False**. The function $f(x) = x^{1/3}$ is continuous at $x = 0$.