HOMEWORK 13

(1) We discussed in class the use of discovery-based learning for exploring concepts. Some concepts seem not to be suitable for this method; others simply can’t be fit in the time available.
   (a) Are there examples of topics that aren’t suitable for discovery-based learning, no matter how much time is available? If not, what topics are most affected by time restrictions?
   (b) Some topics lend themselves naturally to discovery, while others are more difficult. What are some surprising approaches to discovery-based learning? (You can describe your own that you have created, or others’ that you have found.)

(2) We discussed in class the tension between wanting to enforce standards (which encourages us to apply penalties for not meeting them), and wanting to reach a broad audience (which encourages giving even failing students a second chance, and possibly a third, fourth, . . .). One surprising resolution to this tension is described in the article “When less is more” by Peter Gray (http://www.psychologytoday.com/print/39676). Read this article, and compare and contrast it with your own views on giving students at all levels a solid mathematical background.

(3) (*) When we point a flashlight towards a wall, we see the image of a circle. Upon tilting it, the circle elongates to an ellipse, then opens out to a parabola, and finally ends up as a hyperbola.
   How should we hold the flashlight to see a parabola? How many different ways are there to accomplish this?

(4) We described the following 2 constructions in class. Both involve a string attached to a ruler at one end, and to a pin at the other end, with a marker pressed against the ruler stretching the string taut.
   (a) Consider sliding the ruler in a direction perpendicular to the ruler. What curve is traced out? Why?
   (b) Consider pivoting/rotating the ruler about a fixed point (on the ruler). What curve is traced out? Why?

(5) Given a fixed line, what transformations can be represented by combinations of the following ‘basic’ transformations:
   • sliding along the line;
   • sliding perpendicular to the line;
   • pivoting/rotating about a point on the line; and
   • pivoting/rotating about a point not on the line.
   You may find it interesting to see how much, if at all, it affects your answer to work with only subsets of these transformations.

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