Motivating Students through Problem Solving and Applications

by Richard N. Aufmann

One way to create an interesting, dynamic classroom environment is through the use of applications. Students who see a real connection between what they are learning and how that applies to their career goals are more motivated to learn. As a result, these students are active participants in class and can potentially act as a catalyst to motivate other students to succeed.

One of the goals of *Exploring Introductory and Intermediate Algebra: A Graphing Approach* is to provide professors with an extensive set of application problems, chosen from a wide variety of disciplines, that will appeal to students. A partial list of these disciplines includes astronomy (planets orbiting Upsilon Andromedae), zoology (sound of a blue whale), business (encrypting business transactions over the Internet), and meteorology (hurricane wind velocity).

To solve application problems, students must develop sound problem-solving strategies. The first section in *Exploring Introductory and Intermediate Algebra: A Graphing Approach* is devoted to problem solving. We introduce the topic through problems or puzzles that require very little or no math skills. Using this approach on the first day of class reduces student anxiety, gets students involved, and sets a tone for the term. For instance, one problem we have students attempt is Exercise 10 in Section 1.1. This problem is based on a puzzle by Raymond Smallyan.

An ewok was visiting an island on which there lived knights, who only make true statements, and knaves, who only make false statements. The ewok needed to find a knight to be a trusty guide. While walking along the shore, the ewok came upon three natives, named Arthur, Bernard, and Charles. The ewok first asked Arthur, "Are Bernard and Charles both knights?" Arthur replied, "Yes." The ewok then asked, "Is Bernard a knight?" Arthur replied "No." Who is a knight and who is a knave?

After each problem, we have students discuss the strategies they (or the group) used to solve a problem. This gives students the opportunity to verbalize their strategy and listen to other approaches that lead to the same result. Sometimes we are asked "Why doesn't this work?" Questions like this are quite instructive and provide for lively debate.

Once we have completed our initial foray into problem solving, we discuss the general problem-solving strategies as presented by George Polya. When students are faced with a problem, we encourage them to: State the goal, Devise a strategy, Solve the problem, and Check your work.

Using data from real-world situations is an excellent way of combining applications and problem solving. One such application gives students data from the America Online website and asks students to determine which pricing plan is best suited to their internet use.

Besides real-data applications, we offer three other opportunities for students to sharpen their problem-solving skills: *Go Figure, Suggested Activities,* and *Explorations.* Here is an example of a *Go Figure.*

GO FIGURE

In a contest to guess how many jelly beans were in a jar, Hector guessed 223, Shannon guessed 215, Suki guessed 220, Deon guessed 221, Saul guessed 217, and Denise guessed 219. Two were off by 4, two were off by 2, one was off by 1, and one was correct. What was the correct number?

Suggested Activities offer cooperative learning opportunities. Some of these activities prepare students to solve certain types of problems without going into all of the mathematics. Here is one such activity.

Suggested Activity

Suppose a coffee merchant blends Mocha Java coffee costing $7 per pound with Kona coffee costing $12 per pound. Will the merchant make a profit by selling the blend for $6 per pound? Will the merchant make a profit by selling the coffee for $10 per pound? Will the coffee merchant make a profit by selling the coffee at $13 per pound.

Explorations generally provide more challenging problem-solving experiences. Here a partial Exploration from that asks students to analyze distance-time functions.

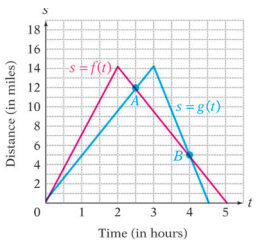
EXPLORATION

Cara and Daren begin from the same point on a bicycle trail and return to that point some time later. The blue graph shows Cara's distance, in miles, from the starting point t hours after starting the trip. The graph in red shows the same information for Daren.

a. In which intervals on the t-axis is ?

b. When is Cara closer to the starting point than Daren?

c. What is the significance of the points at which the graphs cross?



If you would like to see some of the ways we use applications and problem solving in *Exploring Introductory and Intermediate Algebra: A Graphing Approach,* please see the following. Some of these references integrate technology as an effective tool for solving some problems.

Heart rate as a function of age, Section 4.3, page 277
Pterosaur wingspan, Section 4.3, Exercise 16, page 288
Focal length of a camera, Section 7.1, Exercise 50, page 472
Highway safety, Section 7.4, Exercise 33, page 517
Speed of a roller coaster, Section 8.2, Exercise 44, page 563
Effect of wind on a 200-m dash, Section 9.5, Exercise 96, page 685

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