Low Stakes Writing Assignment #1: Ill-formed Problem

General Description: Give students a poorly specified mathematical (or programming) problem. Give them the scenario that a boss has posed this question and that they must ask the boss for clarification by asking their boss questions. On a note card, they should write down these questions of clarification, and then ask individuals to read out their questions. Answer these questions and show the result: a well-formed mathematical question. Collect the cards and give a completion grade.

Example: Build a mathematical model for population growth.

Types of Questions Students Might Ask:

For what type of organism are we building a population growth model?
Are there organisms that immigrate into the population?
Are there organisms that emigrate out of the population?
What is the birth rate of the population?
What percentage of the population can breed?
At what rate is the birth rate changing?
What type of effect does the food supply in the area have on population have?

Example of a question that is well-formed:

Write a difference equation that describes the growth of a population with the following characteristics:

a) The initial population of organisms is 1,000,000.
b) Each year the number of births is equal to 2% of the total population from the previous year.
c) Each year the number of deaths is equal to 1.5% of the total population from the previous year.
d) Each year, a net of 50,000 organisms emigrate into the population.
e) No other issues affect the growth of the population than a - d.

Discussion Questions:

a) What limitations are there in the application of the result of solving this difference equation?
b) What parameters might it be worthwhile to vary in the study of this model?
c) What difficulties would be have it we attempted to incorporate more variables into the model?

Low Stakes Writing Assignment #2: Identify Assumptions and What to Prove

General Description: State a mathematical problem (something a student might see on a homework assignment) and ask them to highlight the assumptions or given information in the problem and what they are supposed to prove.

Example #1: Prove that for all positive integers x, y and z, there are no solutions to the equation $x^3 + y^3 = z^3$.

Assumption: x, y and z are positive integers.
Need to Prove: No values can be substituted into the equation $x^3 + y^3 = z^3$ to make it true.

Example #2: Given that a triangle has two equal angles, show that the triangle is isosceles.

Assumption: A triangle has two equal angles.
Need to Prove: The triangle is isosceles.

Low Stakes Writing Assignment #3: Grade a Student Response

General Description: Give students a sample student response to a quiz question and a grading rubric for the question. Have students grade the assignment, leaving comments for the person who wrote the answer.

Example:

Quiz Question: Find all solutions for x in the following equation:

$$x^2 - 4x + 3 = 2x^2 + 3x - 5$$

Student Response:

$$x^2 - 4x + 3 = 2x^2 + 3x - 5$$
$$(x - 1)(x - 3) = (2x + 5)(x - 1)$$
$$x - 3 = 2x + 5$$
$$-8 = x$$

Grading Criteria:
> 10 pts total
> 2 pts for simplifying the equation
> 2 pts for arriving at a quadratic to factor or solve
> 2 pts for getting the requisite roots
> 2 pts for the first answer
> 2 pts for the second answer

Discussion: What mistake did this student make? How should we mark the response based on this grading criteria?

Lesson: No grading criteria is ever complete. In grading, we must isolate the mathematical content students have applied correctly and what they have applied incorrectly. Then, we have to find a way to assign points to the response and give students feedback so that they understand their mistake.