Author: Maureen Grady

# Situations Project

Situation A:

**Prompt:** In a high school pre-calculus class students were learning to evaluate limits. Given the problem $\lim_{x \to \infty}\left(\frac{1}{x}\cdot 2^x\right)$, a student concluded that the limit must be 0 because $\lim_{x \to \infty}\left(\frac{1}{x}\right)$ was equal to zero and zero times anything was equal to zero.

**Focus 1:** The theorem $\lim_{x \to a}\left(f(x)\cdot g(x)\right) = \lim_{x \to a}(f(x))\cdot \lim_{x \to a}(g(x))$ applies only when $\lim_{x \to a}(f(x))$ and $\lim_{x \to a}(g(x))$ exist. In this case the theorem does not apply since $\lim_{x \to \infty}(2^x)$ does not exist.

**Focus 2:** A graphing calculator can be used to explore this problem both by examining the graph of the function $f(x) = \left(\frac{1}{x}\cdot 2^x\right)$ as x goes to infinity and by examining the behaviors of the two functions $f(x) = \left(\frac{1}{x}\right)$ and $g(x) = \left(2^x\right)$. This limit can be explored numerically by using the tables of values generated for the two functions.

Situation B:

**Prompt:** A student new to using graphing calculators was using one to generate ordered pairs for the equation $y = x^2 + 1$. He generated the points: (2, 5), (1, 2), (0, 1), (-1, 0), (-2, -3).

**Focus 1:** It is important to understand why $-2^2$ and $(-2)^2$ are not equivalent expressions.

**Focus 2:** It is important for students and teachers to recognize the limitations and idiosyncrasies of the technology that they use. Different calculators handle expressions like $-2^2$ in different ways. Most scientific calculators will evaluate it as 4 while most graphing calculators will evaluate it as -4.