Practice Solutions – V

1. The formula for the volume of a square-based pyramid is $V = \frac{1}{3}s^2h$.

   a. Rewrite the formula to solve for s.

   $$V = \frac{1}{3}s^2h$$
   $$3V = s^2h$$
   $$\frac{3V}{h} = s^2$$
   $$\pm\sqrt{\frac{3V}{h}} = s$$

   Because the length cannot be negative, the formula is

   $$s = \sqrt{\frac{3V}{h}}$$

   b. What restrictions are on the variables V and h?

   Because this radical is a square root (index is two), all variables must be greater than or equal to zero. Note also that h is in the denominator, therefore h cannot equal zero.

   $V \geq 0, V \in \mathrm{R}$

   $h > 0, h \in \mathrm{R}$

2. The velocity, v, in feet per second, of a roller coaster at the bottom of a hill is related to the vertical drop, h, in feet. The velocity, v_0, in feet per second, of the roller coaster at the top of the hill can be calculated using the formula $v_0 = \sqrt{v^2 - 64h}$.

   a. Explain why $v_0 = v - 8h$ is not equivalent to the given formula.

   The two equations are not equivalent because when taking the square root of the given formula, the square roots of the terms that are subtracted cannot be taken separately. Alternatively, when $v^2 - 64h$ is factored as a difference of squares, the factors are $(v - 8\sqrt{h})(v + 8\sqrt{h})$, which are not identical (and thus not representing a perfect square).

b. What velocity will a roller coaster have at the bottom of a 225 ft hill if it starts with a velocity of 0 ft/s at the top?

$$\begin{aligned} v_0 &= \sqrt{v^2 - 64h} \\ 0 &= \sqrt{v^2 - 64(225)} \\ (0)^2 &= \left(\sqrt{v^2 - 14\ 400}\right)^2 \\ 0 &= v^2 - 14\ 400 \\ 14\ 400 &= v^2 \\ \pm\sqrt{14\ 400} &= \sqrt{v^2} \\ \pm 120 &= v \end{aligned}$$

Because the roller coaster is going down, which is in a negative direction, the velocity is -120 ft/s. Alternatively, it can be stated that the roller coaster has a speed of 120 ft/s downward.

Please complete *Lesson 3.3 Explore Your Understanding Assignment*, *Final Review Assignment*, and *Check Point* located in *Workbook 3B*.