3. [11 points] The UM Dance Club met up with the UM Math Modeling Club to write formulas for different dancer’s jumps. They measure one dancer’s total time in the air as 1 second and their maximum height as 4 feet. They know that the function $D(t)$ which gives the dancer’s height (in feet) as a function of time after they jump (in seconds) is a quadratic function.

   a. [3 points] One member of the Math Modeling Club wants to find the formula for $D(t)$ using the zeros of the function, so is starting with the form:

   $$D(t) = a(t - r)(t - s)$$

   To model the dancer’s jump described above, what are possible values of $r$ and $s$ and how do you know?

   $$r = \underline{\quad}$$
   $$s = \underline{\quad}$$

   **Explanation:**

   b. [3 points] Another member of the Math Modeling Club wants to write a formula using vertex form of a quadratic function:

   $$D(t) = a(t - h)^2 + k$$

   To model the dancer’s jump described above, what are the values of $h$ and $k$ in this formula and how do you know?

   $$h = \underline{\quad}$$
   $$k = \underline{\quad}$$

   **Explanation:**
The UM Dance Club met up with the UM Math Modeling Club to write formulas for different dancer’s jumps. They measure one dancer’s total time in the air as 1 second and their maximum height as 4 feet. They know that the function $D(t)$ which gives the dancer’s height (in feet) as a function of time after they jump (in seconds) is a quadratic function.

c. [3 points] Find the exact value of $a$ in the formulas above. You can use either of your equations to do this. Show all work.

\[ a = \text{______________} \]

d. [2 points] From the context of the problem alone—without relying on or referring to your calculation above—would you expect the value of $a$ to be positive or negative? Why?

\[ a > 0 \quad a < 0 \quad \text{NOT ENOUGH INFORMATION} \]

Explanation: