**5.** [10 points] Leena climbs a tree, picks an apple, and throws it into a basket that is on the ground 9 meters away from the base of the tree. The apple's path is the shape of a parabola, reaching its peak of 10 meters above the ground when its horizontal location is 4 meters away from the tree. Let $H(m)$ be the function that gives the apple's height, in meters, when its horizontal location is $m$ meters away from the tree.

**a.** [3 points] Write a formula for $H(m)$ in vertex form. Show any needed work.

*Solution:* The vertex is $(4, 10)$, so we know $H(m) = a(m-4)^2 + 10$. Then, since we must have $H(9) = 0$, we can solve $0 = a(9-4)^2 + 10$ to find that $a = -\frac{2}{5}$.

**Answer:** $H(m) =$ $-\frac{2}{5}(m-4)^2 + 10$

**b.** [3 points] Write a formula for $H(m)$ in factored form. Show any needed work.

*Solution:* Since 9 is one zero and the vertex is at $m = 4$, the other zero of the parabola must be $-1$ by symmetry. We can solve for $a$ similarly to part **a**. or just note that the $a$-value must be the same.

**Answer:** $H(m) =$ $-\frac{2}{5}(m-9)(m+1)$

**c.** [2 points] Find the value of $H(0)$ in decimal form, then interpret what it means in the context of this problem.

**Answer:** $H(0) =$ 3.6

**Interpretation:**

*Solution:* Leena was 3.6 meters above the ground when she threw the apple.

**d.** [2 points] Leena attempts to throw an apple to her friend Toya, who is behind a wall that is 10 meters away and 2 meters tall. Her throw sets the apple on a path such that, when its horizontal location is $m$ meters away from her, its height in meters is given by $L(m) = -0.2m^2 + 1.5m + 6$. Does the apple get to Toya? Circle the correct answer and provide a brief explanation.

**Yes** **No**

**Explanation:**

*Solution:* We can find that $L(10) = 1$, so the height of the apple is only 1 meter when it reaches the fence. It will hit the fence rather than go over it, since the fence is 2 meters tall. Or, one could also find the time at which the apple is 2 meters off the ground by solving $L(m) = 2$. Since the positive solution is about 7.8 meters, we know that the apple will be at that height well before it reaches the fence horizontally.