

“Launching a Projectile” Answers

QUESTIONS:

1) Possible errors...

1. Math errors

- a. mixed units
- b. calculation error
- c. set up equations incorrectly

2. The ball was “robbed” of energy, which decreased its horizontal velocity

- a. ball bounced
- b. rolling requires energy
- c. friction

2) $v = 50$ miles/hour
 $y = 3$ m
 $x = ?$

First, we need to notice that there are mixed units – miles and meters

$$v = \frac{50 \text{ miles}}{\text{hr}} \times \frac{1609 \text{ meters}}{3600 \text{ seconds}} = \mathbf{22.35 \text{ m/s}}$$

Next, we need to use the y equation to find the time

$$y = \frac{1}{2}gt^2$$

$$t = \sqrt{(2y/g)} = \sqrt{(2(3\text{m})/9.81 \text{ m/s}^2)} = \mathbf{0.78 \text{ seconds}}$$

Finally, we can use v and t to find the range

$$x = vt = (22.35 \text{ m/s})(0.78 \text{ s}) = \mathbf{17.47 \text{ m}}$$

3) The football must be thrown at an angle of 45 degrees; that will result in the greatest range.

4) $y = 5$ m $g = 10 \text{ m/s}^2$
 $x = 20$ m $v = ?$

$$y = \frac{1}{2}gt^2 \quad \rightarrow \quad t = 1 \text{ s}$$

$$x = vt \quad \rightarrow \quad \mathbf{v = 20 \text{ m/s}}$$

5) The distance a projectile falls below the straight line path is $d = 1/2gt^2$.

$$d = \frac{1}{2}(9.81 \text{ m/s}^2)(0.25 \text{ s})^2 = \mathbf{0.31 \text{ m}}$$

$$d = \frac{1}{2}(9.81 \text{ m/s}^2)(0.50 \text{ s})^2 = \mathbf{1.23 \text{ m}}$$

$$d = \frac{1}{2}(9.81 \text{ m/s}^2)(0.75 \text{ s})^2 = \mathbf{2.76 \text{ m}}$$

$$d = \frac{1}{2}(9.81 \text{ m/s}^2)(1.00 \text{ s})^2 = \mathbf{4.91 \text{ m}}$$

