

Projectile Motion (Launched at an angle) - Answer Key

1. Soccer Ball at 30 m/s , 60°

- (a) Initial vertical velocity: $v_{0y} \approx 26.0\text{ m/s}$.
Initial horizontal velocity: $v_{0x} = 15.0\text{ m/s}$.
- (b) The horizontal component is constant.
- (c) There is no horizontal acceleration; gravity acts only in the vertical direction.
- (d) The ball will be in the air for approximately 5.30 s .
- (e) The ball will go approximately 79.5 m .
- (f) The maximum height reached by the ball is approximately 34.4 m .
- (g) After 1 s , the velocity is approximately 22.1 m/s at 47.1° above the horizontal.

2. Golf Ball at 70 m/s , 25°

- The ball goes approximately 383 m .

3. Ball Launched from Cliff

- (a) Initial vertical velocity: $v_{0y} = 7.25\text{ m/s}$.
Initial horizontal velocity: $v_{0x} \approx 12.6\text{ m/s}$.
- (b) The ball lands approximately 35.2 m from the base of the cliff.
- (c) The maximum height above the ground is approximately 20.9 m .
- (d) The velocity just before it hits the ground is approximately 23.8 m/s at 58.1° below the horizontal.

4. Ball Launched from Building (Upwards)

- The building is approximately 413 m tall.

5. Ball Launched from Building (Downwards)

- The building is approximately 799 m tall.

6. Soccer Ball Kicked Towards Wall

- The ball hits the wall at a height of approximately 2.04 m .

7. Basketball Player's Throw

- (a) The vertical component of the velocity at the level of the net is $\pm 7.60\text{ m/s}$.
- (b) There are two answers because the ball passes through the height of the net twice: once on its way up (with a positive vertical velocity) and once on its way down (with a negative vertical velocity).