

Worksheet 3.3
Projectiles in 2D

1. A rock is thrown horizontally from the top of a cliff 98 m high, with a horizontal speed of 27 m/s.
 - (a) For what interval of time is the rock in the air?
 - (b) How far from the base of the cliff does the rock land?
 - (c) With what velocity does the rock hit?
2. A rescue pilot wishes to drop a package of emergency supplies so that it lands as close as possible to a target. If the plane travels with a velocity of 81 m/s and is flying 125 m above the target, how far away (horizontally) from the target must the rescue pilot drop the package?
3. A bullet is fired with a horizontal velocity of 330 m/s from a height of 1.6 m above ground. Assuming the ground is level how far from the gun will the bullet hit the ground?
4. A fireman is standing on top of a building 20.0 m high. He finds that if he holds the hose so that water issues from it horizontally at 12 m/s, the water will hit a burning wall of an adjacent building at a height of 15.0 m above the ground. What is the horizontal distance from the fireman to the building?
5. An earth bound golfer strikes a golf ball giving it a velocity of 48 m/s at an angle of 50° to the horizontal.
 - (a) What are the vertical and horizontal components of the ball's initial velocity?
 - (b) How long is the ball in the air?
 - (c) What is the horizontal distance covered by the ball while in flight?
 - (d) What velocity does the ball have at the top of its trajectory?
6. A golf ball was struck from the first tee at Lunar Golf and Country Club. It was given a velocity of 48 m/s at an angle of 40° to the horizontal. On the moon, $a_{\text{gravity}} = -1.6 \text{ m/s}^2$.
 - (a) What are the vertical and horizontal components of the ball's initial velocity?
 - (b) For what interval of time is the ball in flight?
 - (c) How far will the ball travel horizontally?
7. An archer standing on the back of a pickup truck moving at 28 m/s fires an arrow straight up at a duck flying directly overhead. The archer misses the duck! The arrow was fired with an initial velocity of 49 m/s relative to the truck.
 - (a) For how long will the arrow be in the air?
 - (b) How far will the truck travel while the arrow is in the air?
 - (c) Where, in relation to the "duckless" archer, will the arrow come down? Will the archer have to 'duck'?

8. A ball is thrown with a velocity of 24 m/s at an angle of 30° to the horizontal.
 - (a) What are the vertical and horizontal components of the initial velocity?
 - (b) How long is the ball in the air?
 - (c) How far away will the ball land?
 - (d) To what maximum height will the ball rise?
 - (e) With what velocity will the ball land?
9. A youngster hits a baseball giving it a velocity of 22 m/s at an angle of 62° with the horizontal. How far will the ball travel before it is caught by a fielder (assuming the fielder catches the ball at the same height that it is hit)?
10. On level ground, a football is thrown up at a certain angle. The ball is in the air 2.0 s and strikes the ground 30.0 m from the thrower. What was the ball's total initial velocity?
11. A pebble is fired from a slingshot with a velocity of 30 m/s. It is fired at an angle of 30° to the horizontal. If its flight is interrupted by a vertical wall 12 m away, at what height does it hit the wall?
12. A diver takes off with a speed of 8.0 m/s from a 3.0 m high diving board at 30° above the horizontal. How much later does she strike the water?
13. A pilot cuts loose two fuel tanks in an effort to gain altitude. At the time of release, the plane was 120 m above the ground and traveling upward at 30° to the horizontal, with a speed of 84 m/s. For how long did the tanks fall and with what speed did they hit the ground?

