

## Unit 5 Problems - Projectiles -

### Vocabulary:

Projectile Trajectory Parabola

### Questions:

1. To an observer looking out a window of a moving car, a rock thrown sideways out the window would appear to fall:
2. To a ground-based observer, the rock from #1 would appear to move in a:
3. What one thing does the vertical and horizontal motion have in common?
4. You are in the back of a slowly moving truck. If you toss a ball straight up, where will it come down? Describe the ball's path from the ground's point of view, and from yours.
5. Explain the physics of the long jump to a friend who wants to maximize his/her jump. Explain what factors will give the best jump.

### Physics Problems: solve for the unknown:

#### I. No initial vertical velocity

1. Ana recklessly drives her car off the edge of a 208 m tall cliff. If her speed was 62.8 m/s, how far from the base of the cliff will her car hit?
2. Ashlee is skydiving without a chute. If her plane is traveling at 129 m/s and is up at 1200 m when she leaps out, how far horizontally will she travel before she hits the ground? Where will the plane be at this time?
3. Austin goes cliff diving off a tall cliff. If he runs at a speed of 3.21 m/s and lands in the water 19.7 m from the base of the cliff, how tall is the cliff?
4. A cat knocks a flower pot off a window ledge at a speed of .329 m/s. If the pot hits the pavement 5.97 m away from the building, how high up was the window?
5. A ball rolls off a table that is 98.7 cm tall. If it hits the ground 39.1 cm away from the table, how fast was it rolling?
6. Karla tosses a penny sideways off a 27.6 m tall bridge. If it splashes 15.9 m away from the bridge, how fast did she toss it?
7. A rabbit is running at 13.2 m/s, straight away from the 32.8 m cliff you are standing on. The rabbit is already 10.0 m away when you throw. With what horizontal speed do you have to throw a rock to nail the bunny in his tracks?
8. Lauren serves the volleyball perfectly over the net with a 12.5 m/s velocity. If she stands 8.3 m away

from the net while serving, how high above the net must she aim the ball?

9. Dan drives 22 m/s off the top of a tall building, landing on the roof of a nearby building 2.47 seconds later. How far away are the two buildings, and how much higher was the first one?

#### II. Range/Projectile motion

1. Young Blood shoots a rifle at a 32.3 degree angle. If the bullet's velocity is 1298 m/s, (a) how far away will the bullet land? (b) how high did it get at it's peak? (c) how long was the bullet traveling through the air?
2. Maryfer tees off with a 5 wood. She hits the ball at 57.9 m/s at a 19.5 degree angle. How far down the fairway does her ball first bounce?
3. Danny hits a baseball at 59.5 m/s at a 49 degree angle. The rear fence is at the same height he hit the ball and is 350 m away. Is it a home run?
4. Ricky takes a jumper from 6.00 meters. He launches the ball at a 63 degree angle and the ball swishes through the net. If his hands were the same height as the net when he released, how fast was the ball traveling?
5. Emi is standing on a tall building when he throws a grenade at 3.27 m/s at a 30° angle upwards. The grenade explodes 3.47 seconds later. How far over and how far up or down was the grenade as it exploded?
6. Charlie kicks a 48 m field goal that had a hang time of 3.45 seconds. What was the initial angle and velocity of the kick?
7. Wild woman Amanda is trying to jump over the Grand Canyon on her motorcycle. Unfortunately she didn't study her physics hard enough and she under-estimated the needed initial speed. She launches off a 45 degree ramp at 133 m/s. The Grand Canyon is 2010 m wide. How far down the side of the cliff does Amanda hit?
8. David is standing on top of the school's roof, 5.3 m off the ground. He throws his graphing calculator at 9.75 m/s at a 55 degree angle. How far away does it land?

1) 409 m  
2)  $2.0 \times 10^3$  m, up  
3) 185 m  
4) 1620 m  
5) 87.2 cm/s  
6) 6.70 m/s  
7) 17.1 m/s  
8) 2.2 m  
9) 54 m apart, 29.9 m higher  
II 1) 155 000 m, 24 500 m up, 141 secs  
2) 215 m  
3) 357 > 350 m; yes!  
4) 8.53 m/s  
5) 9.83 m over,  
6) 22 m/s @ 51°  
7) 235 m down  
8) 12 m



CALVIN AND  
HOBBS  
copyright  
Watterson. Dist.  
by UNIVERSAL  
PRESS  
SYNDICATE.  
Reprinted with  
permission. All  
rights reserved.