**2-Dimensional Motion**

Directions: Show the solutions (i.e. your work) to these on a separate sheet of paper.

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| 1.56 s7.5 m4.8 m/s x + -15.3 m/s y | 1. Fred leaves the edge of a 12m tall cliff with a horizontal velocity of 4.8 m/s. What time is he in the air? How far from the base of the cliff does he land? What is his velocity upon impact with the water in terms of x and y components? |
| 1.082 s5.74 m-10.6 m/s12.2 m/s, 60o below horiz | 2. Mr. Murray leaps from the edge of the retaining wall trying to get away from an angry motorist. He is running at 6.1 m/s and lands 6.6 m out into the yard below. What time is he in the air? How high is the cliff? What is his final vertical velocity? What is his velocity of impact in terms of an angle and magnitude? |
| 3.96 m12.2 m/s7.1 m | 3. Rachel leaps from the edge of a cliff with a velocity of 3.3 m/s horizontally. She hits the water 1.2 seconds later. How far out does she land? What is her speed when she hits? How high is the cliff?  |
| 67.6 m/s10.8 s454 m | 4. A golf ball leaves the ground with an initial vertical velocity of 53 m/s and a horizontal velocity of 42 m/s. a) Draw the initial velocity vector. Find the initial speed. b) For what time is the ball in the air? c) How far does it go in this time? |
| 12.9 m/s15.3 m/s3.1 s40m | 5. A football is kicked by Joe at an angle of 50 degrees above the horizontal at a speed of 20 m/s. a) Draw a picture of the initial velocity vector. b) What is the horizontal velocity? c) What is the initial vertical velocity component? d) What time will the ball be in the air? e) What distance will it go in that time?  |
| 590 m/s413 m/s84.3 s49,700 m | 6. A rifle is fired at an angle 35o above the horizontal at a speed of 720 m/s. a) Draw a picture of the initial velocity vector. b) What is the horizontal velocity? c) What is the initial vertical velocity component? d) What time will the shell be in the air? e) What distance will it go in that time? |
| 1.74 m/s50.6 s75.8 m | 7. A river has a current of 1.5 m/s, and a swimmer has a velocity of .89 m/s. If they head straight across the river, what will be their speed (hypotenuse) with respect to the shore? If the river is 45 m wide, how much time will it take them to cross? How far downstream will they drift in that time? |
| 2.14 m/s28 m2.29 m/s | 8. A canoe heads straight across a river with a current of .80 m/s. It takes the canoe 35 seconds to cross the 75 m wide river. What is the speed of the canoe with respect to the water? How far does the canoe drift downstream? What is the speed of the canoe with respect to the shore? |
| 5.3 m/s630m720m48sAppleFrom the time calculations | 9. Red Elk has to swim across the river where his friend Magenta Antelope has a pie that they are going to share. The river has a current of 4 m/s, and Red Elk can swim at 3.5 m/s when he’s really hungry. And he is really hungry. What is his speed with respect to the shore? If it takes him 180 seconds to cross the river, how wide is it? How far downstream does he get swept? If he can run back along the shore toward the pie at 15 m/s, how long does it take him to meet his friend? What kind of pie was it? How do you know? |
|  | Use the range and angle equations for this part: ,  |
| 12,948 m, 23o | 10. Angle = 67o, Speed = 420 m/s, Range = ? Other angle with same range? |
| 84 m, 78o | 11. Angle = 12o, Speed = 45 m/s, Range = ? Other angle with same range? |
| 16.2m, 8o | 12. Angle = 82o, Speed = 24 m/s, Range = ? Other angle with same range? |
| 15.9o, 74.1o | 13. Speed = 34 m/s, Range = 62 m, Angles = ? |
| 24.2o, 65.8o | 14. Speed = 12 m/s, Range = 11 m, Angles = ? |
| Can't be done! | 15. Speed = 24 m/s, Range = 62 m, Angle = ? |