

#3 Motion: Vectors and Projectile Motion

Equations: $x = v_0t + \frac{1}{2}at^2$ $v = v_0 + at$ $v_f^2 = v_0^2 + 2a\Delta x$ $a^2 + b^2 = c^2$ SOHCAHTOA

- 1) What is the displacement if you travel 50m north, 20m east, 30m south, 10m west, and then 20m south?
- 2) What is the displacement if you move 3.0km west, and then 4.0km north?
- 3) At what angle will a boat travel if it is traveling at 12.2m/s perpendicular to the river's current of 3.80m/s. What is its resultant velocity?
- 4) What are the x and y component vectors for an object shot at a 42.3° angle at 65.3m/s?
- 5) You walk to visit a bunch of friends and you travel 500.m north, 200.m east, 300m south, and then 400m west. What is your total displacement?
- 6) A plane flies due east from San Francisco to Washington, D.C. for 5.60×10^3 km. Then it flies to Boston which is 900.km at an angle of 55.0° east of north. What was the total displacement?
- 7) A plane is traveling with a horizontal velocity of 250m/s when it drops a bomb that falls 15600m to the ground. Excluding air resistance, how far did the bomb travel in the x direction? If the plane continued to fly in the same direction, where would it be when the bomb landed?
- 8) You are investigating a car accident. A car broke through the guard rail on a bridge and fell 35m in the y direction while traveling 96m in the x direction. If the speed limit on the road is 30.m/s, was the car speeding?
- 9) A ball is thrown with an upward velocity component of 30.0m/s and a horizontal velocity component of 5.00m/s. What angle was it thrown at? What is its velocity at 3.00s? At 4.00s? At 6.00s?
- 10) A gun is fired on flat level ground at a 10.0° angle with a velocity of 185m/s. How long is it in the air?
- 11) A cannon fires a cannonball on flat level ground at a 32.0° angle with a velocity of 125m/s. How high will the cannon ball go. How far will it travel?

Answers

- 1) 10m east
- 2) 5km 53.1° north of west
- 3) 17.3° , 12.8m/s
- 4) $v_x = 48.3\text{m/s}$, $v_y = 43.9\text{m/s}$
- 5) 282.8m 45° north of west
- 6) 6360km
- 7) 14000m, right overhead
- 8) Yes, it was traveling over 36m/s
- 9) 80.5° , 5m/s, -11.2m/s 63.4° below horizontal, -30.4m/s 80.5° below horizontal
- 10) 6.424s
- 11) 219m, 1.40×10^3 m