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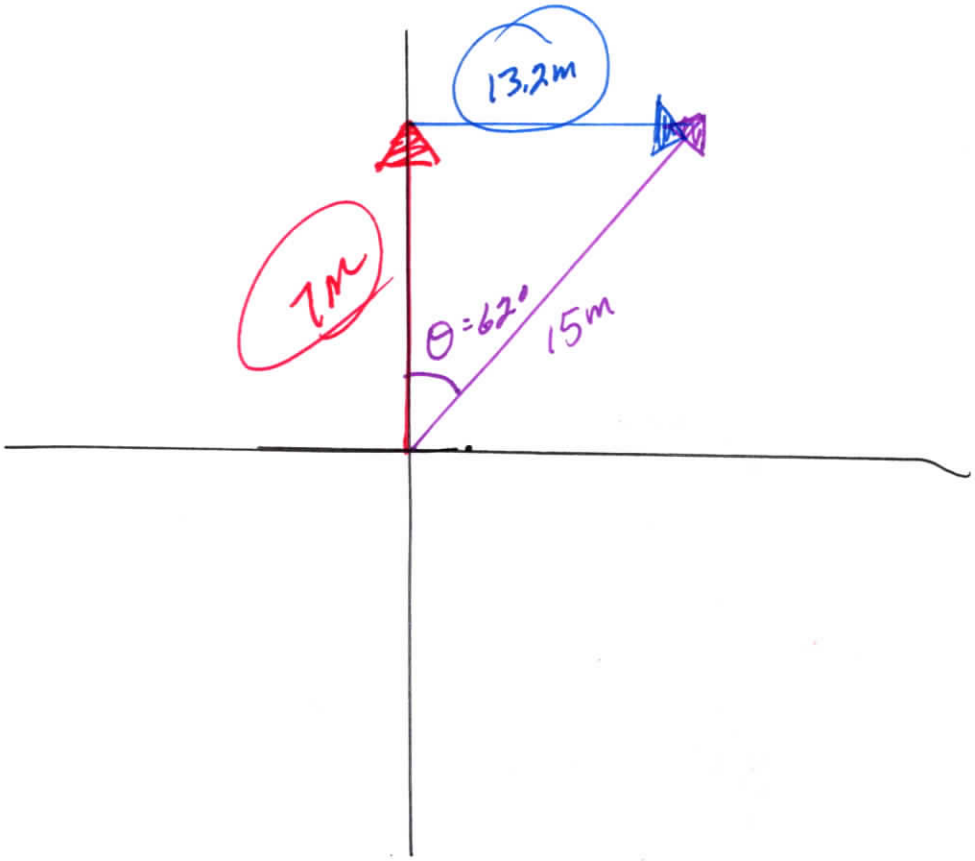
Vector Test

FT vector (20)

Directions: Solve the following problems showing all work. Each problem is worth 5 points.

1) Resolve the following vector into components:
   a. 15m @ 62 degrees east of north



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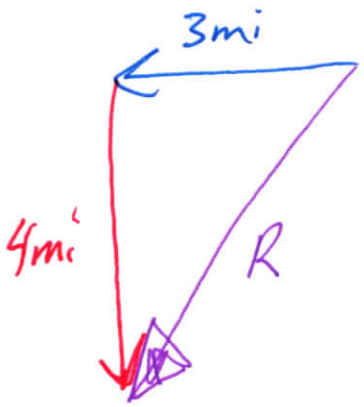
2) Draw a sketch of the addition of the following two vectors. Label the resultant with an R
   a. 3 miles west
   b. 4 miles south



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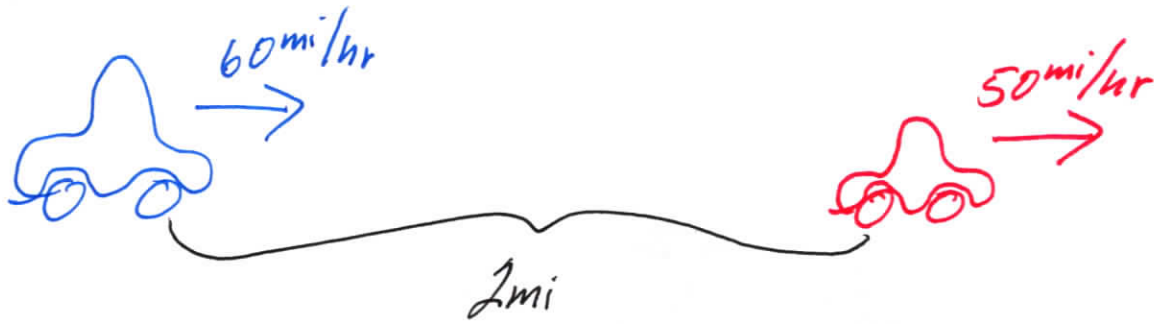
3) A red car is driving north 50 mi/hr on US-15. A blue car is traveling north at 60 mi/hr. The blue car starts 2 miles behind the red car. How long does it take the blue car to catch the red car?



Blue Car WRT Red Car

$v = 10\ mi/hr$

$x = 2\ mi$

$t = ?$

$x = vt$

$\frac{x}{v} = t = \frac{2\ mi}{10\ mi/hr} = .2\ hr = 12\ min$

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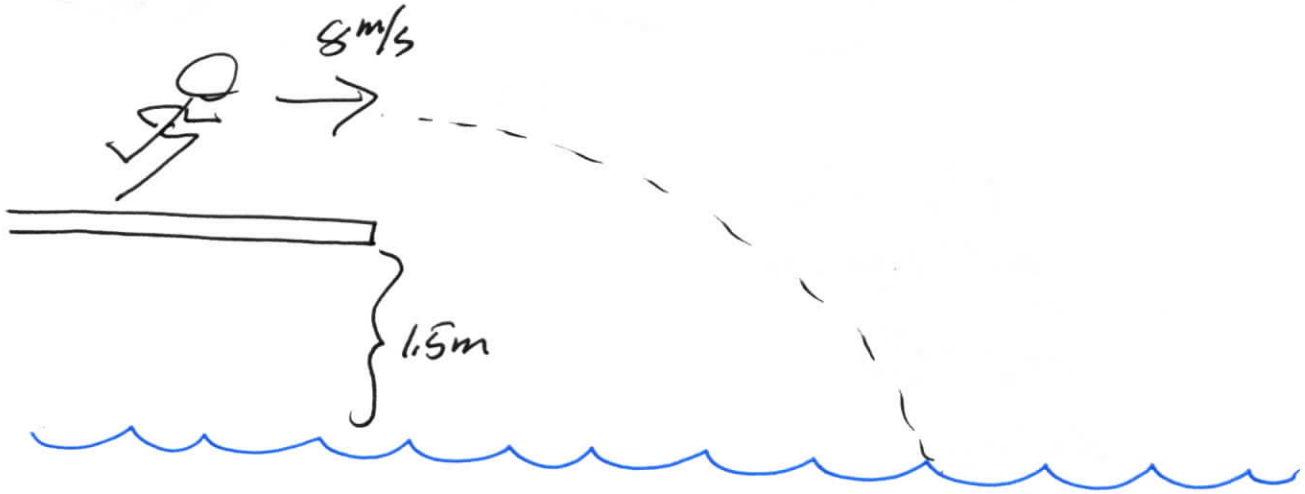
4) A diving board is 1.5 m above the water in a pool. Someone runs out and off the end of the diving board at 8 m/s. How far out from the end of the diving board do they hit the water? Assume they did not jump up at the end of the board.



Y

$y = -1.5\,m$

$a = -9.8\,m/s^2$

$t = ?$

$v_{0y} = zero$

$y = v_0 t + \frac{1}{2} a t^2$

$y = \frac{1}{2} a t^2$

$\sqrt{\frac{2y}{a}} = t = \sqrt{\frac{(2)(-1.5\,m)}{-9.8\,m/s^2}} = .55\,s$

X

$x = ?$

$v_{0x} = 8\,m/s$

$t = .55\,s$

$a = zero$

$x = v_0 t + \frac{1}{2} a t^2$

$x = v_0 t$

$x = (8\,m/s)(.55\,s)$

$x = 4.4\,m$

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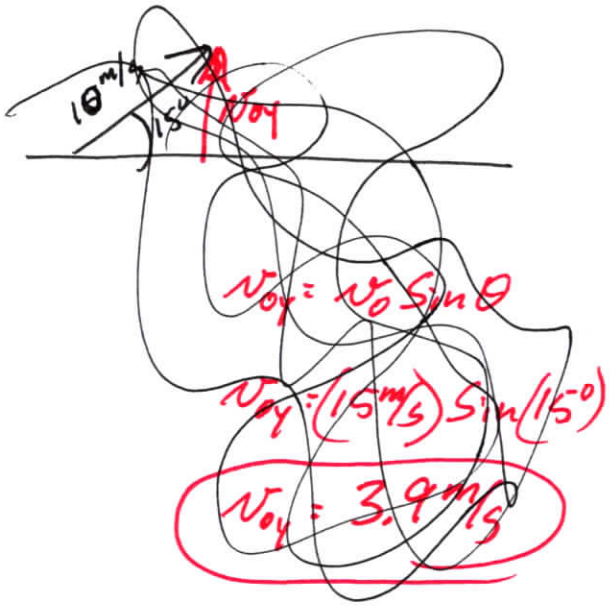
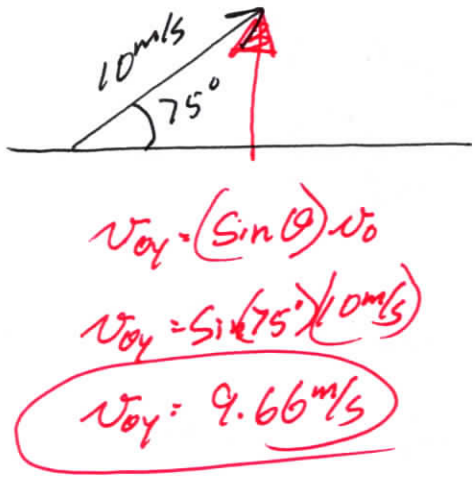
5) A small cannon fires a metal ball at 10 m/s at 75 degrees above the horizontal Determine the vertical velocity of the metal ball





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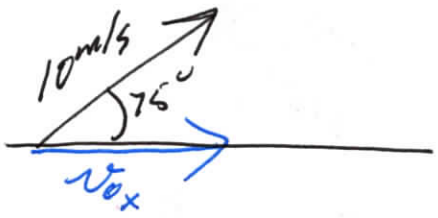
6) A small cannon fires a metal ball at 10 m/s at 75 degrees above the horizontal Determine the horizontal velocity of the metal ball



$v_{0x} = v_0 \cos\theta$

$v_{0x} = (10\ m/s)\cos 75°$

$v_{0x} = 2.6\ m/s$

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7) A small cannon fires a metal ball at 10 m/s at 75 degrees above the horizontal Determine the highest point in the trajectory of the ball (How high does it go?

$v_{oy} = 9.66\ m/s$

$y = ?$

$a = -9.8\ m/s^2$

v_y = zero - highest point

$$v_y^2 = v_{oy}^2 + 2ay$$

$$\frac{v_y^2 - v_{oy}^2}{2a} = y$$

$$\frac{0 - (9.66\ m/s)^2}{(2)(-9.8\ m/s^2)} = y$$

$$4.8\ m = y$$

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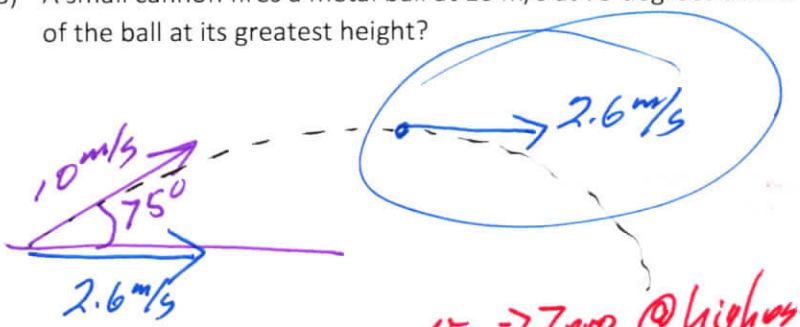
8) A small cannon fires a metal ball at 10 m/s at 75 degrees above the horizontal What is the speed of the ball at its greatest height?



v_y => Zero @ highest point

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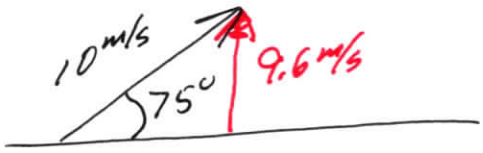
9) A small cannon fires a metal ball at 10 m/s at 75 degrees above the horizontal How long will the ball be in the air?



y

$t = ?$

$v_{oy} = 9.66\ m/s$

$v_y = 9.66\ m/s$

$a = -9.6\ m/s^2$

$v_y = v_{oy} + at$

$\frac{v_y - v_{oy}}{a} = t$

$\frac{-9.66\ m/s - 9.66\ m/s}{-9.8\ m/s^2} = t$

$1.97s = t$

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10) A small cannon fires a metal ball at 10 m/s at 75 degrees above the horizontal How far away from the cannon will the ball land? (Assume the ground is level)

x

$x = ?$

$t = 1.97s$

$v_{0x} = 2.6 m/s$

$a = zero$

$x = v_0 t + \frac{1}{2} a t^2$

$x = (2.6 m/s)(1.97s)$

$x = 5.13 m$