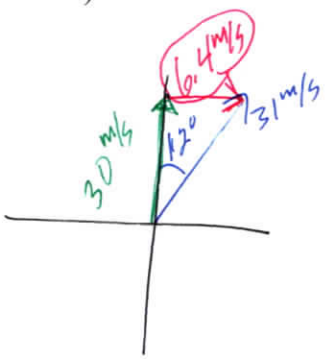
Answer Key Pd1

Vector Test

AT Vector (18)

Directions: Solve the following problems, showing all work and circling your answer. Each is worth 5 points.

1) Resolve the following vector: 31 m/s @ 12 degrees east of north.



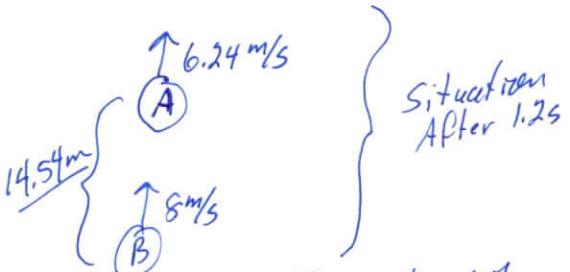
2) A ball is thrown up in the air, with no horizontal velocity, at 18m/s. At the same position and 1.2 seconds later, a second ball is thrown up in the air at 8m/s. Determine the height that the balls collide.

Position & Velocity of "A" After 1.2s

$t = 1.2s$
$v_0 = 18 m/s$
$v = ?$
$y = ?$
$a = -9.8 m/s^2$

$v = v_0 + at$
$v = (18 m/s) + (-9.8 m/s^2)(1.2s)$
$v = 6.24 m/s$

$y = v_0 t + \frac{1}{2} a t^2$
$y = (18 m/s)(1.2s) + (\frac{1}{2})(-9.8 m/s^2)(1.2s)^2$
$y = 14.54m$



Solve For The Time When They Are Both At the Same Position

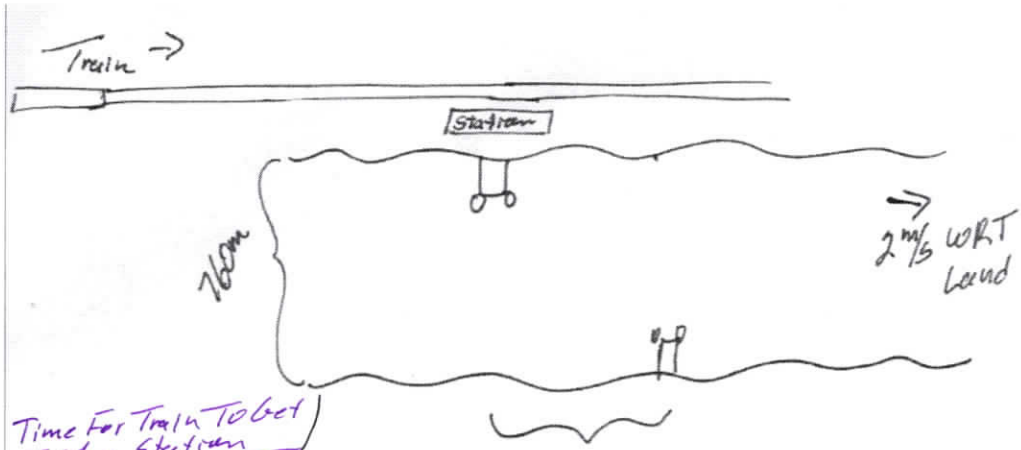
A	B
$x_0 = 14.54m$	$x_0 = zero$
$x = ?$	$x = ?$
$v_0 = 6.24 m/s$	$v_0 = 8 m/s$
$a = -9.8 m/s^2$	$a = -9.8 m/s^2$
$t = ?$	$t = ?$

$x_0 + v_0 t + \frac{1}{2} a t^2 = x_0 + v_0 t + \frac{1}{2} a t^2$
$(14.54m) + (6.24 m/s)t + (\frac{1}{2})(-9.8 m/s^2)t^2 = (8 m/s)t + (\frac{1}{2})(-9.8 m/s^2)t^2$

$14.54m + (6.24m)t = (8 m/s)t$
$14.54m = (1.76m)t$
$t = 8.26s$

$y = v_0 t + \frac{1}{2} a t^2$
$y = (8 m/s)(8.26s) + (-\frac{1}{2})(9.8 m/s^2)(8.26s)^2$
$y = 263m$ Below Ground

3) Using the diagram below as reference, imagine that you need to cross a river in a boat to catch a train. Trains typically roll into a station, people get on and people get off and the train rolls. It's a safe assumption that if the goal is to catch a train, you really need to be standing on the loading platform when the train rolls in. So, you are on the other side of the river at the dock. You have a motorboat that you will use to cross the river from one dock to the other. You will need to cross the 760m wide river and travel upstream 800m to the dock on the far side, all while the water is flowing at 2 m/s WRT land. The train is coming; it is 3 miles (4800m) away traveling at 80mi/hr (35.8 m/s…This is how fast passenger trains travel). The train uniformly accelerates to stop at the station from 3 miles out. Determine the slowest speed of the boat required WRT water to make it across the river in time to catch the train



Time For Train To Get To the Station

$x = 4800m$

$v_0 = 35.8 m/s$

$t = ?$

$v = zero$

$v^2 = v_0^2 + 2ax$

$\frac{-v_0^2}{2x} = a$

$v = v_0 + at$

$0 = v_0 + \left(\frac{-v_0^2}{2x}\right)t$

$\frac{-v_0}{-v_0^2/2x} = t$

$\frac{2x}{v_0} = t = \frac{(2)(4800m)}{35.8 m/s}$

$t = 268.2s$

Upstream Speed of Boat WRT Land

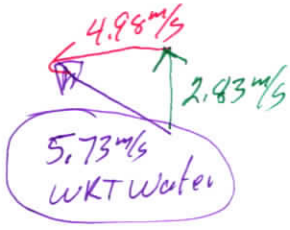
$\frac{800m}{268.2s} = 2.98 m/s$

Upstream Speed of Boat WRT ~~Land~~ Water

$2.98 m/s + 2 m/s = 4.98 m/s$ WRT Water

Speed of Boat WRT Land & Water To Cross

$\frac{760m}{268.2s} = 2.83 m/s$ WRT Water



4) The spring guns used in the lab launch a ball with a muzzle speed of 5m/s. If the gun is fired at 75 degrees above the horizontal, determine the speed of the ball at its highest point.

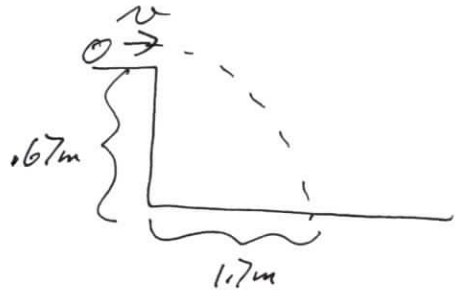
@highest Point; the y-Velocity Is Zero. Only Remaining Is x-Velocity

1.29 m/s

5) The 16 inch/50 caliber Mark 7 is the "Big Gun" that was built on the Iowa –class battleships such as the USS Iowa, USS Missouri, and the USS New Jersey. The Iowa Class Battleships followed the North Carolina class ships. The Iowa class ships were the last of the battleships to be designed. These guns were 50 calibers long—or 50 times their 16-inch (406 mm) bore diameter which makes the barrels 66.6 feet (20 m) long, from breech face to muzzle. Each gun weighed about 239,000 pounds (108,000 kg) without the breech, or 267,900 pounds (121,517 kg) with the breech. They fired projectiles weighing from 1,900 to 2,700 pounds (850 to 1,200 kg, which is the mass/weight of a typical car) at a maximum speed of 2,690 feet per second (820 m/s). What was the greatest range for these guns?

$$X = \frac{v_0^2}{g} = \frac{(820\,m)^2}{9.8\,m/s^2} = 68612\,m = 42.9\,miles$$

6) A ball rolls off a table that is 67 cm above the floor. If the ball lands 1.7m out from the edge of the table, determine how fast the ball was rolling on the table.



y

$y = -.67m$

$t = ?$

$a = -9.8 m/s^2$

$v_0 = zero$

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

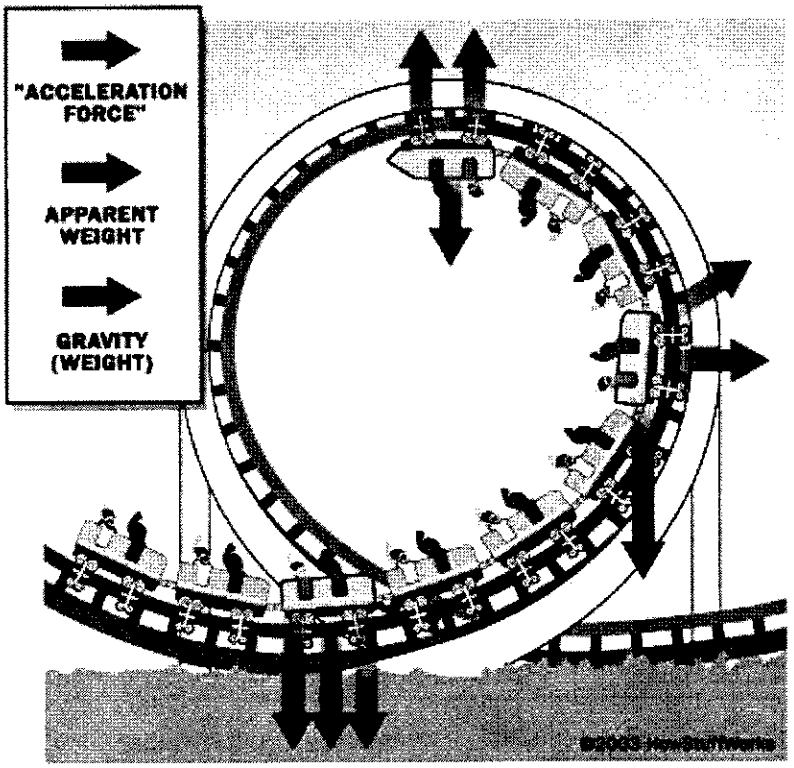
$\sqrt{\frac{2y}{a}} = t$

$\sqrt{\frac{-(2)(.67m)}{-9.8 m/s^2}} = t = .37 s$

$\frac{1.7m}{.37s} = 4.59 m/s$

7) You are preparing to cross a river that is 840 m wide. As you stand on the bank of the river, you notice the river is flowing at 2.3 m/s WRT land. You are able to paddle your kayak at 3.2 m/s WRT water. You are planning to cross this river to get to the other side in less than 5 minutes. Determine the speed of the water WRT ground as you paddle your kayak across the river.

2.3 m/s



This graphic is just a space filler so the pages work out right. But more interesting, it is just WRONG. Notice the credit in the lower corner. This is an example how there is just WRONG stuff on the internet!!!