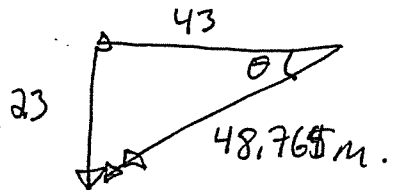
KEY

Physics 12 Unit 1 Worksheet #2

Name: _____ Date: _____

Vectors

1. A dog walks 26 m South then 43 m West then 3 m North. Find the resultant displacement (magnitude and direction).



$\tan\theta = \frac{23}{43}$

$\theta = 28.1^\circ$ S of W.

2. A Plane travels 580 km North, than 200 km 25 degrees West of South. Find the resultant displacement.

(2) use sin Law.

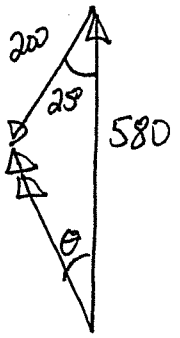
$\frac{\sin\theta}{200} = \frac{\sin 25^\circ}{408}$

$\sin\theta = 0.20716$

$\theta = 11.956$

$\theta = 12.0^\circ$ W of N

(1) → can't use pythagoras



one angle, so use cosine law

$c^2 = a^2 + b^2 - 2ab\cos\theta$

$= 580^2 + 200^2 - 2(580)(200)(\cos 25^\circ)$

$c = 408\ m$

3. A bird flies 25 m West and than 86 m 40 degrees East of North. Find the resultant displacement.

(2) $\frac{\sin\theta}{86} = \frac{\sin 50}{72.5}$

$\sin\theta = \cancel{0.84529}\ .90868$

$\theta = \cancel{57.7}\ 65.3^\circ$

65° N of W

OR

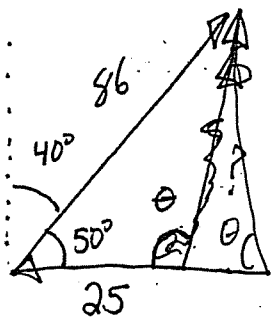
25° W of N.

(1) one angle, use cos law

$c^2 = a^2 + b^2 - 2ab\cos\theta$

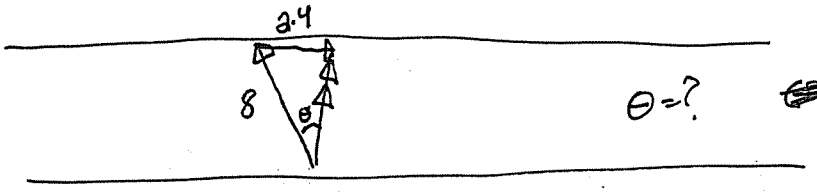
$= 86^2 + 25^2 - 2(86)(25)\cos 50^\circ$

$c = 72.5\ m$



Kinematics C1 Relative Velocity

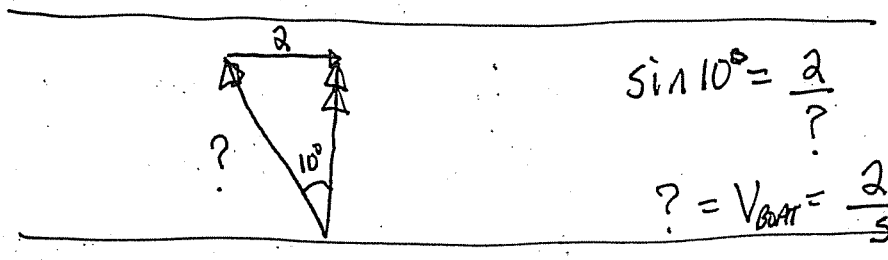
1. A boat has a velocity of 8 m/s relative to the water. The current of the river it is crossing is 2.4 m/s. What angle/direction does the boat need to travel so that it's resultant velocity is directly across the river?



$\theta = ?$ $\sin\theta = \frac{opp}{hyp} = \frac{2.4}{8}$

$\theta = 17.5°$

2. A boat is pointed 10 degrees up stream. The current of the river is 2 m/s. What does the velocity of the boat relative to the water need to be so that the boat travel directly across the river and does not drift down stream at all?



$\sin 10° = \frac{2}{?}$

$? = V_{BOAT} = \frac{2}{\sin 10°} = 11.5\ m/s$

Kinematics C2 Motion in 1D and 2D

1. How long would it take to travel to 48 km to Aspen Grove if you travel at 97 km/hr?

$t = \frac{d}{V} = \frac{48}{97} = 0.495\ hr = 29.690 = 29.7\ mins$

2. You travel at 45 km/hr for 50 mins and then you travel 60 km in 48 mins. Find the average velocity for the entire trip.

$0.8\overline{3}\ hr$ (50 mins) ↳ $0.8\ hr$ (48 mins)

$d_1 = V \cdot t = 45 \times 0.8\overline{3} = 37.5\ km$

$V_{AVG} = \frac{d_{TOT}}{t_{TOT}}$

$= \frac{d_1 + d_2}{t_1 + t_2} = \frac{37.5 + 60}{0.8\overline{3} + 0.8} = \frac{97.5\ km}{1.6\overline{3}\ hr} = 59.7\ km/hr.$

3. How much distance does it take a car to stop if the car is travelling at 110 km/hr ($30.5\overline{5}$ m/s) and it can de accelerate at 5.1 m/s^2 and the reaction time of the driver is 1.5 seconds?

$d_{TOT} = d_1 + d_2$.

d_1: reaction time

d_2: braking distance.

$d_1 = v \cdot t = (30.5\overline{5})(1.5) = 45.83\overline{3}$ m.

$V_f^2 = V_i^2 + 2ad$

$0 = (30.55)^2 + 2(5.1)(d_2)$

$d_2 = 91.533$ m

$d_{TOT} = 137$ m

4. If you throw a ball straight up, what velocity is needed if you want the max height of the ball to be 7.6 m?

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

$V_i = ?$

$d = 7.6$

$V_f = 0$ @ top

$V_f^2 = V_i^2 + 2ad$.

$0 = V_i^2 + 2(-9.8)(7.6)$.

$V_i = 12.2$ m/s

5. A bullet is fired at 280 m/s at a height of 1.5 m. Find the range of the bullet.

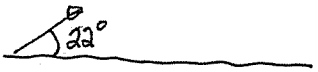
↳ horizontally.

drop time $= t = \sqrt{\frac{2d}{a}} = \sqrt{\frac{3}{9.8}} = 0.55328$ m.

$d = v \cdot t = 280 \times t = 154.91$

$= 155$ m.

6. Find the range (horizontal distance) for a projectile that is launched at 860 m/s at 22 degrees above the horizon.



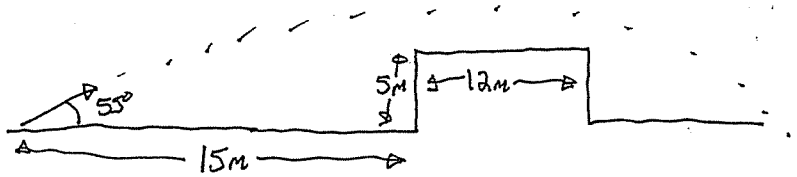
① $V_x = 860 \cos 22 = 797.38$

$V_y = 860 \sin 22 = 322.16$

② Hang time $t = \frac{2V_i}{a} = 65.747$ sec

③ $d = V_x t = 52,400$ m $= 52.4$ km.

7. A arrow is shot at 47 m/s at an angle of 55 degrees above the horizon. If a building is 15 m away, 5 m tall, and 12 m wide, does the arrow clear the building or not?



$V_x = 26.958$ m/s $V_y = 38.500$ m/s

time to get to building $t_1 = \frac{d}{V} = \frac{15}{26.958} = 0.55642$ sec.

time to get past building $t_2 = \frac{d}{V} = \frac{27}{V_x} = 1.0016$ sec

? what is height between t_1 and t_2

$h = ?$ @ t_1 $d = v_i t + \frac{1}{2} a t^2 = (38.5)(.55642) + \frac{1}{2}(-98)(.55642)^2 = 19.905$ m.

$h = ?$ @ t_2 $d = v_i t + \frac{1}{2} a t^2 = 33.645$ m.

arrow clears building