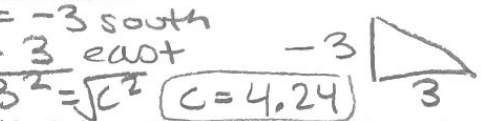
Unit 3 Physics Study Guide: Name: Key

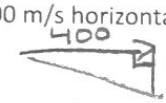
1. Add or subtract the following vectors:
   a. 5 m positive & 8 m positive $5+8=$ 13 m positive
   b. 7 m north & 3 m north $7+3=$ 10 m North
   c. 6 m positive, 3 m positive, 2 m negative $(6m+3m)-2m=$ 7m positive

2. Add the following right angle vectors using Pythagorean Theorem
   a. 10 km south & 35 km west $\sqrt{10^2+35^2}=\sqrt{c^2}$ $c=36.4$
   b. 50 m north & 28 m east $\sqrt{50^2+28^2}=\sqrt{c^2}$ $c=57.3$
   c. 7 m north, 8 m east, 10 m south & 5 m west $7-10=-3$ south, $8-5=3$ east



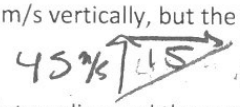
$\sqrt{-3^2+3^2}=\sqrt{c^2}$ $c=4.24$

3. Solve the following word problems:
   a. A plane is flying at 400 m/s horizontally and the wind is pushing it down at 100 m/s. What is the total speed of the plane?



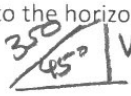
$\sqrt{400^2+100^2}=\sqrt{c^2}$ $c=412.3$

   b. A boat is traveling across a river at 45 m/s vertically, but the water is pushing it horizontally at 15 m/s. What is the total speed of the boat?



$\sqrt{(45)^2+(15)^2}=\sqrt{c^2}$ 47.4 m/s

4. If you are given the angle at which an object is traveling and the total speed of the object, you can find the horizontal and vertical components using COS and SIN in your calculator.
   a. The plane is flying at a 45° angle to the horizontal and has a total speed of 350 m/s. How fast is the plane traveling horizontally and vertically?



$Vx=350\cos 45=247.5$ m/s - horizontal
$Viy=350\sin 45=247.5$ m/s - vertical

   b. The boat is traveling at a 15° angle on the river with a total speed of 50 m/s. How fast is the boat moving horizontally and vertically?

$Vx=50\cos 15=48.3$ m/s - horizontal
$Viy=50\sin 15=12.9$ m/s - vertical

5. Adding Vectors: Find the resultant vector (magnitude and direction) of the three vectors below:
   $V_1=32$ m/s @ 70°
   $V_2=40$ m/s @ 118°
   $V_3=22$ m/s @ 245°

	x	y
32 m/s @ 70	10.9	30
40 m/s @ 118	-18.8	35.3
22 m/s @ 245	-9.3	-19.9
Total	-17.2	45.4

$(-17.2)^2+(45.4)^2=c^2$
magnitude $c=48.5$
$\tan^{-1}\left(\frac{45.4}{17.2}\right)=69°$
direction $180-69=111°$

Horizontally Launched Projectiles

6. A pool ball leaves a 0.60-meter high table with an initial horizontal velocity of 2.4 m/s. Predict the time required for the pool ball to fall to the ground and the horizontal distance between the table's edge and the ball's landing location.
   $dy=\frac{1}{2}gt^2$ $.60=\frac{1}{2}(-9.8)t^2$ $t=.35$ s $dx=Vxt$ $dx=(2.4)(.35)=.84$ m
7. A soccer ball is kicked horizontally off a 22.0-meter high hill and lands a distance of 35.0 meters from the edge of the hill. Determine the initial horizontal velocity of the soccer ball.
   $dy=\frac{1}{2}gt^2$ $22=\frac{1}{2}(-9.8)t^2$ $t=2.12$ s
   $dx=Vxt$
   $\frac{35 \text{ m/s}}{2.12}=Vx(2.12)$
   $Vx=16.5$ m/s

Projectiles Launched at an angle

8. A football is kicked with an initial velocity of 25 m/s at an angle of 45-degrees with the horizontal. Determine the time of flight, the horizontal distance, and the peak height of the football.
   time of flight = 3.6s
   horizontal dist = 63.8m
   peak = 15.9m
9. A long jumper leaves the ground with an initial velocity of 12 m/s at an angle of 28-degrees above the horizontal. Determine the time of flight, the horizontal distance, and the peak height of the long-jumper.
   $Vx=10.6$
   $Viy=5.6$
   time of flight = 1.14s
   horizontal dist = 12.1m
   peak = 1.6m