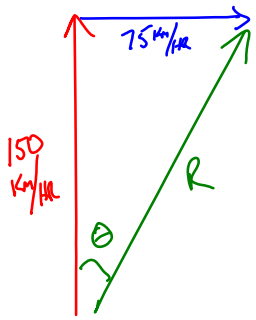
Name _____ **Date** _____
Teacher _____ **Period** _____

Vector Worksheet 3 (with Kinematics Review)

1. An airplane flies north at 150 km/h. There is a wind blowing at 75 km/h to the east. What is the plane's velocity with respect to the ground?



$R^2 = 150^2 + 75^2$

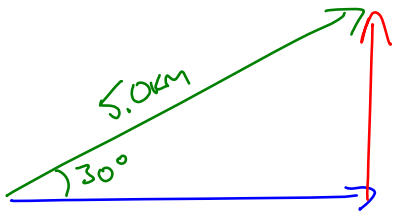
$R = 167.7\ km/hr$

$\tan\theta = \frac{75}{150}$

$\theta = \tan^{-1}\left(\frac{75}{150}\right) = 26.6^\circ$

$R = 167.7\ km/hr,\ 26.6^\circ$ East of North (+1 +1 +1)

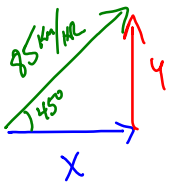
2. A biker rides 5.0 km, 30.0^0 North of East. What are the north and east components of this displacement?



$X = 5.0\cos 30^\circ = 4.3\ km$ (+1)

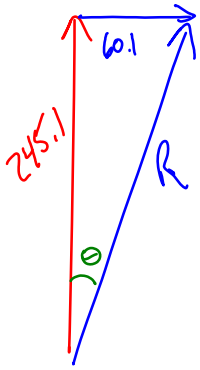
$Y = 5.0\sin 30^\circ = 2.5\ km$ (+1)

3. An airplane flies due north at 185 km/h. There is a wind blowing at 85 km/h to the northeast. What is the plane's velocity with respect to the ground?



$Y = 85\sin 45^\circ = 60.1\ km/hr$ North

$X = 85\cos 45^\circ = 60.1\ km/hr$ East



$R^2 = 245.1^2 + 60.1^2$

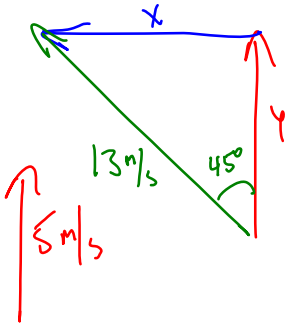
$R = 252.4$ (+1)

$\tan\theta = \left(\frac{60.1}{245.1}\right)$

$\theta = \tan^{-1}\left(\frac{60.1}{245.1}\right)$

$\theta = 13.8^\circ$ East of North (+1 +1)

4. A powerboat heads due northwest at 13 m/s across a river that flows due north at 5.0 m/s. What is the velocity (both magnitude and direction) of the motorboat with respect to the shore?



$Y = 13\cos 45^\circ = 9.19\ m/s$

$X = 13\sin 45^\circ = 9.19\ m/s$

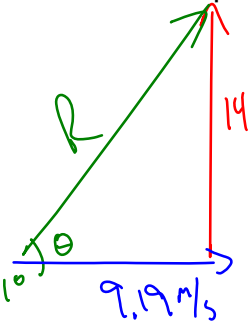
Totals

$Y = 14.19\ m/s$

$X = 9.19\ m/s$

$R = 16.9\ m/s$

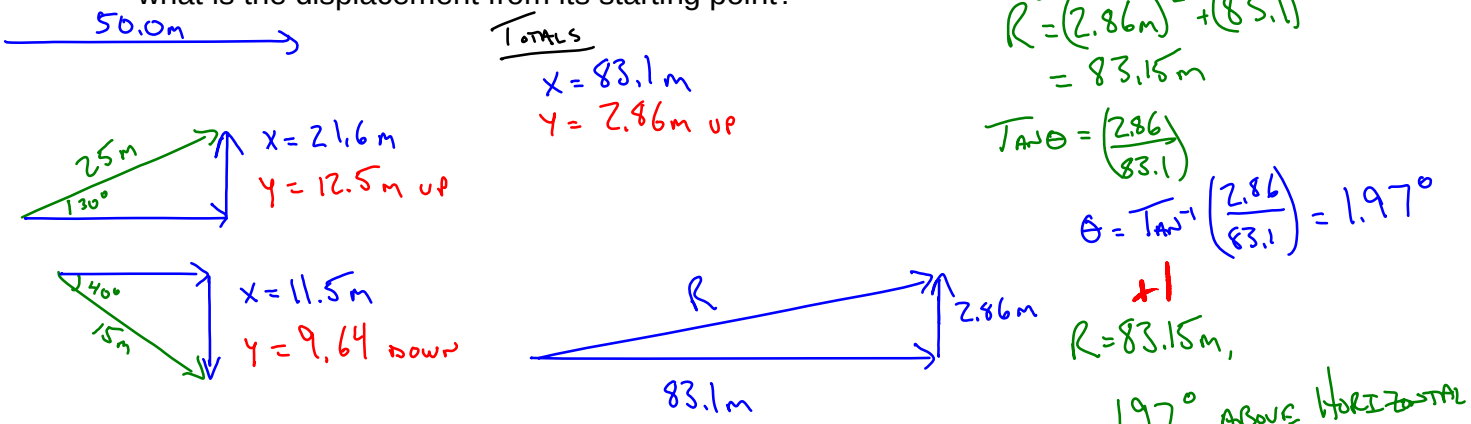
$\theta = \tan^{-1}\left(\frac{14.19}{9.19}\right) = 57.1^\circ$



$R = 16.9\ m/s$ (+1)

57.1° North of West (+1 +1)

5. A roller coaster starts its ride by going 50.0 m along a straight track. The coaster then travels up a 25.0 meter incline at an angle of 30.0^0 to the horizontal. It then goes down a 15.0 meter ramp that dips 40^0 below the horizontal. When the coaster reaches the bottom of the ramp, what is the displacement from its starting point?



$R^2 = (2.86m)^2 + (83.1)^2$

$= 83.15m$

$\tan\theta = \left(\frac{2.86}{83.1}\right)$

$\theta = \tan^{-1}\left(\frac{2.86}{83.1}\right) = 1.97^\circ$

+1

$R = 83.15m,$

1.97° ABOVE HORIZONTAL

+1 +1

Kinematics Review

6. A plane lands on a straight runway traveling at a speed of 35 km/h. What is the plane's acceleration if it comes to rest in 7.00s?

7. An object thrown straight up into the air reaches a maximum height of 23 m above its initial position. What was the objects initial velocity? What is its position 1.3 seconds into its motion?

8. A drag racer traveling at a speed of 200.0 km/h on a straight track ejects its parachute and slows to a speed of 20.0 km/h in 12.0 seconds. What is the acceleration of the racer? What distance did it travel in the 12.0 s interval?

9. A train on a straight, level track has an initial speed of 45.0 km/h. A uniform of 1.50 m/s^2 acceleration is applied to the train while it travels a distance of 200.0 meters. What is the final speed of the train? How long does it take the train to reach that speed?