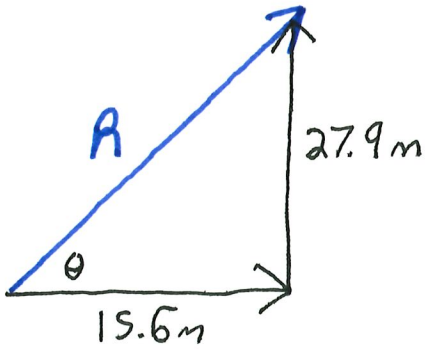
2D Vector Practice Name:_____

**Adding and Subtracting Vectors**

For each of the following draw a diagram and determine the resultant vector (both magnitude and direction). Round all degrees to nearest whole degree, follow sig fig rules otherwise.

1. 15.6m East + 27.9m North



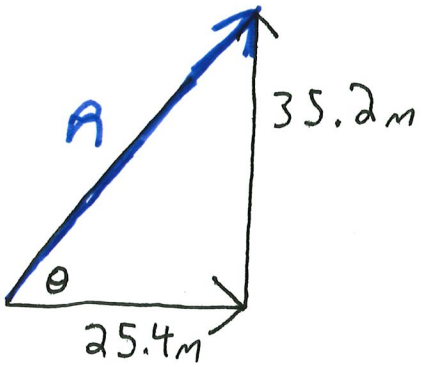

$$\text{Magnitude} = \sqrt{15.6m^2 + 27.9m^2}$$

$$= 32.0m$$

$$\theta = \tan^{-1}\left(\frac{27.9m}{15.6m}\right) = 61^\circ$$

32.0m, 61° North of East

2. 25.4m East + 35.2m North




$$\text{Magnitude} = \sqrt{25.4m^2 + 35.2m^2}$$

$$= 43.4m$$

$$\theta = \tan^{-1}\left(\frac{35.2m}{25.4m}\right) = 54^\circ$$

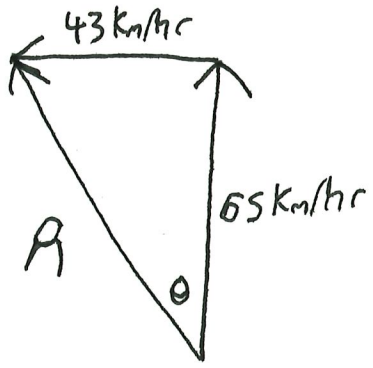
43.4m, 54° North of East

2D Vector Practice

Name:_____

3. 65 km/hr North – 43 km/hr East

$= 65\ km/hr\ N + 43\ km/hr\ W$




$Magnitude = \sqrt{43^2 + 65^2}$

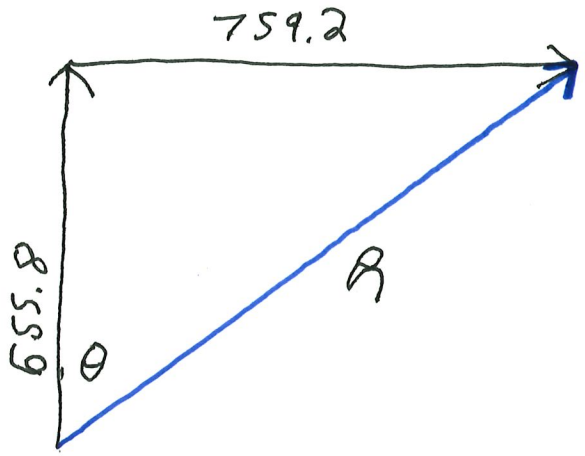
$= 78\ km/hr$

$\theta = \tan^{-1}\left(\frac{43}{65}\right) = 33°$

78 km/hr, 33° West of North

4. 655.8 km/hr North – 759.2 km/hr West

$= 655.8\ km/hr + 759.2\ km/hr\ East$




Magnitude

$\sqrt{655.8^2 + 759.2^2}$

$= 1003.22$

$\approx 1003\ km/hr$

$\theta = \tan^{-1}\left(\frac{759.2}{655.8}\right) = 49°$

1003 km/hr, 49° East of North

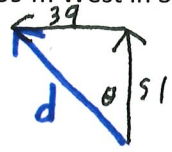
2D Vector Practice

Name:_____

**2D Kinematics**

5. Someone walks 51 m North, then 39 m West in 32.3 seconds, what is their average velocity?

① Determine displacement:




$\text{Magnitude} = \sqrt{39^2 + 51^2}$

$= 64.2028\ m$

$\text{Angle} = \tan^{-1}\left(\frac{39}{51}\right) = 37°$

② Velocity: Direction will be same as displacement

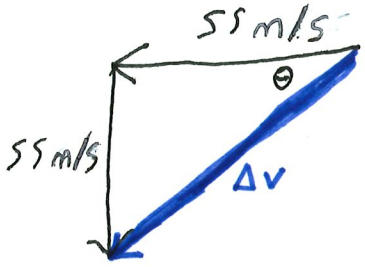
$\text{speed} = \frac{64.2028\ m}{32.3\ sec} = 1.9877\ m/s \approx 2.0\ m/s$

2.0 m/s, 37° W of N

6. A car turns a corner, they change from travelling 55 m/s North, to 55 m/s West in 3.5 seconds. What is their acceleration? $a = \frac{\Delta v}{t} = \frac{v_f - v_0}{t}$

① Determine change in velocity: 55 m/s West − 55 m/s N

= 55 m/s West + 55 m/s S




$\sqrt{55^2 + 55^2} = 77.7817\ m/s$

$\theta = \tan^{-1}\left(\frac{55}{55}\right) = 45°$

② Determine acceleration $a = \frac{77.7817\ m/s}{3.5\ sec} = 22\ m/s^2$

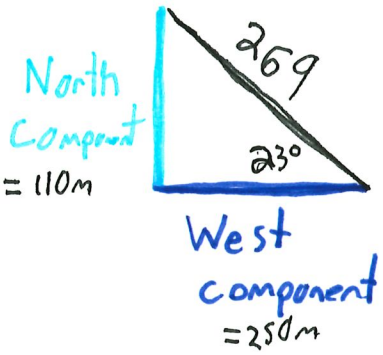
22 m/s², 45° S of W

2D Vector Practice

Name:_____

**Vector Components**

7. What are the North and West components of the vector: 269 metres, 23° North of West




$\cos 23^\circ = \frac{West}{269} \rightarrow 269 \cdot \cos 23^\circ = West$

$247.62m$

$\approx 250m$

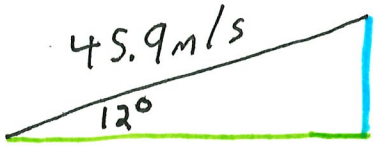
$\sin 23^\circ = \frac{North}{269} \rightarrow \sin 23 \times 269 = North$

$105.11m$

$\approx 110m$

North component is 110m, West is 250m

8. What are the horizontal and vertical components of the vector: 45.9 m/s, 12° above the horizontal.




vertical component

$\sin 12 = \frac{\text{vertical comp}}{45.9 m/s}$

$45.9 \times \sin 12 = \text{vertical component}$

$9.54 m/s = \text{vertical component}$

$\approx 9.5 m/s$

horizontal component

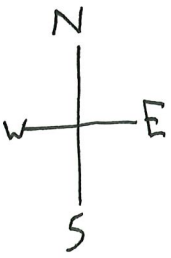
$\cos 12 = \frac{\text{horizontal component}}{45.9 m/s}$

$45.9 \times \cos 12 = 44.897$

$\approx 45 m/s$

Horizontal component is 45 m/s

Vertical component is 9.5 m/s



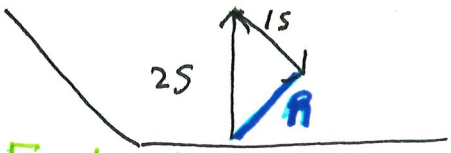

# 2D Vector Practice

Name:_____

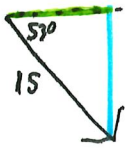
9. Use vector components to add:

25 m/s North + 15 m/s at 53° S of E

Starting rough diagram

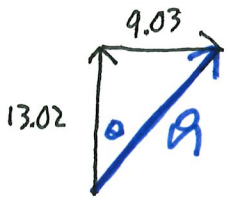







$\cos 53 \times 15 = 9.03 \text{ m/s East}$

$\sin 53 \times 15 = 11.98 \text{ m/s South}$

| North/South component | East/West component | Total |
|---|---|---|
| 25m N + 11.98 S<br>= 25 − 11.98<br>= 13.02 m/s N | 9.03 m/s E |  |



Magnitude

$= \sqrt{13.02^2 + 9.03^2}$

$= 16 \text{ m/s}$

$\theta = \tan^{-1}\left(\frac{9.03}{13.02}\right) = 35°$

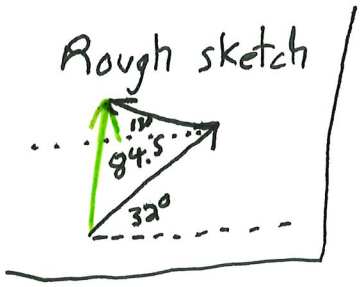
16m/s, 35° E of N

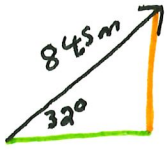
2D Vector Practice

Name:_____

10. Use vector components to add:

84.5 m at 32° N of E + 29 m at 13° N of W




$\sin 32 \times 84.5 = 44.78\text{m N}$

$\cos 32 \times 84.5 = 71.66\text{m E}$


$\sin 13 \times 29 = 6.52\text{m N}$

$\cos 13 \times 29 = 28.26\text{m W}$

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North/South component

$44.78\text{m N} + 6.52\text{m N} = 51.3\text{m N}$

East/West component

$71.66\text{m E} + 28.26\text{m W}$

$= 71.66\text{m E} - 28.26\text{m E} = 43.4\text{m E}$

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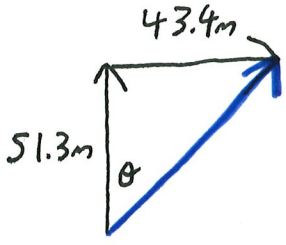


$\sqrt{51.3^2 + 43.4^2}$

$= 67\text{m}$

$\theta = \tan^{-1}\left(\frac{43.4}{51.3}\right) = 40°$

67m, 40° East of North