a.

Generic Vector Problems

KEY

NAME:

- 1. A small child is lost in the woods. From his initial starting point, he wanders 500 m east, then 200 m north, then 200 m east then 600 m south then 300 m west.
 - a. Graphically represent his wanderings to find his final displacement vector.



- b. Algebraically calculate his final displacement vector (unit vector form.)
 - $\Delta X = 500 + 200 300 = +400$ $\Delta y = 200 - 600 = -400$ $S_{0}[\Delta \Gamma] = 400\hat{\iota} - 400\hat{j} m$
- c. Algebraically calculate the magnitude and direction of his displacement vector.

2. Vector A is $5\mathbf{i} + 8\mathbf{j} - 7\mathbf{k}$ and vector B is $3\mathbf{i} - 4\mathbf{j} + 2\mathbf{k}$.

What is
$$A + B?$$

 $B\hat{b} + 4\hat{j} - 5\hat{k}$

b. What is $\vec{A} - \vec{B}$?

c. What is
$$3\vec{A}$$
? $15\hat{v} + 24\hat{y} - 21\hat{k}$

- d. What is the magnitude of \vec{B} ? (usually written as $|\vec{B}|$, or simply B) B = $\sqrt{3^2 + (-4)^2 + 2^2} = \sqrt{5.39}$
- 3. A ball is thrown with an initial velocity of 30 m/s at an angle of 35° up from the horizontal.a. What is this velocity in unit-vector form?

$$\frac{30}{35} v_{y} = 30 \cos 35 = 24.6 m/s$$

$$\frac{35}{V_{x}} v_{y} = 30 \sin 35 = 17.2 m/s$$

$$\sqrt{v} = 24.6 c + 17.2 c m/s$$

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b. If you added a velocity of 40 m/s straight down (-40j), what is the final velocity?

4. Add these vectors. Clearly mark the resultant vector.



- 5. A car's velocity vector is given by 30i + 40j. Give a vector that has the same magnitude, but is perpendicular to the first vector, and in the **i-j** plane.
 - $\begin{array}{rcl} 40\,\hat{c} 30\,\hat{j} & \left(\begin{array}{c} \text{Think of it as } \bot \ \text{slopes} \\ & \text{or} & \\ -40\,\hat{c} + 30\,\hat{j} \end{array} \right) & \left(\begin{array}{c} \text{Think of it as } \bot \ \text{slopes} \\ & \text{m}_1 = \frac{a}{b} \end{array} \right) \\ \end{array}$
- 6. A projectile has an initial velocity of 7i + 12j m/s. What is a velocity that is complimentary to that initial angle and has the same magnitude?









Extra! Prove the Pythagorean Theorem and the Law of Cosines. (On separate sheet of paper.)

Answers:				
1 b) 400 i – 400 i	c) 566 @ –45°	2. a) 8 i + 4 j – 5 k	b) 2 i + 12 j – 9 k	c) 15 i + 24 j – 21 k
d) 5.39	Ś a) 24.6 i + 17.2 j m/s	b) 24.6 i – 2 2.8 j	5) —40 i + 3 0j	6) 12 i + 7 j m/s
7 a) 11.2 @ 63.4°	b) 10 @ 127°	c) 316 @ 18.4°	ď) 51 @ −27°	8 a) 217 i + 125 j m/s
b) –8.5 i + 14.7 j m/s²	c) 2.1 i – 4.5 j m	d) –70.5 i – 25.7 j m/s	9 a) a ll b	b) b = 0 c) a ⊥ b