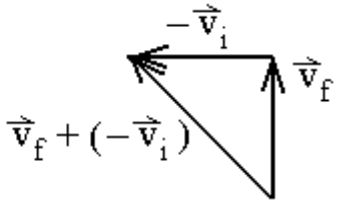
Phy 131 - Assignment 2

A. 1.

Your arrow should point up and to the left. (It should be the $\vec{v}_f - \vec{v}_i$ as shown.)



2.

given: $m = 4$ kg, $\vec{v}_o = 3\hat{i}$ m/s, $\vec{v}_f = (8\hat{i} + 10\hat{j})$ m/s, $t = 8$ sec

find: a) $\vec{F}$ b) $|F|$

a) $\vec{a} = \frac{\Delta \vec{v}}{\Delta t} = \frac{(8\hat{i} + 10\hat{j}) - (3\hat{i})}{8} = \frac{5\hat{i} + 10\hat{j}}{8} = \left(\frac{5}{8}\hat{i} + \frac{10}{8}\hat{j}\right)$ m/s²

$\vec{F} = m\vec{a} = (4 \text{ kg})\left(\frac{5}{8}\hat{i} + \frac{10}{8}\hat{j} \text{ m/s}^2\right) = \boxed{\frac{5}{2}\hat{i} + 5\hat{j} \text{ N}}$ ANS

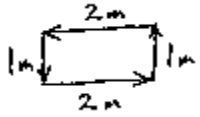
(The question does not say that $\vec{F}$ should be in component form. I just left it that way because it's easiest. But if you gave the answer as 5.59 N at 63.4°, that's ok too.)

b) $|F| = \sqrt{F_x^2 + F_y^2}$ (Pythagorean thm.)

$= \sqrt{(2.5)^2 + 5^2} = \sqrt{31.25} = \boxed{5.59 \text{ N}}$ ANS

B. 1. No, never. The magnitude of a vector is just how "long" it is, regardless of its direction. (Similar to the absolute value of a scalar, hence the use of the same symbol.)

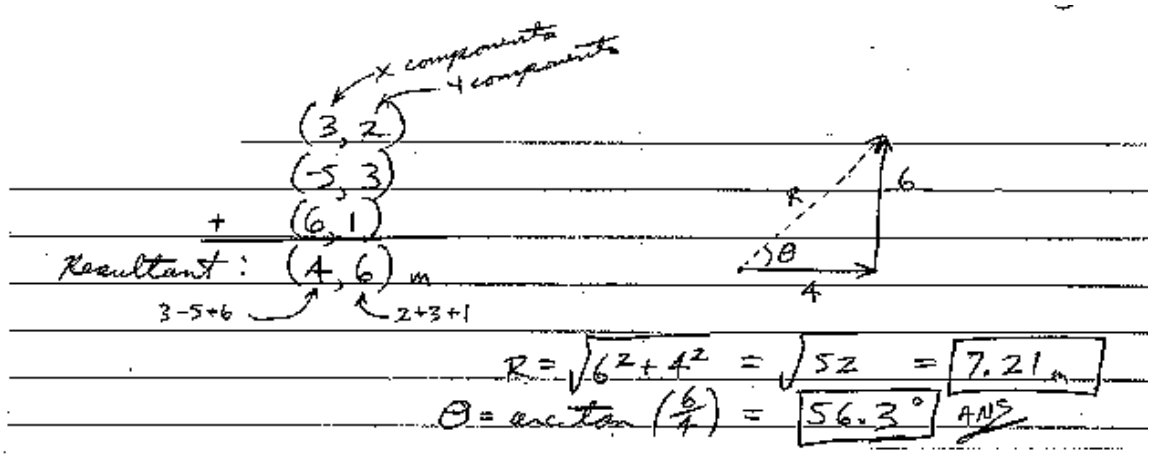
2. Displacement = 0. Displacement is a vector, so you add the displacements like this:



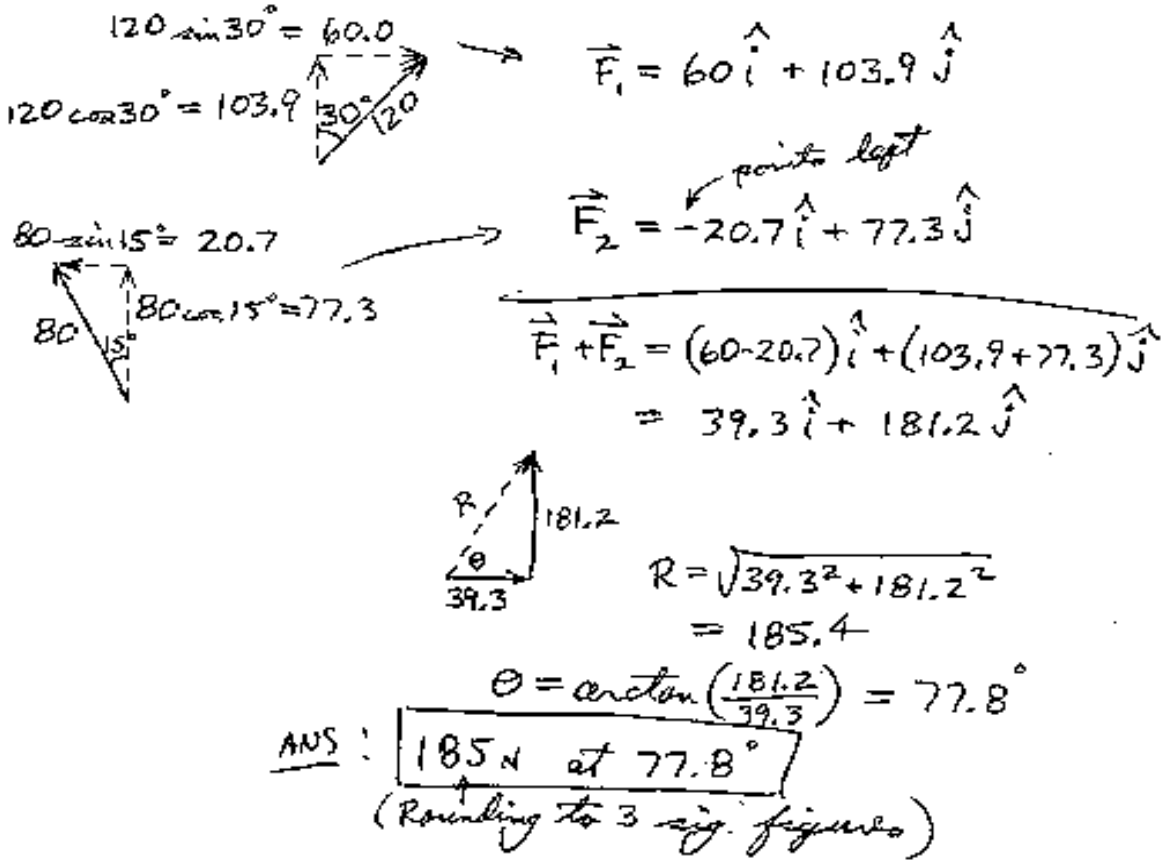
(The resultant drawn from where you started to where you ended up is zero.)

Distance traveled = 6 m. Distance is a scalar, so you add the distances like this: 2 + 1 + 2 + 1 = 6.

3.



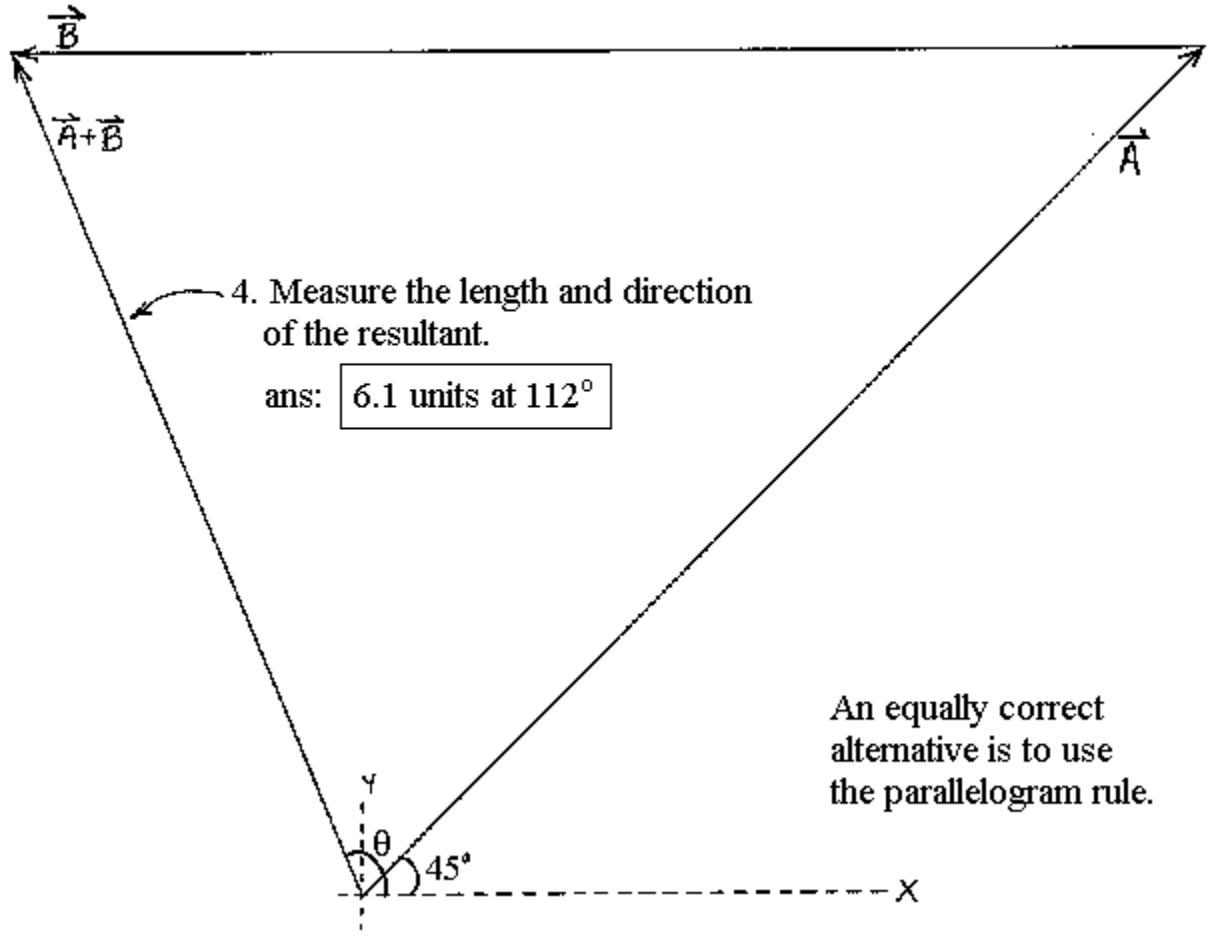
C.



D. Step 1: Choose a scale. The larger the picture the more accurate, so use the largest convenient scale that fits on the sheet of paper. I used 1 inch = 1 "unit" on my original, but the scanned copy below is a little under ¾ of that size.

2. Draw $\vec{A}$ and $\vec{B}$ head-to-tail, carefully measuring the lengths and directions. A ruler and protractor will be provided if this is the quiz question.

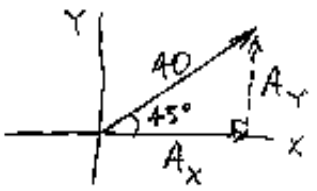
3. Draw the resultant from the tail of $\vec{A}$ to the head of $\vec{B}$.

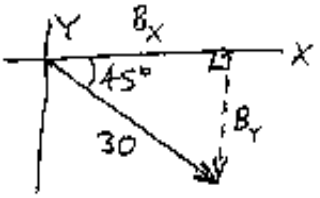


E.

(4)

a)





$A_X = 40 \cos 45° = 28.28$

$A_Y = 40 \sin 45° = 28.28$

$B_X = 30 \cos 45° = 21.21$

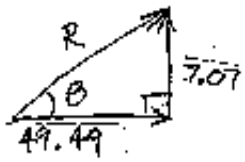
$B_Y = -30 \sin 45° = -21.21$ ← DOWN

$\text{Resultant} = (28.28\hat{i} + 28.28\hat{j}) + (21.21\hat{i} - 21.21\hat{j})$

$= \underbrace{(28.28 + 21.21)}_{49.49}\hat{i} + \underbrace{(28.28 - 21.21)}_{7.07}\hat{j}$

$\boxed{49.5\hat{i} + 7.07\hat{j} \text{ UNITS}}$

b)

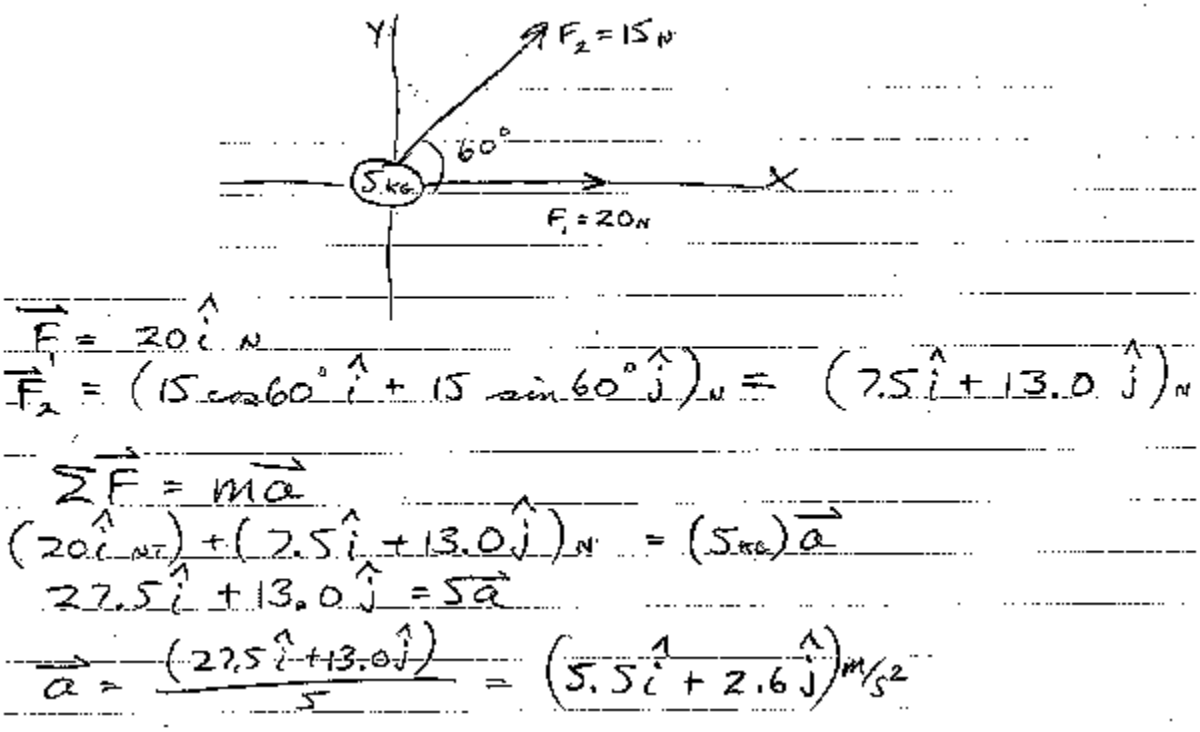


$R = \sqrt{7.07^2 + 49.49^2} = \boxed{50.0 \text{ UNITS}}$

$\theta = \arctan\left(\frac{7.07}{49.49}\right) = \boxed{8.13°}$

F. 1. a. No, b. No, c. yes, d. no. Velocity has a direction; the other three things do not.

2.



Magnitude: $a = \sqrt{5.5^2 + 2.6^2} = 6.08\ \text{m/s}^2$

Direction: $\theta = \arctan\left(\frac{2.6}{5.5}\right) = 25.3°$