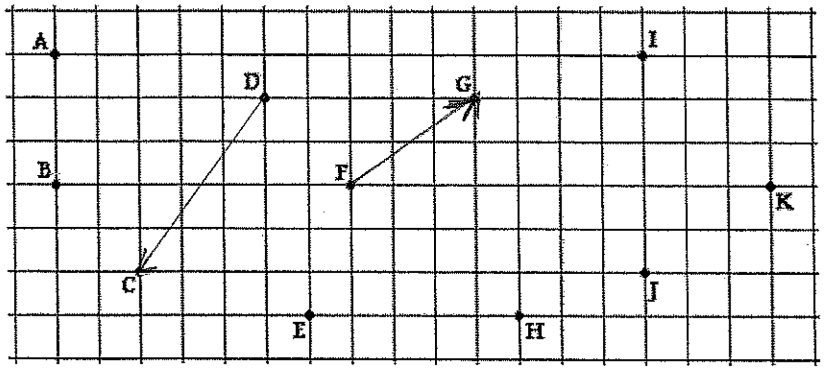
PHY 621 Resolving Vectors Name Anne Surrs

1. Consider the grid shown below. Suppose each letter presents the position of an object at a given time.

   a) Draw and label the total displacement vector on the grid below for an object that moves from position D to F to C.

   b) Draw and label the total displacement vector on the grid below for an object that moves from position F to H to G.



c) What is the direction for the displacement vector you drew in (a) using the three methods below:

CCW = 233°

compass = [W 53° S]

CW= -127°

d) What is the direction for the displacement vector you drew in (b) using the three methods below:

CCW = 34°

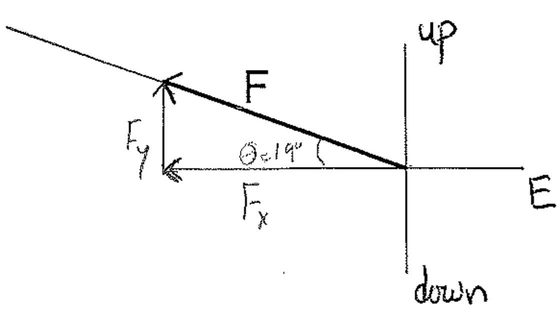
compass = [E 34° N]

CW= -326°

e) Identify one example of a vector that is equal and opposite to $\overrightarrow{JK}$. $\overrightarrow{GF}$

2. a) Draw the horizontal and vertical force components on the diagram below. Label each.

b) Given the scale 1.0 cm = 7.5 N, complete the following measurements as requested. Show the actual measures given, raw converted measurement, and the final rounded measurement. On diagram, indicate the angle you measured using your favourite Greek letter.



$|F| = 3.4\text{ cm} \times \frac{7.5N}{1.0cm} = 25.5N = 26\ N$

$|Fy| = 1.1\text{ cm} \times \frac{7.5N}{1.0cm} = 8.25N = 8.2\ N$

F = 26N [W 19° up]

(for dir. use compass method)

$Fx = 3.2\text{ cm} \times \frac{7.5N}{1.0cm} = 24N$

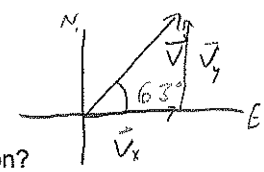
= 24 N [W]

Full Solution Problems: Provide a list of givens. Include equations and show intermediate steps.

use 2 sig figs

4. When the whistle blows, you run as fast as you can for 30 s. The coach tells you that your average velocity during the run was 4.85 m/s [E 63 ° N].

a) Sketch your average velocity vector in the space below. Resolve the vector into its perpendicular component vectors. (All vectors need to be labelled.)



b) When the run ended, what was your displacement in the north direction? (Mathematical solution)

$\vec{V} = 4.85\ m/s\ [E\ 63°\ N]$

$\Delta t_1 = 30\ s$

$\Delta d_y = ?$

$V_x = V\cos(\theta) = (4.85\ m/s)\cos(63°) = 2.20185\ m/s$

$V_y = V\sin(\theta) = (4.85\ m/s)\sin(63°) = 4.32138\ m/s$

$\Delta \vec{d}_y = \vec{V}_y \Delta t_1 = (4.32138\ m/s)(30\ s) = 129.64\ m$

$= \boxed{130\ m\ [N]}$

c) How much time would have elapsed from when the whistle blew until you were 40.0 m east of your starting position? (Mathematical solution)

$V_x = 2.20\ m/s\ [E]$

$\Delta t_2 = ?$

$\Delta d_x = 40.0\ m\ [E]$

$\Delta \vec{d}_y = \vec{V}_x \Delta t$

$\Delta t = \frac{\Delta \vec{d}_x}{\vec{V}_x} = \frac{40.0\ m}{2.20185\ m/s} = 18.1665\ s = \boxed{18.2\ s}$

5. Sadie is positioned 1.8 km west of Colonel Gray when her car breaks down! Sadie decides to walk home. This takes her 25 minutes. Her home is located 3.6 km south of Colonel Gray.

a) Use graphical method (scale diagram) to calculate Sadie's displacement during the walk. Remember to include details like givens, scale factors, compass, labels, raw measurements, conversions, etc.

b) Use your answer in (a) to find Sadie's average velocity in km/h. (Mathematical solution)

$\vec{d}_1 = 1.8\ km\ [W]$

$\vec{d}_2 = 3.6\ km\ [S]$

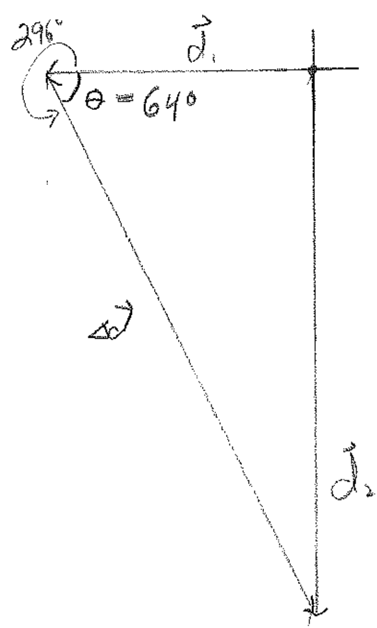
$\Delta t = 25\ min$

$\Delta \vec{d} = \vec{d}_2 - \vec{d}_1$

Scale: $1.0\ cm = 0.5\ km$

$1.8\ km \times \frac{1.0\ cm}{0.5\ km} = 3.6\ cm$

$3.6\ km \times \frac{1.0\ cm}{0.5\ km} = 7.2\ cm$



a) $\Delta d = 8.0\ cm \times \frac{0.5\ km}{1.0\ cm} = 4.0\ km$

$\Delta \vec{d} = 4.0\ km\ [296°]$ or $[E\ 64°\ S]$

b) $\Delta t = 25\ min \times \frac{60\ s}{1\ min} = 1500\ s$

$\Delta \vec{v} = \frac{\Delta \vec{d}}{\Delta t} = \frac{4.0 \times 10^3\ m}{1500\ s} = 2.667\ m/s$

$\Delta \vec{v} = 2.7\ m/s\ [E\ 64°\ S]$