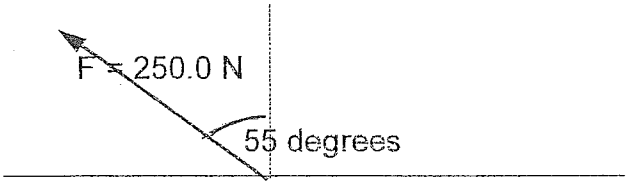
Name: Answer Key

Vector Kinematics ~~Quiz~~ Practice – Physics ~~11, Block 4~~ 12

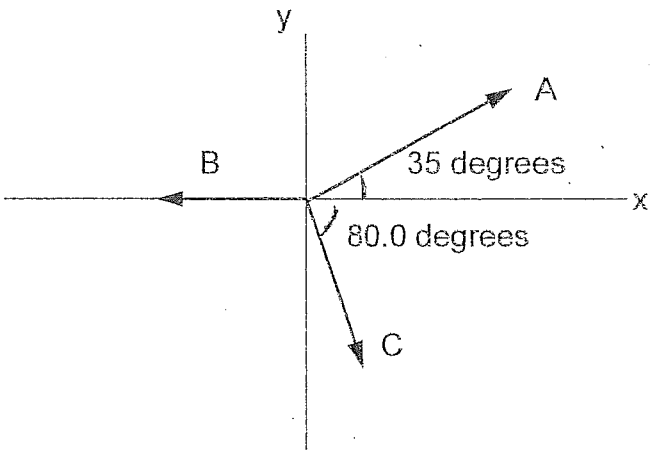
USE FOOLSCAP PAPER TO ANSWER ALL THE QUESTIONS. STAPLE THE QUESTION SHEET TO THE ANSWER SHEET. REMEMBER TO SHOW ALL WORK (INCLUDING DIAGRAMS), AND BE CAREFUL WITH UNITS AND SIGNIFICANT DIGITS!!!

1. What are the x and y components of the vector shown?



Use the following diagram for questions 2 and 3.

A: 100.0 N
B: 50.0 N
C: 70.0 N



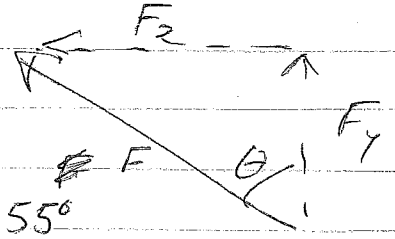
2. Use **graphical methods** (i.e, a scale diagram) to determine the resultant of: **A + B - C**

3. Use **analytical methods** (i.e, components) to determine the resultant of: **B + C – A**

4. A boat can travel at 10.0 m/s in still water. The rivers current is flowing at 4.0 m/s East and the river is 120.0 m wide.
   a. If the boat heads directly North, across the river, how long will it take to reach the opposite side of the river?
   b. How far is the boat pushed downstream by the time it reaches the opposite shore?
   c. If instead the boat is aimed upstream so that it goes directly across the river, what direction should the boat head?
   d. What is the resultant velocity for the situation in (c)?

5. An airplane can travel at 450.0 km/h in still air. A wind is blowing from the East with a 80.0 km/h. What should the planes' heading be if it needs to go to a place that is in the direction 35.0 degrees east of south?

1. $\sin\theta = \frac{F_x}{F}$



$\therefore F_x = F\sin\theta = 250.0\,N \sin 55°$

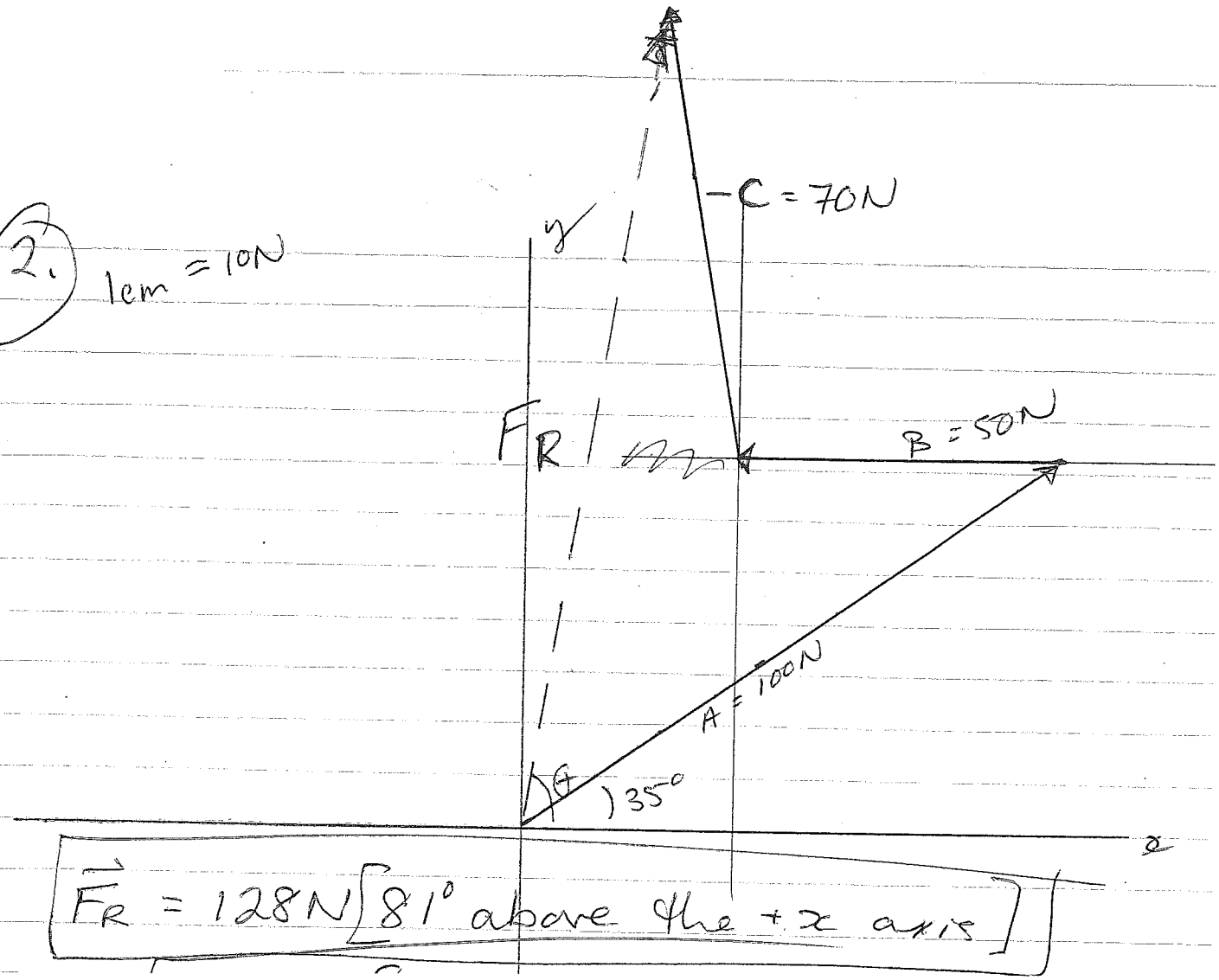
$\boxed{F_x = -2.0 \times 10\,N}$

$\cos\theta = \frac{F_y}{F}$

$\therefore F_y = F\cos\theta = (250.0\,N)\cos 55°$

$\boxed{F_y = 1.4 \times 10^2\,N}$

2. 1cm = 10N



$\boxed{\vec{F}_R = 128\,N \text{ [81° above the +x axis]}}$

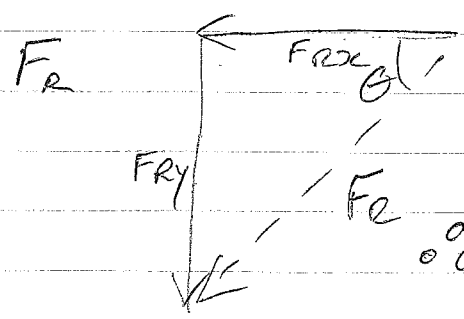
3.

	x	y
A	$A_x = (100\cos 35^\circ)(N)$	$A_y = (100\sin 35^\circ)N$
B	$B_x = -50.0N$	$B_y = 0$
C	$C_x = (70\cos 80^\circ)N$	$C_y = (-70\sin 80^\circ)N$

$$F_{Rx} = B_x + C_x - A_x$$
$$= (-50.0N) + (70.0N\cos 80^\circ) - (100.0\cos 35^\circ$$
$$F_{Rx} = -119.76N$$

$$F_{Ry} = B_y + C_y - A_y$$
$$= 0 + (-70\sin 80^\circ) - (100\sin 35^\circ)$$
$$= -126.29N$$

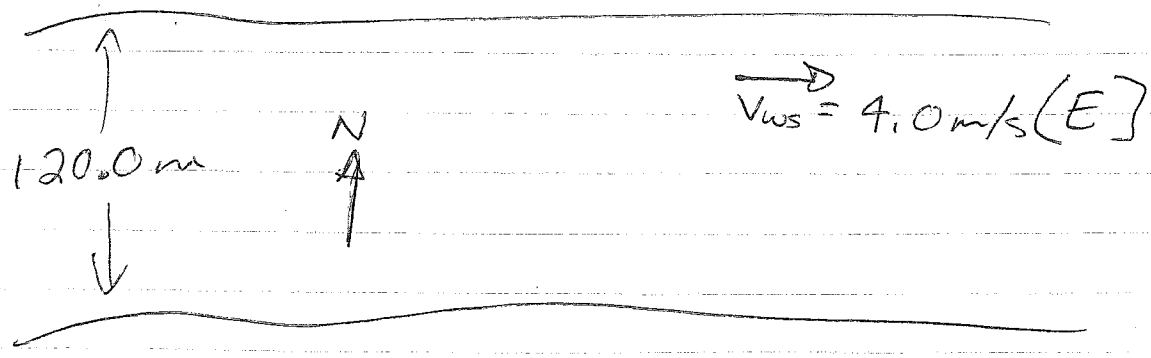
$$F_R = \sqrt{(119.76)^2 + (126.29)^2} = 174.01$$



$$\theta = \tan^{-1}\left[\frac{F_{Ry}}{F_{Rx}}\right] = \tan^{-1}\left[\frac{126.29}{119.76}\right] = 46.52^\circ$$

$F_R = 174N\ [46.5^\circ$ below the $-x$ axis$]$

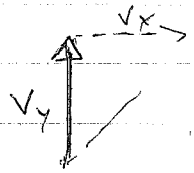
4.



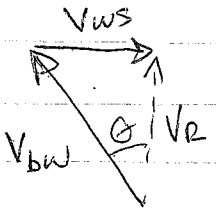
$V_{bw} = 10.0\,m/s$

(a) $V_y = \frac{d_y}{t}$ $\therefore t = \frac{d_y}{V_y} = \frac{120.0\,m}{10.0\,m/s}$ $\boxed{t = 12.0\,s}$

(b) $d_x = v_x t = (4.0\,m/s)(12.0\,s)$ $\boxed{d_x = 48.0\,m\,[E]}$



(c) $\sin\theta = \frac{V_{ws}}{V_{bw}}$



$\therefore \theta = \sin^{-1}\left[\frac{4.0\,m/s}{10.0\,m/s}\right]$

$\therefore \boxed{\theta = 24^\circ \text{ W of N}}$

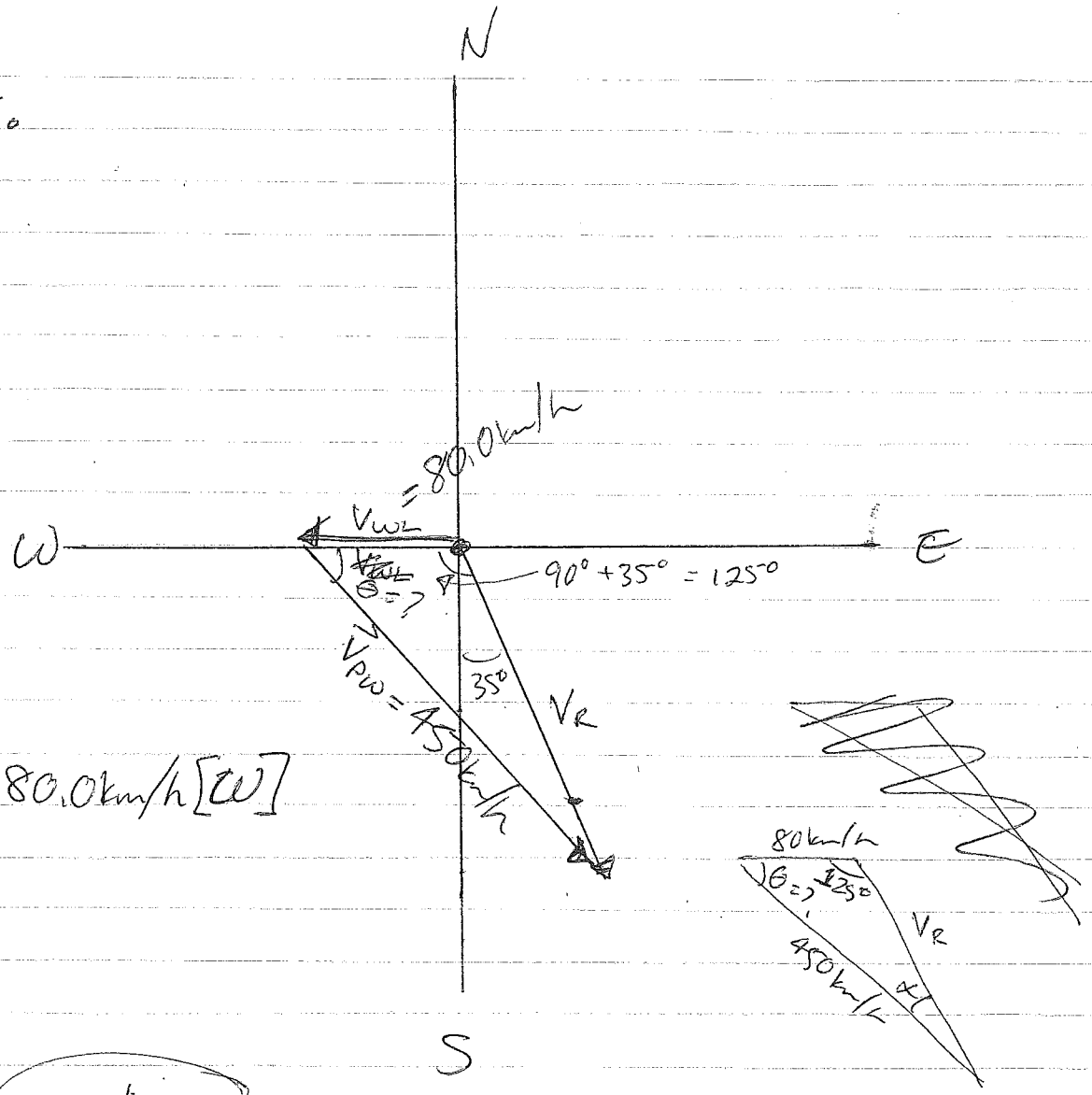
boats heading

(d) $V_R = \sqrt{V_{bw}^2 - V_{ws}^2}$

$= \sqrt{10^2 - 4^2}$

$\boxed{\vec{V}_R = 9.2\,m/s\,[N]}$

5.



$\vec{V}_{WL} = 80.0\,km/h\,[W]$

Sin Law

$$\frac{\sin 125^\circ}{450} = \frac{\sin\alpha}{80} \qquad \therefore \alpha = \sin^{-1}\left[\frac{80\sin 125^\circ}{450}\right]$$

Then $\theta = 180^\circ - 125^\circ - \alpha$

$$= 180^\circ - 125^\circ - \sin^{-1}\left[\frac{80\sin 125^\circ}{450}\right]$$

$$= 46.626^\circ$$

$\therefore$ The plane should head

46.6° S of E

(or // 43.4° ~~[illegible]~~)

E of S