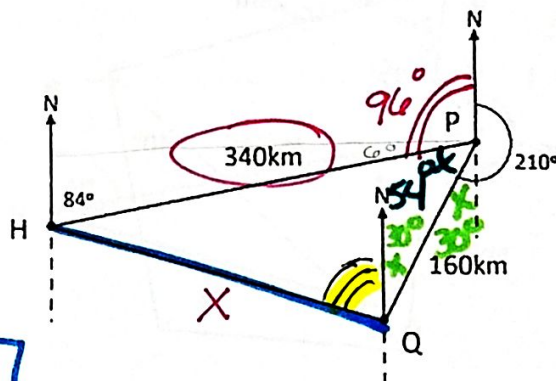


340 km

1) A ship sails from harbor H on a bearing of  $84^\circ$  (from North) for ~~360~~ 340 km until it reaches point P. It then sails on a bearing of  $210^\circ$  for 160 km until it reaches point Q.



a) Calculate the distance between point Q and the harbor.

$$X^2 = 160^2 + 340^2 - 2(160)(340)\cos 54^\circ$$

$$X^2 = 77,248.96 \quad \boxed{X = 277.9 \text{ km}}$$

b) On what bearing must the ship sail to return directly to the harbor from Q? (from North)

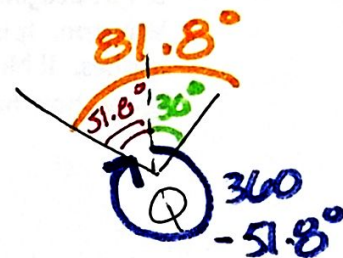
$$\frac{\sin Q}{340} = \frac{\sin 54}{277.9}$$

$$\sin Q = .9898$$

$$\frac{340 \sin 54}{277.9} = \frac{277.9 \sin Q}{277.9}$$

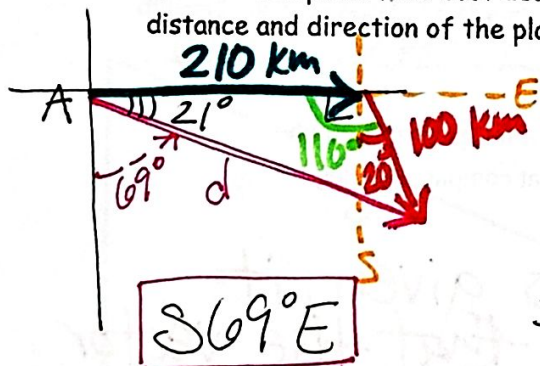
$$Q = 81.8$$

$$81.8 - 30 = 51.8^\circ$$



**Bearing  $308.2^\circ$  from N**

2. An airplane flies east 210 kilometers before turning  $S20^\circ E$  and flying 100 km. Find the distance and direction of the plane from its starting point.



$$d^2 = 210^2 + 100^2 - 2(210)(100)\cos 110$$

$$d^2 = 68464.8$$

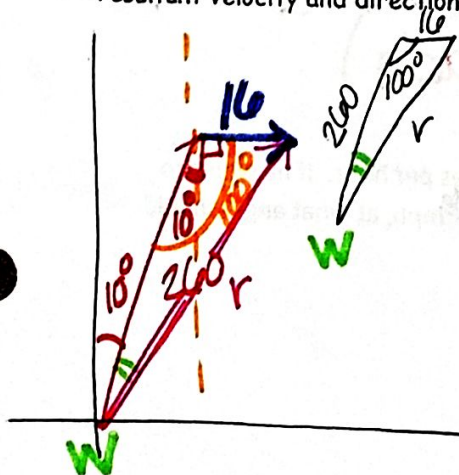
$$\boxed{d = 261.7}$$

$$\frac{\sin A}{100} = \frac{\sin 110}{261.7}$$

$$\frac{261.7 \sin A}{261.7} = \frac{100 \sin 110}{261.7}$$

$$\sin A = .359 \quad A = 21^\circ$$

3. An airplane is heading  $N10^\circ E$  at 260 mph. A 16 mph wind blows from the west. Find the plane's resultant velocity and direction.



$$r^2 = 260^2 + 16^2 - 2(260)(16)\cos 100$$

$$r^2 = 69300.75$$

$$\boxed{r = 263.3 \text{ mph}}$$

$$\frac{\sin W}{16} = \frac{\sin 100}{263.3}$$

$$\frac{16 \sin 100}{263.3} = \frac{263.3 \sin W}{263.3}$$

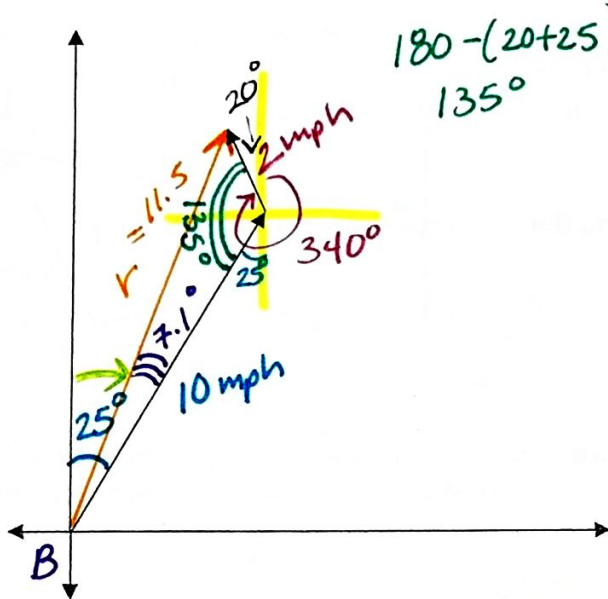
$$\sin W = .0598$$

$$W = 3.4^\circ$$

$$10 + 3.4 = 13.4^\circ$$

**N  $13.4^\circ$  E**

4) a) A motorboat travels across a lake at a speed of 10 mph and at a bearing of  $25^\circ$ . (measured from due North) The current of the lake due to the wind is a steady 2 mph at a bearing of  $340^\circ$ . Label the diagram below with the given speeds and bearings. (figure not drawn to scale)



b) Find the resulting speed of the boat.

$$r^2 = 2^2 + 10^2 - 2(2)(10)\cos 135$$

$$r^2 = 132.3$$

$$r = 11.5 \text{ mph}$$

c) Find the resulting bearing of the boat. (from due North)

$$\frac{\sin B}{2} = \frac{\sin 135}{11.5}$$

$$2 \sin 135 = 11.5 \sin B$$

$$\frac{2 \sin 135}{11.5} = \sin B$$

$$\sin B = .123$$

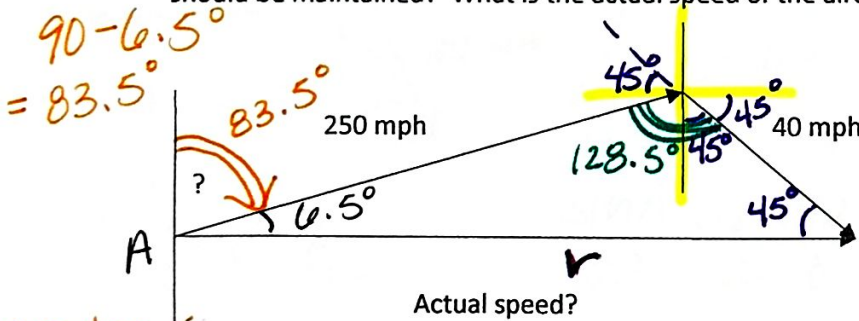
$$B = 7.1^\circ$$

$$25 - 7.1$$

↓  
Bearing

$$= 17.9^\circ$$

5) The pilot of an aircraft wishes to head directly east, but is faced with a wind speed of 40 mph from the northwest. If the pilot maintains an airspeed of 250 mph, what compass heading should be maintained? What is the actual speed of the aircraft? (Hint: find the actual speed first.)



$$180 - (45 + 6.5) = 128.5^\circ$$

$$r^2 = 250^2 + 40^2 - 2(250)(40)\cos 128.5$$

$$r^2 = 76,550.29$$

$$r = 276.7 \text{ mph}$$

Actual Speed

Bearing  
N  $83.5^\circ$  E  
OR  
 $83.5^\circ$

$$\frac{\sin A}{40} = \frac{\sin 45}{250}$$

$$\frac{250 \sin A}{250} = \frac{40 \sin 45}{250}$$

$$\sin A = .113 \quad A = 6.5^\circ$$

7) Olive wants to row a canoe across a river that flows at a rate of 2 miles per hour. If he wants to end up directly across from where she begins and he rows at an average of 5 mph, at what angle should she aim her canoe upstream?

