You are on a treasure hunt and your map says "Walk due west for 57.1 paces, then walk 70.0 ° north of west for 71.3 paces, and finally walk due north for 64.6 paces." What is the magnitude of the component of your displacement in the direction (a) due north and (b) due west?

Solution

These are vectors (x – west direction, y – north direction).

Vector 1 - due west means no vertical component.

$$V_x = 57.1 \;\; V_y = 0$$

Vector 2 - You are given the direction (70 degrees north of west) and magnitude (length of hypotenuse) 71.3.

$$V_x = 71.3 * \cos 70 = 24.39 \; paces \;\; V_y = 71.3 * \sin 70 = 67 \; paces$$

Vector 3 - Due north - no horizontal or 'x' component.

$$V_x = 0 \;\; V_y = 64.6$$

Now we must add all the V_x and V_y components together:

$$D_x = 57.1 + 24.39 + 0 = 81.49 \; paces \; D_y = 0 + 67 + 64.6 = 131.6 \; paces,$$

where D_x is displacement in the direction due west and D_y is displacement in the direction due north.

Answer: (a) $81.49 \; paces$; (b) $131.6 \; paces$.