If **A** = 28 m [E75°N], **B** = 35 m [E24°S], **C** = 22 m [W50°N], and **D** = 40 m [W30°S] Find:

b. 4C + 3D {160 m [W2.6°N]}

Components

$C_E = -22\cos 50° = -14.1\text{m}$

$C_N = +22\sin 50° = +16.9\text{m}$

$D_E = -40\cos 30° = -34.6\text{m}$

$D_N = -40\sin 30° = -20\text{m}$

East Calculation

$R_E = 4C_E + 3D_E$

$= 4(-14.1) + 3(-34.6)$

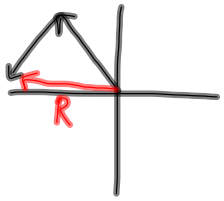
$= -160.2\text{ m}$

North Calculation

$R_N = 4C_N + 3D_N$

$= 4(16.9) + 3(-20)$

$= +7.6\text{ m}$



Resultant

$R = \sqrt{R_E^2 + R_N^2} = 160.4\text{ m}$

$\theta = \tan^{-1}\left|\frac{R_N}{R_E}\right| = \tan^{-1}\left|\frac{7.6}{-160.2}\right|$

$\theta = 2.7°$

$\vec{R} = 160.4\text{m}\ [\text{W } 2.7°\ \text{N}]$

d. 2D – C {79.2 m [W46°S]}

$C = 22\text{ m}\ [W50°N]$

$D = 40\ [W30S]$

Components

$C_E = -22\cos 50° = -14.1\text{m}$

$C_N = +22\sin 50° = +16.9\text{m}$

$D_E = -40\cos 30° = -34.6\text{m}$

$D_N = -40\sin 30° = -20\text{m}$

East

$R_E = 2D_E - C_E$

$= 2(-34.6) - (-14.1)$

$= -69.2 + 14.1 = -55.1\text{m}$ (west)

North

$R_N = 2D_N - C_N$

$= 2(-20) - (16.9)$

$= -40 - 16.9 = -56.9\text{m}$ (south)

$\vec{R} = \sqrt{R_E^2 + R_N^2} = \sqrt{(-55.1)^2 + (-56.9)^2}$

$\vec{R} = 79\text{m}$

$\theta = \tan^{-1}\left|\frac{R_N}{R_E}\right|$

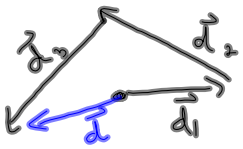
$\theta = \tan^{-1}\left|\frac{-56.9}{-55.1}\right| = 46°$

$\vec{R} = 79\text{m}\ [W46°S]$

Physics 122: Application of Vectors Examples

1. What is the average velocity of a car that drives 66 km [E], 52 km [W33°N], and 45 km [W73°S] in 3.1 hours?

$\vec{v}_{avg} = \frac{\vec{d}}{t}$



$\vec{d}$ = vector sum of all three vectors.

$\vec{d} = \vec{d}_1 + \vec{d}_2 + \vec{d}_3$

$d_{1E} = 66\cos\theta = 66\ km$ $\quad d_{1N} = 66\sin\theta = 0\ km$

$d_{2E} = -52\cos 33 = -43.6\ km$ $\quad d_{2N} = +52\sin 33 = 28.3$

$d_{3E} = -45\cos 73 = -13.1$ $\quad d_{3N} = -45\sin 73 = -43$

$d_E = d_{1E} + d_{2E} + d_{3E}$

$= 66 - 43.6 - 13.1 = 9.3\ km$

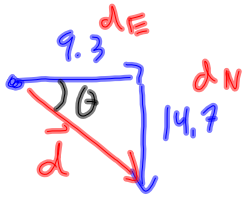
$d_N = d_{1N} + d_{2N} + d_{3N}$

$= 0 + 28.3 - 43 = -14.7\ km$

$\vec{d} = \sqrt{d_E^2 + d_N^2}$

$= \sqrt{(9.3)^2 + (-14.7)^2}$

$= 17.4\ km$



$\theta = \tan^{-1}\left|\frac{d_N}{d_E}\right| = \tan^{-1}\left|\frac{-14.7}{9.3}\right| = 58°$

$\vec{d} = 17.4\ km\ [E\ 58°S]$

$\vec{v}_{avg} = \frac{\vec{d}}{t} = \frac{17.4\ km\ [E\ 58°S]}{3.1\ h}$

$= 5.6\ \frac{km}{h}\ [E\ 58°S]$