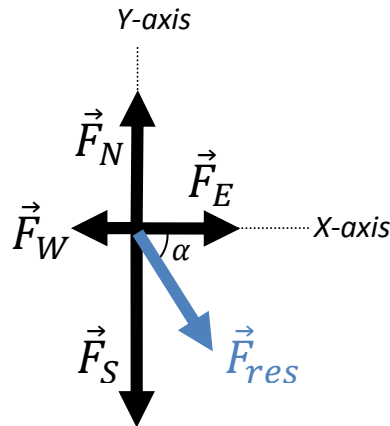Answer on Question #63905, Physics / Mechanics | Relativity

Question:

Four forces act at a point. The first, 500 grams acts due south, the second, 50 grams acts
due west, the third, 400 grams acts due north, and the fourth, 100 grams acts due east.
What is the magnitude and direction of the resultant?

Solution:

These four forces may be represented in Cartesian coordinate system:

$\vec{F}_S = (0; -500), \ \vec{F}_W = (-50; 0), \ \vec{F}_N = (0; 400), \vec{F}_E = (100; 0).$

The resultant force
$\vec{F}_{res} = \vec{F}_S + \vec{F}_W + \vec{F}_N + \vec{F}_E = (0 + (-50) + 0 + 100; -500 + 0 + 400 + 0) = (50; -100)$

To find its magnitude we must calculate the length of vector $\vec{F}_{res}$:

$L = |\vec{F}_{res}| = \sqrt{(F^x_{res})^2 + (F^y_{res})^2} = \sqrt{(50)^2 + (-100)^2} \cong 111.8 \ grams$

Azimuth (A) of vector $\vec{F}_{res}$ is equal to $90° + \alpha$

$\cos \alpha = \frac{F^x_{res}}{L}, \ \ \alpha = \cos^{-1} \frac{F^x_{res}}{L} = \cos^{-1} \frac{50}{111.8} = 63.4°$ and $A = 90° + 63.4° = 153.4°$

Answer:

111.8 $grams$ and 153.4° from north