

## Answer on Question #42418 – Math – Analytical Geometry

### Question.

Two forces with magnitudes of 150 and 75 pounds act on an object at angles of  $30^\circ$  and  $150^\circ$  respectively. Find the direction and magnitude of the resultant force. Round to two decimal places in all intermediate steps and in your final answer.

Given:

$$F_1 = 150 \text{ pounds}$$

$$F_2 = 75 \text{ pounds}$$

$$\alpha_1 = 30^\circ$$

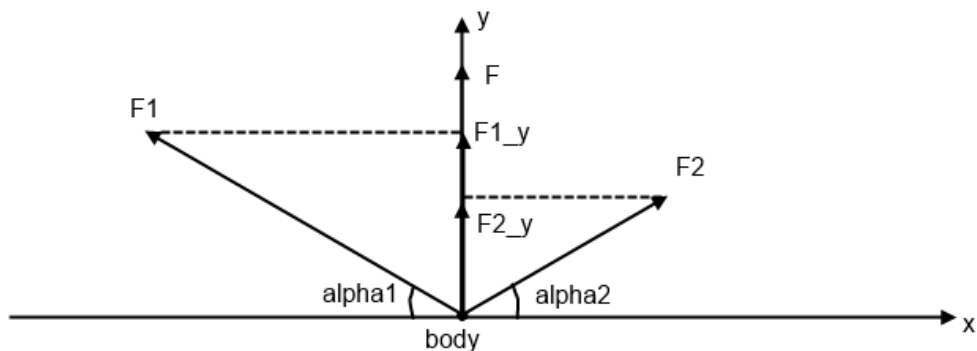
$$\alpha_2 = 150^\circ$$

Find:

$F = ?$  is the magnitude of resultant force

$\alpha = ?$  is the direction of resultant force

### Solution.



In the general case, the direction of the resultant force is determined by the parallelogram rule. But since  $\alpha_1 = \pi - \alpha_2$  we can project forces  $F_1$  and  $F_2$  on y-axis and it's will be resultant force:

$$\alpha = \alpha_1 + \frac{\alpha_2 - \alpha_1}{2} = 30^\circ + 60^\circ = 90^\circ$$

$$F = F_{1y} + F_{2y} = F_1 \cos\left(\alpha_1 - \frac{\pi}{2}\right) + F_2 \cos\left(\frac{\pi}{2} - \alpha_2\right)$$

$$F = F_1 \cos\left(\alpha_1 - \frac{\pi}{2}\right) + F_2 \cos\left(\frac{\pi}{2} - \alpha_2\right) = F_1 \cos(60^\circ) + F_2 \cos(60^\circ) = (F_1 + F_2) \cos(60^\circ)$$

Calculate:

$$F = (150 + 75) \cdot \frac{1}{2} = \frac{225}{2} = 112.5 \text{ pounds}$$

**Answer.**

The magnitude of resultant force is  $F = 112.5$  pounds

The direction of resultant force  $\alpha = 90^\circ$