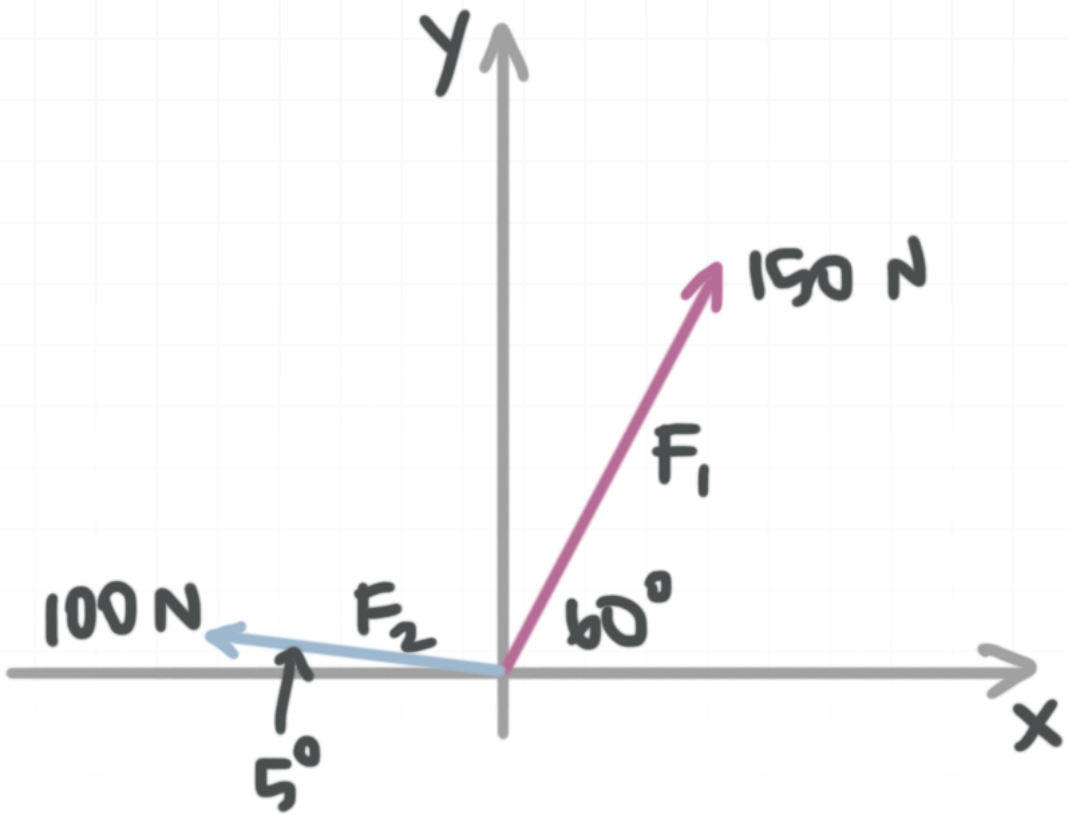
Topic: Magnitude and angle of the resultant force

Question: What is the the magnitude and angle of the resultant force of the vectors?



Answer choices:

A 139.66 N and 82.99°

B 121.57 N and 97.01°

C 140.79 N and 100.07°

D 121.57 N and 82.99°

Solution: C

The first vector has a force of 150 N, and a $60°$ angle from the horizontal axis. Since it's in the first quadrant, we'll use a positive sign on each term.

$$F_1 = 150\cos 60°\mathbf{i} + 150\sin 60°\mathbf{j}$$

$$F_1 = 75\mathbf{i} + 129.90\mathbf{j}$$

$$F_1 = \langle 75, 129.90 \rangle$$

The second vector has a force of 100 N, and a $5°$ angle from the horizontal axis. Since it's in the second quadrant, we'll use a negative sign on the x -term and a positive sign on the y-term.

$$F_2 = -100\cos 5°\mathbf{i} + 100\sin 5°\mathbf{j}$$

$$F_2 = -99.62\mathbf{i} + 8.72\mathbf{j}$$

$$F_2 = \langle -99.62, 8.72 \rangle$$

Add F_1 and F_2 to get the resultant force.

$$F_R = 75\mathbf{i} + 129.90\mathbf{j} - 99.62\mathbf{i} + 8.72\mathbf{j}$$

$$F_R = -24.62\mathbf{i} + 138.62\mathbf{j}$$

$$F_R = \langle -24.62, 138.62 \rangle$$

Find the magnitude of the resultant force using the distance formula.

$$D = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$D_R = \sqrt{(-24.62 - 0)^2 + (138.62 - 0)^2}$$

$$D_R = \sqrt{606.14 + 19{,}215.50}$$

$$D_R = 140.79$$

Find the angle of the resultant force.

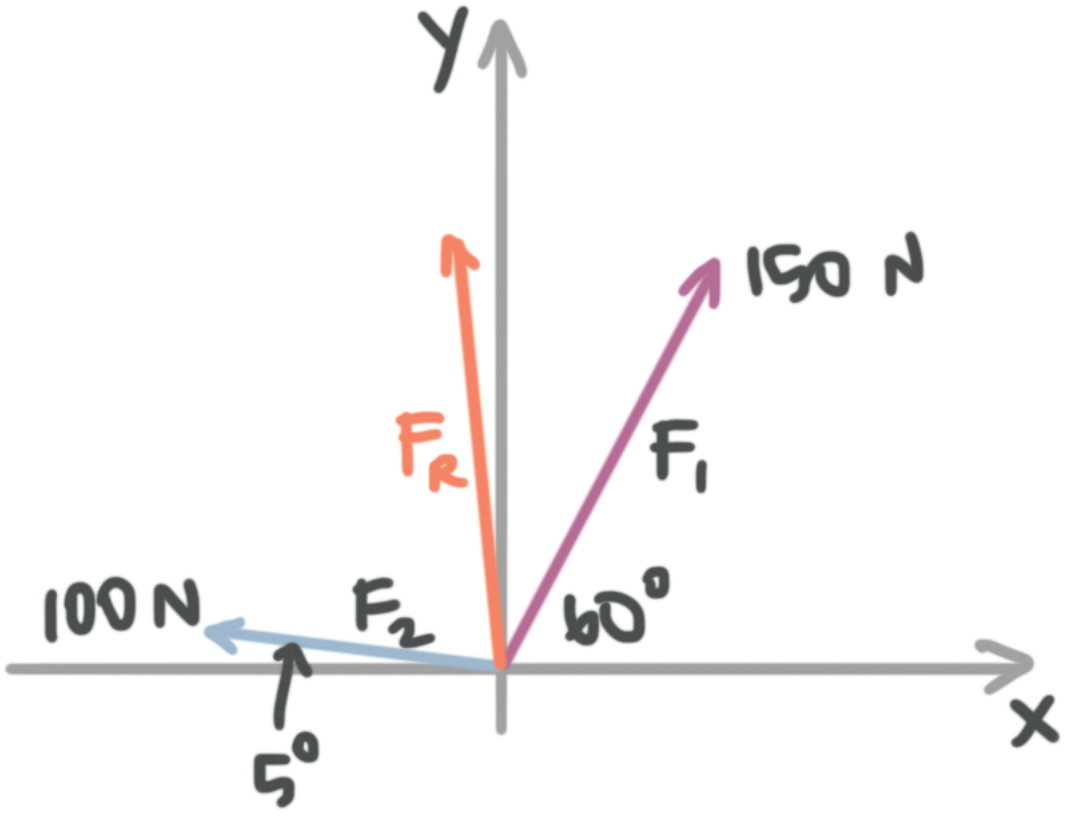
$$\theta_R = 180° - \arctan \frac{|y|}{|x|}$$

$$\theta_R = 180° - \arctan \frac{138.62}{24.62}$$

$$\theta_R = 180° - 79.93°$$

$$\theta_R = 100.07°$$

The magnitude of the resultant force is 140.79 N and the angle of the resultant force is $100.07°$.



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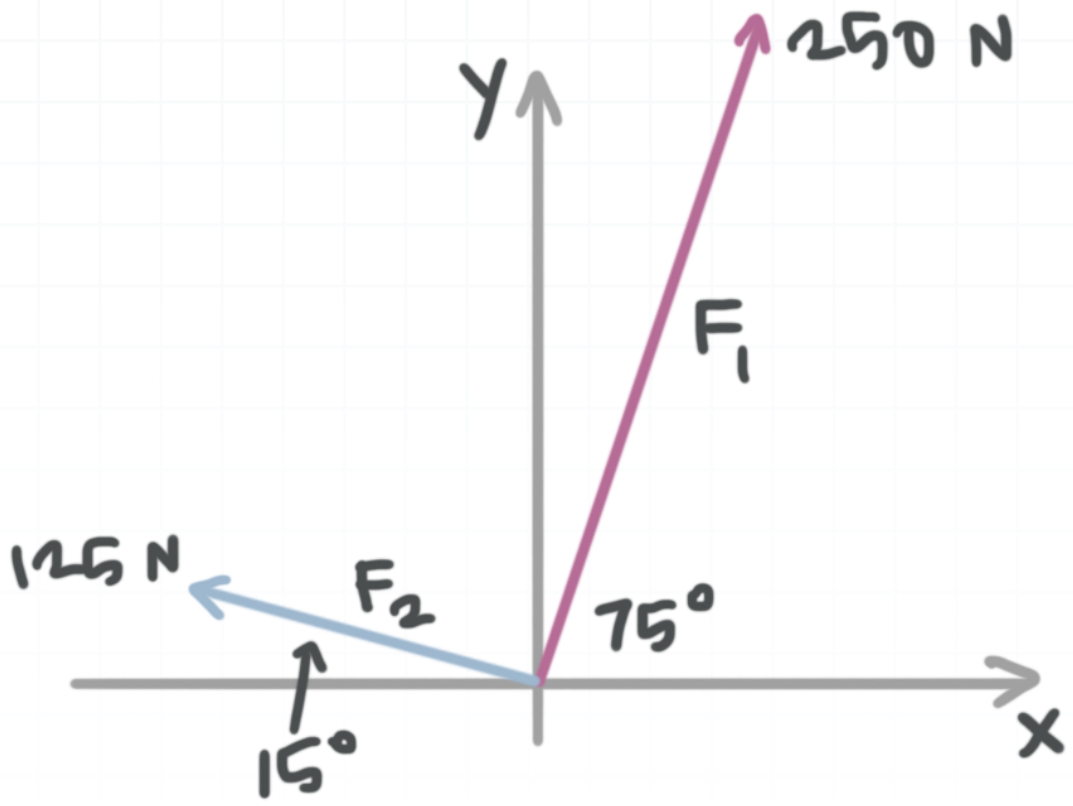


Answer choices:

A	279.51 N	and	101.56°
B	279.51 N	and	78.44°
C	217.79 N	and	101.56°
D	217.79 N	and	78.44°

Solution: A

The first vector has a force of 250 N, and a $75°$ angle from the horizontal axis. Since it's in the first quadrant, we'll use a positive sign on each term.

$$F_1 = 250\cos 75°\mathbf{i} + 250\sin 75°\mathbf{j}$$

$$F_1 = 64.70\mathbf{i} + 241.48\mathbf{j}$$

$$F_1 = \langle 64.70, 241.48 \rangle$$

The second vector has a force of 125 N, and a $15°$ angle from the horizontal axis. Since it's in the second quadrant, we'll use a negative sign on the x -term and a positive sign on the y-term.

$$F_2 = -125\cos 15°\mathbf{i} + 125\sin 15°\mathbf{j}$$

$$F_2 = -120.74\mathbf{i} + 32.35\mathbf{j}$$

$$F_2 = \langle -120.74, 32.35 \rangle$$

Add F_1 and F_2 to get the resultant force.

$$F_R = 64.70\mathbf{i} + 241.48\mathbf{j} - 120.74\mathbf{i} + 32.35\mathbf{j}$$

$$F_R = -17.05\mathbf{i} + 138.62\mathbf{j}$$

$$F_R = \langle -56.04, 273.83 \rangle$$

Find the magnitude of the resultant force using the distance formula.

$$D = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$D_R = \sqrt{(-56.04 - 0)^2 + (273.83 - 0)^2}$$

$$D_R = \sqrt{3{,}140.48 + 74{,}982.87}$$

$$D_R = 279.51$$

Find the angle of the resultant force.

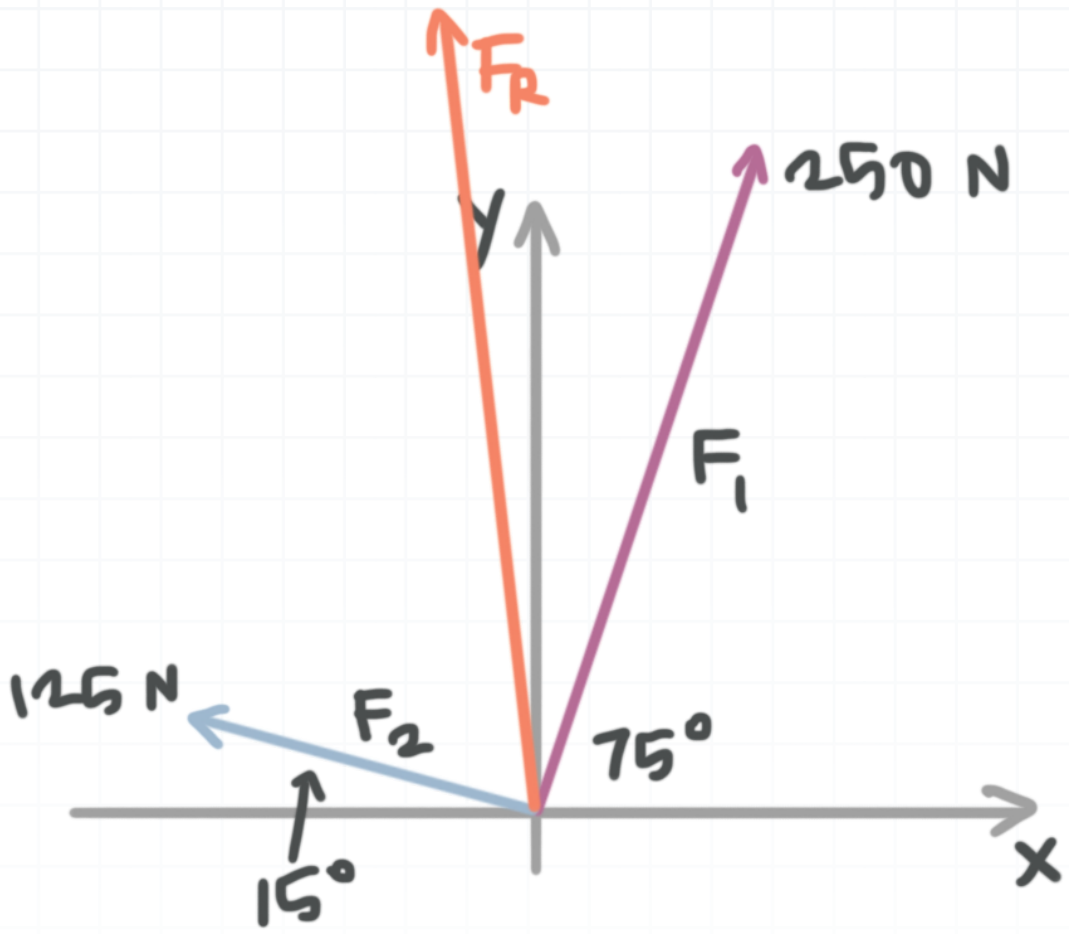
$$\theta_R = 180^\circ - \arctan \frac{|y|}{|x|}$$

$$\theta_R = 180^\circ - \arctan \frac{273.83}{56.04}$$

$$\theta_R = 180^\circ - 78.44^\circ$$

$$\theta_R = 101.56^\circ$$

The magnitude of the resultant force is 279.51 N and the angle of the resultant force is 101.56°.



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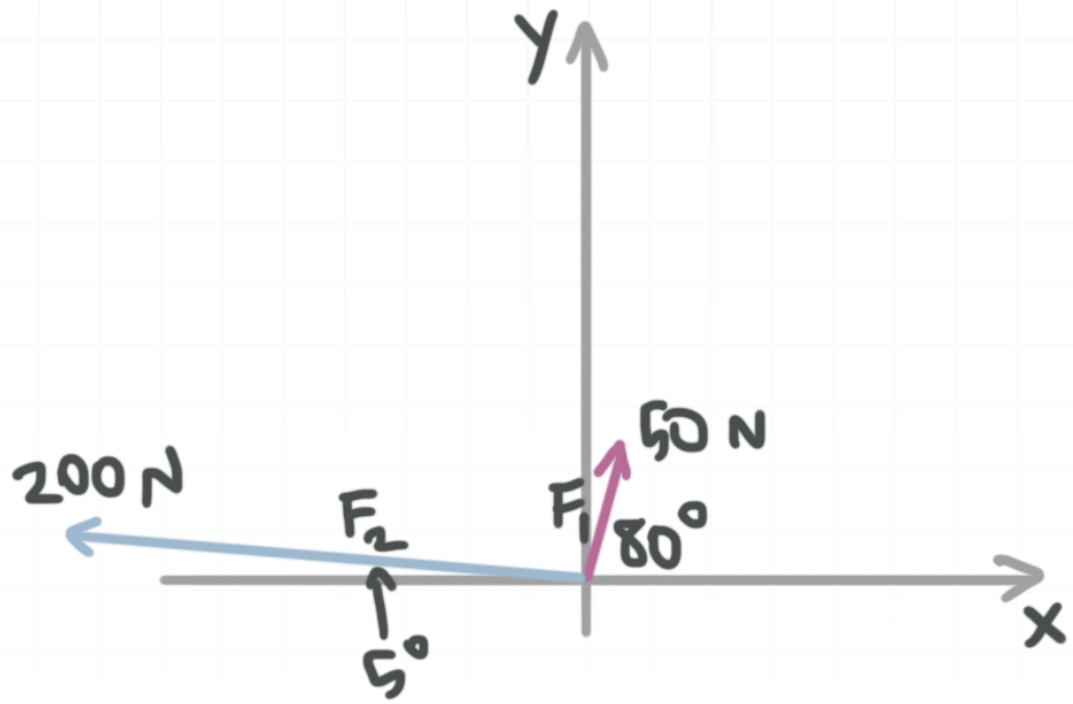

Answer choices:

A 201.89 N and 19.28°

B 257.23 N and 160.72°

C 257.23 N and 19.28°

D 201.89 N and 160.72°

Solution: D

The first vector has a force of 50 N, and an $80°$ angle from the horizontal axis. Since it's in the first quadrant, we'll use a positive sign on each term.

$$F_1 = 50\cos 80°\mathbf{i} + 50\sin 80°\mathbf{j}$$

$$F_1 = 8.68\mathbf{i} + 49.24\mathbf{j}$$

$$F_1 = \langle 8.68, 49.24 \rangle$$

The second vector has a force of 200 N, and a $5°$ angle from the horizontal axis. Since it's in the second quadrant, we'll use a negative sign on the x -term and a positive sign on the y-term.

$$F_2 = -200\cos 5°\mathbf{i} + 200\sin 5°\mathbf{j}$$

$$F_2 = -199.24\mathbf{i} + 17.43\mathbf{j}$$

$$F_2 = \langle -199.24, 17.43 \rangle$$

Add F_1 and F_2 to get the resultant force.

$$F_R = 8.68\mathbf{i} + 49.24\mathbf{j} - 199.24\mathbf{i} + 17.43\mathbf{j}$$

$$F_R = -190.56\mathbf{i} + 66.67\mathbf{j}$$

$$F_R = \langle -190.56, 66.67 \rangle$$

Find the magnitude of the resultant force using the distance formula.

$$D = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$D_R = \sqrt{(-190.56 - 0)^2 + (66.67 - 0)^2}$$

$$D_R = \sqrt{36{,}313.11 + 4{,}444.89}$$

$$D_R = 201.89$$

Find the angle of the resultant force.

$$\theta_R = 180° - \arctan\frac{|y|}{|x|}$$

$$\theta_R = 180° - \arctan\frac{66.67}{190.56}$$

$$\theta_R = 180° - 19.28°$$

$$\theta_R = 160.72°$$

The magnitude of the resultant force is 201.89 N and the angle of the resultant force is $160.72°$.