Solutionbank M1

Heinemann Modular Maths for Edexcel AS and A-level

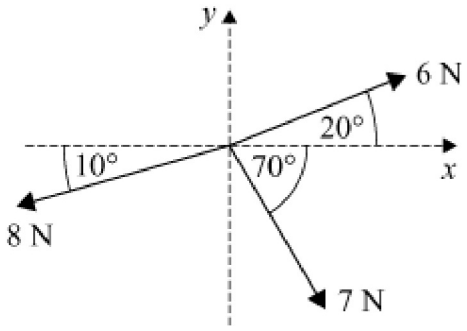
4 Forces

Exercise D, Question 5

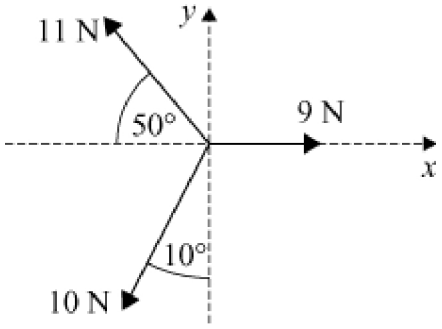
Question:

Find the magnitude and the direction of the resultant force in each of the following cases:

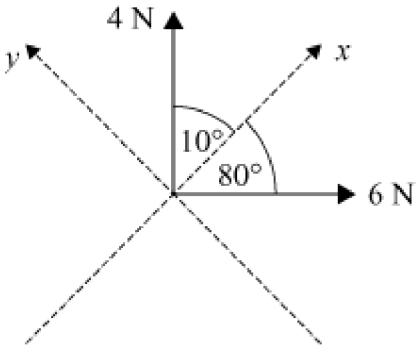
(a)



(b)



(c)



(d)

Solution:

(a)

$\mathbf{R} = (6\cos 20° + 7\cos 70° - 8\cos 10°)\mathbf{i} + (6\sin 20° - 7\sin 70° - 8\sin 10°)\mathbf{j}$

$\mathbf{R} = 0.15383...\mathbf{i} - 5.9149...\mathbf{j}$

$\therefore |\mathbf{R}| = \sqrt{0.15383^2 + (-5.9149)^2}$

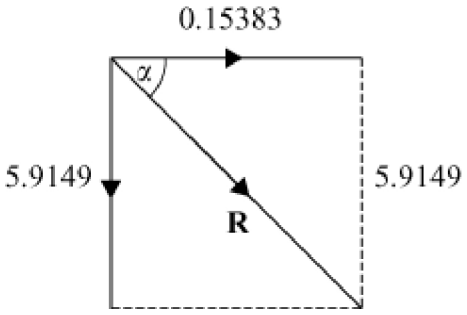
$= 5.9169...$

i.e. $|\mathbf{R}| = 5.92$ N (3 s.f.)

then $\tan\alpha = \frac{5.9149...}{0.15383...}$

i.e. $\alpha = 88.510...°$

i.e. at 88.5° below the positive **i** direction.



$\mathbf{R} = (9 - 11\cos 50° - 10\sin 10°)\mathbf{i} + (11\sin 50° - 10\cos 10°)\mathbf{j}$

i.e. $\mathbf{R} = 0.19285...\mathbf{i} - 1.4215...\mathbf{j}$

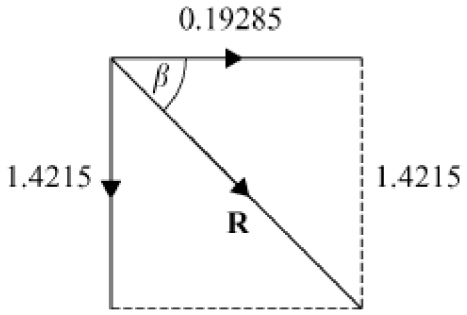
$\therefore |\mathbf{R}| = \sqrt{0.19285...^2 + (-1.4215...)^2} = 1.4346...$

(b) i.e. $|\mathbf{R}| = 1.43$ N (3 s.f.)

$\tan\beta = \frac{1.4215...}{0.19285...}$

i.e. $\beta = 82.274...°$

i.e. at 82.3° below the positive **i** direction.



(c)

$\mathbf{R} = (6\cos 80° + 4\cos 10°)\mathbf{i} + (4\sin 10° - 6\sin 80°)\mathbf{j}$

$\mathbf{R} = 4.9811...\mathbf{i} - 5.2142...\mathbf{j}$

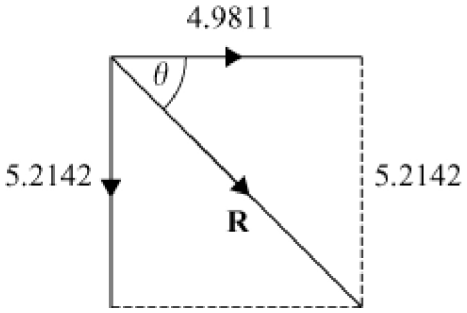
$|\mathbf{R}| = \sqrt{4.9811^2 + (-5.2142)^2}$

$|\mathbf{R}| = 7.2111...$

i.e. $|\mathbf{R}| = 7.21$ N (3 s.f.)

$\tan\theta = \frac{5.2142...}{4.9811...}$

i.e. $\theta = 46.309...°$ i.e. at 46.3 ° below the positive i direction (3 s.f.)



(d)

$\mathbf{R} = (11\cos 30° - 10\sin 80° - 9\sin 10°)\mathbf{i} + (9\cos 10° - 10\cos 80° - 11\sin 30°)\mathbf{j}$

$\mathbf{R} = -1.8846...\mathbf{i} + 1.6267...\mathbf{j}$

$\therefore |\mathbf{R}| = \sqrt{(-1.8846)^2 + (1.6267)^2}$

$|\mathbf{R}| = 2.4896...$

$|\mathbf{R}| = 2.49$ N (3 s.f.)

$\tan\phi = \frac{1.8846...}{1.6267}$

$\phi = 49.199...°$

$\therefore$ at $90° + \phi$ $= 90° + 49.199...°$

$= 139.19...°$

i.e. at 139° above the positive **i** direction (3 s.f.)