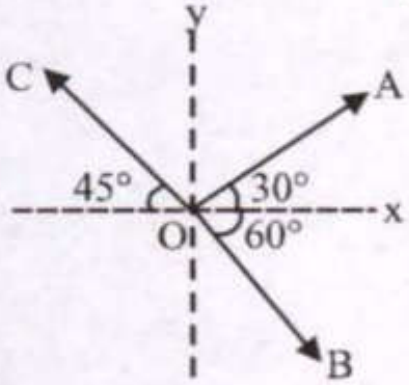
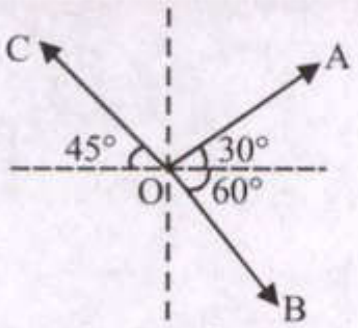
1. The magnitude of vectors $\overrightarrow{OA}$, $\overrightarrow{OB}$ and $\overrightarrow{OC}$ in the given figure are equal. The direction of $\overrightarrow{OA}+\overrightarrow{OB}-\overrightarrow{OC}$ with x-axis will be :- [Aug. 26, 2021 (I)]



(a) $\tan^{-1}\dfrac{\left(1-\sqrt{3}-\sqrt{2}\right)}{\left(1+\sqrt{3}+\sqrt{2}\right)}$ (b) $\tan^{-1}\dfrac{\left(\sqrt{3}-1+\sqrt{2}\right)}{\left(1+\sqrt{3}-\sqrt{2}\right)}$

(c) $\tan^{-1}\dfrac{\left(\sqrt{3}-1+\sqrt{2}\right)}{\left(1-\sqrt{3}+\sqrt{2}\right)}$ (d) $\tan^{-1}\dfrac{\left(1+\sqrt{3}-\sqrt{2}\right)}{\left(1-\sqrt{3}-\sqrt{2}\right)}$

ans (a)



Say, magnitudes of vectors is r.

$$\overrightarrow{OA}=r\left[\cos 30^\circ\hat{i}+\sin 30\hat{j}\right]=r\left[\frac{\sqrt{3}}{2}\hat{i}+\frac{1}{2}\hat{j}\right]$$

$$\overrightarrow{OC}=r\left[\cos 45^\circ(-\hat{i})+\sin 45\hat{j}\right]=r\left[-\frac{1}{\sqrt{2}}\hat{i}+\frac{1}{\sqrt{2}}\hat{j}\right]$$

$$\overrightarrow{OB}=r\left[\cos 60^\circ\hat{i}-\sin 60\hat{j}\right]=r\left[\frac{1}{2}\hat{i}-\frac{\sqrt{3}}{2}\hat{j}\right]$$

$$\therefore\ \overrightarrow{OA}+\overrightarrow{OB}-\overrightarrow{OC}$$

$$=r\left[\left(\frac{\sqrt{3}+1}{2}+\frac{1}{\sqrt{2}}\right)\hat{i}+\left(\frac{1}{2}-\frac{\sqrt{3}}{2}-\frac{1}{\sqrt{2}}\right)\hat{j}\right]$$

$\therefore$ Angle made by vector with x-axis

$$\tan^{-1}\left[\frac{\frac{1}{2}-\frac{\sqrt{3}}{2}-\frac{1}{\sqrt{2}}}{\frac{\sqrt{3}}{2}+\frac{1}{2}+\frac{1}{\sqrt{2}}}\right]=\tan^{-1}\left[\frac{1-\sqrt{3}-\sqrt{2}}{\sqrt{3}+1+\sqrt{2}}\right]$$