Exercise 10.1

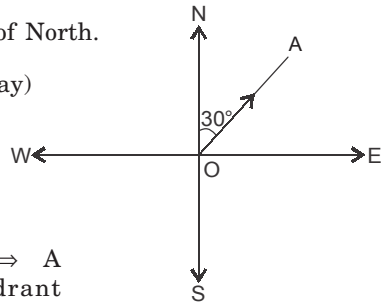
1. Represent graphically a displacement of 40 km, 30° east of north.

Sol. Displacement 40 km, 30° East of North.

$\Rightarrow$ Displacement vector $\overrightarrow{OA}$ (say)

such that $|\overrightarrow{OA}| = 40$ (given)

and vector $\overrightarrow{OA}$ makes an angle 30° with North in East-North quadrant.



Note. α° South of West $\Rightarrow$ A vector in South-West quadrant making an angle of α° with West.

2. Check the following measures as scalars and vectors:

(*i*) 10 kg (*ii*) 2 meters north-west (*iii*) 40°

(*iv*) 40 Watt (*v*) 10^{-19} coulomb (*vi*) 20 m/sec^2.

Sol. (*i*) 10 kg is a measure of mass and therefore a **scalar.** ($\because$ 10 kg has no direction, it is magnitude only).

(*ii*) 2 meters North-West is a measure of velocity (*i.e.,* has magnitude and direction both) and hence is a **vector.**

(*iii*) 40° is a measure of angle *i.e.,* is magnitude only and, therefore, a scalar.

(*iv*) 40 Watt is a measure of power (*i.e.,* 40 watt has no direction) and, therefore, a scalar.

(*v*) 10^{-19} coulomb is a measure of electric charge (*i.e.,* is magnitude only) and, therefore, a scalar.

(*vi*) 20 m/sec^2 is a measure of acceleration *i.e.,* is a measure of rate of change of velocity and hence is a vector.

3. Classify the following as scalar and vector quantities:

(*i*) time period (*ii*) distance (*iii*) force

(*iv*) velocity (*v*) work done.

Sol. (*i*) Time-scalar (*ii*) Distance-scalar (*iii*) Force-vector

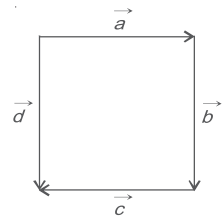
(*iv*) Velocity-vector (*v*) Work done-scalar.

4. In the adjoining figure, (a square), identify the following vectors.

(*i*) Coinitial

(*ii*) Equal

(*iii*) Collinear but not equal.



Sol. (*i*) $\vec{a}$ and $\vec{d}$ have same initial point and, therefore, coinitial vectors.

(*ii*) $\vec{b}$ and $\vec{d}$ have same direction and same magnitude. Therefore, $\vec{b}$ and $\vec{d}$ are equal vectors.

(*iii*) $\vec{a}$ and $\vec{c}$ have parallel supports, so that they are collinear. Since they have opposite directions, they are not equal. Hence $\vec{a}$ and $\vec{c}$ are collinear but not equal.

5. Answer the following as true or false.

(*i*) $\vec{a}$ and $-\vec{a}$ are collinear.

(*ii*) Two collinear vectors are always equal in magnitude.

(*iii*) Two vectors having same magnitude are collinear.

(*iv*) Two collinear vectors having the same magnitude are equal.

Sol. (*i*) True.

(*ii*) False. ($\because \vec{a}$ and $2\vec{a}$ are collinear vectors but $|2\vec{a}| = 2|\vec{a}|$)

(*iii*) False.

($\because |\hat{i}| = |\hat{j}| = 1$ but $\hat{i}$ and $\hat{j}$ are vectors along x-axis (OX) and y-axis (OY) respectively.)

(*iv*) False.

($\because$ Vectors $\vec{a}$ and $-\vec{a}$ ($= (-1)\vec{a} = m\vec{a}$) are collinear vectors and $|\vec{a}| = |-\vec{a}|$ but we know that $\vec{a} \neq -\vec{a}$ because their directions are opposite).

Note. Two vectors $\vec{a}$ and $\vec{b}$ are said to be equal if

(*i*) $|\vec{a}| = |\vec{b}|$ (*ii*) $\vec{a}$ and $\vec{b}$ have same (like) direction.