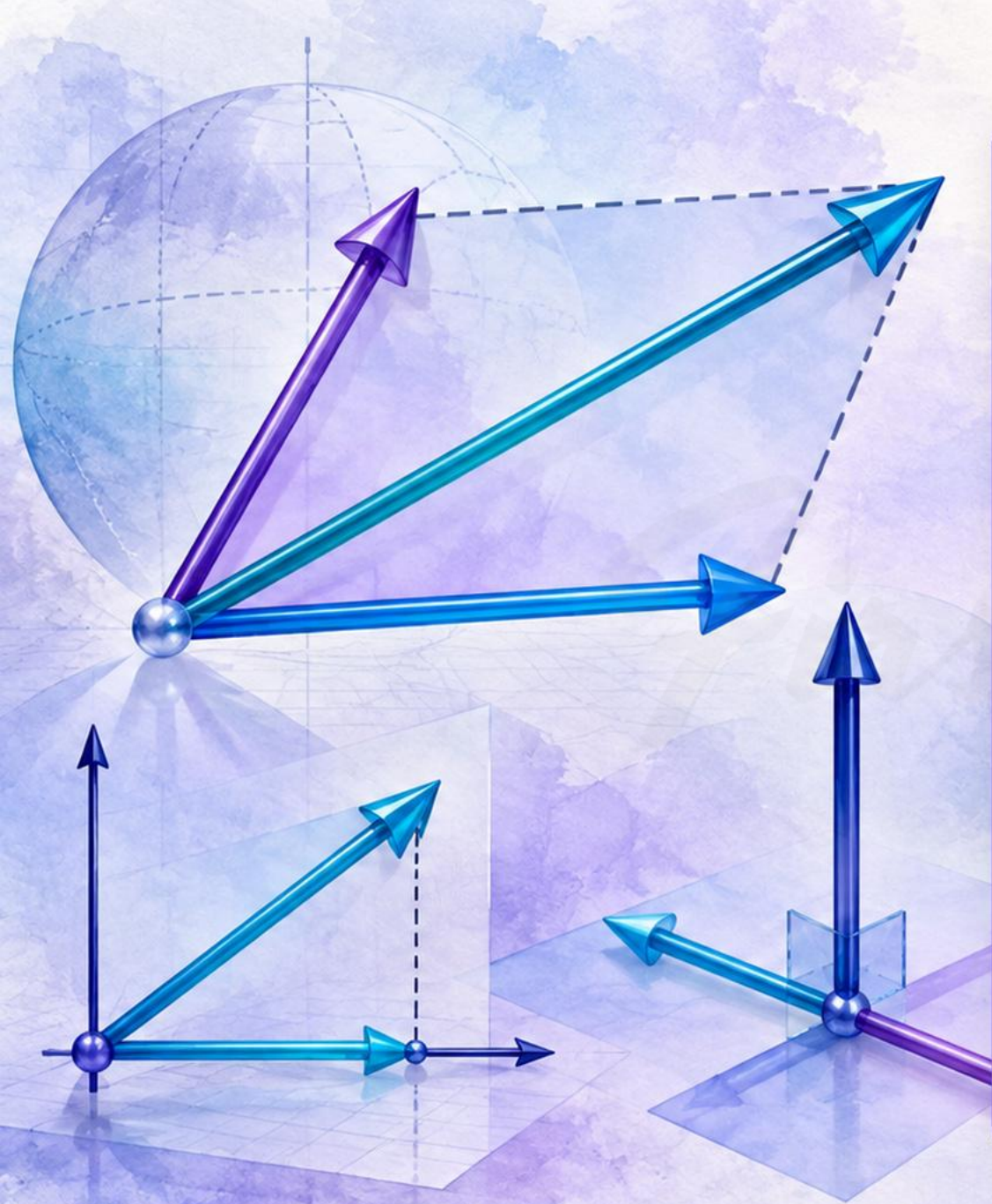




MATHEMATICS • CLASS 12

10

CHAPTER

Vector Algebra

NCERT SOLUTIONS

VECTOR ALGEBRA – EXERCISE 10.1 Q1

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

Answer:

Take East as the positive x -axis (unit vector $\hat{i}$) and North as the positive y -axis (unit vector $\hat{j}$).

A displacement of 40 km, 30° east of north makes an angle of 30° with the north (y) direction towards east ($+x$ direction).

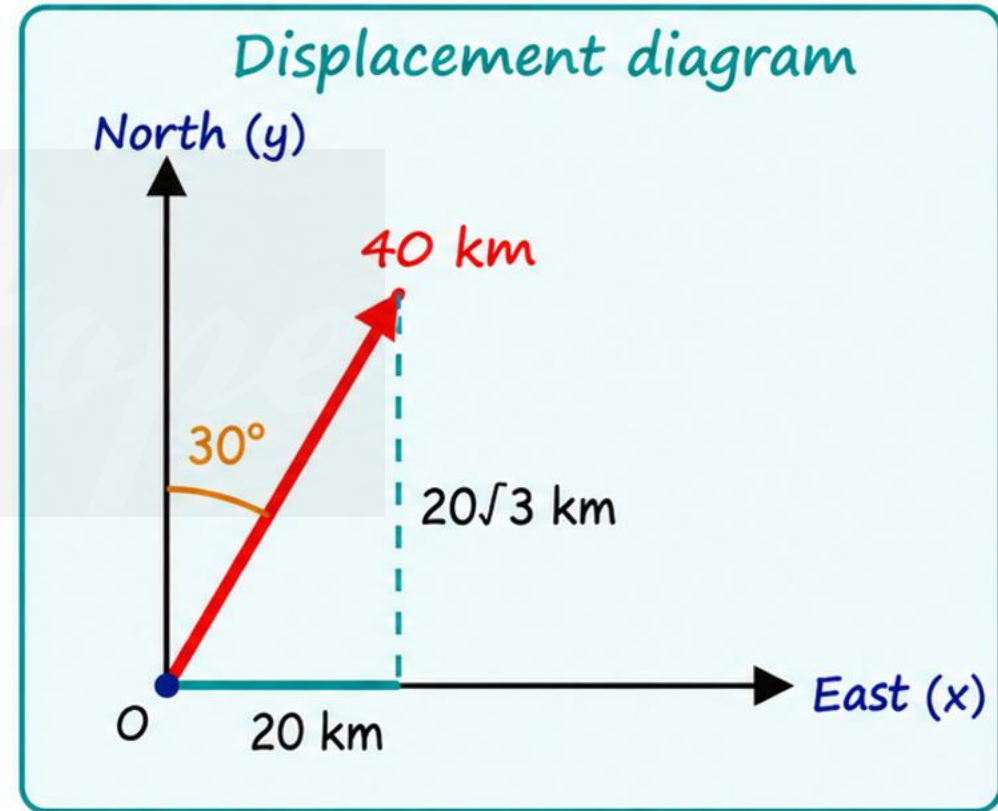
Components:

$$\text{East component} = 40 \sin 30^\circ = 40 \times \frac{1}{2} = 20 \text{ km.}$$

$$\text{North component} = 40 \cos 30^\circ = 40 \times \frac{\sqrt{3}}{2} = 20\sqrt{3} \text{ km.}$$

Hence, the displacement vector in unit vector form is $20\hat{i} + 20\sqrt{3}\hat{j}$ km.

Hence, Vector = $20\hat{i} + 20\sqrt{3}\hat{j}$ km.



VECTOR ALGEBRA — EXERCISE 10.1 Q2

Q. Classify (i) 10 kg, (ii) 2 metres north-west, (iii) 40° , (iv) 40 watt, (v) 10^{-19} coulomb, (vi) 20 m/s^2 .

Answer:

(i) 10 kg

Mass is a scalar quantity because it has only magnitude and no direction.

Hence, 10 kg is a scalar.

(ii) 2 metres north-west

Displacement is a vector quantity because it has both magnitude (2 m) and direction (north-west).

Hence, 2 metres north-west is a vector.

(iii) 40°

An angle is a scalar quantity. It represents only a measure (magnitude) and does not have a direction in the vector sense.

Hence, 40° is a scalar.

(iv) 40 watt

Power is a scalar quantity because it has only magnitude and no direction.

Hence, 40 watt is a scalar.

(v) 10^{-19} coulomb

Electric charge is a scalar quantity because it has only magnitude (it can be positive or negative, but does not have a direction).

Hence, 10^{-19} coulomb is a scalar.

(vi) 20 m/s^2

Acceleration is a vector quantity because it has both magnitude (20 m/s^2) and a direction.

Hence, 20 m/s^2 is a vector.

VECTOR ALGEBRA — EXERCISE 10.1 Q3

Q. Classify the following as scalar and vector quantities.

- (i) time period (ii) distance (iii) force (iv) velocity (v) work done

Answer:

(i) **Time period**

Time period is a scalar quantity because it is completely described by its magnitude only. It has no direction.

Hence, time period is a scalar quantity.

(ii) **Distance**

Distance is a scalar quantity because it has only magnitude (length of the path traversed) and no direction.

Hence, distance is a scalar quantity.

(v) **Work done**

Work done is a scalar quantity because it is given by a single numerical value (magnitude) and has no direction.

Hence, work done is a scalar quantity.

(iii) **Force**

Force is a vector quantity because it has both magnitude and direction. The direction specifies the direction in which the force acts on a body.

Hence, force is a vector quantity.

(iv) **Velocity**

Velocity is a vector quantity because it has both magnitude (speed) and direction (direction of motion).

Hence, velocity is a vector quantity.

VECTOR ALGEBRA — EXERCISE 10.1 Q4

Q. In Fig 10.6 (a square), identify the following vectors.

- (i) Coinitial (ii) Equal (iii) Collinear but not equal.

Answer:

(i) Coinitial vectors

Two vectors are coinitial if they have the same initial point (i.e., they start from the same point), irrespective of their directions and magnitudes.

In Fig 10.6, vectors $\vec{a}$ and $\vec{d}$ both start from the top-left corner of the square.

Hence, coinitial vectors:
 $\vec{a}$ and $\vec{d}$.

(ii) Equal vectors

Two vectors are equal if they have the same magnitude and the same direction.

In Fig 10.6, vectors $\vec{b}$ and $\vec{d}$ are along the two vertical sides of the square. Both are directed downwards and have the same length (each equal to the side of the square).

Hence, equal vectors:
 $\vec{b}$ and $\vec{d}$.

(iii) Collinear but not equal vectors

Two vectors are collinear if they lie on the same straight line or on parallel lines. They are not equal if their directions (or magnitudes) are different.

In Fig 10.6, vectors $\vec{a}$ and $\vec{c}$ are along the two horizontal sides of the square. They are parallel (collinear) but have opposite directions, so they are not equal.

Hence, collinear but not equal vectors:
 $\vec{a}$ and $\vec{c}$.

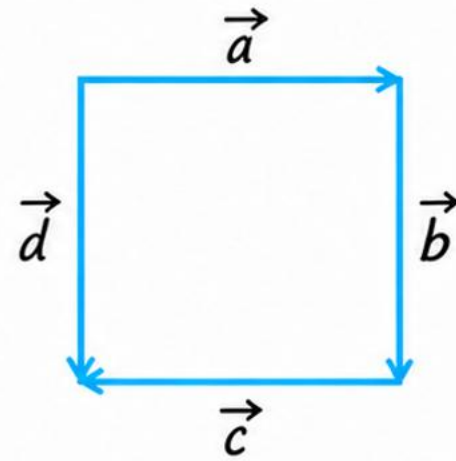


Fig 10.6

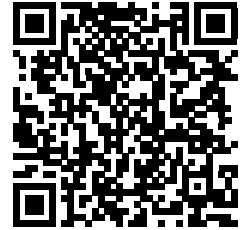


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