

EXERCISE 27.1

Q1.

Solution:

Let us consider l , m , and n be the direction cosines of a line.

So,

$$l = \cos 90^\circ = 0$$

$$m = \cos 60^\circ = \frac{1}{2}$$

$$n = \cos 30^\circ = \frac{\sqrt{3}}{2}$$

Hence,

The direction cosines of the line are $0, \frac{1}{2}, \frac{\sqrt{3}}{2}$

Q2.

Solution:

Let us consider l , m , and n be the direction cosines of a line.

Then,

$a = 2, b = -1, c = -2$ will be the direction ratios of the line.

So by using the formula,

$$l = \pm \frac{a}{\sqrt{a^2 + b^2 + c^2}}, m = \pm \frac{b}{\sqrt{a^2 + b^2 + c^2}}, n = \pm \frac{c}{\sqrt{a^2 + b^2 + c^2}}$$

We get,

$$l = \frac{2}{\sqrt{2^2 + (-1)^2 + (-2)^2}}, m = \frac{-1}{\sqrt{2^2 + (-1)^2 + (-2)^2}}, n = \frac{-2}{\sqrt{2^2 + (-1)^2 + (-2)^2}}$$

$$l = \frac{2}{\sqrt{9}}, m = \frac{-1}{\sqrt{9}}, n = \frac{-2}{\sqrt{9}}$$

$$l = \frac{2}{3}, m = -\frac{1}{3}, n = -\frac{2}{3}$$

Hence,

The direction ratios of the line are $2/3, -1/3, -2/3$

Q3.

Solution:

We know that the direction ratios of the line joining $(-2, 4, -5)$ and $(1, 2, 3)$ are $(1+2, 2-4, 3+5) = (3, -2, 8)$

Then,

$$a = 3, b = -2, c = 8$$

So let us find the direction cosines:

$$\begin{aligned} & \frac{3}{\sqrt{3^2 + (-2)^2 + 8^2}}, \frac{-2}{\sqrt{3^2 + (-2)^2 + 8^2}}, \frac{8}{\sqrt{3^2 + (-2)^2 + 8^2}} \\ &= \frac{3}{\sqrt{77}}, \frac{-2}{\sqrt{77}}, \frac{8}{\sqrt{77}} \end{aligned}$$

Hence,

The direction cosines are $\frac{3}{\sqrt{77}}, \frac{-2}{\sqrt{77}}, \frac{8}{\sqrt{77}}$

Q4.

Solution:

We know that,

A(2, 3, -4), B(1, -2, 3) and C(3, 8, -11)

So,

The direction ratios of AB = (1-2, -2-3, 3+4) = (-1, -5, 7)

The direction ratios of BC = (3-1, 8+2, -11-3) = (2, 10, -14)

Then,

The direction cosines of AB and AC

$-1/2 = -5/10 = 7/-14$ are proportional.

We also know that,

B is a common point between two lines,

Hence, the points A(2, 3, -4), B(1, -2, 3) and C(3, 8, -11) are collinear.

Q5.

Solution:

We know that,

A(3, 5, -4), B(-1, 1, 2) and C(-5, -5, -2)

So,

The direction ratios of side AB = (-1-3, 1-5, 2+4) = (-4, -4, 6)

So,

The direction cosines of AB is

$$\begin{aligned} & \frac{-4}{\sqrt{(-4)^2 + (-4)^2 + 6^2}}, \frac{-4}{\sqrt{(-4)^2 + (-4)^2 + 6^2}}, \frac{6}{\sqrt{(-4)^2 + (-4)^2 + 6^2}} \\ &= \frac{-4}{\sqrt{68}}, \frac{-4}{\sqrt{68}}, \frac{6}{\sqrt{68}} \\ &= \frac{-2}{\sqrt{17}}, \frac{-2}{\sqrt{17}}, \frac{3}{\sqrt{17}} \end{aligned}$$

Now,

The direction ratios of side BC = (-5+1, -5-1, -2-2) = (-4, -6, -4)

So,

The direction cosines of BC is

$$\begin{aligned} & \frac{-4}{\sqrt{(-4)^2 + (-6)^2 + (-4)^2}}, \frac{-6}{\sqrt{(-4)^2 + (-6)^2 + (-4)^2}}, \frac{-4}{\sqrt{(-4)^2 + (-6)^2 + (-4)^2}} \\ &= \frac{-4}{\sqrt{68}}, \frac{-6}{\sqrt{68}}, \frac{-4}{\sqrt{68}} \\ &= \frac{-2}{\sqrt{17}}, \frac{-3}{\sqrt{17}}, \frac{-2}{\sqrt{17}} \end{aligned}$$

Now,

The direction ratios of side AC = $(-5-3, -5-5, -2+4) = (-8, -10, 2)$

So,

The direction cosines of AC is

$$\begin{aligned} & \frac{-8}{\sqrt{(-8)^2 + (-10)^2 + 2^2}}, \frac{-10}{\sqrt{(-8)^2 + (-10)^2 + 2^2}}, \frac{2}{\sqrt{(-8)^2 + (-10)^2 + 2^2}} \\ &= \frac{-8}{\sqrt{168}}, \frac{-10}{\sqrt{168}}, \frac{2}{\sqrt{168}} \\ &= \frac{-4}{\sqrt{42}}, \frac{-5}{\sqrt{42}}, \frac{1}{\sqrt{42}} \end{aligned}$$



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