1.4.28

EE25BTECH11012-BEERAM MADHURI

Question:
Find the position vector of a point **R** which divides the line joining two points **P** and **Q** whose position vectors are $(2\mathbf{a} + \mathbf{b})$ and $(\mathbf{a} - 3\mathbf{b})$ externally in the ratio 1 : 2. Also, show that **P** is the mid point of the line segment RQ.
Solution:

Variable	Position vectors
P	(2a+b)
Q	(a-3b)

TABLE 0: Variables used

$$\mathbf{R} = \frac{2(\mathbf{P}) - 1(\mathbf{Q})}{2 - 1}$$
$$= \frac{2(2a + b) - (a - 3b)}{1}$$
$$= 3a + 5b$$

Hence Position vector of **R** is 3a + 5b
let **P** divides $\overline{RQ}$ in k:1 ratio then

$$\mathbf{P} = \frac{k(\mathbf{R}) + 1(\mathbf{Q})}{k + 1}$$
$$2a + b = \frac{k(3a + 5b) + a - 3b}{k + 1}$$
$$(2a + b)(k + 1) = (3k + 1)a + (5k - 3)b$$

Comparing coefficients of a:

$$2k + 2 = 3k + 1$$
$$k = 1$$

Hence **P** divides $\overline{RQ}$ in 1:1 ratio, P is midpoint of $\overline{RQ}$.

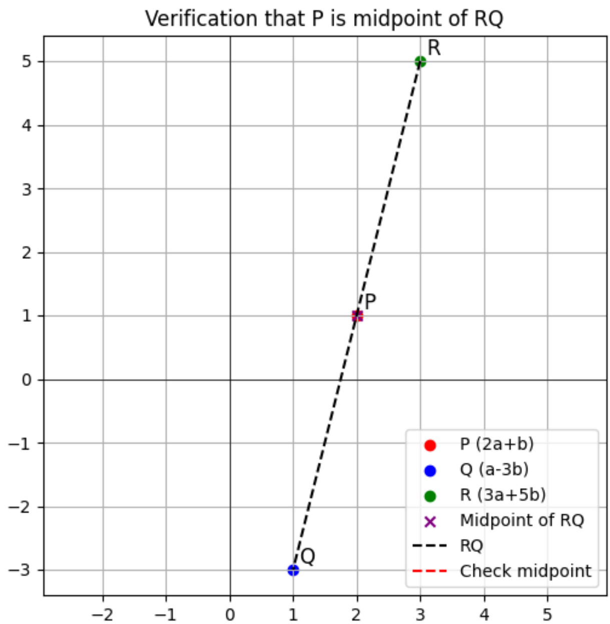
Verification that P is midpoint of RQ
R
P
Q
5
4
3
2
1
0
−1
−2
−3
−2
−1
0
1
2
3
4
5
P (2a+b)
Q (a-3b)
R (3a+5b)
Midpoint of RQ
RQ
Check midpoint

Fig. 0.1: PLOT