



**JAB SAARA INDIA  
VEDANTU PE ONLINE PADHEGA**

## Vedantu Scholarship Admission Test

- ✓ WIN an assured Scholarship upto 100%
- ✓ Take the Online Test from the comfort of your home
- ✓ It's Absolutely FREE
- ✓ For **Class 6-12** **CBSE | ICSE | JEE | NEET**

**Register NOW**

Limited Seats!

# BEST RESULTS FROM ONLINE CLASSES

548

RANKS  
ACROSS  
INDIA

268

RANKS  
IN TOP  
10K

1 OUT OF 3

STUDENTS WHO CLEARED  
JEE MAINS SECURED A  
RANK IN JEE ADVANCED



Mumbai se  
Dhruv Rambhia

✓ AIR 43



Panchkula se  
Madhav Goel

✓ AIR 208



Gurugram se  
Tanmay Gangwar

✓ AIR 227

• JEE Adv. •

27

STUDENTS

SCORED  
ABOVE  
600

46

STUDENTS

SCORED  
ABOVE  
550



Patiala se  
Shaurya Bhatia

✓ 682/720



Maharashtra se  
Anjaney Pandey

✓ 670/720



Surat se  
Tanishi Bhatt

✓ 670/720

• NEET •

157 Students

Scored above 90% in 12th



Lucknow se  
Arya Verma

✓ 98.40%



Jharkhand se  
Akshat Kumar

✓ 98.20%



Dubai se  
Navya Ratnan

✓ 98.00%

• 12<sup>TH</sup> Boards •

171 Students

Scored above 90% in 10th



Chennai se  
Meera Ranjan

✓ 98.8%



Jhajjar se  
Ayush Singh

✓ 98.2%



Patna se  
Shambhavi Sinha

✓ 98.2%

• 10<sup>TH</sup> Boards •



Malappuram se  
Senin Ahammed

✓ 100%



Rajahmundry se  
Reshma M

✓ 99.4%



Dahod se  
Ummehani N

✓ 97.92%

• State Boards •

## Vedantu Scholarship Admission Test

- ✓ WIN an assured Scholarship upto 100%
- ✓ Take the Online Test from the comfort of your home
- ✓ It's Absolutely FREE
- ✓ For Class 6-12 CBSE | ICSE | JEE | NEET

Register **NOW**

Limited Seats!

### Exercise 12.1

#### Question 1:

Find the coordinates of the point which divides the line segment joining the points  $(-2, 3, 5)$  and  $(1, -4, 6)$  in the ratio  
(i) 2:3 internally, (ii) 2:3 externally.

#### Solution 1:

(i) The coordinates of point R that divides the line segment joining points P  $(x_1, y_1, z_1)$  and Q  $(x_2, y_2, z_2)$  internally in the ratio m: n are

$$\left( \frac{mx_2 + nx_1}{m+n}, \frac{my_2 + ny_1}{m+n}, \frac{mz_2 + nz_1}{m+n} \right)$$

Let R  $(x, y, z)$  be the point that divides the line segment joining points  $(-2, 3, 5)$  and  $(1, -4, 6)$  internally in the ratio 2:3

$$x = \frac{2(1) + 3(-2)}{2+3}, y = \frac{2(-4) + 3(3)}{2+3}, \text{ and } z = \frac{2(6) + 3(5)}{2+3}$$

$$\text{i.e., } x = \frac{-4}{5}, y = \frac{1}{5}, \text{ and } z = \frac{27}{5}$$

Thus, the coordinates of the required point are  $\left( \frac{-4}{5}, \frac{1}{5}, \frac{27}{5} \right)$

(ii) The coordinates of point R that divides the line segment joining points P  $(x_1, y_1, z_1)$  and Q  $(x_2, y_2, z_2)$  externally in the ratio m: n are

$$\left( \frac{mx_2 - nx_1}{m-n}, \frac{my_2 - ny_1}{m-n}, \frac{mz_2 - nz_1}{m-n} \right)$$

Let R  $(x, y, z)$  be the point that divides the line segment joining points  $(-2, 3, 5)$  and  $(1, -4, 6)$  externally in the ratio 2:3

$$x = \frac{2(1) - 3(-2)}{2-3}, y = \frac{2(-4) - 3(3)}{2-3}, \text{ and } z = \frac{2(6) - 3(5)}{2-3}$$

$$\text{i.e., } x = -8, y = 17, \text{ and } z = 3$$

Thus, the coordinates of the required point are  $(-8, 17, 3)$ .

#### Question 2:

Given that P  $(3, 2, -4)$ , Q  $(5, 4, -6)$  and R  $(9, 8, -10)$  are collinear. Find the ratio in which Q divides PR.

#### Solution 2:

Let point Q  $(5, 4, -6)$  divide the line segment joining points P  $(3, 2, -4)$  and R  $(9, 8, -10)$  in the ratio k:1.

Therefore, by section formula,

$$(5, 4, -6) = \left( \frac{k(9) + 3}{k+1}, \frac{k(8) + 2}{k+1}, \frac{k(-10) - 4}{k+1} \right)$$

$$\Rightarrow \frac{9k + 3}{k+1} = 5$$

$$\Rightarrow 9k + 3 = 5k + 5$$

$$\Rightarrow 4k = 2$$

$$\Rightarrow k = \frac{2}{4} = \frac{1}{2}$$

Thus, point Q divides PR in the ratio 1:2.

---

**Question 3:**

Find the ratio in which the YZ-plane divides the line segment formed by joining the points  $(-2, 4, 7)$  and  $(3, -5, 8)$ .

**Solution 3:**

Let the YZ plane divide the line segment joining points  $(-2, 4, 7)$  and  $(3, -5, 8)$  in the ratio  $k:1$ .

Hence, by section formula, the coordinates of point of intersection are given by

$$\left( \frac{k(3) - 2}{k + 1}, \frac{k(-5) + 4}{k + 1}, \frac{k(8) + 7}{k + 1} \right)$$

On the YZ plane, the x-coordinate of any point is zero.

$$\Rightarrow \frac{3k - 2}{k + 1} = 0$$

$$\Rightarrow 3k - 2 = 0$$

$$\Rightarrow k = \frac{2}{3}$$

Thus, the YZ plane divides the line segment formed by joining the given points in the ratio 2:3.

---

**Question 4:**

Using section formula, show that the points A  $(2, -3, 4)$ , B  $(-1, 2, 1)$  and C  $\left(0, \frac{1}{3}, 2\right)$  are collinear.

**Solution 4:**

The given points are A  $(2, -3, 4)$ , B  $(-1, 2, 1)$ , and C  $\left(0, \frac{1}{3}, 2\right)$

Let P be a point that divides AB in the ratio  $k:1$ .

Hence, by section formula, the coordinates of P are given by

$$\left( \frac{k(-1) + 2}{k + 1}, \frac{k(2) - 3}{k + 1}, \frac{k(1) + 4}{k + 1} \right)$$

Now, we find the value of k at which point P coincides with point C.

By taking  $\frac{-k + 2}{k + 1} = 0$ , we obtain  $k = 2$ .

For  $k = 2$ , the coordinates of point P are  $\left(0, \frac{1}{3}, 2\right)$

i.e.,  $\left(0, \frac{1}{3}, 2\right)$  is a point that divides AB externally in the ratio 2:1 and is the same as point P.

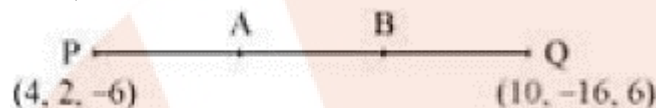
Hence, points A, B, and C are collinear.

**Question 5:**

Find the coordinates of the points which trisect the line segment joining the points P (4, 2, -6) and Q (10, -16, 6).

**Solution 5:**

Let A and B be the points that trisect the line segment joining points P (4, 2, -6) and Q (10, -16, 6)



Point A divides PQ in the ratio 1:2. Therefore, by section formula, the coordinates of point A are given by

$$\left( \frac{1(10) + 2(4)}{1+2}, \frac{1(-16) + 2(2)}{1+2}, \frac{1(6) + 2(-6)}{1+2} \right) = (6, -4, -2)$$

Point B divides PQ in the ratio 2:1. Therefore, by section formula, the coordinates of point B are given by

$$\left( \frac{2(10) + 1(4)}{2+1}, \frac{2(-16) + 1(2)}{2+1}, \frac{2(6) + 1(-6)}{2+1} \right) = (8, -10, 2)$$

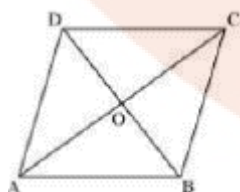
Thus, (6, -4, -2) and (8, -10, 2) are the points that trisect the line segment joining points P (4, 2, -6) and Q (10, -16, 6).

**Miscellaneous Exercise****Question 1:**

Three vertices of a parallelogram ABCD are A (3, -1, 2), B (1, 2, -4) and C (-1, 1, 2). Find the coordinates of the fourth vertex.

**Solution 1:**

The three vertices of a parallelogram ABCD are given as A (3, -1, 2), B (1, 2, -4), and C (-1, 1, 2). Let the coordinates of the fourth vertex be D (x, y, z).



We know that the diagonals of a parallelogram bisect each other.

Therefore, in parallelogram ABCD, AC and BD bisect each other.

∴ Mid-point of AC = Mid-point of BD



$$\Rightarrow \left( \frac{3-1}{2}, \frac{-1+1}{2}, \frac{2+2}{2} \right) = \left( \frac{x+1}{2}, \frac{y+2}{2}, \frac{z-4}{2} \right)$$

$$\Rightarrow (10, 2) = \left( \frac{x+1}{2}, \frac{y+2}{2}, \frac{z-4}{2} \right)$$

$$\Rightarrow \frac{x+1}{2} = 1, \frac{y+2}{2} = 0, \text{ and } \frac{z-4}{2} = 2$$

$$\Rightarrow x = 1, y = 2 \text{ and } z = 8$$

Thus, the coordinates of the fourth vertex are (1, -2, 8).

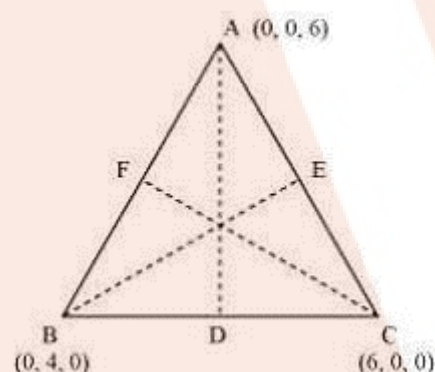
---

### Question 2:

Find the lengths of the medians of the triangle with vertices A (0, 0, 6), B (0, 4, 0) and (6, 0, 0).

### Solution 2:

Let AD, BE, and CF be the medians of the given triangle ABC



Since AD is the median, D is the mid-point of BC

$$\text{Coordinates of point D} = \left( \frac{0+6}{2}, \frac{4+0}{2}, \frac{0+0}{2} \right) = (3, 2, 0)$$

$$AD = \sqrt{(0-3)^2 + (0-2)^2 + (6-0)^2} = \sqrt{9+4+36} = \sqrt{49} = 7$$

Since BE is the median, E is the mid-point of AC.

$$\text{Coordinate of point E} = \left( \frac{0+6}{2}, \frac{0+0}{2}, \frac{0+6}{2} \right) = (3, 0, 3)$$

$$BE = \sqrt{(3-0)^2 + (0-4)^2 + (3-0)^2} = \sqrt{9+16+9} = \sqrt{34}$$

Since CF is the median, F is the mid-point of AB

$$\text{Coordinates of point F} = \left( \frac{0+0}{2}, \frac{0+4}{2}, \frac{6+0}{2} \right) = (0, 2, 3)$$

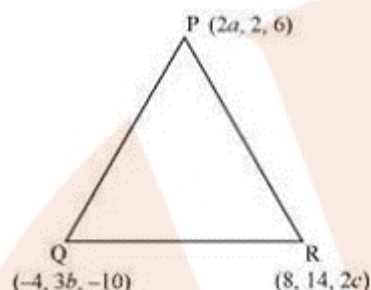
$$\text{Length of CF} = \sqrt{(6-0)^2 + (0-2)^2 + (0-3)^2} = \sqrt{36+4+9} = \sqrt{49} = 7$$

Thus, the lengths of the medians of  $\triangle ABC$  are 7,  $\sqrt{34}$ , and 7.

---

**Question 3:**

If the origin is the centroid of the triangle PQR with vertices P (2a, 2, 6), Q (-4, 3b, -10) and R (8, 14, 2c), then find the values of a, b and c.

**Solution 3:**

It is known that the coordinates of the centroid of the triangle, whose vertices are  $(x_1, y_1, z_1)$ ,  $(x_2, y_2, z_2)$  and  $(x_3, y_3, z_3)$ , are

$$\frac{x_1 + x_2 + x_3}{3}, \frac{y_1 + y_2 + y_3}{3}, \frac{z_1 + z_2 + z_3}{3}$$

Therefore, coordinates of the centroid of

$$\Delta PQR = \left( \frac{2a - 4 + 8}{3}, \frac{2 + 3b + 14}{3}, \frac{6 - 10 + 2c}{3} \right) = \left( \frac{2a + 4}{3}, \frac{3b + 16}{3}, \frac{2c - 4}{3} \right)$$

It is given that origin is the centroid of  $\Delta PQR$

$$\Rightarrow \frac{2a + 4}{3} = 0, \frac{3b + 16}{3} = 0 \text{ and } \frac{2c - 4}{3} = 0$$

$$\Rightarrow a = -2, b = -\frac{16}{3} \text{ and } c = 2$$

Thus, the respective values of a, b and c are  $-2, -\frac{16}{3}$  and 2

**Question 4:**

Find the coordinates of a point on y-axis which are at a distance of  $5\sqrt{2}$  from the point P (3, -2, 5).

**Solution 4:**

If a point is on the y-axis, then x-coordinate and the z-coordinate of the point are zero.

Let A (0, b, 0) be the point on the y-axis at a distance of  $5\sqrt{2}$  from point P (3, -2, 5).

Accordingly,  $AP = 5\sqrt{2}$

$$\begin{aligned} \Rightarrow AP^2 &= 50 \\ \Rightarrow (3-0)^2 + (-2-b)^2 + (5-0)^2 &= 50 \\ \Rightarrow 9 + 4 + b^2 + 4b + 25 &= 50 \\ \Rightarrow b^2 + 4b - 12 &= 0 \\ \Rightarrow b^2 + 6b - 2b - 12 &= 0 \\ \Rightarrow (b+6)(b-2) &= 0 \\ \Rightarrow b &= -6 \text{ or } 2 \end{aligned}$$

Thus, the coordinate of the required points are (0, 2, 0) and (0, -6, 5)

---

### Question 5:

A point R with x-coordinate 4 lies on the line segment joining the points P (2, -3, 4) and Q (8, 0, 10). Find the coordinates of the point R.

[Hint: suppose R divides PQ in the ratio k: 1.] The coordinates of the point R are given by

### Solution 5:

The coordinates of points P and Q are given as P (2, -3, 4) and Q (8, 0, 10). Let R divide line segment PQ in the ratio k:1.

Hence, by section formula, the coordinates of point R are given by

$$\left( \frac{k(8) + 2}{k + 1}, \frac{k(0) - 3}{k + 1}, \frac{k(10) + 4}{k + 1} \right) = \left( \frac{8k + 2}{k + 1}, \frac{-3}{k + 1}, \frac{10k + 4}{k + 1} \right)$$

It is given that the x-coordinate of point R is 4

$$\begin{aligned} \frac{8k + 2}{k + 1} &= 4 \\ 8k + 2 &= 4k + 4 \\ 4k &= 2 \\ k &= \frac{1}{2} \end{aligned}$$

Therefore, the coordinates of points R are

$$\left( 4, \frac{-3}{\frac{1}{2} + 1}, \frac{10\left(\frac{1}{2}\right) + 4}{\frac{1}{2} + 1} \right) = (4, -2, 6)$$


---

### Question 6:

If A and B be the points (3, 4, 5) and (-1, 3, -7), respectively, find the equation of the set of points P such that  $PA^2 + PB^2 = k^2$ , where k is a constant.

### Solution 6:



The coordinates of points A and B are given as (3, 4, 5) and (-1, 3, -7) respectively. Let the coordinates of point P be (x, y, z).

On using distance formula, we obtain

$$\begin{aligned}PA^2 &= (x-3)^2 + (y-4)^2 + (z-5)^2 \\&= x^2 + 9 - 6x + y^2 + 16 - 8y + z^2 + 25 - 10z \\&= x^2 - 6x + y^2 - 8y + z^2 - 10z + 50\end{aligned}$$

$$\begin{aligned}PB^2 &= (x-1)^2 + (y-3)^2 + (z-7)^2 \\&= x^2 - 2x + y^2 - 6y + z^2 + 14z + 59\end{aligned}$$

Now, if  $PA^2 + PB^2 = k^2$ , then

$$(x^2 - 6x + y^2 - 8y + z^2 - 10z + 50) + (x^2 + 2x + y^2 - 6y + z^2 + 14z + 59) = k^2$$

$$\Rightarrow 2x^2 + 2y^2 + 2z^2 - 4x - 14y + 4z + 109 = k^2$$

$$\Rightarrow 2(x^2 + y^2 + z^2 - 2x - 7y + 2z) = k^2 - 109$$

$$\Rightarrow x^2 + y^2 + z^2 - 2x - 7y + 2z = \frac{k^2 - 109}{2}$$

Thus, the required equation is  $x^2 + y^2 + z^2 - 2x - 7y + 2z = \frac{k^2 - 109}{2}$ .

---



Access of Full  
Syllabus Course



Crash Course to Revise  
Entire Syllabus



Test Series and  
Assignment



Chapter Wise Course to  
help you master One chapter



Notes & Recordings  
of every class



Unlimited In-class  
Doubt Solving




Use **VPROP** & Get Extra **20% OFF**

**Subscribe Now**

<https://vdnt.in/VPROP>

**GRADES 6-12 | CBSE | ICSE | JEE | NEET**

# Download **Vedantu Learning APP**

-  Free LIVE MasterClasses
-  Unlimited Access to Study Materials
-  Specially Designed Tests



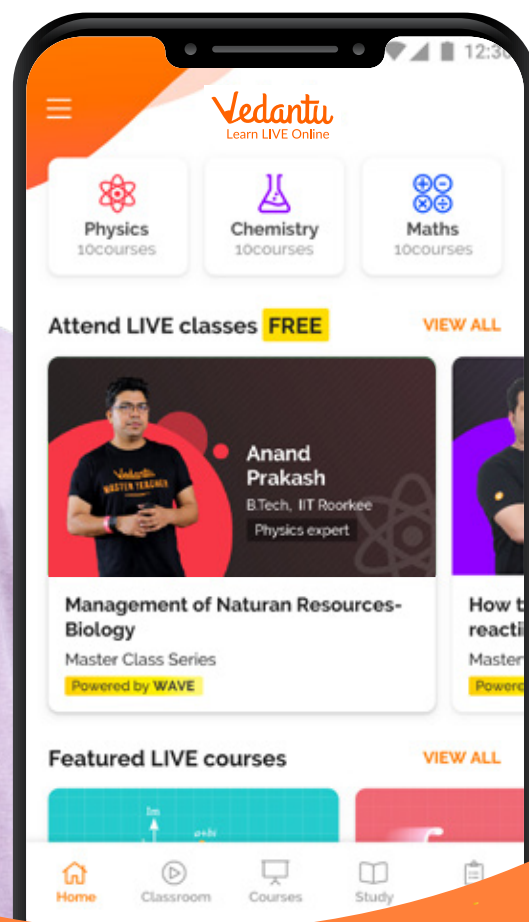
**Google Play**

Best of 2019 Winner

**USER'S CHOICE  
APP AWARD 2019**



Category  
**Everyday Essentials**



**DOWNLOAD  
THE APP**



GET IT ON  
**Google Play**



Download on the  
**App Store**

**Thank You**  
for downloading the PDF



**Samajh Aayega toh  
Maza Aayega!!**

**Vedantu**

## **FREE MASTER CLASS SERIES**

- ✓ For **Grades 6-12th** targeting **JEE, NEET, CBSE, ICSE** & many more
- ✓ **Free 60 Minutes LIVE Interactive** classes everyday
- ✓ Learn from India's **Best Master Teachers**

Register for **FREE**

Limited Seats!