



## MATHS

# BOOKS - OBJECTIVE RD SHARMA MATHS VOL I (HINGLISH)

## THREE DIMENSIONAL COORDINATE SYSTEM

### Illustration

1. In the following figure, if the coordinates of  $P$  are  $(a, b, c)$  then the coordinates of  $A$ ,  $B$  and  $C$  are respectively

A.  $(a, 0, 0)$ ,  $(b, 0, 0)$ ,  $(c, 0, 0)$

B.  $(a, 0, 0)$ ,  $(0, b, 0)$ ,  $(0, 0, c)$

C.  $(0, 0, a)$ ,  $(0, b, 0)$ ,  $(c, 0, 0)$

D.  $(a, b, c)$ ,  $(b, c, a)$ ,  $(c, a, b)$

**Answer: A**



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2. In Fig 4 the coordinates of point D are

A.  $(b, a, 0)$

B.  $(a, b, 0)$

C.  $(b, c, 0)$

D.  $(0, b, c)$

**Answer: B**



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3. In fig. 28.7 if the coordinates of point  $P$  are  $(a, b, c)$  then Write the coordinates of points A, B, C, D, E and F. Write the coordinates of the feet of the perpendiculars from the point P to the coordinate axes. Write the coordinates of the feet of the perpendicular from the point  $P$  on the coordinate planes  $XY$ ,  $YZ$  and  $ZX$ . Find the perpendicular distances of point  $P$  from  $XY$ ,  $YZ$  and  $ZX$  – planes. Find the perpendicular distances of the point  $P$  from the coordinate axes. Find the coordinates of the reflection of  $P$  are  $(a, b, c)$ . Therefore  $OA = a$ ,  $OB = b$  and  $OC = c$ .

A.  $(a, b, 0)$ ,  $(0, b, c)$ ,  $(a, 0, c)$

B.  $(a, b, 0)$ ,  $(b, c, 0)$ ,  $(a, c, 0)$

C.  $(0, b, c)$ ,  $(a, 0, c)$ ,  $(a, b, 0)$

D.  $(a, 0, c)$ ,  $(0, b, c)$ ,  $(a, b, 0)$

**Answer: A**



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4. In fig. 28.7 if the coordinates of point  $P$  are  $(a, b, c)$  then Write the coordinates of points A, B, C, D, E and F. Write the coordinates of the feet of the perpendiculars from the point P to the coordinate axes. Write the coordinates of the feet of the perpendicular from the point  $P$  on the coordinate planes  $XY$ ,  $YZ$  and  $ZX$ . Find the perpendicular distances of point  $P$  from  $XY$ ,  $YZ$  and  $ZX$  – planes. Find the perpendicular distances of the point  $P$  from the coordinate axes. Find the coordinates of the reflection of  $P$  are  $(a, b, c)$ . Therefore  $OA = a$ ,  $OB = b$  and  $OC = c$ .

A.  $a, b, c$

B.  $b, c, a$

C.  $c, a, b$

D. none of these

**Answer: C**



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5. In fig. 28.7 if the coordinates of point  $P$  are  $(a, b, c)$  then Write the coordinates of points A, B, C, D, E and F. Write the coordinates of the feet of the perpendiculars from the point P to the coordinate axes. Write the coordinates of the feet of the perpendicular from the point  $P$  on the coordinate planes  $XY$ ,  $YZ$  and  $ZX$ . Find the perpendicular distances of point

$P$  from  $XY$ ,  $YZ$  and  $ZX$  – planes. Find the perpendicular distances of the point  $P$  from the coordinate axes. Find the coordinates of the reflection of  $P$  are  $(a, b, c)$ . Therefore  $OA = a$ ,  $OB = b$  and  $OC = c$ .

A.  $\sqrt{a^2 + b^2}$ ,  $\sqrt{b^2 + c^2}$ ,  $\sqrt{c^2 + a^2}$

B.  $\sqrt{b^2 + c^2}$ ,  $\sqrt{c^2 + a^2}$ ,  $\sqrt{a^2 + b^2}$

C.  $\sqrt{c^2 + a^2}$ ,  $\sqrt{a^2 + b^2}$ ,  $\sqrt{b^2 + c^2}$

D.  $a, b, c$

**Answer: B**



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6. In Fig if the coordinates of  $P$  are  $(a, b, c)$  then the reflections or images of  $P$  in  $XY$ ,  $YZ$  and  $ZX$ -planes are

A.  $(a, b, -c), (-a, b, c), (a, -b, c)$

B.  $(a, -b, -c), (-a, b, -c), (-a, -b, c)$

C.  $(-a, -b, c), (a, -b, -c), (-a, b, -c)$

D.  $(a, b, 0), (0, b, c), (a, 0, c)$

**Answer: A**



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7. If planes are drawn parallel to the coordinate planes through the points  $P(x_1, y_1, z_1)$  and  $Q(x_2, y_2, z_2)$  then the lengths of the edges of the parallelepiped formed are

A.  $x_2 - x_1, y_2 - y_1, z_2 - z_1$

B.  $x_2 + x_1, y_2 + y_1, z_2 + z_1$

C.  $x_1x_2, y_1y_2, z_1z_2$

D. none of these

**Answer: A**



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**8.** The perpendicular distance of the point  $(6, 5, 8)$  from y-axis is

A. 5 units

B. 6 units

C. 8 units

D. 10 units

**Answer: D**





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9. If the extremities (end points) of a diagonal of a square are  $(1, -2, 3)$  and  $(2, -3, 5)$  then find the length of the side of square.

A.  $\sqrt{6}$

B.  $\sqrt{3}$

C.  $\sqrt{5}$

D.  $\sqrt{7}$

**Answer: B**



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10. The point equidistant from the  $O(0, 0, 0)$ ,  $A(a, 0, 0)$ ,  $B(0, b, 0)$  and  $C(0, 0, c)$  has the coordinates

A.  $(a, b, c)$

B.  $(a/2, b/2, c/2)$

C.  $(a/3, b/3, c/3)$

D.  $(a/4, b/4, c/4)$

**Answer: B**



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11. Determine the point in  $XY - plane$  which is equidistant from three points  $A(2, 0, 3)$ ,  $B(0, 3, 2)$  and  $C(0, 0, 1)$ .

A.  $(2, 0, 8)$

B.  $(0, 3, 1)$

C.  $(3, 2, 0)$

D.  $(3, 2, 1)$

**Answer: C**



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**12.** The cosine of the angle of the triangle with vertices

$A(1, -1, 2)$ ,  $B(6, 11, 2)$  and  $C(1, 2, 6)$  is

A.  $\frac{63}{65}$

B.  $\frac{36}{65}$

C.  $\frac{16}{65}$

D.  $\frac{13}{64}$

**Answer: B**



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**13.** Let  $P(2, -1, 4)$  and  $Q(4, 3, 2)$  are two points and as point  $R$  on  $PQ$  is such that  $3PQ = 5QR$ , then the coordinates of  $R$  are

A.  $\left(\frac{14}{5}, \frac{3}{5}, \frac{16}{5}\right)$

B.  $\left(\frac{16}{5}, \frac{7}{5}, \frac{14}{5}\right)$

C.  $\left(\frac{11}{4}, \frac{1}{2}, \frac{13}{4}\right)$

D. none of these

**Answer: A**



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14. Let  $A(2, -1, 4)$  and  $B(0, 2, -3)$  be the points and C be a point on AB produced such that  $2AC = 3AB$ , then the coordinates of C are

A.  $\left(\frac{1}{2}, \frac{5}{4}, -\frac{5}{4}\right)$

B.  $\left(-\frac{1}{2}, \frac{7}{4}, -\frac{13}{4}\right)$

C.  $(6, -7, 18)$

D. none of these

**Answer: D**



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15. Find the ratio in which the line joining the points  $(1, 2, 3)$  and  $(-3, 4, -5)$  is divided by the  $xy$  - plane . Also, find the coordinates of the point of division.

- A. 3:5 internally
- B. 5:3 externally
- C. 3:5 externally
- D. 5:3 internally

**Answer: A**



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16. In  $\triangle ABC$  the mid points of the sides AB, BC and CA are  $(l, 0, 0)$ ,  $(0, m, 0)$  and  $(0, 0, n)$  respectively. Then,

$\frac{AB^2 + BC^2 + CA^2}{l^2 + m^2 + n^2}$  is equal to

A. 2

B. 4

C. 8

D. 16

**Answer: C**

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17. The coordinates of the points where the line segment joining  $A(5, 1, 6)$  and  $B(3, 4, 1)$  crosses the  $yz$ -plane are

A.  $\left(0, \frac{17}{2}, \frac{13}{2}\right)$

B.  $\left(0, -\frac{17}{2}, \frac{13}{2}\right)$

C.  $\left(0, \frac{17}{2}, -\frac{13}{2}\right)$

D.  $\left(0, -\frac{17}{2}, -\frac{13}{2}\right)$

**Answer: C**



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**18.** The ratio in which the join of the points  $A(2, 1, 5)$  and  $B(3, 4, 3)$  is divided by the plane  $2x + 2y - 2z = 1$ , is

A. 7: 5

B. 5: 7

C. 5: 3

D. 3: 5

**Answer: B**





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19. If a line makes angle  $\alpha$ ,  $\beta$  and  $\gamma$  with the axes respectively then  $\sin^2 \alpha + \sin^2 \beta + \sin^2 \gamma =$

A. 1

B. 2

C. 3

D. none of these

**Answer: B**



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20. If a line makes angle  $\alpha$ ,  $\beta$  and  $\gamma$  with the coordinate axes respectively, then  $\cos 2\alpha + \cos 2\beta + \cos 2\gamma =$

A. 2

B. -1

C. 1

D. 2

**Answer: B**



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21. If a line makes angle  $\frac{\pi}{3}$  and  $\frac{\pi}{4}$  with x-axis and y-axis respectively then the angle made by the line with z-axis, is

A.  $\frac{\pi}{2}$

B.  $\frac{\pi}{3}$

C.  $\frac{\pi}{4}$

D.  $\frac{5\pi}{12}$

**Answer: B**



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22. The direction cosines of a vector  $\vec{r}$  which is equally inclined with OX, OY and OZ are

A.  $\pm \frac{1}{\sqrt{3}}, \pm \frac{1}{\sqrt{3}}, \pm \frac{1}{\sqrt{3}}$

B.  $\pm \frac{1}{3}, \pm \frac{1}{3}, \pm \frac{1}{3}$

C.  $\pm \frac{1}{\sqrt{2}}, \pm \frac{1}{2}, \pm \frac{1}{2}$

D. none of these

**Answer: A**



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23. A vector  $\vec{r}$  is inclined at equal to  $OX$ ,  $OY$  and  $OZ$ . If the magnitude of  $\vec{r}$  is 6 units, find  $\vec{r}$ .

A.  $\sqrt{3}(\pm \hat{i} \pm \hat{j} \pm \hat{k})$

B.  $2\sqrt{3}(\pm \hat{i} \pm \hat{j} \pm \hat{k})$

C.  $6(\pm \hat{i} \pm \hat{j} \pm \hat{k})$

D. none of these

**Answer: B**



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24. If OA is equally inclined to OX,OY ,OZ and if A is  $\sqrt{3}$  units from the origin then the coordinates of A are

A.  $(3, 3, 3)$

B.  $(-1, 1, -1)$

C.  $(-1, 1, 1)$

D.  $(1, 1, 1)$

**Answer: D**



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25. If  $\frac{1}{2}, \frac{1}{3}, n$  are direction cosines of a line, then the value of  $n$  is

A.  $\frac{\sqrt{23}}{6}$

B.  $\frac{23}{6}$

C.  $\frac{2}{3}$

D.  $\frac{1}{6}$

**Answer: A**



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**26.** If the direction ratios of a lines are proportional to

1, - 3, 2 then its direction cosines are

A.  $\frac{1}{\sqrt{14}}, \frac{-3}{\sqrt{14}}, \frac{2}{\sqrt{14}},$

B.  $\frac{1}{\sqrt{14}}, \frac{2}{\sqrt{14}}, \frac{3}{\sqrt{14}}$

C.  $-\frac{1}{\sqrt{14}}, \frac{3}{\sqrt{14}}, \frac{2}{\sqrt{14}}$

D.  $-\frac{1}{\sqrt{14}}, \frac{-2}{\sqrt{14}}, \frac{-3}{\sqrt{14}}$

**Answer: A**



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27. The projections of a line segment on the coordinate axes are 12,4,3 respectively. The length and direction cosines of the line segment are

A. 13,  $\frac{12}{13}, \frac{4}{13}, \frac{3}{13}$

B. 19,  $\frac{12}{19}, \frac{4}{19}, \frac{3}{19}$

C. 11,  $\frac{12}{11}, \frac{14}{11}, \frac{3}{11}$

D. none of these

**Answer: A**



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28. If  $\vec{r}$  is a vector of magnitude 21 and has direction ratios proportional to 2,-3,6 then  $\vec{r}$  is equal to

A.  $6\hat{i} + 9\hat{j} - 18\hat{k}$

B.  $6\hat{i} - 9\hat{j} - 18\hat{k}$

C.  $6\hat{i} - 9\hat{j} + 18\hat{k}$

D. none of these

**Answer: C**



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29. If  $P(x, y, z)$  is a point on the line segment joining  $Q(2, 2, 4)$  and  $R(3, 5, 6)$  such that projections of  $\overrightarrow{OP}$  on the axes are  $\frac{13}{5}$ ,  $\frac{19}{5}$ ,  $\frac{26}{5}$  respectively, then  $P$  divides  $QR$  in the ratio

A. 1:2

B. 3:2

C. 2:3

D. 3:1

**Answer: B**



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30. The direction cosines of the line passing through  $P(2, 3, -1)$  and the origin are

A.  $\frac{2}{\sqrt{14}}, \frac{3}{\sqrt{14}}, \frac{1}{\sqrt{14}}$

B.  $\frac{2}{\sqrt{14}}, -\frac{3}{\sqrt{14}}, \frac{1}{\sqrt{14}}$

C.  $-\frac{2}{\sqrt{14}}, -\frac{3}{\sqrt{14}}, \frac{1}{\sqrt{14}}$

D.  $-\frac{2}{\sqrt{14}}, -\frac{3}{\sqrt{14}}, -\frac{1}{\sqrt{14}}$

**Answer: D**



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31. The projection of the line segment joining the points  $A(-1, 0, 3)$  and  $B(2, 5, 1)$  on the line whose direction ratios are proportional to 6,2,3 is

A.  $\frac{10}{7}$

B.  $\frac{22}{7}$

C.  $\frac{18}{7}$

D. none of these

**Answer: B**



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**32.** Find the direction cosines of a vector  $\vec{r}$  which is equally inclined with OX, OY and OZ are

A.  $\pm \frac{1}{\sqrt{3}}, \pm \frac{1}{\sqrt{3}}, \pm \frac{1}{\sqrt{3}}$

B.  $\pm \frac{1}{3}, \pm \frac{1}{3}, \pm \frac{1}{3}$

C.  $\pm \frac{1}{\sqrt{2}}, \pm \frac{1}{2}, \pm \frac{1}{2}$

D. none of these

**Answer: A**



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**33.** A vector  $\vec{r}$  is inclined at equal to  $OX$ ,  $OY$  and  $OZ$ . If the magnitude of  $\vec{r}$  is 6 units, find  $\vec{r}$ .



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**34.** Find the angle between two lines whose direction ratios are proportional to  $1, 1, 2$  and  $(\sqrt{3} - 1), (-\sqrt{3} - 1), 4$ .

A.  $45^\circ$

B.  $30^\circ$

C.  $60^\circ$

D.  $90^\circ$

**Answer: A**



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35. If  $P(0, 1, 2)$ ,  $Q(4, -2, 1)$  and  $O(0, 0, 0)$  are three points, then  $\angle POQ =$

A.  $\frac{\pi}{6}$

B.  $\frac{\pi}{4}$

C.  $\frac{\pi}{3}$

D.  $\frac{\pi}{2}$

**Answer: D**



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36. If A,B,C,D are  $(2,3,-1),(3,5,-3),(1,2,3),(3,5,7)$  respectively, then the angle between AB and CD, is

A.  $\frac{\pi}{2}$

B.  $\frac{\pi}{3}$

C.  $\frac{\pi}{4}$

D.  $\frac{\pi}{6}$

Answer: A



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37. Find the acute angle between the two straight lines whose direction cosines are given by  $l + m + n = 0$  and  $l^2 + m^2 - n^2 = 0$

A.  $\frac{\pi}{2}$

B.  $\frac{\pi}{3}$

C.  $\frac{\pi}{4}$

D.  $\frac{\pi}{6}$

**Answer: B**



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38. ABC is a triangle in a plane with vertices  $A(2, 3, 5)$ ,  $B(-1, 3, 2)$  and  $C(\lambda, 5, \mu)$ . If the median

through A is equally inclined to the coordinate axes, then the value of  $\lambda^3 + \mu^3 + 5$  is

- A. 676
- B. 1130
- C. 1348
- D. 1077

**Answer: C**



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## Section I Solved Mcqs

1. For every point  $P(x, y, z)$  on the  $xy$ -plane, a.  $x = 0$  b.  $y = 0$  c.  $z = 0$  d.  $x = y = z = 0$



A.  $x = 0$

B.  $y = 0$

C.  $z = 0$

D. none of these

**Answer: C**



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2. For every point  $P(x, y, z)$  on the x-axis, (except the origin),

A.  $x = 0, y = 0, y \neq 0$

B.  $x = 0, z = 0, y \neq 0$

C.  $y = 0, z = 0, x \neq 0$

D. none of these

**Answer: C**



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3. A rectangular parallelepiped is formed by planes drawn through the points  $(5, 7, 9)$  and  $(2, 3, 7)$  parallel to the coordinate planes. The length of an edge of this rectangular parallelepiped is

A. 2

B. 3

C. 4

D. all of these

**Answer: D**



4. A parallelepiped is formed by planes drawn through the points  $(2, 3, 5)$  and  $(5, 9, 7)$ , parallel to the coordinate planes.

The length of a diagonal of the parallelepiped is 7 unit b.  $\sqrt{38}$  unit c.  $\sqrt{155}$  unit d. none of these

A. 7

B.  $\sqrt{38}$

C.  $\sqrt{155}$

D. none of these

**Answer: A**



5. The  $xy$ -plane divides the line joining the points  $(-1,3,4)$  and  $(2,-5,6)$

A. internally in the ratio 2:3

B. externally in the ratio 2:3

C. internally in the ratio 3:2

D. externally in the ratio 3:2

**Answer: B**



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6. The points

$A(5, -1, 1)$ ,  $B(7, -4, 7)$ ,  $C(1, -6, 10)$  and  $D(-1, -3, 4)$

are the vertices of a

A. trapezium

B. rectangle

C. rhombus

D. square

**Answer: C**



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7. A line makes an angle of  $60^\circ$  with each of X-axis and Y-axis.

Find the acute angle made by the line with Z-axis.

A.  $30^\circ$

B.  $60^\circ$

C.  $75^\circ$

D.  $45^\circ$

**Answer: D**



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8. If the direction cosines of a line are  $\frac{1}{c}, \frac{1}{c}, \frac{1}{c}$  then (A)  $c > 0$

(B)  $0 < c < 1$  (C)  $c = \pm \sqrt{3}$  (D)  $c > 2$

A.  $0 < c < 1$

B.  $c > 2$

C.  $c > 0$

D.  $c = \pm \sqrt{3}$

**Answer: D**



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9. Find the acute angle between the two straight lines whose direction cosines are given by  $l + m + n = 0$  and  $l^2 + m^2 - n^2 = 0$

A. 0

B.  $\pi/6$

C.  $\pi/4$

D.  $\pi/3$

**Answer: D**



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10. The direction ratios of two lines are given by  $a + b + c = 0$ ,  $2ab + 2ac - bc = 0$ . Then the angle between the lines is

A.  $\pi$

B.  $\frac{2\pi}{3}$

C.  $\frac{\pi}{2}$

D.  $\frac{\pi}{3}$

**Answer: B**



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11. Find the angle between the following pair of lines: A line with direction ratios 2,2,1 and a line joining (3,1,4) to (7,2,12)



A.  $\cos^{-1}\left(\frac{2}{3}\right)$

B.  $\cos^{-1}\left(-\frac{2}{3}\right)$

C.  $\tan^{-1}\left(\frac{2}{3}\right)$

D. none of these

**Answer: A**



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12. The projection of the line joining the points  $(3, 4, 5)$  and  $(4, 6, 3)$  on the line joining the points  $(-1, 2, 4)$  and  $(1, 0, 5)$  is

A.  $\frac{4}{3}$

B.  $\frac{2}{3}$

C.  $\frac{1}{3}$

D.  $\frac{1}{2}$

**Answer: A**



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**13.** The projection of a line segment on the coordinate axes are 2,3,6. Then the length of the line segment is

A. 7

B. 5

C. 1

D. 11

**Answer: A**



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14. A line makes the same angle  $\theta$  with each of the  $x$  and  $z$ -axes. If the angle  $\beta$ , which it makes with  $y$ -axis, is such that  $\sin^2 \beta = 3 \sin^2 \theta$  then  $\cos^2 \theta$  equals

A.  $\frac{2}{5}$

B.  $\frac{1}{5}$

C.  $\frac{3}{5}$

D.  $\frac{2}{3}$

**Answer: C**



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15. A line AB in three-dimensional space makes angles  $45^\circ$  and  $120^\circ$  with the positive x-axis and the positive y-axis respectively. If AB makes an acute angle  $q$  with the positive z-axis, then  $q$  equals (1)  $45^\circ$  (2)  $60^\circ$  (3)  $75^\circ$  (4)  $30^\circ$

A.  $60^\circ$

B.  $75^\circ$

C.  $30^\circ$

D.  $45^\circ$

**Answer: A**



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16. The angle between the lines whose direction cosines satisfy the equations  $l + m + n = 0$  and  $l^2 = m^2 + n^2$  is

A.  $\pi/6$

B.  $\pi/2$

C.  $\pi/3$

D.  $\pi/4$

**Answer: C**



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**Exercise**

1. If the x-coordinate of a point  $P$  on the join of  $Q(2, 2, 1)$  and  $R(5, 1, -2)$  is 4, then its z-coordinate is

A. 2

B. 1

C. -1

D. -2

**Answer: C**



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2. The distance of the point  $P(a,b,c)$  from the x-axis is

A.  $\sqrt{b^2 + c^2}$

B.  $\sqrt{a^2 + c^2}$

C.  $\sqrt{a^2 + b^2}$

D.  $\sqrt{a^2 + b^2 + c^2}$

**Answer: A**



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**3.** Ratio in which the xy-plane divides the joint of  $(1, 2, 3)$  and  $(4, 2, 1)$ , is

A. 3: 1 internally

B. 3: 1 externally

C. 1: 2 internally

D. 2: 1 externally

**Answer: B**



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4. If  $P(3, 2, -4)$ ,  $Q(5, 4, -6)$  and  $R(9, 8, -10)$  are collinear, then  $R$  divides  $PQ$  in the ratio

- A. 3: 2 internally
- B. 3: 2 externally
- C. 2: 1 internally
- D. 2: 1 externally

**Answer: B**



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5.  $A(3, 2, 0)$ ,  $B(5, 3, 2)$ ,  $(-9, 6, -3)$  are the vertices of  $\triangle ABC$  and  $AD$  is the bisector of  $\angle BAC$  which meets at  $D$ .

Find the coordinates of  $D$ ,

- A.  $(19/8, 57/16, 17/16)$
- B.  $(-19/8, 57/16, 17/16)$
- C.  $(19/8, -57/16, 17/16)$
- D. none of these

**Answer: A**



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6. A line passes through the points  $(6, -7, -1)$  and  $(2, -3, 1)$ . Find the direction cosines of

the line if the line makes an acute angle with the positive direction of the x-axis.

A.  $\frac{2}{3}, -\frac{2}{3}, -\frac{1}{3}$

B.  $-\frac{2}{3}, \frac{2}{3}, \frac{1}{3}$

C.  $\frac{2}{3}, -\frac{2}{3}, \frac{1}{3}$

D.  $\frac{2}{3}, \frac{2}{3}, \frac{1}{3}$

**Answer: A**



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7. If a line makes angles  $\alpha, \beta, \gamma$  with the positive direction of coordinate axes, then write the value of  $\sin^2 \alpha + \sin^2 \beta + \sin^2 \gamma$ .

A. 1

B. 2

C. 3

D. 4

**Answer: B**



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8. If  $P$  is a point in space such that  $OP = 12$  and  $\overrightarrow{OP}$  is inclined at angle of  $45^\circ$  and  $60^\circ$  with  $OX$  and  $OY$  respectively, then the position vector of  $P$  is

A.  $6\hat{i} + t\hat{j} \pm 6\sqrt{2}\hat{k}$

B.  $6\hat{i} + 6\sqrt{2}\hat{j} \pm 6\hat{k}$

C.  $6\sqrt{2}\hat{i} + 6\sqrt{j} \pm 6\hat{k}$

D. none of these

**Answer: C**



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9. A vector  $\vec{OP}$  is inclined to  $OX$  at  $45^\circ$  and  $OY$  at  $60^\circ$ . Find the angle at which  $\vec{OP}$  is inclined to  $OZ$ .

A.  $75^\circ$

B.  $60^\circ$  or  $120^\circ$

C.  $75^\circ$  or  $105^\circ$

D.  $255^\circ$

**Answer: B**



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10. A vector  $\vec{r}$  is equally inclined with the coordinates axes. If the tip of  $\vec{r}$  is in the positive octant and  $|\vec{r}| = 6$ , then  $\vec{r}$  is

A.  $2\sqrt{3}(\hat{i} - \hat{j} + \hat{k})$

B.  $2\sqrt{3}(-\hat{i} + \hat{j} + \hat{k})$

C.  $2\sqrt{3}(\hat{i} + \hat{j} - \hat{k})$

D.  $2\sqrt{3}(\hat{i} + \hat{j} + \hat{k})$

Answer: D



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11. If  $\vec{r}$  is a vector of magnitude 21 and has direction ratios proportional to 2,-3,6 then  $\vec{r}$  is equal to

A.  $6\hat{i} - 9\hat{j} + 18\hat{k}$

B.  $6\hat{i} + 9\hat{j} + 18\hat{k}$

C.  $6\hat{i} - 9\hat{j} + 18\hat{k}$

D.  $6\hat{i} + 9\hat{j} - 18\hat{k}$

**Answer: A**



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12. The direction cosines of the lines bisecting the angle between the lines whose direction cosines are

$l_1, m_1, n_1$  and  $l_2, m_2, n_2$  and the angle between these lines

is  $\theta$ , are

A.  $\frac{l_1 + l_2}{2 \sin \theta / 2}, \frac{m_1 + m_2}{2 \sin \theta / 2}, \frac{n_1 + n_2}{2 \sin \theta / 2}$

B.  $\frac{l_1 + l_2}{2 \cos \theta / 2}, \frac{m_1 + m_2}{2 \cos \theta / 2}, \frac{n_1 + n_2}{2 \cos \theta / 2}$

C.  $\frac{l_1 - l_2}{2 \sin \theta / 2}, \frac{m_1 - m_2}{2 \sin \theta / 2}, \frac{n_1 - n_2}{2 \sin \theta / 2}$

D.  $\frac{l_1 - l_2}{2 \cos \theta / 2}, \frac{m_1 - m_2}{2 \cos \theta / 2}, \frac{n_1 - n_2}{2 \cos \theta / 2}$

**Answer: B**



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**13.** Find the coordinates of the foot of the perpendicular drawn from point  $A(1, 0, 3)$  to the join of points  $B(4, 7, 1)$  and  $C(3, 5, 3)$ .

A.  $(5/3, 7/3, 17/3)$

B.  $(5, 7, 17)$

C.  $(5/7, -7/3, 17/3)$

D.  $(-5/3, 7/3, -17/3)$

**Answer: A**



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**14.** The foot of the perpendicular drawn from a point with position vector  $\hat{i} + 4\hat{k}$  on the joining the points having position vectors as  $-11\hat{j} + 3\hat{k}$  and  $2\hat{i} - 3\hat{j} + \hat{k}$  has the position vector

A.  $4\hat{i} + 5\hat{j} + 5\hat{k}$



B.  $4\hat{i} + 5\hat{j} - 5\hat{k}$

C.  $5\hat{i} + 4\hat{j} - 5\hat{k}$

D.  $4\hat{i} - 5\hat{j} + 5\hat{k}$

**Answer: B**



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15. The projections of a directed line segment on the coordinate axes are 12,4,3. The direction cosines of the line are

A.  $\frac{12}{13}, -\frac{4}{13}, \frac{3}{13}$

B.  $-\frac{12}{13}, -\frac{4}{13}, \frac{3}{13}$

C.  $\frac{12}{13}, \frac{4}{13}, \frac{3}{13}$

D. none of these

Answer: C



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16. Let  $l_1, m_1, n_1; l_2, m_2, n_2$  and  $l_3, m_3, n_3$  be the direction cosines of three mutually perpendicular lines. Show that the direction ratios of the line which makes equal angles with each of them are

$$(l_1 + l_2 + l_3), (m_1 + m_2 + m_3), (n_1 + n_2 + n_3)$$

A.  $l_1 + l_2 + l_3, m_1 + m_2 + m_3, n_1 + n_2 + n_3$

B.  $\frac{l_1 + l_2 + l_3}{\sqrt{3}}, \frac{m_1 + m_2 + m_3}{\sqrt{3}}, \frac{n_1 + n_2 + n_3}{\sqrt{3}}$

C.  $\frac{l_1 + l_2 + l_3}{3}, \frac{m_1 + m_2 + m_3}{3}, \frac{n_1 + n_2 + n_3}{3}$

D. none of these

**Answer: B**



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17. If  $P(x, y, z)$  is a point on the line segment joining  $Q(2, 2, 4)$  and  $R(3, 5, 6)$  such that the projections of  $\vec{OP}$  on the axes are  $13/5$ ,  $19/5$  and  $26/5$ , respectively, then find the ratio in which  $P$  divides  $QR$ .

A. 1 : 2

B. 3 : 2

C. 2 : 3

D. 1 : 3

**Answer: B**



18. If  $O$  is the origin,  $OP = 3$  with direction ratios  $-1, 2, \text{ and } -2$ , then find the coordinates of  $P$ .

A.  $(-1, 2, -2)$

B.  $(1, 2, 2)$

C.  $(-19, 2/9, -2/9)$

D.  $(3, 5, -9)$

**Answer: A**



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19. A mirror and a source of light are situated at the origin  $O$  and at a point on  $OX$ , respectively. A ray of light from the source strikes the mirror and is reflected. If the direction ratios of the normal to the plane are  $1, -1, 1$ , then find the  $DCs$  of the reflected ray.

A.  $\frac{1}{3}, \frac{2}{3}, \frac{2}{3}$

B.  $-\frac{1}{3}, \frac{2}{3}, \frac{2}{3}$

C.  $-\frac{1}{3}, -\frac{2}{3}, -\frac{2}{3}$

D.  $-\frac{1}{3}, -\frac{2}{3}, \frac{2}{3}$

**Answer: D**



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20. Find the angle between any two diagonals of a cube.

A.  $30^\circ$

B.  $45^\circ$

C.  $\cos^{-1}\left(\frac{1}{\sqrt{3}}\right)$

D.  $\cos^{-1}\left(\frac{1}{3}\right)$

**Answer: D**



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21. A line makes angles  $\alpha$ ,  $\beta$ ,  $\gamma$  and  $\delta$  with the diagonals of a cube, prove that  $\cos^2 \alpha + \cos^2 \beta + \cos^2 \gamma + \cos^2 \delta = \frac{4}{3}$

A.  $1/3$

B.  $\frac{2}{3}$

C.  $\frac{4}{3}$

D.  $\frac{8}{3}$

**Answer: C**



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**22.** If  $P(0, 1, 2)$ ,  $Q(4, -2, 1)$  and  $O(0, 0, 0)$  are three points

then  $\angle POQ = \frac{\pi}{6}$  b.  $\frac{\pi}{4}$  c.  $\frac{\pi}{3}$  d.  $\frac{\pi}{2}$

A.  $\frac{\pi}{6}$

B.  $\frac{\pi}{4}$

C.  $\frac{\pi}{3}$

D.  $\frac{\pi}{2}$

**Answer: D**



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