Unit 13 · Coordinates in Space

WORKSHEET

Full marks 35

Name _____ Class _____ Roll no. _____ Date _____ Marks _____ / 35

1 Key words [3]

Fill in the blanks with words from the box. Two words in the box are not needed. Each blank carries 0.5 mark.

collinear	coordinate plane	direction cosines	direction ratios	octant	origin	parallel	right-handed

The point where the three axes meet is the _____. Each pair of axes fixes a _____, and the three planes cut space into eight parts. The cosines of the angles a line makes with the positive axes are its _____; any three numbers proportional to them are its _____. The axes are drawn _____: curl the fingers of your right hand from OX to OY and the thumb points along OZ. Points that lie on one straight line are _____.

2 True or false [3]

Write ✓ for a true statement and ✗ for a false one. Correct the false ones.

i. The point $(0, 0, -5)$ lies on the Z-axis. ☐

ii. Every point in the ZX-plane has $z = 0$. ☐

iii. 1, 2, 3 can be the direction cosines of a line. ☐

iv. A line can make 45° with each of the three axes. ☐

v. Lines with direction ratios $2, -4, 6$ and $-1, 2, -3$ are parallel. ☐

vi. The distance of $P(x, y, z)$ from the X-axis is $|x|$. ☐

3 Multiple choice [6]

Choose the correct option for each of the following questions.

i. A point on the Y-axis has coordinates of the form: [1]

a. $(x, 0, z)$ **b.** $(0, y, 0)$

c. $(x, y, 0)$ **d.** $(0, y, z)$

ii. The distance of $(2, -6, 3)$ from the origin is: [1]

a. -1 **b.** 7

c. 11 **d.** 49

iii. The distance of $P(3, 7, -4)$ from the Y-axis is: [1]

a. 3 **b.** 5

c. 7 **d.** $\sqrt{74}$

iv. A line has direction ratios 4, −4, 2. Its direction cosines are: [1]

a. $\frac{2}{3}, -\frac{2}{3}, \frac{1}{3}$ **b.** $\frac{2}{3}, \frac{2}{3}, \frac{1}{3}$

c. $\frac{2}{5}, -\frac{2}{5}, \frac{1}{5}$ **d.** $\frac{1}{9}, -\frac{1}{9}, \frac{1}{18}$

v. A line makes 45° with the X-axis and 45° with the Y-axis. The angle it makes with the Z-axis is: [1]

a. 0° **b.** 45°

c. 60° **d.** 90°

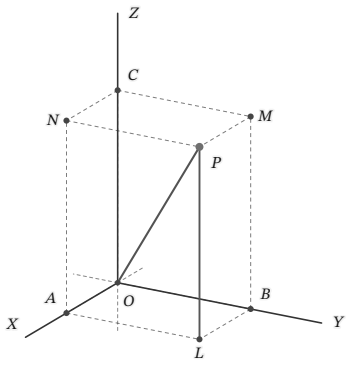
vi. A line makes angles α, β, γ with the axes. Then $\cos 2\alpha + \cos 2\beta + \cos 2\gamma$ is: [1]

a. −1 **b.** 0

c. 1 **d.** 2

4 Coordinates in the box [2]

The drawing shows the point $P(2, 3, 4)$ and its box.



Write the coordinates of L, M, N and C, the feet of the perpendiculars from P.

5 Short questions [10]

Answer the following questions. Show your working.

a. $A(2, -1, 3)$ and $B(-4, 1, 0)$. [5]

a. Find AB. [2]

b. Find the point on the Z-axis that is equally far from A and B. [3]

Answer:

b. $A(-1, 2, 4)$, $B(1, 5, 5)$ and $C(5, 11, 7)$. **[5]**

a. Show, using direction ratios, that A, B and C are collinear. [3]

b. Which of the three points lies between the other two? Check your answer with the distances. [2]



Answer: _____

6 Long question **[8]**

Answer the following question. Show your working.

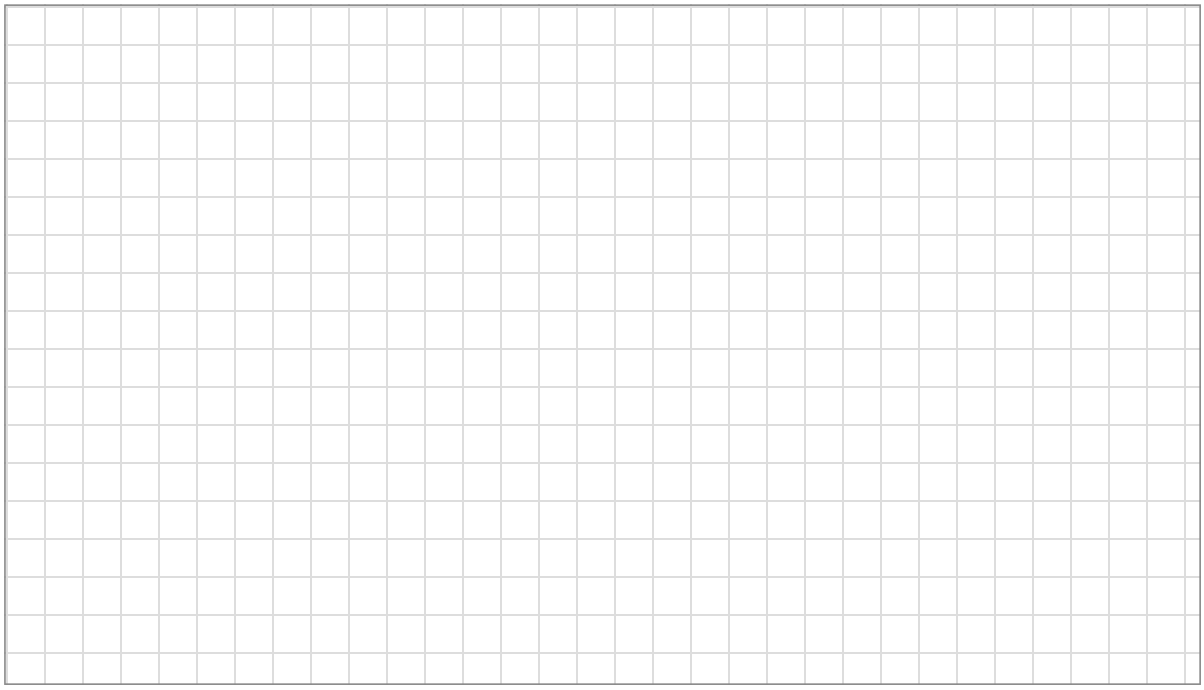
$A(3, 1, 5)$, $B(1, 2, 3)$ and $C(3, 4, 2)$.

a. Show that $\triangle ABC$ is right-angled and isosceles. [2]

b. Find the direction cosines of AC and the angles it makes with the axes. [2]

c. Find the area of $\triangle ABC$. [2]

d. Find D such that $ABCD$ is a square, and check that AD and BC have the same direction ratios. [2]



Answer: _____

7 Think [3]

For $A(0, 0, 0)$, $B(1, 2, 2)$, $C(1, 0, 0)$ and $D(3, 4, 4)$, Rojina finds that AB has direction ratios 1, 2, 2 and CD has 2, 4, 4. She says: "They are proportional, so A, B, C and D all lie on one line." Is she right? Explain, and say what else she should have checked.

8 Activity: Your classroom in coordinates (not marked)

You need: a measuring tape and a long string. Take a corner of the floor as O, the two floor edges as the X- and Y-axes and the upright edge as the Z-axis. Measure the coordinates (in meters) of the middle of a light and of the door handle.

Point	x (m)	y (m)	z (m)
the light			
the door handle			

Distance from the light to the handle, by the formula: _____ m. Measured with the string: _____ m. Direction cosines of the string: $l =$ ____, $m =$ ____, $n =$ ____. Does $l^2 + m^2 + n^2$ come close to 1?