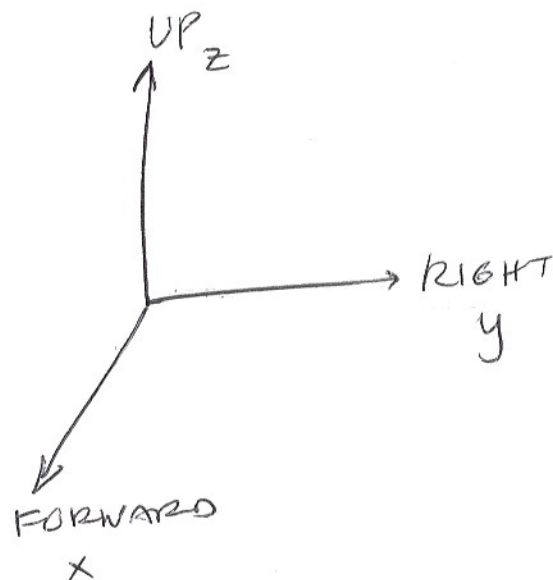


11.1 3D



OCTANTS

- 1: $x > 0, y > 0, z > 0$
- 2: $x < 0, y > 0, z > 0$
- 3: $x < 0, y < 0, z > 0$
- 4: $x > 0, y < 0, z > 0$
- 5: $x > 0, y > 0, z < 0$
- 6: $x < 0, y > 0, z < 0$
- 7: $x < 0, y < 0, z < 0$
- 8: $x > 0, y < 0, z < 0$

$(-5, 10, -3)$ IS IN $O_{2+4} = O_6$
IN Q_2

SINCE $z < 0$

$(5, -7, 4)$ IS O_4
IN Q_4
SINCE $z > 0$

IN WHICH OCTANTS IS $yz < 0$?

$x > 0, y > 0, z < 0 \rightarrow O_{1+5} = O_6$

$x < 0, y > 0, z < 0 \rightarrow O_{2+5} = O_7$

$x > 0, y < 0, z > 0 \rightarrow O_4$

$x < 0, y < 0, z > 0 \rightarrow O_3$

MIDPOINT OF (x_1, y_1, z_1) AND (x_2, y_2, z_2)

$$\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}, \frac{z_1 + z_2}{2} \right)$$

DISTANCE BETWEEN (x_1, y_1, z_1) AND (x_2, y_2, z_2)

$$\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2 + (z_2 - z_1)^2}$$

EQ'N OF ~~CIRCLE~~^{SPHERE} WITH CENTER (a, b, c) WITH RADIUS r

↳ ALL POINTS WHICH ARE r AWAY FROM (a, b, c)

IE. DISTANCE BETWEEN (x, y, z) AND (a, b, c) IS r

$$\begin{aligned} & \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2 + (z_2 - z_1)^2} \quad \boxed{(x-a)^2 + (y-b)^2 + (z-c)^2 = r^2} \\ & = \sqrt{(x-a)^2 + (y-b)^2 + (z-c)^2} = r \end{aligned}$$

FIND EQ'N OF SPHERE WITH $P(-5, 4, 1)$ AND $Q(-1, -4, -3)$
AS ENDPOINTS OF A DIAMETER

CENTER = MIDPOINT OF P, Q

$$= \left(\frac{-5 + -1}{2}, \frac{4 + -4}{2}, \frac{1 + -3}{2} \right) = (-3, 0, -1)$$

RADIUS = $\frac{1}{2}$ DISTANCE BETWEEN P, Q

$$= \frac{1}{2} \sqrt{(-1 - -5)^2 + (-4 - 4)^2 + (-3 - 1)^2}$$

$$= \frac{1}{2} \sqrt{4^2 + (-8)^2 + (-4)^2}$$

$$= \frac{1}{2} \sqrt{4^2 (1^2 + (-2)^2 + (-1)^2)}$$

$$= \frac{1}{2} \cdot 4 \sqrt{1 + 4 + 1}$$

$$= 2\sqrt{6}$$

$$(x - -3)^2 + (y - 0)^2 + (z - -1)^2 = (2\sqrt{6})^2$$

$$(x + 3)^2 + y^2 + (z + 1)^2 = 24$$

$$x^2 + 6x + 9 + y^2 + z^2 + 2z + 1 = 24$$

$$x^2 + y^2 + z^2 + 6x + 2z - 14 = 0 \leftarrow \text{FIND CENTER + RADIUS}$$



$$\begin{aligned} &1x^2 + 6x + \overset{+9}{\underset{\left(\frac{+6}{2}\right)^2=9}} + 1y^2 + 1z^2 + 2z + \overset{+1}{\underset{\left(\frac{+2}{2}\right)^2=1}} = 14 + 9 + 1 \\ &(x+3)^2 + (y)^2 + (z+1)^2 = 24 \end{aligned}$$

$$\text{CENTER } (-3, 0, -1) \quad \text{RADIUS} = \sqrt{24} = 2\sqrt{6}$$

TRACES ARE INTERSECTION OF A SURFACE
WITH COORDINATE PLANES

FIND THE xy -, xz - AND yz - TRACES OF
SPHERE $(x-2)^2 + (y+3)^2 + (z-1)^2 = 4$

xy -PLANE $\rightarrow z=0$

$$(x-2)^2 + (y+3)^2 + (0-1)^2 = 4$$

$$(x-2)^2 + (y+3)^2 = 3$$

CIRCLE CENTER $(2, -3, 0)$

RADIUS $\sqrt{3}$

IN xy -PLANE

xz -PLANE $\rightarrow y=0$

$$(x-2)^2 + (0+3)^2 + (z-1)^2 = 4$$

$$(x-2)^2 + (z-1)^2 = -5$$

NO xz -TRACE

yz -TRACE $\rightarrow x=0$

$$(y+3)^2 + (z-1)^2 = 0$$

POINT $(0, -3, 1)$

11.2 3D VECTORS

