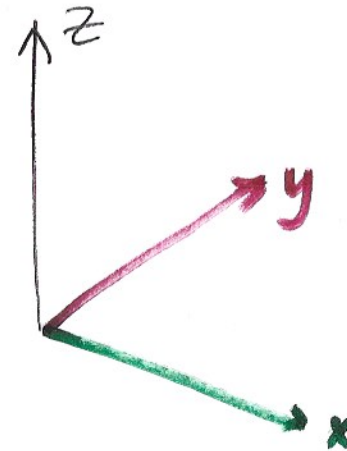
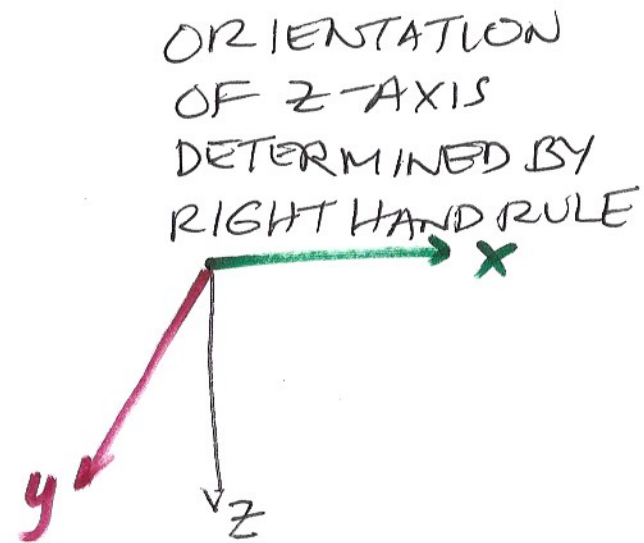
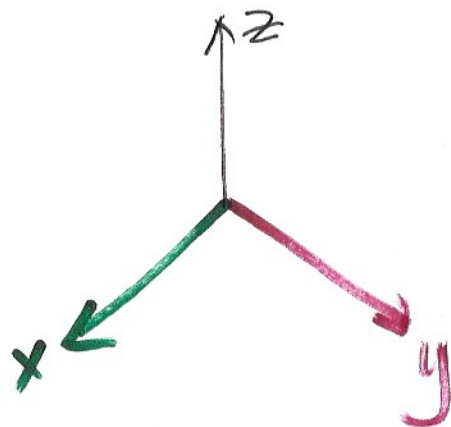
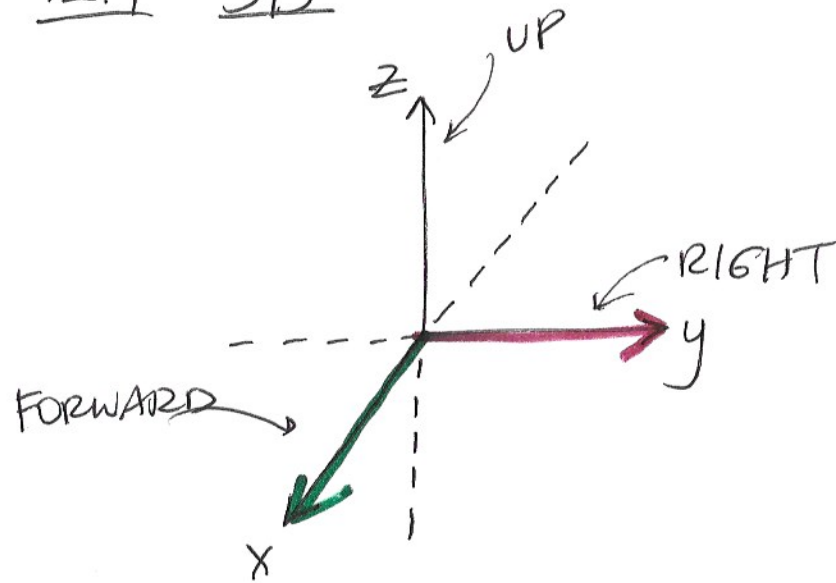
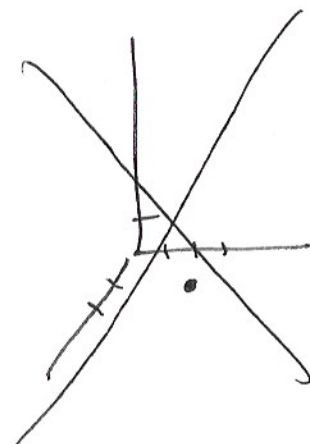
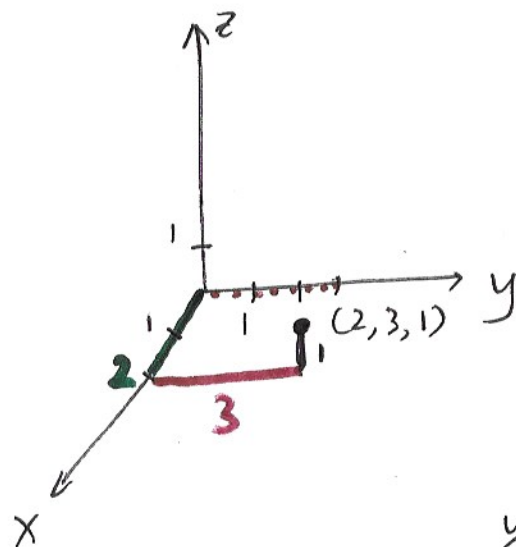


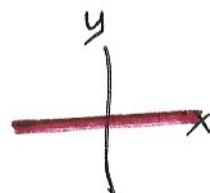
12.1 3D



PLOT $\begin{matrix} x & y & z \\ (2, 3, 1) \end{matrix}$

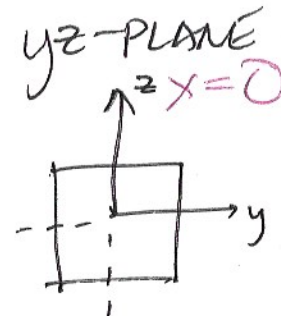
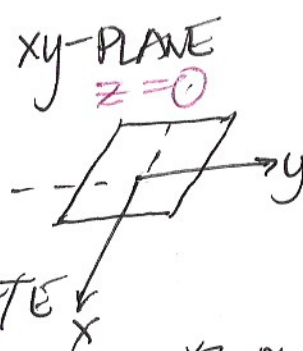


IN 2D
 X-AXIS $y=0$
 Y-AXIS $x=0$



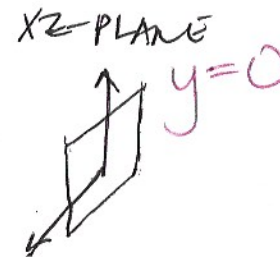
COORDINATE PLANES
 CONTAIN 2

COORDINATE AXES



IN 3D
 X-AXIS $y=z=0$
 Y-AXIS $x=z=0$
 Z-AXIS $x=y=0$

COORDINATE
 AXES



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

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

EQUATION OF ~~CIRCLE~~^{SPHERE} CENTER (a, b, c) RADIUS r

$$r = \sqrt{(x - a)^2 + (y - b)^2 + (z - c)^2}$$

$$(x - a)^2 + (y - b)^2 + (z - c)^2 = r^2$$

FIND THE EQ'N OF THE SPHERE WITH

$\underbrace{(-1, 4, 3)}_P$ AND $\underbrace{(5, -2, -7)}_Q$ AS ENDPONTS OF A DIAMETER

$$\begin{aligned}\text{CENTER} = \text{MIDPOINT OF } P, Q &= \left(\frac{-1+5}{2}, \frac{4+(-2)}{2}, \frac{3+(-7)}{2} \right) \\ &= (2, 1, -2)\end{aligned}$$

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

$$= \frac{1}{2} \sqrt{(5-(-1))^2 + (-2-4)^2 + (-7-3)^2}$$

$$= \frac{1}{2} \sqrt{6^2 + (-6)^2 + (-10)^2}$$

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

$$= \frac{1}{2} \cdot 2 \sqrt{9+9+25}$$

$$= \sqrt{43}$$

$$\begin{aligned}(x-2)^2 + (y-1)^2 + (z+2)^2 \\ = 43\end{aligned}$$

$$(x-2)^2 + (y-1)^2 + (z+2)^2 = 43$$

$$x^2 - 4x + 4 + y^2 - 2y + 1 + z^2 + 4z + 4 = 43$$

$$x^2 + y^2 + z^2 - 4x - 2y + 4z - 34 = 0$$



FIND CENTER + RADIUS

$$|x^2 - 4x + 4| + |y^2 - 2y + 1| + |z^2 + 4z + 4| = 34 + 4 + 1 + 4$$



$$\left(\frac{-4}{2}\right)^2 = 4$$



$$\left(\frac{-2}{2}\right)^2 = 1$$

$$(x-2)^2 + (y-1)^2 + (z+2)^2 = 43$$

$$\text{CENTER} = (2, 1, -2)$$

$$\text{RADIUS} = \sqrt{43}$$

TRACE (INTERSECTION OF A SURFACE IN 3D WITH A PLANE)

FIND EQ'N OF xy -TRACE OF OUR SPHERE

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



INTERSECTION WITH xy -PLANE ($z=0$)

$$(x-2)^2 + (y-1)^2 + (\cancel{0}+2)^2 = 4$$

$$(x-2)^2 + (y-1)^2 = 39$$

CIRCLE CENTER $(2, 1, 0)$

RADIUS $\sqrt{39}$

IN xy -PLANE

CYLINDERS

