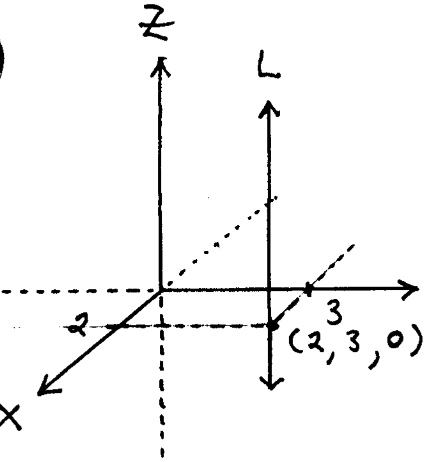
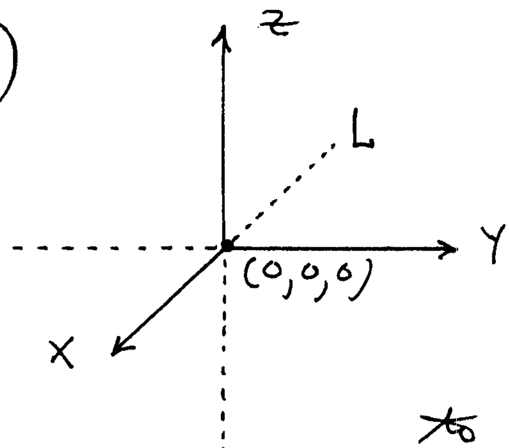
# Section 12.1

1)



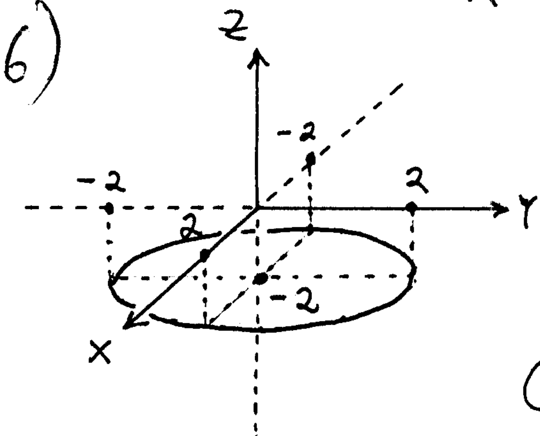

The set of points with $X=2$ and $Y=3$ is the line L passing through the point $(2,3,0)$ and parallel to the z-axis

3)



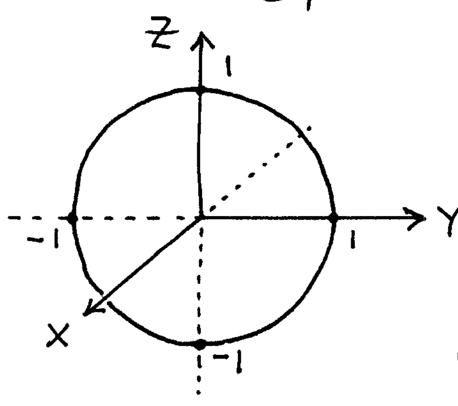

The set of points with $Y=0$ and $Z=0$ is the line L passing through the point $(0,0,0)$ and parallel to the x-axis (L is the X-axis)

6)



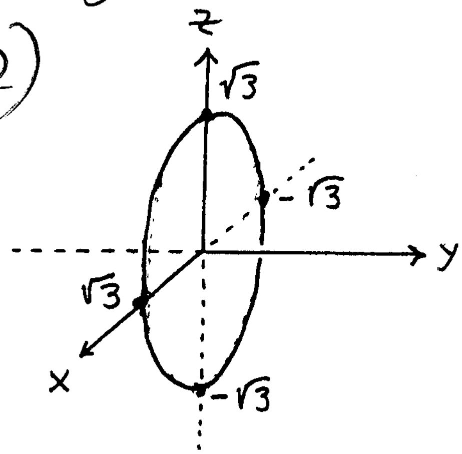

The set of points with $X^2+Y^2=4$ and $Z=-2$ is the set of points on the circle $X^2+Y^2=4$ (center $(0,0)$, radius 2) lying in the plane $Z=-2$ (parallel to the XY-plane)

8)




The set of points with $Y^2+Z^2=1$ and $X=0$ is the set of points on the circle $Y^2+Z^2=1$ (center $(0,0)$, radius 1) lying in the plane $X=0$ ( $YZ$-plane)

12)



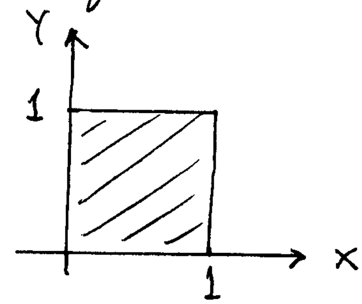

The set of points with $X^2+(Y-1)^2+Z^2=4$ and $Y=0 \rightarrow X^2+(-1)^2+Z^2=4$ $\rightarrow X^2+Z^2=3=(\sqrt{3})^2$ is the set of points lying on the circle $X^2+Z^2=3$ (center $(0,0)$, radius $\sqrt{3}$) and in the plane $Y=0$ ($XZ$-plane)

17) a.) $X \geq 0$, $Y \geq 0$, $Z=0$: The set of points in the 1st quadrant of the $XY$-plane

b.) $X \geq 0$, $Y \leq 0$, $Z=0$: The set of points in the 4th quadrant of the $XY$-plane

18) a.) $0 \leq X \leq 1$ : The set of points lying on and between the parallel planes $X=0$ ($YZ$-plane) and $X=1$.

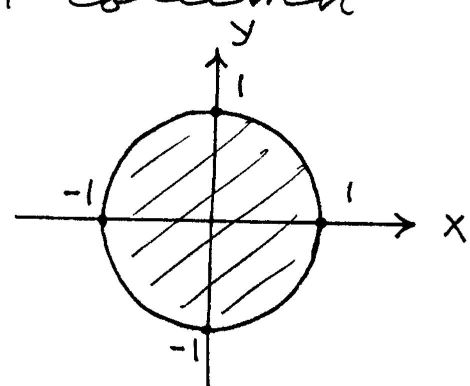
b.) $0 \leq X \leq 1$, $0 \leq Y \leq 1$ : The set of points on and inside the vertical (parallel to $Z$-axis) square column passing through the given 1 by 1 square in the $XY$-plane.



c.) $0 \le x \le 1$, $0 \le y \le 1$, $0 \le z \le 1$ : The set of points on and inside the 1 by 1 by 1 cube in the 1st octant.

20) a.) $x^2 + y^2 \le 1$, $z = 0$ : The set of points lying on and inside the circle $x^2 + y^2 = 1$ (center $(0,0)$, radius 1) in the plane $z = 0$ (xy-plane)

c.) $x^2 + y^2 \le 1$ : The set of points on and inside the vertical (parallel to z-axis) circular column passing through the given circle of radius 1




21) b.) $x^2 + y^2 + z^2 = 1$, $z \ge 0$ : The set of points lying on or inside the top half of the sphere $x^2 + y^2 + z^2 = 1$ (center $(0,0,0)$, radius 1)

22) a.) $x = y$, $z = 0$ : The set of points lying on the line $x = y$ in the plane $z = 0$ (xy-axis)

b.) $x = y$ : The set of points on the plane passing through the line $x = y$ (in the xy-plane) and parallel to the z-axis.

26) a.) $X = 3$ b.) $Y = -1$ c.) $Z = 2$

27) a.) $Z = 1$ b.) $X = 3$ c.) $Y = -1$

28) a.) $X^2 + Y^2 = 2^2$, $Z = 0$
b.) $Y^2 + Z^2 = 2^2$, $X = 0$
c.) $X^2 + Z^2 = 2^2$, $Y = 0$

30) a.) $(X+3)^2 + (Y-4)^2 = 1^2$, $Z = 1$
b.) $(Y-4)^2 + (Z-1)^2 = 1^2$, $X = -3$
c.) $(X+3)^2 + (Z-1)^2 = 1^2$, $Y = 4$

31) a.) $Y = 3$, $Z = -1$
b.) $X = 1$, $Z = -1$
c.) $X = 1$, $Y = 3$

32) all points $(x, Y, Z)$ equidistant from $(0,0,0)$ and $(0,2,0)$ :

$$\sqrt{(X-0)^2 + (Y-0)^2 + (Z-0)^2} = \sqrt{(X-0)^2 + (Y-2)^2 + (Z-0)^2}$$

$\rightarrow \cancel{X^2} + Y^2 + \cancel{Z^2} = \cancel{X^2} + (Y-2)^2 + \cancel{Z^2}$

$\rightarrow \cancel{Y^2} = \cancel{Y^2} - 4Y + 4 \rightarrow 4Y = 4 \rightarrow$

$\boxed{Y = 1}$ (a plane parallel ~~to the~~ XZ-plane)

34) all points $(x, Y, Z)$ 2 units from $(0,0,1)$ and 2 units $(0,0,-1)$ :

$$\sqrt{(x-0)^2+(y-0)^2+(z-1)^2} = 2 \quad \text{and}$$
$$\sqrt{(x-0)^2+(y-0)^2+(z+1)^2} = 2 \rightarrow$$

$$x^2+y^2+(z-1)^2 = 4 \quad \text{and}$$
$$x^2+y^2+(z+1)^2 = 4 \rightarrow$$
$$\cancel{x^2}+\cancel{y^2}+(z-1)^2 = \cancel{x^2}+\cancel{y^2}+(z+1)^2 \rightarrow$$
$$\cancel{z^2}-2z+\cancel{1} = \cancel{z^2}+2z+\cancel{1} \rightarrow 4z=0$$
$\rightarrow \quad z=0$ ; then

$$x^2+y^2+(0-1)^2=4 \rightarrow$$
$$\boxed{x^2+y^2=3 \text{ and } z=0}$$

36) $0 \le x \le 2,\ 0 \le y \le 2,\ 0 \le z \le 2$

37) $z \le 0$

38) $x^2+y^2+z^2=1$ and $z \ge 0$

39) a.) $(x-1)^2+(y-1)^2+(z-1)^2 < 1^2$
b.) $(x-1)^2+(y-1)^2+(z-1)^2 > 1^2$

42) $D = \sqrt{(2--1)^2+(5-1)^2+(0-5)^2}$
$= \sqrt{9+16+25} = \sqrt{50} = 5\sqrt{2}$

43) $D = \sqrt{(4-1)^2+(-2-4)^2+(7-5)^2}$
$= \sqrt{9+36+4} = \sqrt{49} = 7$

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

$\rightarrow$ center $(-2,0,2)$, radius $2\sqrt{2}$

52) $(x-0)^2+(y-(-1))^2+(z-5)^2=2^2 \rightarrow$

$x^2+(y+1)^2+(z-5)^2=4$

55) $x^2+y^2+z^2+4x-4z=0 \rightarrow$

$(x^2+4x+\underline{\underline{4}})+y^2+(z^2-4z+\underline{\underline{4}})=4+4 \rightarrow$

$(x+2)^2+y^2+(z-2)^2=8=(2\sqrt{2})^2 \rightarrow$

center $(-2,0,2)$, radius $2\sqrt{2}$

58) $3x^2+3y^2+3z^2+2y-2z=9 \rightarrow$

$3x^2+(3y^2+2y\quad)+(3z^2-2z\quad)=9 \rightarrow$

$3x^2+3(y^2+\frac{2}{3}y\quad)+3(z^2-\frac{2}{3}z\quad)=9 \rightarrow$

$x^2+(y^2+\frac{2}{3}y\quad)+(z^2-\frac{2}{3}z\quad)=3 \rightarrow$

$x^2+(y^2+\frac{2}{3}y+\frac{1}{9})+(z^2-\frac{2}{3}z+\frac{1}{9})=3+\frac{1}{9}+\frac{1}{9} \rightarrow$

$(x-0)^2+(y+\frac{1}{3})^2+(z-\frac{1}{3})^2=\frac{29}{9}=\left(\frac{\sqrt{29}}{3}\right)^2 \rightarrow$

center $(0,-1/3,1/3)$, radius $\frac{\sqrt{29}}{3}$

59) a.) Distance from $(x,y,z)$ and point $(x,0,0)$ (on the x-axis):

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

$=\sqrt{y^2+z^2}$.

b.) Distance from $(X,Y,Z)$ and point $(0,Y,0)$ (on the $Y$-axis):

$$D = \sqrt{(X-0)^2 + (Y-Y)^2 + (Z-0)^2}$$

$$= \sqrt{X^2 + Z^2}$$

c.) Distance from $(X,Y,Z)$ and point $(0,0,Z)$ (on the $Z$-axis):

$$D = \sqrt{(X-0)^2 + (Y-0)^2 + (Z-Z)^2}$$

$$= \sqrt{X^2 + Y^2}$$

60) a.) Distance from $(X,Y,Z)$ and point $(X,Y,0)$ (on $XY$-plane):

$$D = \sqrt{(X-X)^2 + (Y-Y)^2 + (Z-0)^2}$$

$$= \sqrt{Z^2} = |Z|$$

b.) Distance from $(X,Y,Z)$ and point $(0,Y,Z)$ (on $YZ$-plane):

$$D = \sqrt{(X-0)^2 + (Y-Y)^2 + (Z-Z)^2} = \sqrt{X^2} = |X|$$

c.) Distance from $(X,Y,Z)$ and point $(X,0,Z)$ (on $XZ$-plane):

$$D = \sqrt{(X-X)^2 + (Y-0)^2 + (Z-Z)^2} = \sqrt{Y^2} = |Y|$$