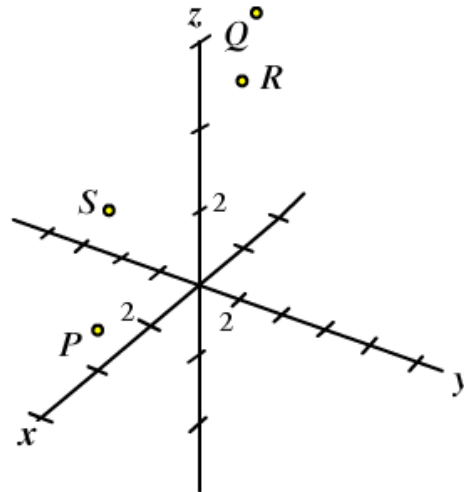


1) Sketch the points  $P(6, 2, 3)$ ,  $Q(-5, -1, 4)$ ,  $R(1, 3, 8)$  and  $S(2, -2, 2)$  on a single set of coordinate axes.



2) Which of the points from problem 1 is closest to:

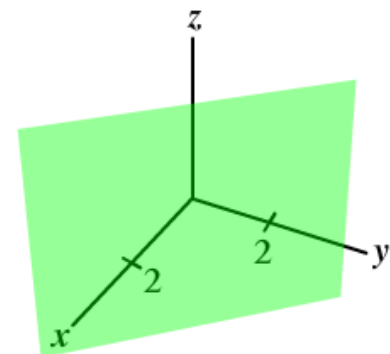
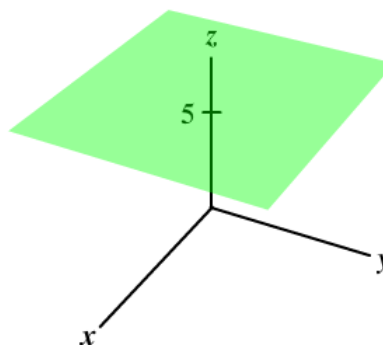
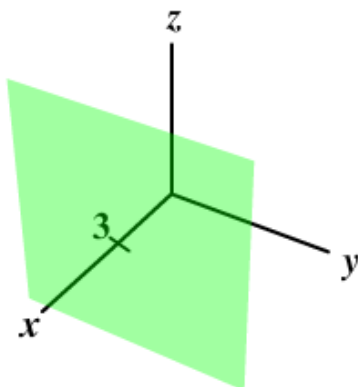
- a)  $xz$  - plane ?
- b)  $xy$  - plane ?
- c)  $yz$  - plane ?

3) What are the projections of point R from problem 1 on the:

- a)  $xz$  - plane ?
- b)  $xy$  - plane ?
- c)  $yz$  - plane ?

4) Describe and sketch the surface in  $\mathbb{R}^3$  represented by the equation:

- a)  $x = 3$
- b)  $z = 5$
- c)  $x + y = 2$



- 5) Determine whether the points lie on a straight line.  $A(5, 1, 3)$ ,  $B(7, 9, -1)$ ,  $C(1, -15, 11)$

$$\boxed{\text{Yes, } |AB| + |AC| = |BC|}$$

- 6) Find the lengths of the sides of the triangle with the indicated vertices, and determine whether the triangle is a right triangle, an isosceles triangle, or neither.  $A(3, 4, 1)$ ,  $B(0, 6, 2)$ ,  $C(3, 5, 6)$

$$\boxed{\text{Isosceles, } |AC| = |BC|}$$

- 7) Find the standard equation of the sphere.
- Center:  $(0, 2, 5)$ , Radius: 2
  - Endpoints of a diameter:  $(2, 0, 0)$ ,  $(0, 6, 0)$
  - Center:  $(-3, 2, 4)$ , tangent to the  $yz$ -plane

a)  $\boxed{x^2 + (y-2)^2 + (z-5)^2 = 4}$

b)  $\boxed{(x-1)^2 + (y-3)^2 + z^2 = 10}$

c)  $\boxed{(x+3)^2 + (y-2)^2 + (z-4)^2 = 9}$

8) Complete the square to write the equation of the sphere in standard form. Find the center and radius.

a)  $x^2 + y^2 + z^2 + 9x - 2y + 10z + 19 = 0$

b)  $4x^2 + 4y^2 + 4z^2 - 24x - 4y + 8z - 23 = 0$

a)  $\text{Center} : \left( -\frac{9}{2}, 1, -5 \right), \text{Radius} : \frac{\sqrt{109}}{2}$

b)  $\text{Center} : \left( 3, \frac{1}{2}, -1 \right), \text{Radius} : 4$

9) Describe in words the region of  $\mathbb{R}^3$  represented by the equation or inequality.

a)  $y = -4$

b)  $y \geq 0$

c)  $0 \leq z \leq 6$

d)  $x^2 + y^2 + z^2 \leq 3$

e)  $x^2 + z^2 \leq 9$

a) Plane parallel to the  $xz$ -plane and 4 units in the direction of the negative  $y$ -axis

b) The inequality represents a half-space consisting of all the points on or to the right of the  $xz$ -plane

c) The inequality represents all the points on or between the horizontal planes  $z = 0$  and  $z = 6$ .

d) The inequality represents all the points whose distance from the origin is at most  $\sqrt{3}$ , this is the set of all points on or inside a sphere of radius  $\sqrt{3}$  and center  $(0, 0, 0)$ .

e) The inequality is the set of all points whose distance from the  $y$ -axis is at most 3, this is the set of all points on or inside a circular cylinder of radius 3 and centered in the  $y$ -axis.

10) Write inequalities to describe the region.

a) The region between  $xy$ -plane and horizontal plane  $z = 5$

b) The solid cylinder that lies on or below the plane  $z = 5$  and on or above the circular trace on the  $xy$ -plane with center located on the origin and radius 2.

c) The solid upper hemisphere of the sphere of radius 4 centered at the origin.

a)  $0 < z < 5$

b)  $x^2 + y^2 \leq 4, 0 \leq z \leq 5$

c)  $x^2 + y^2 + z^2 \leq 16, z \geq 0$