NOTES FROM YESTERDAY:

Dot Product:

If $\vec{\mathbf{u}} = \langle a_1, a_2, a_3 \rangle$ and $\vec{\mathbf{v}} = \langle b_1, b_2, b_3 \rangle$

then $\mathbf{u} \bullet \mathbf{v} = a_1 b_1 + a_2 b_2 + a_3 b_3$

If u•v = 0, then vector u and v are perpendicular.

NOTES: 9.5

The **cross product** finds a vector that is perpendicular (orthogonal) to 2 given vectors that are in the same plane.

a x b = cross product

↑ ***Not a multiplication symbol. A matrix will be used to calculate the cross product.***

Example: find a 3rd vector that is perpendicular to the two given vectors.

$$\vec{a} = \langle -2, -3, 1 \rangle$$

$$\vec{b} = \langle 2, 5, -4 \rangle$$

so... $\bar{a} \times \bar{b} = \langle ?, ?, ? \rangle$

Given:

$$\begin{array}{cccc} & \vec{i} & \vec{j} & \vec{k} \\ \vec{a} = & \langle -2, & -3, & 1 \rangle \end{array}$$

$$\vec{b} = \langle 2, 5, -4 \rangle$$

1st step: set up a 3 by 3 determinant

$$\begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ -2 & -3 & 1 \\ 2 & 5 & -4 \end{vmatrix}$$

2nd step: evaluate using 2 by 2 *minor* determinants

$$\vec{i}\begin{vmatrix} -3 & 1 \\ 5 & -4 \end{vmatrix} - \vec{j}\begin{vmatrix} -2 & 1 \\ 2 & -4 \end{vmatrix} + \vec{k}\begin{vmatrix} -2 & -3 \\ 2 & 5 \end{vmatrix}$$

See notes 10.6 for more details about determinants!!

2nd step: evaluate using 2 by 2 minor determinants

$$\vec{i}\begin{vmatrix}-3 & 1\\ 5 & -4\end{vmatrix} - \vec{j}\begin{vmatrix}-2 & 1\\ 2 & -4\end{vmatrix} + \vec{k}\begin{vmatrix}-2 & -3\\ 2 & 5\end{vmatrix}$$

$$(12-5)i - (8-2)j + (-10+6)k$$

$$7i - 6j - 4k = \langle 7, -6, -4 \rangle$$

EQUATION OF A SPHERE

NOTES: 9.3 (part 2)

An equation of a sphere with center $C(h, k, l)$ and radius r is

$$(x-h)^2 + (y-k)^2 + (z-l)^2 = r^2$$

Example: Center = (5, -2, 13) Radius = 8

h k l

Equation of Sphere:

$$\boxed{(x-5)^2 + (y+2)^2 + (z-13)^2 = 64}$$

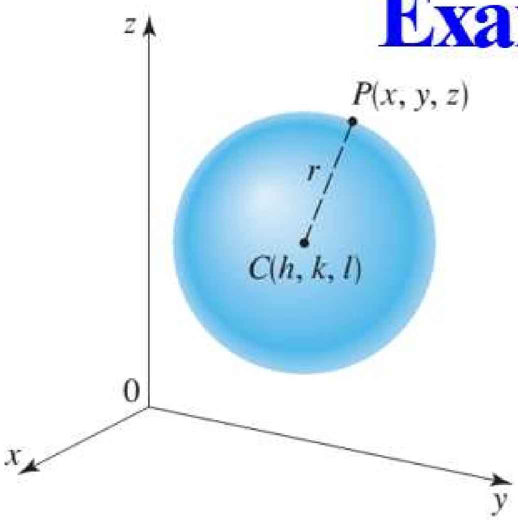

FIGURE 8 Sphere with radius r and center $C(h, k, l)$

Assignment: 9.3#18, 11-17 9.5#3,4,7,8,10a,11a

$x^2 + y^2 - 14y + \underline{49} + z^2 + 6z + \underline{9} = 0 + \underline{49} + \underline{9}$

Complete the square

$\boxed{x^2 + (y-7)^2 + (z+3)^2 = 58}$

r^2

$\boxed{\begin{array}{l} \text{Center} = (0, 7, -3) \\ \text{Radius} = \sqrt{58} \end{array}}$

15–18 ■ **Center and Radius of a Sphere** Show that the equation represents a sphere, and find its center and radius.

15. $x^2 + y^2 + z^2 - 10x + 2y + 8z = 9$

16. $x^2 + y^2 + z^2 + 4x - 6y + 2z = 10$

17. $x^2 + y^2 + z^2 = 12x + 2y$

18. $x^2 + y^2 + z^2 = 14y - 6z$

Solve by gathering like terms and completing the square.

9.3 #18, 11-17 and
9.5 #3, 4, 7, 8, 10,11

√check odd answers in book

<u>CHECK EVEN ANSWERS:</u>

$\sqrt{58}$ $\quad 2\sqrt{6}$ $\quad \langle 1, 11, -19\rangle$

$\langle -1, -3, -9\rangle$ $\quad \langle 7, 1, 4\rangle$

(-2, 3, -1) (0, 7, -3)

$$x^2+(y-7)^2+(z+3)^2=58$$

$$(x+1)^2+(y-4)^2+(z+7)^2=9$$

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

$$(x+10)^2+y^2+(z-1)^2=11$$