I. Introduction - Distribute Syllabus.


III. In 2-Dim.

IV. The Distance Between 2 points.
   A. In 2 dimensions (review)

V. Circles and Spheres.
   A. Eq. for a circle w/ center @ the origin and radius r:
      \[ x^2 + y^2 = r^2 \] (p. 331)
   B. Eq. circle C(h, k) and radius r
      \[ (x-h)^2 + (y-k)^2 = r^2 \]
   C. Eq for a sphere w/ C(0,0,0) and radius r
      \[ x^2 + y^2 + z^2 = r^2 \]
   D. Eq. for a sphere w/ C(h,k,l) & radius r
      \[ (x-h)^2 + (y-k)^2 + (z-l)^2 = r^2 \]
VI. "Untangling" equations:

Find the center and radius of the sphere:

\[ x^2 + y^2 + z^2 - 4x + 6y = 3 \]

Solution:

1. Complete the square.

\[ x^2 - 4x + 4 + y^2 + 6y + 9 + z^2 = 3 + 4 + 9 \]

\[ (x-2)^2 + (y+3)^2 + z^2 = 16 \]

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The center of the sphere is \( C(2, -3, 0) \) and \( r = 4 \).

VII. §13.1: p. 833: #14. Find an equation of the sphere that passes through the origin and whose center is at \( P(1, 2, 3) \).

Solution:

1. Find radius. \( d(P, O) = \sqrt{1^2 + 2^2 + 3^2} = \sqrt{14} \)

\[ d(P, O) = \sqrt{(x_2-x_1)^2 + (y_2-y_1)^2 + (z_2-z_1)^2} \]

\[ = \sqrt{(1-0)^2 + (2-0)^2 + (3-0)^2} = \sqrt{14} \]

2. The required equation is \( (x-1)^2 + (y-2)^2 + (z-3)^2 = 14 \).

VIII. §13.2: Vectors, p. 834 (798).

A. Interpretation of Vectors.


2. Analytic ("points" in the plane).

3. Abstractly.

B. Analytic:

\[ \vec{a} = \begin{pmatrix} a_1 \\ a_2 \\ a_3 \end{pmatrix} \]

or \( \vec{a} = a_1 \vec{i} + a_2 \vec{j} + a_3 \vec{k} \)

C. Addition of Vectors.

1. Geometrically

\[ \vec{a} + \vec{b} = \vec{c} \]

Vector addition obeys the commutative property.

2. Analytic:

\[ \vec{a} = \begin{pmatrix} a_1 \\ a_2 \\ a_3 \end{pmatrix} \] and \( \vec{b} = \begin{pmatrix} b_1 \\ b_2 \\ b_3 \end{pmatrix} \),

then \( \vec{a} + \vec{b} = \begin{pmatrix} a_1 + b_1 \\ a_2 + b_2 \\ a_3 + b_3 \end{pmatrix} \) (is done "component-wise")
3. Vector Addition satisfies the associative property:
\[ \vec{a} + (\vec{b} + \vec{c}) = (\vec{a} + \vec{b}) + \vec{c} \]

4. Other Important properties of vectors.

1. Scalar Mult (p. 835).

Example in 3-D.
Let \( \vec{a} = \langle 2, 7, -9 \rangle \), then
\[ -\frac{1}{2} \vec{a} = \langle -1, -\frac{7}{2}, \frac{9}{2} \rangle \]

IX. POD. 833, p. 833: #16

Show eq. rep. sphere. Find C and r
\[ x^2 + y^2 + z^2 = 4x - 2y. \]

Write it up neatly ½ turn it in tomorrow.

POD = "Problem of the Day."