MATH 110, Fall 2013
Tutorial #2
September 18, 2013

Today's main problems

The line L is defined by the equation $y = -2x + 3$.

1. Find a constant k so that the equation

$$2y + kx = 6$$

   also describes L

2. Write L in vector form and write down a normal vector for L.

3. Let A be the point on L closest to the origin. Draw L, its normal vector, and the vector from A to the origin. Clearly label all right angles.

4. Find the distance from A to the origin and the coordinates of A.

Further questions

5. Find the distance from the point $p_1 = (2, 1, -3)$ to the plane with equation $3x - y + 4z = 1$.

6. Find vector and parametric form of the line parallel to $\vec{u} = \begin{bmatrix} 2 \\ -1 \\ 0 \end{bmatrix}$ that passes through the point $p = (1, -1, 3)$. Does this line have a normal form?

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Challenge questions

7. What is the distance between the sphere of radius 2 centered at $p = (1, 1, 1)$ and the plane with normal vector $\vec{n} = \begin{bmatrix} 1 \\ 1 \\ 0 \end{bmatrix}$ passing through the point $(-1, -1, -1)$?

8. Find the distance between the lines

$$L_1(t) = t \begin{bmatrix} 1 \\ 1 \\ -2 \end{bmatrix} + \begin{bmatrix} 3 \\ 3 \\ -3 \end{bmatrix}$$

and

$$L_2(t) = t \begin{bmatrix} -2 \\ 1 \\ 0 \end{bmatrix} + \begin{bmatrix} 0 \\ -1 \\ 0 \end{bmatrix}.$$

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Tutorial #2. Instructions for TAs

Objectives

Normal vectors and direction vectors are confusing at first, but allow you to solve problems that used to be quite hard. We'd like to become familiar with them.

Hidden objectives

There are formulas for all of these things in your textbook, but if you memorize them, you'll fail at more sophisticated problems. We'd like to see the geometry of these objects and use our basic tools of vector addition, dot products, and projection to solve all of these problems.

Suggestions

The days main problem will probably take the whole class time. For an intro, you could remind everyone of normal, vector, and parametric form, and emphasise that vector and parametric form are essentially the same thing but with different notation.

Wrapup

Choose a question that most of the class has started but not yet finished, or a question that people particularly struggled with.

Solutions

1.