Friday plans:

Quiz

IA time

-in the last 10 minutes of class, pause to write me a note about what you accomplished

e-mail

We learned four things about vectors last class:

*Calculating vector direction
*Multiplying vectors
*Vector magnitude
*Parallel and Perpendicular vectors

Today we'll learn how to calculate the point where two vectors intersect.

But why does it matter?


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Where does the line $4x - 2y = 3$ intersect

$$y = \frac{x}{3} - \frac{7}{6}\ ?$$

2D

Today's learning objective:

By the end of class, I will be able to visualize vector addition and multiplication as well as find the point of intersection between two vectors.

Today's language objective:

3D

*I will use the term "intersection" with peers when referring to the point at which two vectors meet.

Let's review:

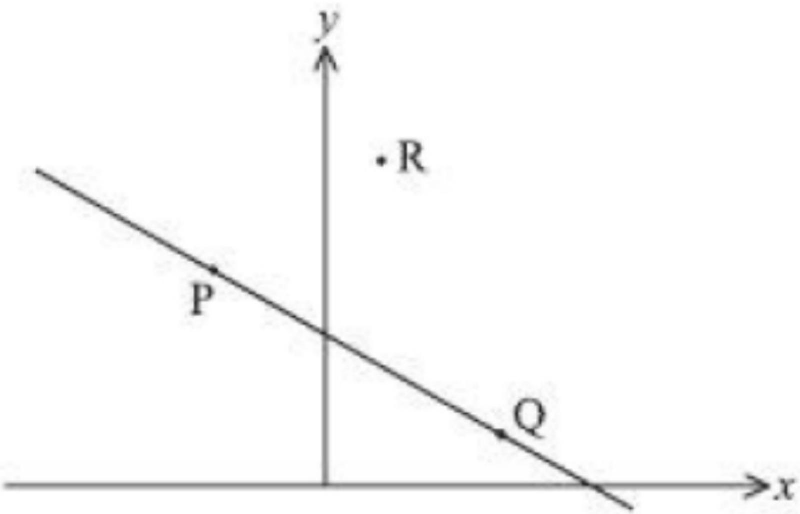
27.) Points P and Q have position vectors $-5\boldsymbol{i} + 11\boldsymbol{j} - 8\boldsymbol{k}$ and $-4\boldsymbol{i} + 9\boldsymbol{j} - 5\boldsymbol{k}$ respectively, and both lie on a line L_1.

(a) (i) Find $\overrightarrow{PQ}$.

$$\begin{pmatrix} 1 \\ -2 \\ 3 \end{pmatrix} \qquad \begin{pmatrix} -4 \\ 9 \\ -5 \end{pmatrix} - \begin{pmatrix} -5 \\ 11 \\ -8 \end{pmatrix}$$

$$i - 2j + 3k$$

30.) The points P(−2, 4), Q (3, 1) and R (1, 6) are shown in the diagram below.



(a) Find the vector $\overrightarrow{PQ}$. $\begin{bmatrix} 5 \\ -3 \end{bmatrix}$

(b) Find a vector equation for the line through R parallel to the line (PQ).

$$L_R = \begin{pmatrix} 1 \\ 6 \end{pmatrix} + t\begin{bmatrix} 5 \\ -3 \end{bmatrix}$$

Now for the new content:

$\begin{pmatrix}12\\-3\\3\end{pmatrix}$

3.) Two lines with equations $r_1 = \begin{pmatrix}2\\3\\-1\end{pmatrix} + s\begin{pmatrix}5\\-3\\2\end{pmatrix}$ and $r_2 = \begin{pmatrix}9\\2\\2\end{pmatrix} + t\begin{pmatrix}-3\\5\\-1\end{pmatrix}$ intersect at the point P. Find the coordinates of P.

(Total 6 m

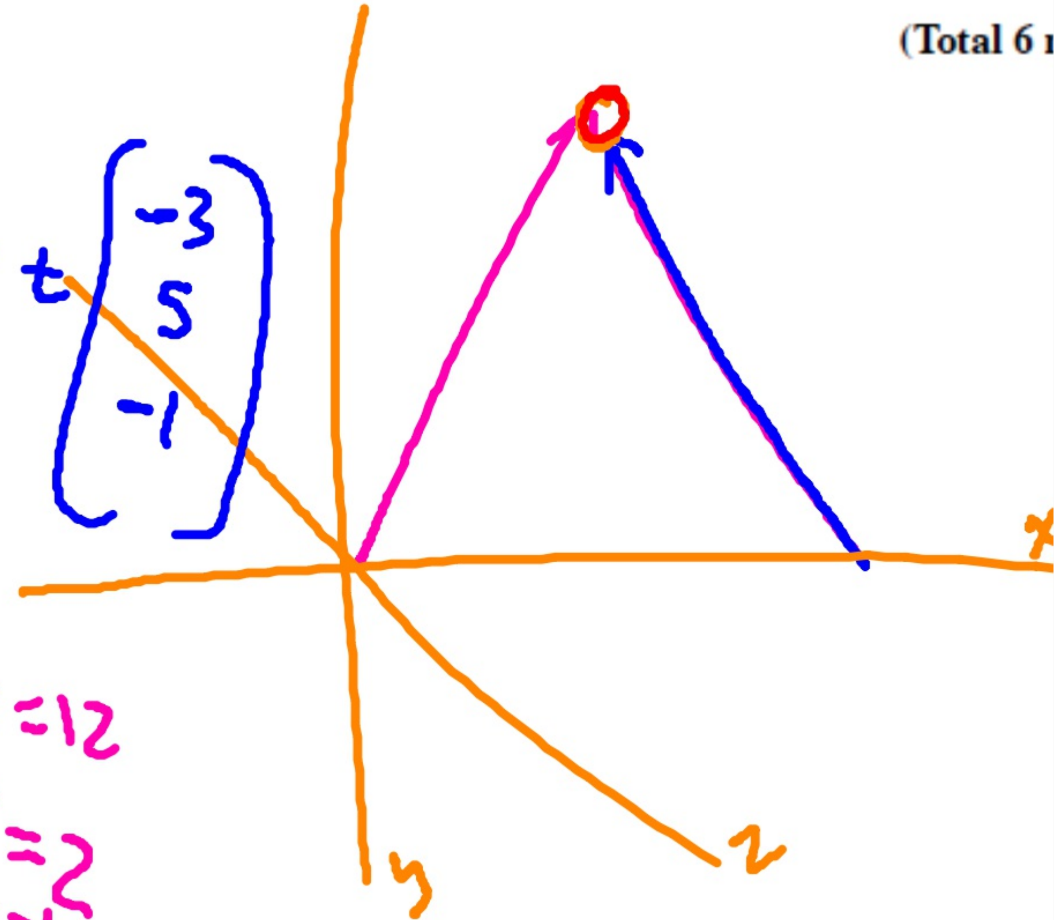
$$\begin{pmatrix}2\\3\\-1\end{pmatrix} + s\begin{pmatrix}5\\-3\\2\end{pmatrix} = \begin{pmatrix}9\\2\\2\end{pmatrix} + t\begin{pmatrix}-3\\5\\-1\end{pmatrix}$$

$2 + 5s = 9 - 3t$

$3 - 3s = 2 + 5t \qquad -2 + 7s = 12$

$\left\{ -1 + 2s = 2 - t \right\} 5$

$-5 + 10s = 10 - 5t \qquad s = 2, \; t = -1$



The line L_1 is represented by $\mathbf{r}_1 = \begin{pmatrix} 2 \\ 5 \\ 3 \end{pmatrix} + s\begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix}$ and the line L_2 by $\mathbf{r}_2 = \begin{pmatrix} 3 \\ -3 \\ 8 \end{pmatrix} + t\begin{pmatrix} -1 \\ 3 \\ -4 \end{pmatrix}$.

The lines L_1 and L_2 intersect at point T. Find the coordinates of T.

(To

$t = 2$

$$\begin{pmatrix} 1 \\ 3 \\ 0 \end{pmatrix}$$

$$2 + s = 3 - t$$
$$5 + 2s = -3 + 3t$$
$$3 + 3s = 8 - 4t$$

12.) The line L_1 is parallel to the z-axis. The point P has position vector $\begin{pmatrix} 8 \\ 1 \\ 0 \end{pmatrix}$ and lies on L_1.

(a) Write down the equation of L_1 in the form $\boldsymbol{r} = \boldsymbol{a} + t\boldsymbol{b}$.

(2)

The line L_2 has equation $\boldsymbol{r} = \begin{pmatrix} 2 \\ 4 \\ -1 \end{pmatrix} + s\begin{pmatrix} 2 \\ -1 \\ 5 \end{pmatrix}$. The point A has position vector $\begin{pmatrix} 6 \\ 2 \\ 9 \end{pmatrix}$.

(b) Show that A lies on L_2.

(4)

Let B be the point of intersection of lines L_1 and L_2.

(c) (i) Show that $\overrightarrow{OB} = \begin{pmatrix} 8 \\ 1 \\ 14 \end{pmatrix}$.

(ii) Find $\overrightarrow{AB}$.

27.) Points P and Q have position vectors $-5\boldsymbol{i} + 11\boldsymbol{j} - 8\boldsymbol{k}$ and $-4\boldsymbol{i} + 9\boldsymbol{j} - 5\boldsymbol{k}$ respectively, an lie on a line L_1.

(a) (i) Find $\overrightarrow{PQ}$.

(ii) Hence show that the equation of L_1 can be written as

$$\boldsymbol{r} = (-5 + s)\,\boldsymbol{i} + (11 - 2s)\,\boldsymbol{j} + (-8 + 3s)\,\boldsymbol{k}.$$

$$L_1 = \begin{pmatrix} -5 \\ 11 \\ -8 \end{pmatrix} + s\begin{pmatrix} 1 \\ -2 \\ 3 \end{pmatrix} =$$

The point R $(\underline{2}, y_1, z_1)$ also lies on L_1.

(b) Find the value of y_1 and of z_1.

The line L_2 has equation $\boldsymbol{r} = 2\boldsymbol{i} + 9\boldsymbol{j} + 13\boldsymbol{k} + t\,(\boldsymbol{i} + 2\boldsymbol{j} + 3\boldsymbol{k})$.

$$L_2 = \begin{pmatrix} 2 \\ 9 \\ 13 \end{pmatrix} + t\begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix}$$

(c) The lines L_1 and L_2 intersect at a point T. Find the position vector of T.