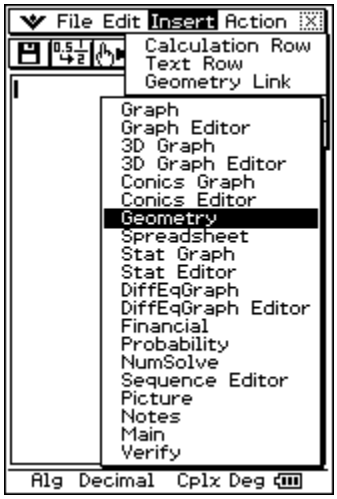
An Introduction to using Vectors within eActivity and Geometry on the ClassPad 330

Name_____

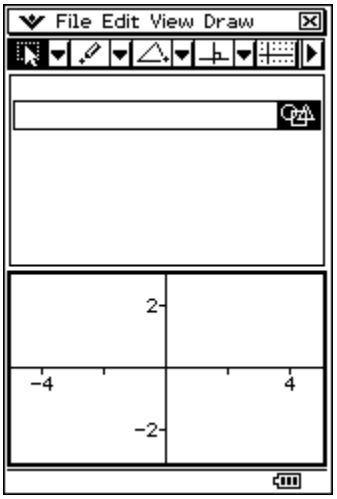
In this part of the activity, we will use the ClassPad to explore the meaning of the value a dot product produces. In closing, you will be introduced to additional ideas for using the ClassPad

Getting the ClassPad ready…

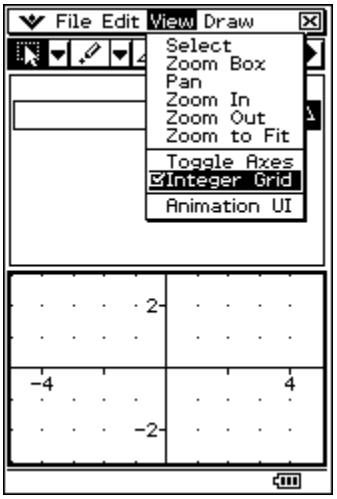
Open eActivity and insert a Geometry Strip



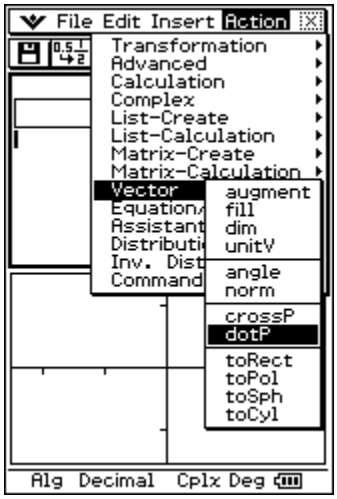
Tap inside the Geometry window and then tap q to see the axes.



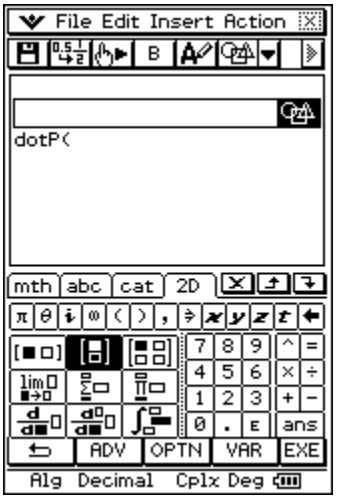
Open the View menu and select Integer Grid



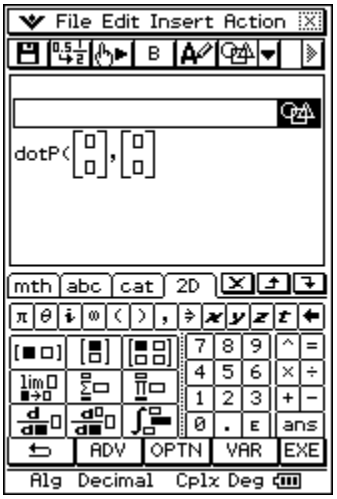
Tap inside eActivity, open the Action menu and select Vector/dotP.



Press k. Tap the 2D tab at the top and then the Calc tab on the bottom.



Tap 7 to create a vector. Add a comma and then create another vector.



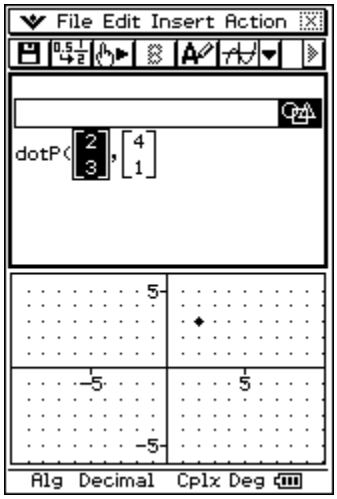
Let $\vec{r} = 2\vec{i} + 3\vec{j}$ ($\vec{r} = \begin{bmatrix} 2 \\ 3 \end{bmatrix}$) and $\vec{s} = 4\vec{i} + 1\vec{j}$ ($\vec{s} = \begin{bmatrix} 4 \\ 1 \end{bmatrix}$)

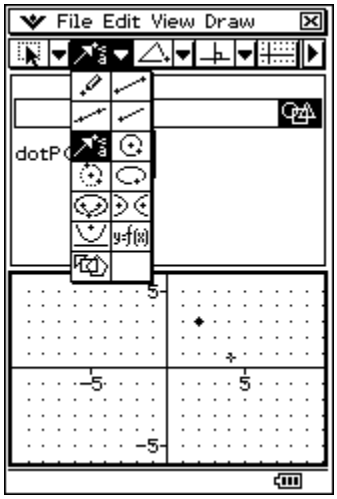
****Input the beginning vectors by tapping inside the matrix template boxes.**

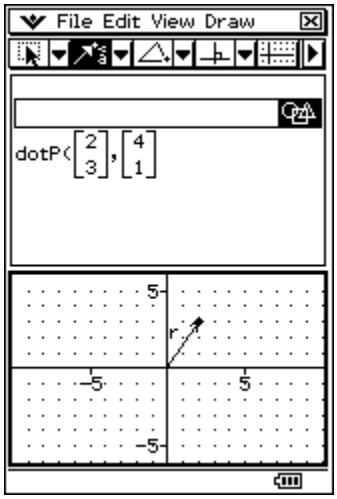
Select the first vector and drag it to the Geometry window (press □ to zoom out)

In Geometry, tap the second and select H (vector drawing tool).

Tap on the origin (0,0) and then tap on our point (2,3). Vector $\vec{r}$ is drawn!





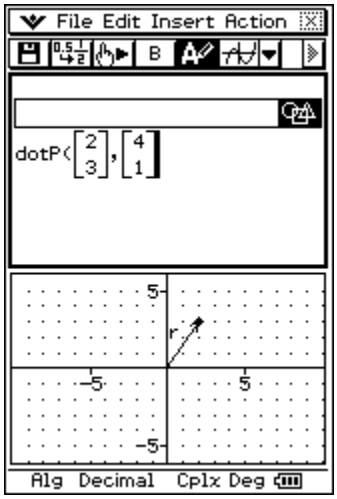


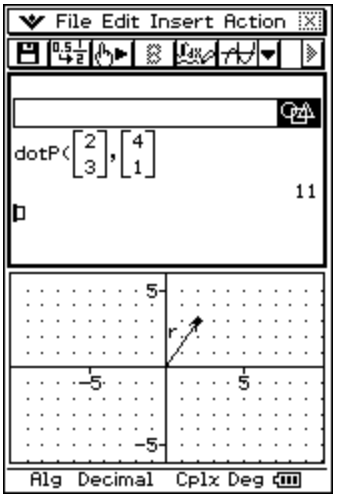
****Select the second vector and drag it to the Geometry window. Draw vector $\vec{s}$ just as you did $\vec{r}$.**

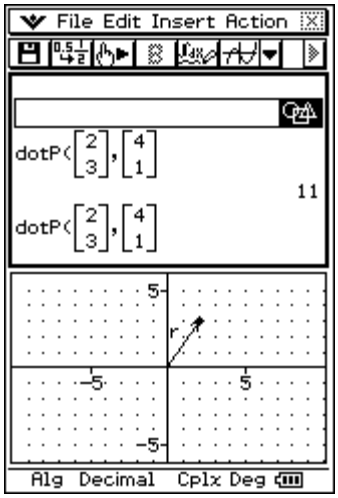
In eActivity, tap on the line containing our expression and change to math (toggle the u button to the < button).

Press EXE. Notice the value of the dot product (soon to make sense).

Select the dotP expression and drag to the next line for editing.





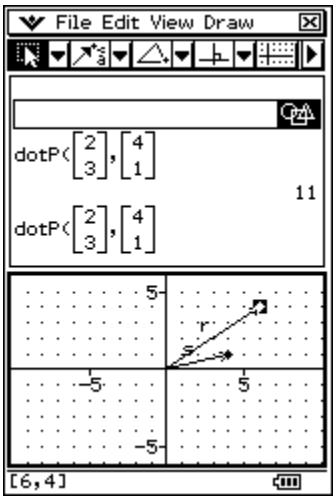


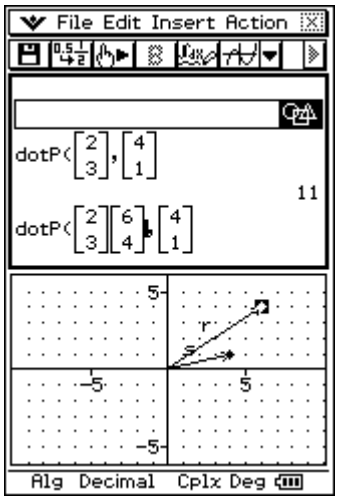
Take a moment to read the questions below and then experiment with the dot product to discover the answers. Select a vector, move it and then drag it back to eActivity to replace either $\vec{r}$ or $\vec{s}$ **.** For example, you can:

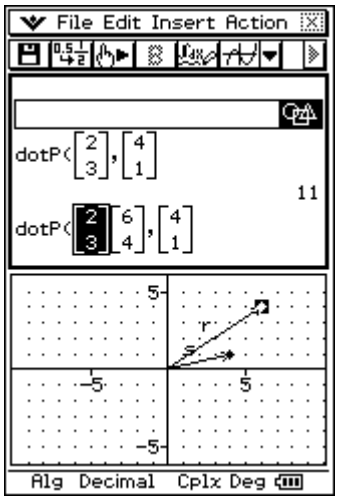
Tap the head of vector $\vec{r}$ **,** release, then press and drag to a new location.

Press on the new head and drag to eActivity. Drop following the older $\vec{r}$ **.**

Select the older $\vec{r}$ and press the K to delete it. Press EXE.







Questions

1. When is the dot product positive? List two sets of vectors whose dot product is positive.

2. When is the dot product negative? List two sets of vectors whose dot product is negative.

3. What can you conjecture about two vectors with a small dot product opposed to a dot product that is large?

4. When is the dot product zero? List two vectors whose dot product is zero.

In conclusion, when we learn the dot product, we are usually given two formulas to find the dot product of two vectors, namely:

$$\vec{r} \bullet \vec{s} = r_1 s_1 + r_2 s_2 + \ldots + r_n s_n \text{ and } \vec{r} \bullet \vec{s} = \|\vec{r}\| \|\vec{s}\| \cos(\theta)$$

Here $\|\vec{r}\|$ is the norm of $\vec{r}$ calculated $\|\vec{r}\| = \sqrt{r_1^2 + r_2^2 + \ldots + r_n^2}$ and θ is the angle of separation between the two vectors. The previous activity is designed to be done before we introduced the second formula above. Following the activity, introduce the second formula and have students explain how this formula helps them show algebraically what they saw visually.

Additional Questions/Ideas to Explore with the ClassPad:

1. Use the formulas above to calculate the angle of separation between our original vectors $\vec{r} = \begin{bmatrix} 2 \\ 3 \end{bmatrix}$ and $\vec{s} = \begin{bmatrix} 4 \\ 1 \end{bmatrix}$.

2. Two people start walking from the same point. One person walks 2 miles east and then 3 miles south. Another person walks 3 miles east and 2 miles north. What is the angle of separation between these two people?

Visit our webpage at http://www.classpad101.com/materials/ for Additional Activities.