Warm - Up

A force of 50 lb acts on an object at an angle of 45° while a second force of 75 lb acts on the same object at an angle of -30°. Find the magnitude and direction of the resultant vector.

SWBAT multiply vectors using the dot product

Agenda:

- Warm-Up
- HW Q's
- Learn Dot Product
- Small Self discovery activity
- Exit Card

Dot Product: Given u = $\langle u_1, u_2 \rangle$ and v = $\langle v_1, v_2 \rangle$

then $u \bullet v = u_1 v_1 + u_2 v_2$

Properties of the Dot Product

Let u, v, and w be vectors and let c be a scalar:

1) $u \bullet v = v \bullet u$
2) $u \bullet u = |u|^2$
3) $0 \bullet u = 0$
4) u(v + w) = uv + uw
5) (cu)v = u(cv) = c(uv)

Find the dot product

a) $\langle 3,4 \rangle * \langle 5, 2 \rangle$

b) $\langle 1, -2 \rangle * \langle -4, 3 \rangle$

c) (2i - j) * (3i - 5j)

Use the dot product to find the length of the vector b = <7, 3>

Angle Between Two Vectors

If θ is the angle between the nonzero vectors of u and v, then

$$\cos \theta = \frac{u \bullet v}{|u||v|}$$

$$\text{and } \theta = \cos^{-1} \frac{u \bullet v}{|u||v|}$$

Find the angle between the vector <2,3> and <-2,5>

Get into small groups and take 10 - 15 minutes to answer the front side of the worksheet.

Be ready to share your findings.

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What did we find out perpendicular lines?

If vector **u** and **v** are perpendicular, that is, if the angle between them is 90^o, then

$$|u||v|\cos 90^o = 0$$

Orthogonal Vectors

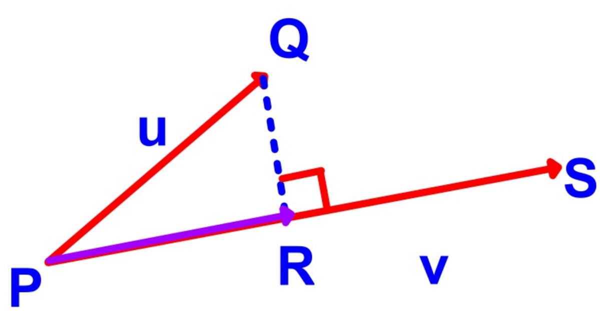
The vectors **u** and **v** are orthogonal IFF $\mathbf{u} \bullet \mathbf{v} = 0$

Orthogonal and Perpendicular

Basically the same except with the zero vector

zero vector is not perpendicular to any thing but is orthogonal to everything

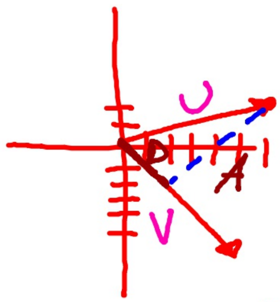
Vector Projections



if **u** and **v** are nonzero vectors, the projection of **u** onto **v** is

$$\text{proj}_{\mathbf{v}}\mathbf{u} = \frac{\mathbf{u}\bullet\mathbf{v}}{|\mathbf{v}|^2}\,\mathbf{v}$$

Find the vector projection of **u** = <6, 2> onto **v** = <5, -5>. Then write **u** as the sum of two orthogonal vectors, one of which is $\text{proj}_v \mathbf{u}$.



$$\text{proj}_v U = \frac{(6,2)\cdot(5,-5)}{\left(\sqrt{5^2 + -5^2}\right)^2}\langle 5,-5\rangle$$

$$= \frac{20}{50}\langle 5,-5\rangle$$

$$D = \langle 2,-2\rangle$$

$$U = D + A$$

$$\langle 6,2\rangle = \langle 2,-2\rangle + A$$

$$\langle 4,4\rangle = A$$

Juan is sitting on a sled on the side of a hill inclined at 45°. The combined weight of Juan and the sled is 140 lbs. What force is required for Rachel to keep the sled from sliding down the hill.

Work:

If **F** is a constant force whose direction is the same as teh direction of AB, then the work W done by **F** in moving an object from A to B is

$$W = |\mathbf{F}||AB|$$

If **F** is a sontant force in any direction, then the **work** W done by **F** in moving an object from A to B is

$$W = \mathbf{F} \bullet AB$$
$$= |\mathbf{F}||AB|\cos\theta$$

Example

Find the work done by a 10 pound force acting in the direction <1,2> in moving an object 3 ft from (0,0) to (3,0).