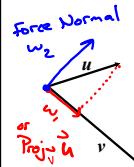# Advanced Math

6-4
(Day 2)

Vectors: Components and Work

Vector Components : Let u and v be non-zero vectors and
$u = w_1 + w_2$, where w_1 and w_2 are orthogonal and w_1 is parallel to v.

w_1 is called the force parallel or the projection of u onto v.

w_2 is called the force normal or the force perpendicular.

*) Draw the the projection of u onto v and the force perpendicular (w_1 and w_2) in the appropriate position at the right. Label the diagram appropriately.

Force Normal w_2

u

w_1 or $Proj_{\vec{v}}\vec{u}$

v

Find the projection of u onto v and the vector component of u orthogonal to v.

$Proj_{\vec{v}}\vec{u} \rightarrow$ Force Parallel

*1) $u = \langle 5, 1 \rangle$
$v = \langle 3, 6 \rangle$

Force Perpendicular or Force Normal

1) draw Force Parallel $\vec{w_1}$
2) draw Force Normal $\vec{w_2}$
3) Find angle of w_1 (θ) or $\vec{v}$

$\theta = tan^{-1}\left(\frac{6}{3}\right)$

Quad I : 63.43°

4) Find angle between $\vec{u} + \vec{v}$

$\theta = cos^{-1}\left(\frac{\vec{u}\cdot\vec{v}}{\|\vec{u}\|\|\vec{v}\|}\right) = cos^{-1}\left(\frac{5\cdot3+6\cdot1}{\sqrt{26}\sqrt{45}}\right) = 52.125°$

5) Find angle of $\vec{w_2}$ (Normal)

$63.43° - 90 = -26.57°$ or $333.43°$

6) Find $\|w_1\|$

$cos\,52.125° = \frac{\|w_1\|}{\sqrt{26}}$

$3.130 = \|w_1\|$

7) Find $\|\vec{w_2}\|$

$sin\,52.125° = \frac{\|w_2\|}{\sqrt{26}}$

$4.025 = \|w_2\|$

$\|w_1\|$ $\|w_2\|$
52.125°
$\sqrt{26}$

8) $Proj_{\vec{v}}\vec{u} = \vec{w_1} = 3.130\left(\vec{i}\cos 63.43° + \vec{j}\sin 63.43°\right) = \langle 1.400, 2.799 \rangle$

9) Force Normal $= \vec{w_2} = 4.025\left(\vec{i}\cos 333.43° + \vec{j}\sin 333.43°\right)$

$= \langle 3.600, -1.800 \rangle$
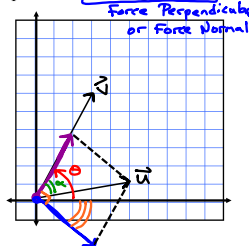
Assignment:
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35-38 all