MAT 397, Section 001, Spring 2016 Solutions **Quiz 2, February 1**

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Problem 1 (15 points)

a) Show that the vectors $\langle 1,3,2\rangle$ and $\langle 1,-5,7\rangle$ are perpendicular.

Vectors $\vec{u},\vec{v}$ are $\perp \rightleftharpoons \vec{u}\cdot\vec{v}=0$

$\langle 1,3,2\rangle \cdot \langle 1,-5,7\rangle = 1(1)+3(-5)+2(7) = 1-15+14 = 0$

b) Find $\mathbf{a}\cdot\mathbf{b}$ if $|\mathbf{a}|=6$, $|\mathbf{b}|=\sqrt{2}$ and if the angle between $\mathbf{a}$ and $\mathbf{b}$ is 45°.

$\vec{a}\cdot\vec{b} = |\vec{a}||\vec{b}|\cos\theta$

$= 6\cdot\sqrt{2}\cdot\cos 45°$

$= 6\sqrt{2}\cdot 1/\sqrt{2}$

$= 6$

c) Find the angle between $\mathbf{a}=\langle 1,0,-1\rangle$ and $\mathbf{b}=\langle 0,1,-1\rangle$.

We Know...

$\vec{a}\cdot\vec{b} = 1(0)+0(1)+-1(-1)$

$= 1$

$|\vec{a}| = \sqrt{1^2+(0)^2+(-1)^2} = \sqrt{2}$

$|\vec{b}| = \sqrt{0^2+1^2+(-1)^2} = \sqrt{2}$

$\vec{a}\cdot\vec{b} = |\vec{a}||\vec{b}|\cos\theta$

$1 = \sqrt{2}\sqrt{2}\cos\theta$

$1 = 2\cos\theta$

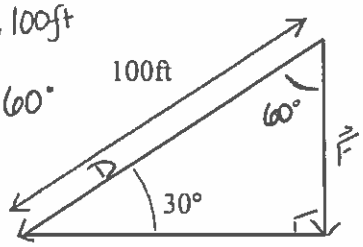
$\cos\theta = 1/2$

$\theta = \cos^{-1}(1/2)$

$\theta = \frac{\pi}{3}$ or $60°$

Problem 2 (5 points)

Suppose a sled of mass 18 ~~lb~~ Kg slides down a hill inclined at an angle of 30°. If the length of the hill is 100 ~~ft~~ m (see figure), what is the work done by the gravitational force?



* If 18lb, 100ft

1) $18\cdot 100\cos 60°$

or

2) $18\cdot 50$

$\times \sin 30°$

As lb's is a force (g is a mass)

$g = 9.81 \approx 10$

$|F| = mg = 18\cdot 10 = 180$

$W = \vec{F}\cdot\vec{D}$

$= |\vec{F}||\vec{D}|\cos\theta$

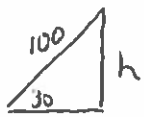
$= 180\cdot 100\cos 60°$

$= 180\cdot 100\cdot 1/2$

$= 18000\cdot 1/2$

$= 9000\ J$

OR



$h = 100\sin 30°$

$= 100\cdot 1/2$

$= 50$

$W = Fd$

$= 180\cdot 50$

$= 9000\ J$