MATH 2574 (Calculus III)
Fri 27 Jan 2017

In-Class Quiz 1:
Vectors and vector-valued functions (§11.1-11.6)

Directions: This quiz is due at the end of lecture.

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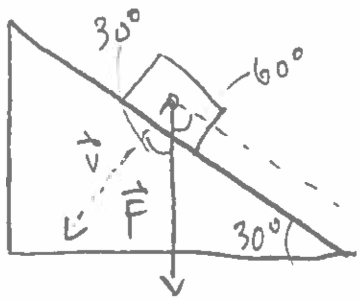
1. **(3 pts)** A block weighing w pounds rests on a ramp with an incline of 30 degrees. If $\mathbf{F}$ is the gravitational force on the block then use the projection formula to find its normal component.

$\vec{v}$ = vector in the normal direction to $\vec{F}$

$= \langle -1, -\sqrt{3} \rangle$



$\vec{N}$ = normal component of $\vec{F}$

$$= \text{proj}_{\vec{v}} \vec{F} = \frac{\vec{F} \cdot \vec{v}}{\vec{v} \cdot \vec{v}} \vec{v} = \frac{0(-1) + (-w)(-\sqrt{3})}{(-1)^2 + (-\sqrt{3})^2} \langle -1, -\sqrt{3} \rangle$$

$$= \frac{\sqrt{3}w}{4} \langle -1, -\sqrt{3} \rangle = \boxed{\left\langle -\frac{\sqrt{3}w}{4}, -\frac{3w}{4} \right\rangle}$$

2. **(1 pt)** If $\mathbf{u}$ and $\mathbf{v}$ form two adjacent sides of a parallelogram, then the area of the parallelogram is:

$|\vec{u} \times \vec{v}|$

3. **(3 pts)** Suppose $\mathbf{r}(t) = \langle x_0, y_0, z_0 \rangle + t\langle a, b, c \rangle$ is the equation of the line ℓ passing through the point (x_0, y_0, z_0) and parallel to the vector $\langle a, b, c \rangle$. What is the equation of the projection of ℓ into the zx-plane?

In the zx-plane, $y = 0$.

$x = x_0 + at$

$z = z_0 + ct$

$\Rightarrow t = \dfrac{z - z_0}{c}$

$\Rightarrow x = x_0 + a\left(\dfrac{z - z_0}{c}\right)$

$\Rightarrow \boxed{x = \dfrac{a}{c} z + \left(x_0 - \dfrac{z_0}{c}\right)}$ ← equation of a line

4. **(1 pt)** A vector-valued function $\mathbf{r}(t)$ is continuous at $t = a$ provided that

$$\lim_{t \to a} \mathbf{r}(t) = \vec{r}(a)$$

5. **(2 pts)** Let $\mathbf{r}(t) = \langle 1, 2t, 3t^2 \rangle$. Compute $\int \mathbf{r}(t)\, dt$.

$= \langle t, t^2, t^3 \rangle + \vec{C}$

↑ constant vector