your name_____

Physics 321 Quiz #1 - Wednesday, Sep. 3

1. (5 pts) On your homework you derived the relation,

$$\sum_k \epsilon_{ijk}\epsilon_{kmn} = \delta_{im}\delta_{jn} - \delta_{in}\delta_{jm}.$$

Use this result to prove

$$\vec{A} \times (\vec{B} \times \vec{C}) = (\vec{A} \cdot \vec{C})\vec{B} - (\vec{A} \cdot \vec{B})\vec{C}.$$

$$\begin{aligned}
[\vec{A} \times (\vec{B} \times \vec{C})]_i &= \sum_{jklm} \epsilon_{ijk} A_j \epsilon_{klm} B_l C_m && (1)\\
&= \sum_{jlm} A_j B_l C_m (\delta_{il}\delta_{jm} - \delta_{im}\delta_{jl}) && (2)\\
&= B_i(\vec{A} \cdot C) - C_i(\vec{A} \cdot \vec{B}). && (3)
\end{aligned}$$

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2. (5 pts) The height of a hill is given by the formula

$$z = 2xy - 3x^2 - 4y^2 - 18x + 28y + 12.$$

Here z is the height in meters and x and y are the east-west and north-south coordinates. Find the position x, y where the hill is the highest, and give its height.

$$\begin{aligned} \partial_x z &= 0 = 2y - 6x - 18 \\ \partial_y z &= 0 = 2x - 8y + 28 \end{aligned}$$

Solve 2 eq.s, 2 unk.s

$$x = -2, y = 3.$$

Plug back into expression for z and get $z = 72$.