① Which expression makes sense: (where · is dot-product)

  a) $\vec{a} \cdot \vec{b} \cdot \vec{c}$

  b) $\|\vec{a}\| (\vec{b} + \vec{c})$

  c) $\vec{a} + \vec{b} + \vec{c}$

  d) $\vec{a} \cdot \vec{b} + \vec{c}$

  e) $\|\vec{a}\| (\|\vec{b} \cdot \vec{c}\|)$ Note: $\text{comp}_{\vec{a}}(\vec{b}) = \|\text{proj}_{\vec{a}}(\vec{b})\|$

② Find $\text{proj}_{\vec{a}}(\vec{b})$ and $\text{comp}_{\vec{a}}(\vec{b})$ for

  a) $\vec{a} = \langle 3, -4 \rangle$ and $\vec{b} = \langle 5, 0 \rangle$

  b) $\vec{a} = \langle 3, 6, -2 \rangle$ and $\vec{b} = \langle 1, 2, 3 \rangle$

③ ✕ The vector $\text{orth}_{\vec{a}}(\vec{b}) = \vec{b} - \text{proj}_{\vec{a}}(\vec{b})$ is called the

  orthogonal projection of $\vec{b}$. Show that

  $\text{orth}_{\vec{a}}(\vec{b})$ is orthogonal to $\vec{a}$. ← and draw a picture showing these vectors

④ Find the work done by a force $\vec{F} = 8i - 6j + 9k$

  that moves an object from the point $(0, 10, 8)$ to the

  point $(6, 12, 20)$ along a straight line.

⑤ A sled is pulled along a level path through

  snow by a rope. A 30 lb force acting at an angle

  of $40°$ moves sled 80 feet. Find the work done

  by the force.

⑥ Find the angle between a diagonal of a cube

  and one of its edges.

⑦ Find the cross product $\vec{a} \times \vec{b}$ for

a) $\vec{a} = \langle 6, 0, -2 \rangle$, $\vec{b} = \langle 0, 8, 0 \rangle$

b) $\vec{a} = \langle 1, 1, -1 \rangle$, $\vec{b} = \langle 2, 4, 6 \rangle$

c) $\vec{a} = \langle t, t^2, t^3 \rangle$, $\vec{b} = \langle 1, 2t, 3t^2 \rangle$

⑧ Prove that $\vec{a} \times \vec{a} = 0$ and that

$\vec{a} \times \vec{b}$ is perpendicular to $\vec{a}$ and to $\vec{b}$

⑨ Which expression does <u>not</u> make sense?

a) $\vec{a} \cdot (\vec{b} \times \vec{c})$ b) $\vec{a} \times (\vec{b} \cdot \vec{c})$

c) $\vec{a} \times (\vec{b} \times \vec{c})$ d) $(\vec{a} \cdot \vec{b}) \times \vec{c}$

e) $(\vec{a} \cdot \vec{b}) \times (\vec{c} \cdot \vec{d})$ f) $(\vec{a} \times \vec{b}) \cdot (\vec{c} \times \vec{d})$

⑩ Is the cross product commutative, i.e. is

$\vec{a} \times \vec{b} = \vec{b} \times \vec{a}$ (try some examples first)

⑪ Find <u>two</u> unit vectors perpendicular to both

$\langle 1, -1, 1 \rangle$ and $\langle 0, 4, 4 \rangle$

⑫ If $\vec{a} \cdot \vec{b} = \vec{a} \cdot \vec{c}$ does it follow that $\vec{b} = \vec{c}$?

If $\vec{a} \times \vec{b} = \vec{a} \times \vec{c}$ does it follow that $\vec{b} = \vec{c}$?