# Answer on Question #46883 – Math – Vector Calculus

1. Given that $\boldsymbol{a} = 5\boldsymbol{i} + 2\boldsymbol{j} - \boldsymbol{k}$ and $\boldsymbol{b} = \boldsymbol{i} - 3\boldsymbol{j} + \boldsymbol{k}$. Find $(\boldsymbol{a} + \boldsymbol{b}) \times (\boldsymbol{a} + \boldsymbol{b})$.
   a) $2\boldsymbol{i} - 12\boldsymbol{j} - 34\boldsymbol{k}$
   b) $2\boldsymbol{i} + 12\boldsymbol{j} + 34\boldsymbol{k}$
   c) $2\boldsymbol{i} - 3\boldsymbol{j} + 12\boldsymbol{k}$
   d) $2\boldsymbol{i} + 2\boldsymbol{k}$

**Remark.**

We know, that cross product of identical vectors equal zero. For example, $\boldsymbol{n} \times \boldsymbol{n} = 0$. In our case we have the same situation. But we have no option "zero". I think the condition of question is a little wrong — it must be: find $(\boldsymbol{a} + \boldsymbol{b}) \times (\boldsymbol{a} - \boldsymbol{b})$.

**Solution.**

We know, that cross product $\boldsymbol{n} \times \boldsymbol{m} = \big(n_y m_z - n_z m_y\big)\boldsymbol{i} + (n_z m_x - n_x m_z)\boldsymbol{j} +$

$+\big(n_x m_y - n_y m_x\big)\boldsymbol{k}$.

Now we must find $(\boldsymbol{a} + \boldsymbol{b})$ and $(\boldsymbol{a} - \boldsymbol{b})$:

$\boldsymbol{a} + \boldsymbol{b} = (5 + 1)\boldsymbol{i} + (2 - 3)\boldsymbol{j} + (-1 + 1)\boldsymbol{k} = 6\boldsymbol{i} - \boldsymbol{j}$;

$\boldsymbol{a} - \boldsymbol{b} = (5 - 1)\boldsymbol{i} + (2 + 3)\boldsymbol{j} + (-1 - 1)\boldsymbol{k} = 4\boldsymbol{i} + 5\boldsymbol{j} - 2\boldsymbol{k}$.

And then we can find $(\boldsymbol{a} + \boldsymbol{b}) \times (\boldsymbol{a} - \boldsymbol{b})$:

$$(\boldsymbol{a} + \boldsymbol{b}) \times (\boldsymbol{a} - \boldsymbol{b}) = \begin{vmatrix} \boldsymbol{i} & \boldsymbol{j} & \boldsymbol{k} \\ 6 & -1 & 0 \\ 4 & 5 & -2 \end{vmatrix} =$$

$$= \big((-1)(-2) - 0(5)\big)\boldsymbol{i} + (0 \cdot 4 - 6(-2))\boldsymbol{j} + (6 \cdot 5 - (-1)4)\boldsymbol{k} =$$

$=2\boldsymbol{i} + 12\boldsymbol{j} + 34\boldsymbol{k}$.

**Answer:**

b) $2\boldsymbol{i} + 12\boldsymbol{j} + 34\boldsymbol{k}$ is correct.