

B-5

$$\vec{a}_1 (2; -1; 2)$$

$$\vec{a}_2 (-1; 2; -4)$$

$$\vec{a}_3 (4; 2; 4)$$

$$\vec{a}_1 \cdot \vec{a}_2 = 2 \cdot (-1) + (-1) \cdot 2 + 2 \cdot (-4) = -2 - 2 - 8 = -12$$

$$|\vec{a}_1| = \sqrt{4 + 1 + 4} = \sqrt{9} = 3$$

$$|\vec{a}_2| = \sqrt{1 + 4 + 16} = \sqrt{21}$$

$$a) \cos(\widehat{\vec{a}_1, \vec{a}_2}) = \frac{\vec{a}_1 \cdot \vec{a}_2}{|\vec{a}_1| |\vec{a}_2|} = \frac{-12}{3 \cdot \sqrt{21}} = -\frac{4\sqrt{21}}{21}$$

$$b) \operatorname{pr}_{\vec{a}_2} \vec{a}_1 = \frac{\vec{a}_1 \cdot \vec{a}_2}{|\vec{a}_2|} = \frac{-12}{\sqrt{21}} = -\frac{4\sqrt{21}}{7}$$

$$c) \vec{a}_1 \times \vec{a}_2 = |\vec{a}_1| \cdot |\vec{a}_2| \cdot \sin(\widehat{\vec{a}_1, \vec{a}_2})$$

$$\sin(\widehat{\vec{a}_1, \vec{a}_2}) = \sqrt{1 - \frac{16}{21}} = \frac{\sqrt{5}}{\sqrt{21}} = \frac{\sqrt{105}}{21}$$

$$\vec{a}_1 \times \vec{a}_2 = 3 \cdot \sqrt{21} \cdot \frac{\sqrt{5}}{\sqrt{21}} = 3\sqrt{5}$$

$$\vec{a}_1 \times \vec{a}_2 = \begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ 2 & -1 & 2 \\ -1 & 2 & -4 \end{vmatrix} = \vec{i}(-1 \cdot (-4) - 2 \cdot 2) - \vec{j}(2 \cdot (-4) - 2 \cdot (-1)) + \vec{k}(4 - (-1)(-1)) =$$

$$= 0\vec{i} + 6\vec{j} + 3\vec{k} = (0; 6; 3)$$

$$d) \frac{1}{2} \vec{a}_1 \times \vec{a}_2 = \frac{3\sqrt{5}}{2}$$

$$e) V = \frac{1}{6} \begin{vmatrix} 2 & -1 & 2 \\ -1 & 2 & -4 \\ 4 & 2 & 4 \end{vmatrix} = \frac{1}{6} (4 \cdot 2 \cdot 2 + (-1) \cdot (-4) \cdot 4 + 2 \cdot (-1) \cdot 2 - (2 \cdot 2 \cdot 4 + 2 \cdot 2 \cdot (-4) + (-1) \cdot (-1) \cdot 4)) = \frac{1}{6} \cdot 24 = 4$$

Ответ: а) $-\frac{4\sqrt{21}}{21}$

б) $-\frac{4\sqrt{21}}{7}$

в) $(0, 6; 3) = 3\sqrt{5}$

г) $\frac{3\sqrt{5}}{2}$

е) 4

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