$$\boxed{1.98}$$

$|a_1| = 1 \qquad |a_2| = 2 \qquad (\widehat{a_1, a_2}) = \frac{2\pi}{3}$

а) $|[a_1, a_2]| = |a_1| \cdot |a_2| \cdot \sin\frac{2\pi}{3} = 1 \cdot 2 \cdot \frac{\sqrt{3}}{2} = \sqrt{3}$

б) $|[2a_1 + a_2,\ a_1 + 2a_2]| = |[2a_1, a_1 + 2a_2] + [a_2, a_1 + 2a_2] = \cancel{[a_1, a_1]}\ 2[a_1, a_1 + 2a_2] +$
$+ [a_2, a_1 + 2a_2] = 2\underbrace{[a_1, a_1]}_{0} + 2[a_1, 2a_2] + [a_2, a_1] + 2\underbrace{[a_2, a_2]}_{0} = 4[a_1, a_2] - [a_1, a_2] =$
$= 3[a_1, a_2] = 3 \cdot \sqrt{3}$

в) $|[a_1 + 3a_2,\ 3a_1 - a_2]| = [a_1, 3a_1 - a_2] + [3a_2, 3a_1 - a_2] = [a_1, 3a_1] - [a_1, a_2] + [3a_2, 3a_1] -$
$- [3a_2, a_2] = 3\underbrace{[a_1, a_1]}_{0} - [a_1, a_2] + 3 \cdot 3[a_2, a_1] - 3\underbrace{[a_2, a_2]}_{0} = \cancel{[a_2, a_1] + 9[a_2, a_1]} =$
$\cancel{= 10[a_2, a_1}$
$= -[a_1, a_2] - 9[a_1, a_2] = |-10[a_1, a_2]| = |-10| \cdot \sqrt{3} = 10\sqrt{3}$

$$\boxed{1.99}$$

$a_1, a_2 - ?\ :\ a_1 + a_2 \parallel a_1 - a_2$

Ответ: нужно, чтобы $a_1 \parallel a_2$

$$\boxed{1.104}$$

$[a, p], [a, q], [a, r]$ – компл. при любых a, p, q, r – ?

По определению вектор $[a, p]$ должен быть $\perp$ пл-ти векторов $\bar{a}$ и $\bar{p}$

(компл. с векторами $[a, q]$ и $[a, r]$)

1.105

$\bar{a}=\{3,-1,1\}$ $\bar{b}=\{1,2,0\}$ α,β - ? : $\alpha i+3j+\beta k \parallel [a,b]$

$$[a,b]=\begin{vmatrix} i & j & k \\ 3 & -1 & 1 \\ 1 & 2 & 0 \end{vmatrix} = i\begin{vmatrix} -1 & 1 \\ 2 & 0 \end{vmatrix} - j\begin{vmatrix} 3 & 1 \\ 1 & 0 \end{vmatrix} + k\begin{vmatrix} 3 & -1 \\ 1 & 2 \end{vmatrix} = -2i+j+7k$$

$$\frac{\alpha}{-2}=\frac{\beta}{7}=\frac{3}{1} \Rightarrow \alpha=-6;\ \beta=21$$

1.112

$\bar{a}=\{2,1,-3\}$ $\bar{b}=\{1,-1,1\}$ $[a,a+b]+[a,[a,b]]$ - ?

$$[a,b]=\begin{vmatrix} i & j & k \\ 2 & 1 & -3 \\ 1 & -1 & 1 \end{vmatrix} = i\begin{vmatrix} 1 & -3 \\ -1 & 1 \end{vmatrix} - j\begin{vmatrix} 2 & -3 \\ 1 & 1 \end{vmatrix} + k\begin{vmatrix} 2 & 1 \\ 1 & -1 \end{vmatrix} = 4i-5j-3k$$

$a+b=\{3,0,-2\}$

$$[a,a+b]=\begin{vmatrix} i & j & k \\ 2 & 1 & -3 \\ 3 & 0 & -2 \end{vmatrix} = i\begin{vmatrix} 1 & -3 \\ 0 & -2 \end{vmatrix} - j\begin{vmatrix} 2 & -3 \\ 3 & -2 \end{vmatrix} + k\begin{vmatrix} 2 & 1 \\ 3 & 0 \end{vmatrix} = -2i-5j-3k$$

$$[a,[a,b]]=\begin{vmatrix} i & j & k \\ 2 & 1 & -3 \\ 4 & -5 & -3 \end{vmatrix} = i\begin{vmatrix} 1 & -3 \\ -5 & -3 \end{vmatrix} - j\begin{vmatrix} 2 & -3 \\ 4 & -3 \end{vmatrix} + k\begin{vmatrix} 2 & 1 \\ 4 & -5 \end{vmatrix} = -18i-6j-14k$$

$$[a,a+b]+[a,[a,b]] = -2i-5j-3k-18i-6j-14k = -20i-11j-17k$$

1.113

$A(2,2,3)$ $B(1,0,4)$ $C(2,3,5)$ $[\overline{AB}+\overline{AC},[\overline{BC},\overline{AB}]]$ - ?

$\overline{AB}(-1,-2,1)$ $\overline{AC}(0,1,2)$ $\overline{BC}(1,3,1)$

$\overline{AB}+\overline{AC}=(-1,-1,3)$

$$[\overline{BC},\overline{AB}]=\begin{vmatrix} i & j & k \\ 1 & 3 & 1 \\ -1 & -2 & 1 \end{vmatrix} = i\begin{vmatrix} 3 & 1 \\ -2 & 1 \end{vmatrix} - j\begin{vmatrix} 1 & 1 \\ -1 & 1 \end{vmatrix} + k\begin{vmatrix} 1 & 3 \\ -1 & -2 \end{vmatrix} = 5i-2j+k$$

$$[\overline{AB}+\overline{AC},[\overline{BC},\overline{AB}]]=\begin{vmatrix} i & j & k \\ -1 & -1 & 3 \\ 5 & -2 & 1 \end{vmatrix} = i\begin{vmatrix} -1 & 3 \\ -2 & 1 \end{vmatrix} - j\begin{vmatrix} -1 & 3 \\ 5 & 1 \end{vmatrix} + k\begin{vmatrix} -1 & -1 \\ 5 & -2 \end{vmatrix} = 5i+16j+7k$$

$\boxed{1.118}$

$\bar{a}_1 = \{4, -2, -3\}$ $\bar{a}_2 = \{0, 1, 3\}$; $\bar{x} \perp \bar{a}_1$ $\bar{x} \perp \bar{a}_2$; $(\widehat{\bar{x}, \bar{j}}) > 90^\circ$; $|x| = 26$

$x(x_x, y_x, z_x) - ?$

$\bar{x} \perp \bar{a}_1 \Rightarrow (\bar{x}, \bar{a}_1) = 0 \Rightarrow 4 \cdot x_x - 2 \cdot y_x - 3 z_x = 0$

$\bar{x} \perp \bar{a}_2 \Rightarrow (\bar{x}, \bar{a}_2) = 0 \Rightarrow 0 \cdot x_x + 1 \cdot y_x + 3 \cdot z_x = 0 \Rightarrow y_x + 3 z_x = 0$

$|x| = 26 \Rightarrow \sqrt{x_x^2 + y_x^2 + z_x^2} = 26$

$\begin{cases} 4x_x - 2y_x - 3z_x = 0 \\ y_x + 3z_x = 0 \\ \sqrt{x_x^2 + y_x^2 + z_x^2} = 26 \end{cases}$ $\begin{cases} 4x_x + 6z_x - 3z_x = 0 \\ y_x = -3z_x \\ x_x^2 + y_x^2 + z_x^2 = 676 \end{cases}$ $\begin{cases} 4x_x + 3z_x = 0 \\ y_x = -3z_x \\ x_x^2 + y_x^2 + z_x^2 = 676 \end{cases}$ $\begin{cases} x_x = -\frac{3z_x}{4} \\ y_x = -3z_x \\ \frac{9z^2x}{16} + 9z^2x + z^2x = 676 \end{cases}$

$\frac{9z^2x + 16 \cdot 9z^2x + 16 \cdot z^2x}{16} = 676$

$9z^2x + 16 \cdot 9z^2x + 16 \cdot z^2x = 676 \cdot 16$

$9z^2x + 16 \cdot 10z^2x = 676 \cdot 16$

$169 z^2x = 676 \cdot 16 \Rightarrow z^2x = \frac{\overset{4}{\cancel{676}} \cdot 16}{\cancel{169}} = 64 \Rightarrow z_x = 8 \Rightarrow x_x = -\frac{3 \cdot 8}{4} = -6 \Rightarrow y_x = -24$

$\bar{x} = \{-6, -24, 8\}$