AG 3D - Sbírka I.

35/4.1 PV přímky a) $A[5,-8,2]$, $\vec{u}=(4,3,-1)$

$x = 5+4t$
$y = -8+3t$
$z = 2-t$

35/4.2 PV přímky p; $A \in p \wedge p \parallel \overleftrightarrow{BC}$

a) $A[9,-3,1]$, $B[-4,-7,6]$ $C[2,-5,3]$

$\vec{u} = \vec{BC} = (6;2;-3)$

$x = 9+6t$
$y = -3+2t$
$z = 1-3t$ //

36/4.14 PV roviny dané

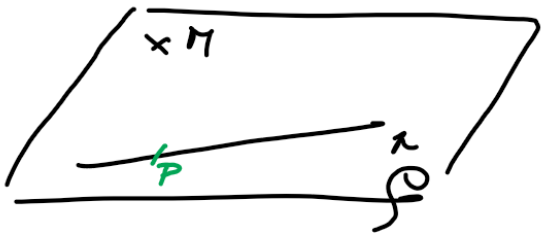
a) $A[1,3,-1]$ $B[2,3,3]$ $C[-2,-5,-7]$

$\vec{u} = \vec{AB} = (1,0,4)$
$\vec{v} = \vec{AC} = (-3,-8,-6)$

$x = 1 + t - 3s$
$y = 3 \quad\quad - 8s$
$z = -1 + 4t - 6s$

37/4.18 PV roviny:

a) $M[3,2,-1]$ a přímkou: $x = 2-t$, $y = 3+2t$, $z = -t$



$P[2,3,0]$

$\vec{u} = (-1,2,-1)$
$\vec{v} = \vec{PM} = (1,-1,-1)$

ρ: $x = 3-t+s$
$y = 2+2t-s$
$z = -1-t-s$

AG3D – Sbírka II.

1) $A[1,0,1]$, $B[-2,1,3]$, $C[4,-1,2]$, $D[1,1,1]$

PV roviny $\overleftrightarrow{ABC}$ a určit zda $D \in \overleftrightarrow{ABC}$

$\vec{u} = \vec{AB} = (-3,1,2)$

$\vec{v} = \vec{AC} = (3,-1,1)$

PV: $x = 1 - 3t + 3s$

$y = t - s$

$z = 1 + 2t + s$

D: $1 = 1 - 3t + 3s \Rightarrow 1 = 1 - 3(1+s) + 3s$

$1 = t - s \Rightarrow t = 1 + s$

$1 = 1 + 2t + s$

$x = 1 - 3 - 3s + 3s$

$0 = -3$

$D \notin \overleftrightarrow{ABC}$

2) PV přímky p procházející bodem $A[2,-1,3]$ a je $\parallel$ s přímkou $\overleftrightarrow{CD}$, $C[2,0,1]$, $D[-1,1,1]$

$\vec{u} = \vec{CD} = (-1,1,0)$

$p: \quad x = 2 - t$

$y = -1 + t$

$z = 3$

38/4.25 najít 3 body v rovině dané ob: $2x - y + 3z - 4 = 0$ které rovina jednoznačně určují

$A[1,1,1]$

$B[0,1,\frac{5}{3}]$

$C[0,0,\frac{4}{3}]$

$2 - 1 + 3z - 4 = 0 \Rightarrow z = 1$

$-1 + 3z - 4 = 0 \Rightarrow 3z = 5 \quad z = \frac{5}{3}$

38/4.27 $\rho: 7x - 8y - 2z + d = 0 \quad A \in \rho \quad A[7,6,-3] \quad d = ?$

$A: \ 49 - 48 + 6 + d = 0 \quad d = -7$

38/4.28 ob rovina procházející 3 body

a) $A[2,-1,0]$ $B[-1,2,-3]$ $C[-2,-3,1]$

$\vec{u} = \vec{AB} = (-3,3,-3) = (-1,1,-1)$

$\vec{v} = \vec{AC} = (-4,-2,1) = (-4,-2,1)$

$\vec{u} \times \vec{v} = (-1,+5,6)$

$\begin{matrix} 1 & -1 \\ -2 & 1 \end{matrix} = 1 - 2 = -1$

ob: $-x + 5y + 6z + d = 0$

$A: \ -2 - 5 + d = 0 \quad d = 7$

$-x + 5y + 6z + 7 = 0$

38/4.29 ob roviny dané PV: $x = 1 - t + 3s$

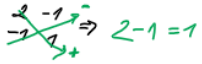
$y = 7 + 2t - s$

$z = -3 - t + s$

$\vec{u} = (-1,2,-1)$ $A[1,7,-3]$

$\vec{v} = (3,-1,1)$

$\vec{u} \times \vec{v} = \vec{n} = (1,-2,-5)$



$\Rightarrow 2 - 1 = 1$

$x - 2y - 5z + d = 0$

$A: \ 1 - 14 + 15 + d = 0 \quad d = -2$

$\rho: x - 2y - 5z - 2 = 0$

38/4.34 ob roviny $A \in \rho$ $A[-3,5,-7]$ $\rho \perp \vec{n}$

$\vec{n} = (1,-2,-1)$

$x - 2y - z + d = 0 \quad A: -3 - 10 + 7 + d = 0 \quad d = 6$

$\rho: x - 2y - z + 6 = 0$

38/4.35 ob roviny proch. bodem $A[2,-3,7]$ a je $\perp$ k přímce

$p: \ x = t$

$y = 2 + 3t$

$z = 1 - t$

$\vec{u} = (1,3,-1) = \vec{n_\rho}$

$x + 3y - z + d = 0$

$A: \ 2 - 9 - 1 + d = 0$

$d = 8$

$\rho: x + 3y - z + 8 = 0$

AG3D - Sbírka III.

39/4.36 OR roviny určené bodem $A[2,-3,1]$ a přímkou $x = t,\ y = 2+3t,\ z = 1-t$

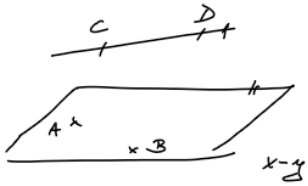
$\vec{u} = (1,3,-1)$ $\quad 5x+2y+11z+d=0$

$B[0,2,1]$ $\quad A:\ 10-6+11+d=0$

$\vec{v} = \vec{AB} = (-2,5,0)$ $\quad d=-15$

$\vec{u}\times\vec{v} = \vec{n_\rho} = (5,2,11)$ $\quad \rho:\ 5x+2y+11z-15=0$

39/4.37 OR roviny procházející body $A[4,-1,2]$, $B[2,0,-1]$ a je $\parallel \rho \overleftrightarrow{CD}$ $C[3,2,-4]$, $D[1,-1,-3]$



$\vec{CD} = \vec{u} = (-2,-3,1)$

$\vec{AB} = \vec{v} = (-2,1,-3)$

$\vec{u}\times\vec{v} = \vec{n_\rho} = (8,-8,-8) = (1,-1,-1)$

$x-y-z+d=0$

$A:\ 4+1-2+d=0 \quad d=-3$ $\quad \rho:\ x-y-z-3=0$

39/4.39 Vzáj. poloha přímek p, q:

a) $p:\ x = 8-4t,\ y = 4+8t,\ z = -12t$ $\quad q:\ x = 3+3s,\ y = 1-6s,\ z = -2+9s$

$\vec{u} = (-4,8,-12) = (-1,2,-3)$ $\quad \vec{v} = (3,-6,9) = (1,-2,3)$

$\vec{u} = -\vec{v} \Rightarrow p \parallel q$

? jsou p a q totožné ?

$P[8,4,0] \to q:\ 8 = 3+3s \Rightarrow s = 5/3$, $4 = 1-6s \Rightarrow s = -1/2$ $\Rightarrow P \notin q$

$p \parallel q$

39/4.40 Vzáj. poloha p a q

$p = \overleftrightarrow{AB}$, $q = \overleftrightarrow{CD}$ $\quad A[2,0,3]$, $B[-2,3,15]$, $C[4,-1,8]$, $D[1,2,-1]$

$\vec{u} = \vec{AB} = (-4,3,12)$

$\vec{v} = \vec{CD} = (-3,3,-9) = (-1,1,-3)$

? $\vec{u} = k.\vec{v}$?

$\vec{u} \neq k.\vec{v} \Rightarrow p \nparallel q$ (různoběžky nebo mimoběžky)

$p:\ x = 2-4t,\ y = 3t,\ z = 3+12t$ $\quad q:\ x = 1-s,\ y = 2+s,\ z = -1-3s$

$p \cap q:\ 1-s = 2-4t$, $2+s = 3t$, $-1-3s = 3+12t$ $\quad *$

$* \quad 3 = 2-t \Rightarrow t = -1,\ s = -5$

ověření 3. rovnicí: $-1+15 \neq 3-12 \Rightarrow p, q$ mimoběžky

40/4.48 Vzáj. poloha rovin ρ a σ

a) $\rho:\ x = 2+3u-v,\ y = 1-9u+v,\ z = -3-12u-2v$

$\vec{a} = (3,-9,-12) = (1,-3,-4)$

$\vec{b} = \quad\quad = (-1,1,-2)$

$\vec{n_\rho} = \vec{a}\times\vec{b} = (10,6,-2) = (5,3,-1)$

$\sigma:\ x = 1-2s+t,\ y = 2s-3t,\ z = 2-4s-4t$

$\vec{c} = (-2,2,-4) = (-1,1,-2)$

$\vec{d} = (1,-3,-4)$

$\vec{n_\sigma} = \vec{n_\rho}$

$\rho \parallel \sigma$ nebo $\rho \equiv \sigma$

$R[2,1,-3]$ $\quad ? R \in \sigma ?$

$2 = 1-2s+t$, $1 = 2s-3t$, $-3 = 2-4s-4t$ $\quad t = -1,\ s = -1$

$-3 = 2+4+4$

$-3 \neq 10 \Rightarrow R \notin \sigma \Rightarrow \rho \parallel \sigma$ (různoběžné)

AG3D – Sbírka IV.

40/451 urči: poloha rovin ρ a σ + průsečnice

a) $\rho: 2x-5y+4z-10=0$ $\quad \sigma: x-y-z-2=0$

$\vec{n}_\rho = (2,-5,4)$, $\vec{n}_\sigma = (1,-1,-1)$ $\Rightarrow \vec{n}_\rho \neq k\vec{n}_\sigma \Rightarrow \rho \nparallel \sigma \Rightarrow$ ex. průsečnice p

$2x-5y+4z-10=0$
$x-y-z-2=0$

$2x-5y = 10-4t$
$x-y = 2+t \quad /\cdot(-2)$ (+)

$z = t$

$-3y = 6-6t \quad /:(-3)$

$y = -2+2t$

$x = 2+t-2+2t = 3t$

$p: x = 3t$
$y = -2+2t$
$z = t$

41/4.57 urči: poloha roviny ρ a přímky p

a) $\rho: x = 1-2r+5s$
$y = 2+3r$
$z = 4s$

$p: x = 4-3t$
$y = 5-3t$
$z = 4-4t$

$P[4,5,4]$

? $p \parallel \rho$?

? $P \in \rho$?

$4 = 1-2r+5s \Rightarrow 4 = 1-2+5 \Rightarrow 4=4 \Rightarrow P \in \rho$
$5 = 2+3r \Rightarrow r = 1$
$4 = 4s \Rightarrow s = 1$

z rovin
kod $Q \in p$: $Q[1,2,0]$
$t=1$

? $Q \in \rho$?
$Q \equiv A \in \rho \Rightarrow Q \in \rho \Rightarrow p \subset \rho$

41/458 urči: poloha ρ a p

c) $\rho: 2x-7y+z-5=0$ $\quad p: x = 4-t$
$y = 8-3t$
$z = 3+2t$

$\vec{n}_\rho = (2,-7,1)$
$\vec{u}_p = (-1,-3,2)$ $\quad \vec{n}_\rho \cdot \vec{u}_p = -2+21+2 = 21 \neq 0$

? $p \parallel \rho$?
$\vec{n}_\rho \perp \vec{u}_p \Rightarrow \vec{n}_\rho \cdot \vec{u}_p = 0$

$\Rightarrow p \nparallel \rho \quad R \in p \cap \rho$

41/460 urči: poloha přímky AB a roviny ρ

e) $A[1,-4,-1]$
$B[7,-4,1]$

$\rho: x+2y-5z+4=0$

? $A \in \rho$? $\quad 1-8+3+4=0 \quad 0=0 \quad A \in \rho$

? $B \in \rho$? $\quad 7-8-3+4=0 \quad 0=0 \quad B \in \rho$

$\Rightarrow \overleftrightarrow{AB} \subset \rho$

AG3D – Sbírka V.

42/4.65 vzáj. poloha p a ϱ + průsečíky

c) $p: \begin{aligned} x &= 7+5t \\ y &= 4+t \\ z &= 5+4t \end{aligned}$ $\quad \varrho: 3x-y+2z-5=0$

? $p \parallel \varrho$? $\vec{u} \cdot \vec{n}_\varrho = 0$

$15-1+8=0 \quad 22 \neq 0$

$\Rightarrow p \nparallel \varrho$

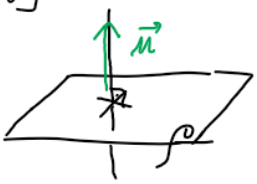
$\vec{u} = (5,1,4)$

$\vec{n}_\varrho = (3,-1,2)$

$R: 3(7+5t)-(4+t)+2(5+4t)-5=0$

$t=-1 \quad x=2, \; y=3, \; z=1$ $\quad R[2;3;1]$

42/4.67 OR roviny procházející $A[1,-3,0]$ a $p \perp$ na p: $\begin{aligned} x &= 1+t \\ y &= 3+2t \\ z &= -7-4t \end{aligned}$



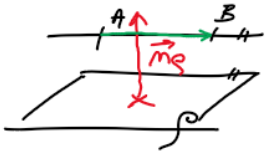
$\vec{u} = (1,2,-4) = \vec{n}_\varrho$

$\varrho: x+2y-4z+d=0$

$A: 1-6+0+d=0 \quad d=5$ $\quad \varrho: x+2y-4z+5=0$

42/4.68 Určete $m \in \mathbb{R}$ tak, aby $\overleftrightarrow{AB} \parallel \varrho$

$A[3,-1,m]$, $B[2,1,3]$, $\varrho: 2x-3y+z-7=0$



$\vec{n}_\varrho = (2,-3,1)$

$\vec{AB} = (-1,2,3-m)$

$\vec{AB} \perp \vec{n}_\varrho \Rightarrow \vec{n}_\varrho \cdot \vec{AB} = 0$

$2(-1)+(-3)\cdot 2+1\cdot(3-m)=0$

$-8+3-m=0$

$m=-5$

42/4.69 vzáj. poloha roviny $x+2y-z+4=0$ a přímky, která je průsečnicí rovin

$\varrho: 2x-y-3z+3=0$, $\sigma: 3x+y-4z+7=0$

$p \in \varrho \cap \sigma \Rightarrow$ PV p:

$\begin{aligned} 2x-y-3z+3 &= 0 \\ 3x+y-4z+7 &= 0 \end{aligned}$

$z=t$

$\left.\begin{aligned} 2x-y &= 3t-3 \\ 3x+y &= 4t-7 \end{aligned}\right\}$ (+)

$5x = 7t-10$

$x = \frac{7}{5}t - 2$

$y = 2x-3t+3 = \frac{14}{5}t - 4 - 3t + 3 = \frac{-1}{5}t - 1$

$p: \begin{aligned} x &= -2+\tfrac{7}{5}t \\ y &= -1-\tfrac{1}{5}t \\ z &= t \end{aligned} \Rightarrow \begin{aligned} x &= -2+7t \\ y &= -7-t \\ z &= 5t \end{aligned}$

$\tau: x+2y-z+4=0$

$\vec{n}_\tau = (1,2,-1)$ $\quad \vec{u}_p = (7,-1,5)$

$\vec{n}_\tau \cdot \vec{u}_p = 7-2-5=0 \Rightarrow \vec{n}_\tau \perp \vec{u}_p \Rightarrow \tau \parallel p$

? $p \subset \tau$?

bod $P[-2,-1,0]$ $\quad \tau: -2-2+0+4=0 \quad 0=0 \Rightarrow P \in \tau$

$\Rightarrow p \subset \tau$ (přímka leží v rovině)

AG3D – Sbírka VI

43/4.73 OR roviny: $M \in \rho \wedge \rho \perp \overleftrightarrow{AB}$

a) $M[3,-1,6]$, $A[3,2,-1]$, $B[5,-1,-3]$

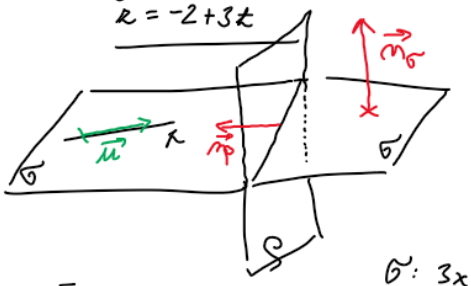
$\vec{u} = \vec{AB} = (2,-3,-2) = \vec{n}_\rho$ $\quad \rho: 2x-3y-2z+d=0$

$M: \quad 6+3-12+d=0 \quad d=3$

$\rho: 2x-3y-2z+3=0$

44/4.77 OR roviny σ: $p \subset \sigma \wedge \sigma \perp \rho$

a) $p: x = 1+6t,\ y = -3-3t,\ z = -2+3t$ $\quad \rho: 6x-y+4z+7=0$



$\vec{n}_\sigma \perp \vec{u}$, $\vec{n}_\sigma \perp \vec{n}_\rho$ $\Rightarrow \vec{n}_\sigma = \vec{u} \times \vec{n}_\rho$

$\vec{u} = (6,-3,+3) = (2,-1,1)$

$\vec{n}_\rho = (6,-1,4)$

$\vec{n}_\sigma = (-3,-2,4) = (3,2,-4)$

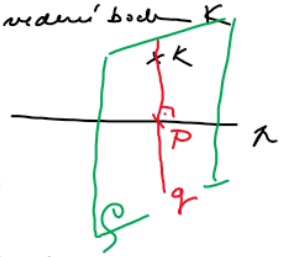
$P[1,-3,-2]$ $\quad \sigma: 3x+2y-4z+d=0$

$P \in \sigma: \quad 3-6+8+d=0 \quad d=-5$

$\sigma: 3x+2y-4z-5=0$

44/4.78 souřadnice paty kolmice vedené bodem K k přímce p

a) $K[5,-4,2]$ $\quad p: x = 1-t,\ y = -4+t,\ z = 7+3t$



$\rho \perp p$, $K \in \rho$? OR ρ?

$\vec{u} = \vec{n}_\rho = (-1,1,3) = (1,-1,-3)$ $\quad \rho: x-y-3z+d=0$

$K: \quad 5+4-6+d=0 \quad d=-6$

$\rho: x-y-3z-6=0$

? $P \in p \wedge \rho$?

$p \to \rho: \quad 1-t+4-t-21-9t-6=0$

$t=-2$

$P[3,-6,1]$

45/4.89 vzdál. bodu $A[5,-1,3]$ od přímky

$p: x = -1+2t,\ y = -5+3t,\ z = -2+2t$

$|AR| = r(A,p)$

$\rho \perp p$, $A \in \rho$ $\quad \vec{u} = \vec{n}_\rho = (2,3,2)$ $\quad \rho: 2x+3y+2z+d=0$

$p \cap \rho: \quad -2+4t-15+9t-4+4t-13=0$ $\quad A: \quad 10-3+6+d=0 \quad d=-13$

$t=2$ $\quad \rho: 2x+3y+2z-13=0$

$R[3,1,2]$ $\quad |AR| = \sqrt{(3-5)^2+(1+1)^2+(2-3)^2} = \sqrt{4+4+1} = 3$

$r(A,p) = 3$

45/4.92 vzdál. bodu $A[3,5,-6]$ od roviny $\rho: 2x-2y+z-8=0$

$$d(A,\rho) = \frac{|a\cdot a_1 + b a_2 + c a_3 + d|}{\sqrt{a^2+b^2+c^2}} \qquad \vec{n}_\rho = (2,-2,1)$$

$$d(A,\rho) = \frac{|3\cdot 2 - 2\cdot 5 - 6 - 8|}{\sqrt{4+4+1}} = \frac{18}{3} = 6$$

AG3D – Sbírka VII.

45/4.94 Dokažte, že $\rho \parallel \sigma$ a určete $\nu(\rho,\sigma)$

$\rho: x+y+z-6=0$ $\quad \vec{n}_\rho = \vec{n}_\sigma \Rightarrow \rho \parallel \sigma$

$\sigma: x+y+z-3=0$

zvolíme $A \in \rho: \; A[0;0;6]$

$$d(A,\sigma) = \frac{|0+0+6-3|}{\sqrt{1^2+1^2+1^2}} = \frac{3}{\sqrt{3}} = \sqrt{3}$$

45/4.95 Dokažte $\rho \parallel \sigma$, $d(\rho,\sigma) = ?$

$\rho: \; x = 2s$
$y = 2r$
$z = 2-r-s \;/\cdot 2$

$\sigma: \; x = 1-u-2v$
$y = u$
$z = v \;/\cdot 2$

$2z = 2-r-s$

$\rho: x+y+2z-4=0$ $\quad \sigma: x+y+2z-1=0$

$\vec{n}_\rho = \vec{n}_\sigma \Rightarrow$
$-4 \neq -1 \Rightarrow$ $\Big\}$ $\rho \parallel \sigma$

$A \in \rho: \; A[0;0;2]$ $\quad d(A,\sigma) = \frac{|0+0+4-1|}{\sqrt{1^2+1^2+2^2}} = \frac{3}{\sqrt{6}} =$

$$= \frac{\sqrt{6}}{2}$$

46/4.97 odchylka ρ a σ

a) $\rho: x+y+2z-5=0$
$\sigma: x-2y-z+3=0$

$|\sphericalangle(\rho,\sigma)| = |\sphericalangle(\vec{n}_\rho, \vec{n}_\sigma)|$

$$\cos\varphi = \frac{|\vec{n}_\rho \cdot \vec{n}_\sigma|}{|\vec{n}_\rho| \cdot |\vec{n}_\sigma|}$$

$\vec{n}_\rho = (1,1,2)$
$\vec{n}_\sigma = (1,-2,-1)$

$$\cos\varphi = \frac{|1-2-2|}{\sqrt{6}\cdot\sqrt{6}} = \frac{3}{6} = \frac{1}{2}$$

$\varphi = 60°$

46/4.98 odchylka rovin

$\rho: 3x+5=0$ $\quad \vec{n}_\rho = (3,0,0)$

$\sigma: \; x = 3+r-2s$
$y = 2-r+2s$
$z = -1-4r$

$\vec{u} = (1,-1,-4)$ $\quad -1 \; -4$
$\vec{v} = (-2,2,0)$ $\quad\;\; 2 \;\; 0$

$\vec{n}_\sigma = (8,8,0) = (1,1,0)$ jde o odlehlost $\vec{n}_\sigma$

$$\cos\varphi = \frac{|24+0+0|}{\sqrt{9}\cdot\sqrt{64+64}} = \frac{24}{3\cdot\sqrt{128}} = \frac{8}{8\cdot\sqrt{2}} = \frac{1}{\sqrt{2}}$$

2.64 $\quad = \frac{\sqrt{2}}{2} \Rightarrow \varphi = 45°$

46/4.99 odchylka přímky p a roviny ρ

$p: \; x = 5+t$
$y = 1+3t$
$z = -2t$

$\rho: 2x-y+3z-4=0$

$\vec{u} = (1;3;-2)$
$\vec{n}_\rho = (2;-1;3)$

$$\cos\psi = \frac{|2-3-6|}{\sqrt{14}\cdot\sqrt{14}} = \frac{7}{14} = \frac{1}{2}$$

$\psi = 60°$ $\quad \varphi = 90° - 60° = 30°$

AG3D – Sbírka VIII.

46/4.100 je dáno: p, σ, ρ

a) $|\sphericalangle p, \rho| = ?$ b) $|\sphericalangle p, \sigma| = ?$ c) $|\sphericalangle \rho, \sigma|$

$p: \begin{aligned} x &= 1+t \\ y &= 2-t \\ z &= t \end{aligned}$ $\rho: 3y + 8 = 0$ $\sigma: \begin{aligned} x &= 5-r-3s \\ y &= 1+r-3s \\ z &= 3+4r \end{aligned}$

a) $\vec{u} = (1,-1,1)$ $\vec{n}_\rho = (0,3,0)$

$\cos\psi = \frac{|-3|}{\sqrt{3}\cdot 3} = \frac{1}{\sqrt{3}} = \frac{\sqrt{3}}{3} \Rightarrow \psi = 54°45'$

$\varphi = 90° - 54°45' = 35°15'$

b) $\vec{a} = (-1,1,4) = (-1,1,4)$

$\vec{b} = (-3,-3,0) = (1,1,0)$

$\vec{a} \times \vec{b} = \vec{n}_\sigma = (12,-12,6) = (2,-2,1)$ 144 144 36 324

$\cos\psi = \frac{|12+12+6|}{\sqrt{3}\cdot\sqrt{324}} = \frac{30}{\sqrt{3}\cdot 18} = \frac{5}{\sqrt{3}\cdot 3}$

$\psi = 15°47'$ $\varphi = 90° - 15°47' = 74°13'$

kontrola: $\vec{n}_\sigma = (-4,4,-2) = (2,-2,1)$

$\cos\psi = \frac{|2+2+1|}{\sqrt{3}\cdot 3} = \frac{5}{\sqrt{3}\cdot 3} \Rightarrow \varphi = 74°13'$

c) $\vec{n}_\rho = (0,3,0)$ $\vec{n}_\sigma = (2,-2,1)$

$\cos\varphi = \frac{|0-6+0|}{\sqrt{3^2}\cdot\sqrt{9}} = \frac{6}{9} = \frac{2}{3}$

$\varphi = 48°11'$

46/4.102 je dáno: p, ρ

a) $|\sphericalangle p, \rho| = ?$ b) $p \cap \rho$

$p: \begin{aligned} x - y + z + 1 &= 0 \\ x + y + 3z - 3 &= 0 \end{aligned}$

$\Rightarrow$?PV?

$z = t$

$x - y = -1 - t$

$x + y = 3 - 3t$

$2x = 2 - 4t$ $1 - 2t + 1 + t = y$

$x = 1 - 2t$ $y = 2 - t$

$\rho: x - y + z = 0$

$p: \begin{aligned} x &= 1-2t \\ y &= 2-t \\ z &= t \end{aligned}$

a) $\vec{u} = (-2,-1,1)$ $\vec{n}_\rho = (1,-1,1)$

$\cos\psi = \frac{|-2+1+1|}{\sqrt{6}\cdot\sqrt{3}} = \frac{0}{\sqrt{18}} = 0$

$\psi = 90° \Rightarrow \varphi = 0°$

b) $P[1,2,0]$

?$P \in \rho$? $1 - 2 + 0 \neq 0$

$P \notin \rho \Rightarrow$

$p \parallel \rho \Rightarrow p \cap \rho = \emptyset$