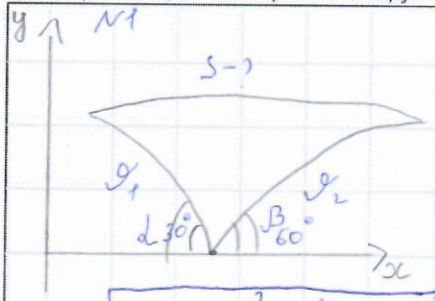
№1



$x_1 = \vartheta_1 \cos\alpha t$

$x_2 = \vartheta_2 \cos\beta t$

$y_1 = \vartheta_1 \sin\alpha t - \frac{gt^2}{2}$

$y_2 = \vartheta_2 \sin\beta t - \frac{gt^2}{2}$

$S = \sqrt{(x_1+x_2)^2 - (y_2-y_1)^2} = \sqrt{(\vartheta_1\cos\alpha t + \vartheta_2\cos\alpha t)^2 - (\vartheta_2\sin\alpha t - \frac{gt^2}{2} - \vartheta_1\sin\alpha t + \frac{gt^2}{2})} =$

$= \sqrt{(\cos\alpha t)^2 \cdot (\vartheta_1+\vartheta_2)^2 + (\sin\alpha t)^2 \cdot (\vartheta_2-\vartheta_1)^2} = t\sqrt{\cos^2\alpha\,(\vartheta_1+\vartheta_2)^2 + \sin^2\alpha(\vartheta_2-\vartheta_1}$

$= t\sqrt{\cos^2\alpha\cdot\vartheta_1^2 + 2\vartheta_1\vartheta_2\cos^2\alpha + \vartheta_2^2\cos^2\alpha + \sin^2\alpha\,\vartheta_2^2 - 2\vartheta_1\vartheta_2\sin^2\alpha + \vartheta_1^2\sin^2\alpha} =$

$= t\sqrt{\vartheta_1^2 + \vartheta_2^2 + 2\vartheta_1\vartheta_2(\cos^2\alpha - \sin^2\alpha)} = t\sqrt{\vartheta_1^2 + \vartheta_2^2 + 2\vartheta_1\vartheta_2\cos 2\alpha} =$

$t\sqrt{5^2 6 + (600 + 2\cdot 24\cdot 400,5} = 1,5\cdot 56 = 84$ м.

№2

$F_1 = k\frac{q^1}{r_1}$

$F_2 = k\frac{q^1}{r_2}$

$q_1^1 + q_2^1 = q_1 + q_2$

$q = q_1 + q_2 = 14\cdot 10^{-9} + (-7\cdot 10^{-9}) = 14\cdot 10^{-9} - 7\cdot 10^{-9} = 7\cdot 10^{-9}$ Кл

$q_2^1 = \frac{(q_1+q_2)r_2}{r_1+r_2} = 5$ нКл

№3

$T_3 = T$

$T_2 = 2T \quad (2=4)$

$T_1 = 2^2 T$

изохора

$A_{3-1} = 0,5\,\nu R\,(T - T_3)$

$\Delta U_{3-1} = 1,5\,\nu R\,(T_1 - T_3)$

$Q_{3-1} = \Delta U_{3-1} + A_{3-1} = 2\,\nu R\,(T_1 - T_3) = 2\,\nu RT\,(2^2 - 1)$

$A = A_{3-1} + A_{2-3} = 0,5\,\nu\,(T_1 - T_3) + \nu R\,(T_3 - T_2) = 0,5\,\nu RT\,(2-1)^2$

$\eta = \frac{A}{Q} = \frac{2-1}{4(2+1)} = 0,15\cdot 100\% = 15\%$