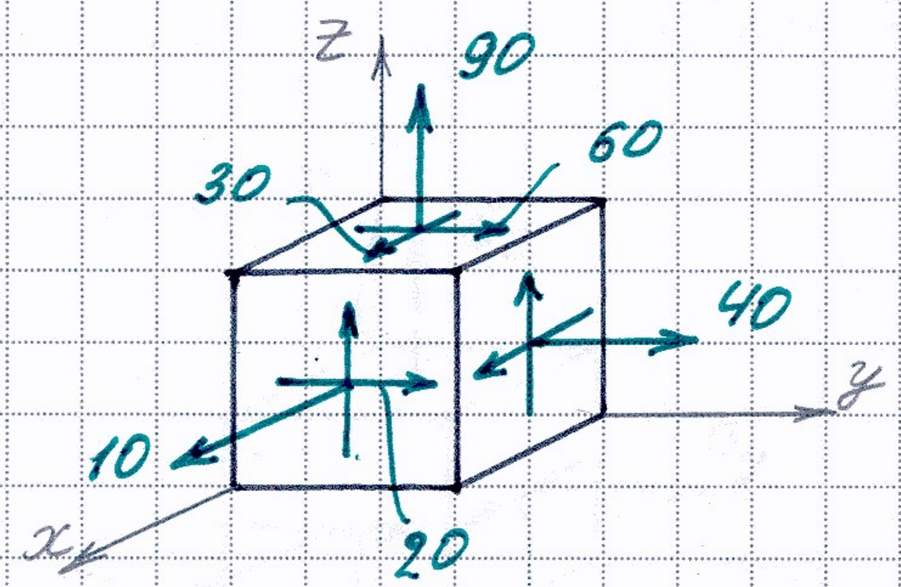
Пример VIII.1



$\sigma_x = +10$ МПа

$\sigma_y = +40$ МПа

$\sigma_z = +90$ МПа

$\tau_{xy} = \tau_{yx} = 20$ МПа

$\tau_{zy} = \tau_{yz} = 60$ МПа

$\tau_{zx} = \tau_{xz} = 30$ МПа

$\sigma_1 = ?$ $\sigma_2 = ?$ $\sigma_3 = ?$

Решение

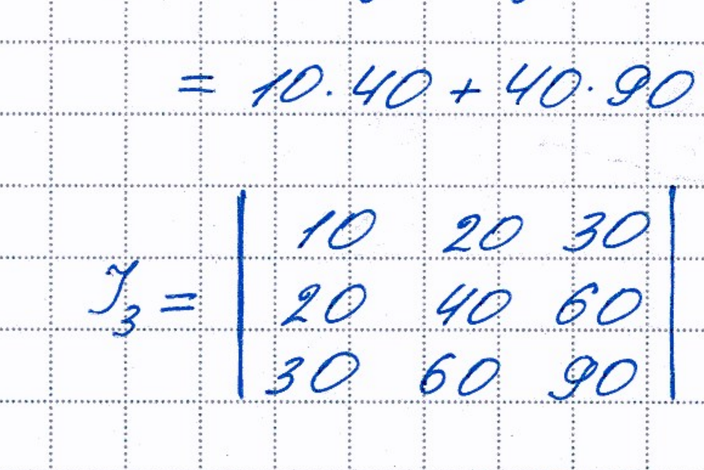
$$J_1 = \sigma_x + \sigma_y + \sigma_z = 10 + 40 + 90 = 140$$

$$J_2 = \sigma_x \cdot \sigma_y + \sigma_y \cdot \sigma_z + \sigma_z \cdot \sigma_x - \tau_{xy}^2 - \tau_{yz}^2 - \tau_{zx}^2 =$$

$$= 10 \cdot 40 + 40 \cdot 90 + 90 \cdot 10 - 60^2 - 20^2 - 30^2 = 0$$

$$J_3 = \begin{vmatrix} 10 & 20 & 30 \\ 20 & 40 & 60 \\ 30 & 60 & 90 \end{vmatrix} = 0$$

$$\sigma^3 - J_1 \sigma^2 + \cancel{J_2 \cdot \sigma}^{\,0} - \cancel{J_3}^{\,0} = 0$$



$$\sigma^3 - 140 \cdot \sigma^2 = 0$$

Корни уравнения: $\sigma' = 0$, $\sigma'' = 0$, $\sigma''' = 140$

$$\sigma_1 \geq \sigma_2 \geq \sigma_3$$

$\left.\begin{array}{l} \sigma_1 = 140 \\ \sigma_2 = 0 \\ \sigma_3 = 0 \end{array}\right\}$ Одноосное напряжённое состояние. ($J_2 = 0$, $J_3 = 0$)