

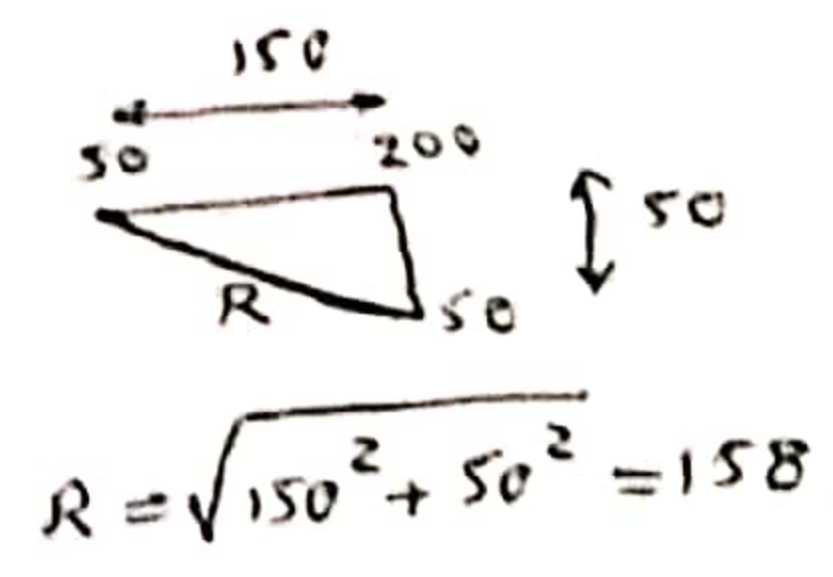
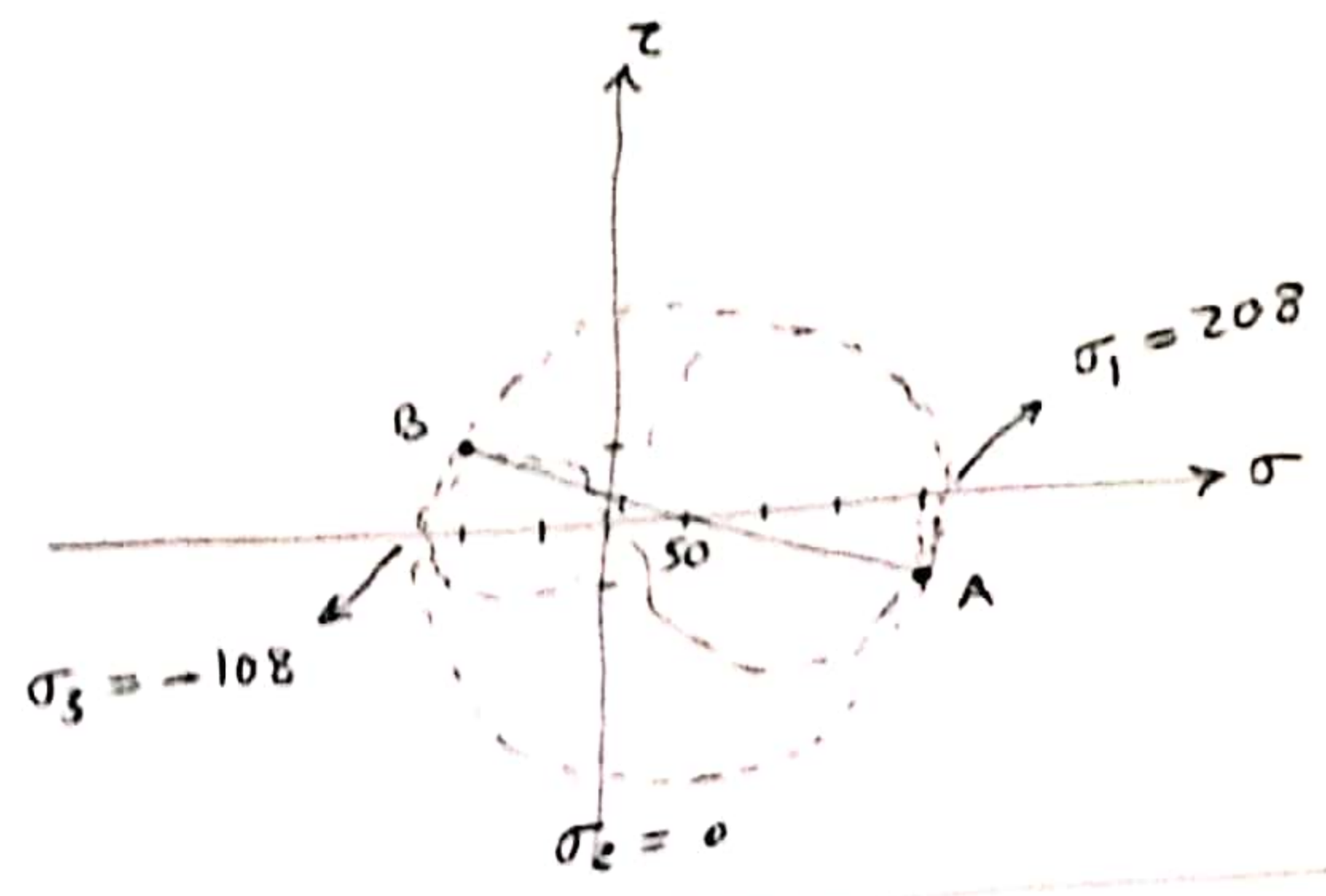
$$\epsilon_f = \frac{\Delta L}{L_0} = \frac{L_f - L_0}{L_0} \begin{cases} \frac{10.8 - 10}{10} = 0.08 \\ \frac{9.4 - 10}{10} = -0.06 \end{cases}$$

$\epsilon_f > 0.05 \Rightarrow$  Material: Ductile  $\rightarrow$   $\left. \begin{matrix} \text{MSS} \\ \text{DE} \\ \text{DCM} \end{matrix} \right\}$  تئوری‌ها

$\sigma_x = 200 \text{ MPa}$   
 $\sigma_y = -100 \text{ MPa}$   
 $\tau_{xy} = 50 \text{ MPa}$

A  $\left| \begin{matrix} 200 \\ -50 \end{matrix} \right.$       B  $\left| \begin{matrix} -100 \\ +50 \end{matrix} \right.$

سازمانهای استاتیکی  
 $\sigma_2 = 0$  در جهت



Theory: MSS  
 ماکزیم تنش برش

$$\sigma_1 - \sigma_3 \stackrel{?}{\gg} S_{yt}$$

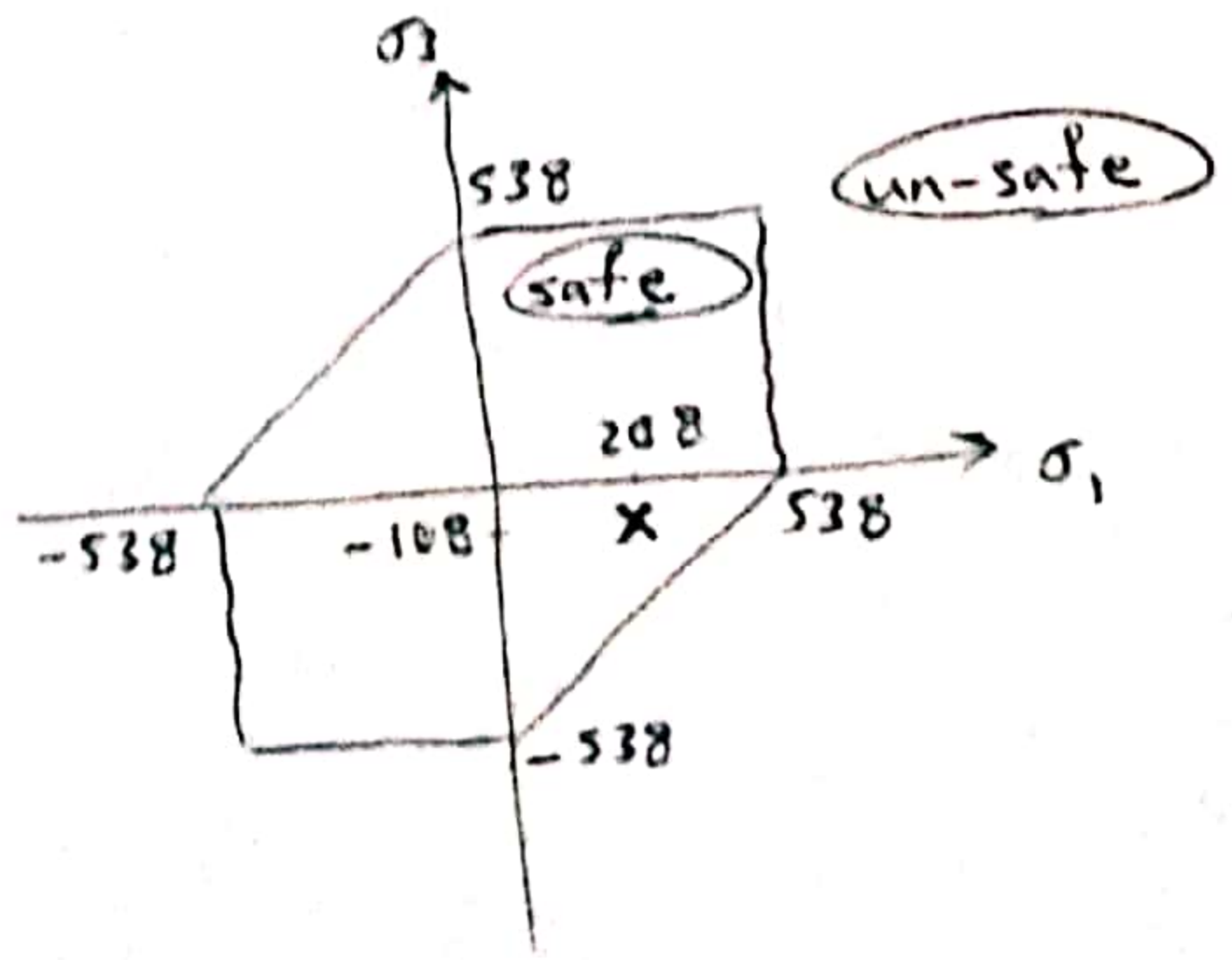
$$208 - (-108) \stackrel{?}{\gg} 538$$

$$316 \stackrel{?}{\gg} 538 \rightarrow \text{نسبت برش کمتر از حد}$$

$$\sigma_1 - \sigma_3 = \frac{S_{yt}}{n}$$

$$\Rightarrow 208 - (-108) = \frac{538}{n} \Rightarrow n = 1.7$$

x نقطه در قبل خط استاتیکی  
 که ناحیه ایمن (safe) است



② Theory: DE  
تشریح

$$\sigma' = \left[ \frac{(\sigma_1 - \sigma_2)^2 + (\sigma_2 - \sigma_3)^2 + (\sigma_3 - \sigma_1)^2}{2} \right]^{1/2}$$

$$\Rightarrow \sigma' = \left[ \frac{(208 - 0)^2 + (0 + 108)^2 + (-108 - 208)^2}{2} \right]^{1/2} = 278 \text{ MPa}$$

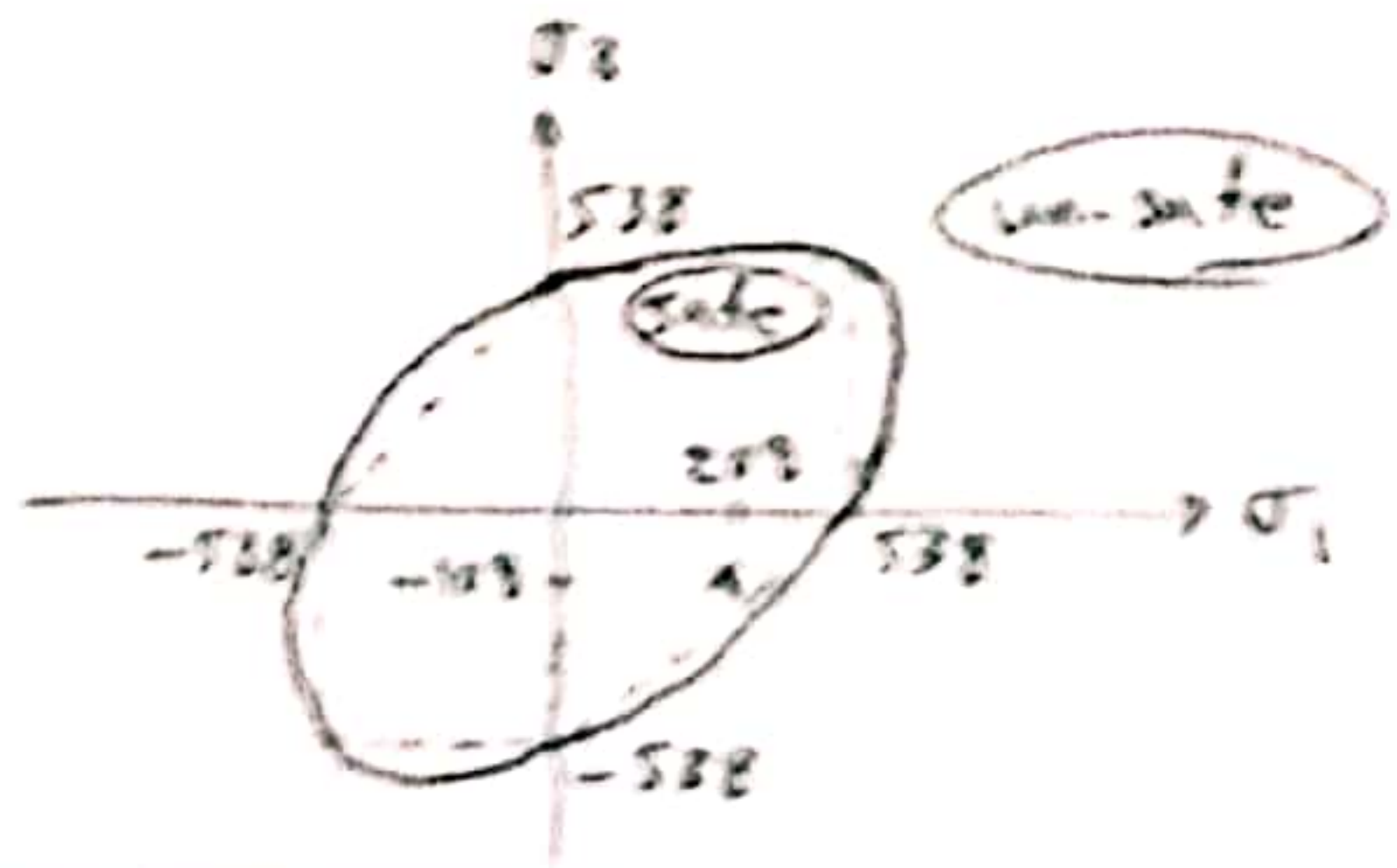
$$\sigma' \geq S_{yt}$$

$$278 \geq 538 \rightarrow \text{تک زخمه!}$$

$$\sigma' = \frac{S_{yt}}{n}$$

$$\Rightarrow 278 = \frac{538}{n} \Rightarrow n = 1.9$$

در نقطه در این خطوط  
که ایمن این (safe) است



Theory: DCM  
کتاب مرادشانی

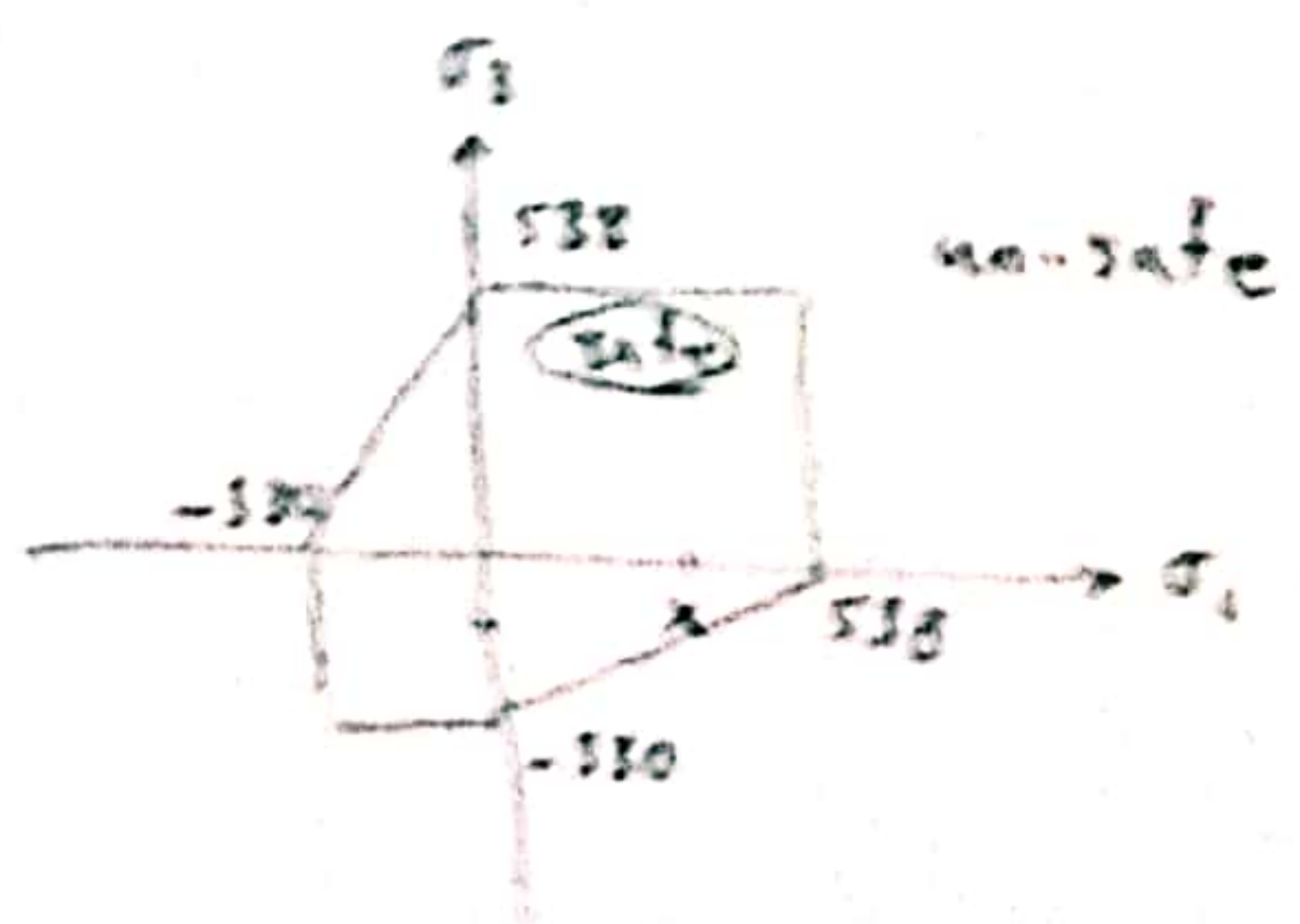
$$\frac{\sigma_1}{S_{yt}} - \frac{\sigma_3}{S_{yc}} \geq 1$$

$$\frac{208}{538} - \frac{-108}{530} \geq 1$$

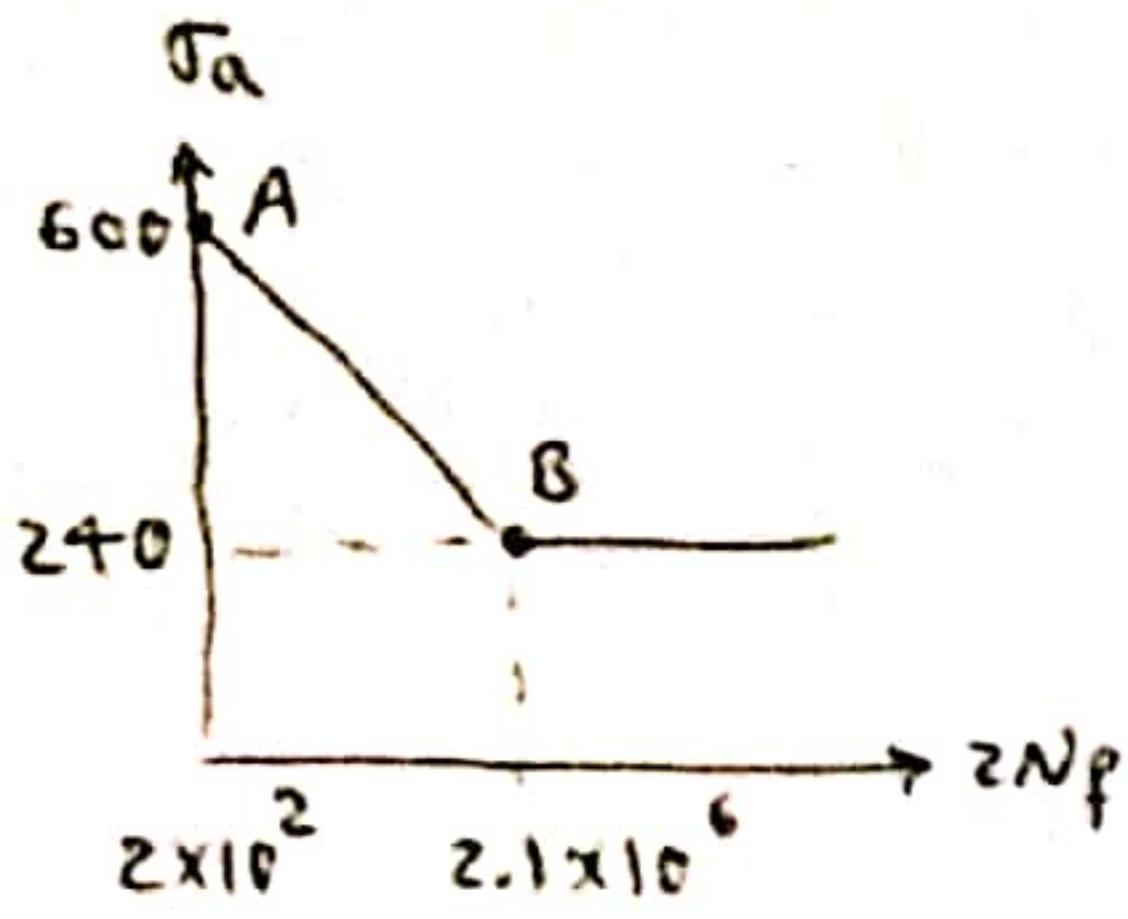
$$0.6 \geq 1 \rightarrow \text{تک زخمه!}$$

$$\frac{\sigma_1}{S_{yt}} - \frac{\sigma_3}{S_{yc}} = \frac{1}{n} \Rightarrow n = 1.7$$

در نقطه در این خطوط  
که ایمن این (safe) است



③

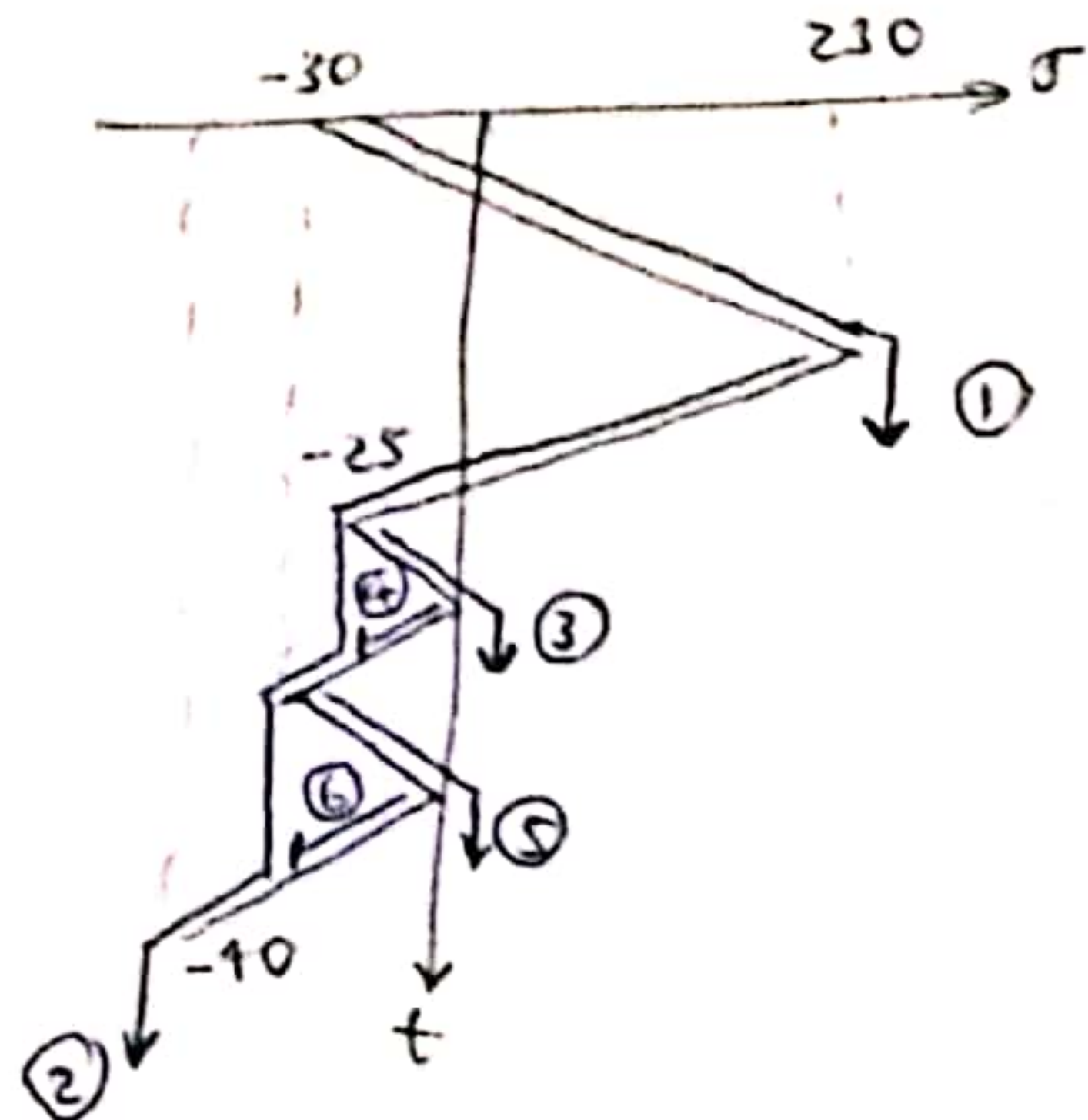
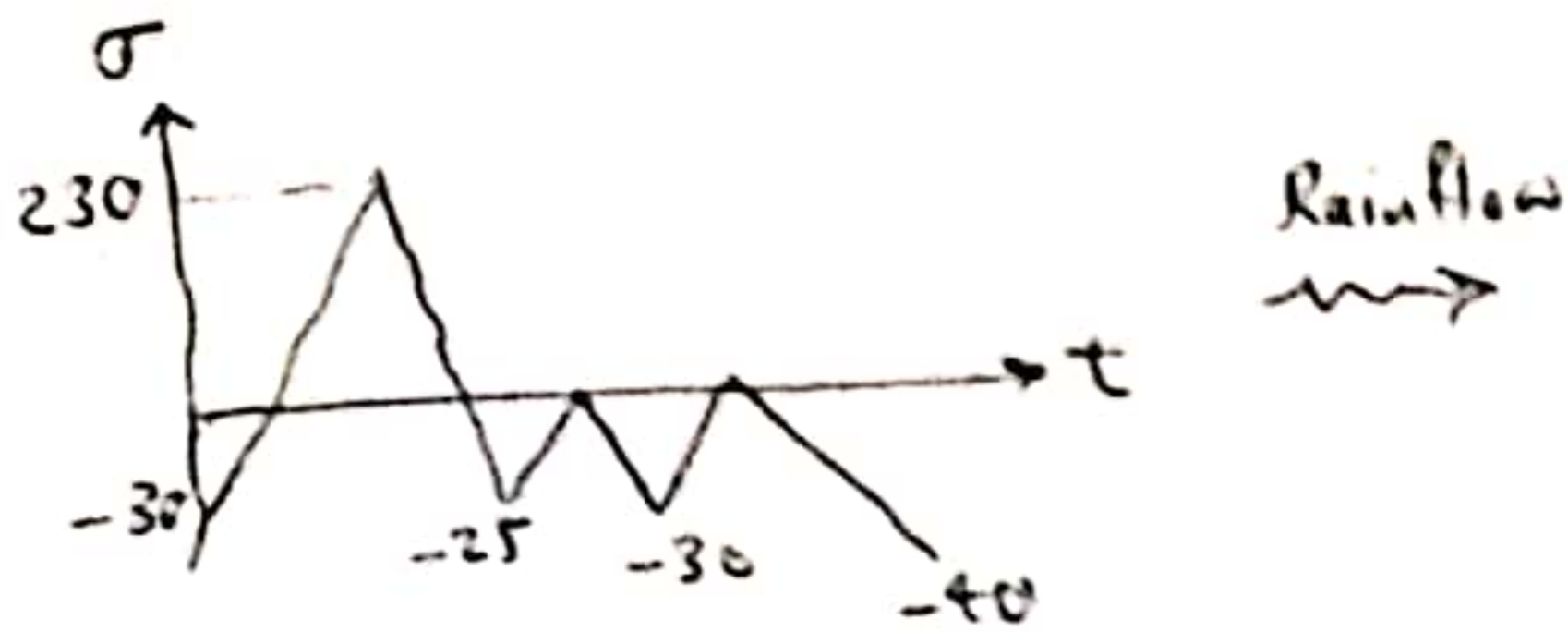


$$\sigma_a = \sigma_f' (zN_f)^b$$

$$\begin{cases} A: 600 = \sigma_f' (2 \times 10^2)^b \\ B: 240 = \sigma_f' (2.1 \times 10^6)^b \end{cases}$$

$$\frac{600}{240} = \left( \frac{2 \times 10^2}{2.1 \times 10^6} \right)^b \Rightarrow \log\left(\frac{600}{240}\right) = b \times \log\left(\frac{2 \times 10^2}{2.1 \times 10^6}\right) \Rightarrow b = -0.1$$

$$A \rightarrow 600 = \sigma_f' (2 \times 10^2)^{-0.1} \Rightarrow \sigma_f' = 1019 \text{ MPa}$$



نقطه	$\sigma_{max}$	$\sigma_{min}$	$\sigma_a$	$\sigma_m$	$\sigma_{a,eq}$	$S_e$	$N_f$ (cycle)
①	230	-30	130	100	152	114	183, 231, 442
②	230	-40	135	95	156	114	141, 253, 754
③	0	-25	12.5	-12.5	12	114	$\infty$
④	0	-25	12.5	-12.5	12	114	$\infty$
⑤	0	-30	15	-15	15	114	$\infty$
⑥	0	-30	15	-15	15	114	$\infty$

$N_f, S_e$  - واحد  
حاصل شده

$$\sigma_a = \frac{\sigma_{max} - \sigma_{min}}{2}$$

$$\sigma_m = \frac{\sigma_{max} + \sigma_{min}}{2}$$

$$\text{Goodman's theory} = \frac{\sigma_a}{\sigma_{a,eq}} + \frac{\sigma_m}{S_{ut}} = 1 \Rightarrow \frac{\sigma_a}{\sigma_{a,eq}} = 1 - \frac{\sigma_m}{S_{ut}}$$

$$\Rightarrow \sigma_{a,eq} = \frac{\sigma_a}{1 - \frac{\sigma_m}{S_{ut}}} \quad \text{⊛}$$

⊕

$$S_e = k_a k_b k_c k_d k_e k_f S'_e$$

S-N curve  $\rightarrow S'_e = 240 \text{ MPa}$

$$k_a = a S_{ut}^b$$

Table 6-2  $\rightarrow$  ~~Ground~~ Machined  $\rightarrow a = 4.51, b = -0.265$

$$\Rightarrow k_a = 4.51 \times (700)^{-0.265} = 0.795$$

$$k_b = 1.51 d^{-0.157} \quad ; \quad 51 < d \leq 254 \text{ mm}$$

$$\Rightarrow k_b = 1.51 \times (100)^{-0.157} = 0.733$$

$k_c = 1$  for bending

$k_d = 1$  کتب از سازه است!

$k_e = 0.814$  Table 6-5 ( $R = 99\%$ )

$k_f = 1$  کتب از عرض سازه است!

$$\Rightarrow S_e = 0.795 \times 0.733 \times 1 \times 1 \times 0.814 \times 1 \times 240 = 114 \text{ MPa}$$

$$152 = 1019 (2N_f)^{-0.1} \Rightarrow \log\left(\frac{152}{1019}\right) = -0.1 \times \log 2N_f \Rightarrow N_{f①} = \bullet \text{ cycle}$$

$$156 = 1019 (2N_f)^{-0.1} \Rightarrow \log\left(\frac{156}{1019}\right) = -0.1 \times \log 2N_f \Rightarrow N_{f②} = \bullet \text{ cycle}$$

183, 231, 442  
 $\uparrow$   
 141, 253, 754  
 $\downarrow$

$$D_{tot} = \sum \frac{0.5}{N_{f,i}} = \frac{0.5}{N_{f①}} + \frac{0.5}{N_{f②}} + \frac{0.5}{\infty} + \frac{0.5}{\infty} + \frac{0.5}{\infty} + \frac{0.5}{\infty} = 6.2 \times 10^{-9}$$

$$N_{tot} = \frac{1}{D_{tot}} = 160 \times 10^6 \text{ (cycle)}$$