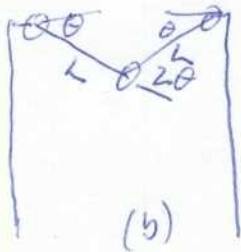
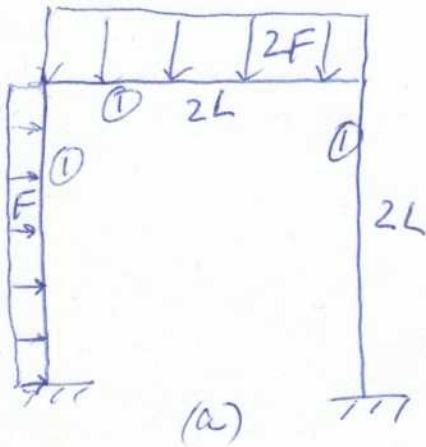
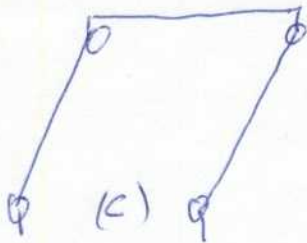


Solution - Assgn 5

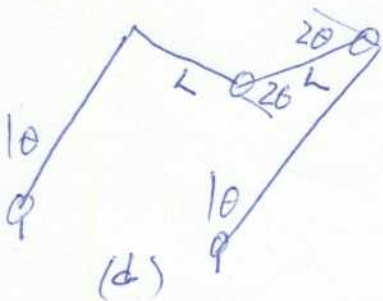
5/0



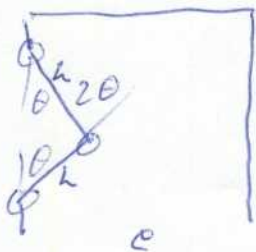
$$4M_0\theta = 2F(L\theta/2) \quad f^+ = 4$$



$$4M_0\theta = FL\theta \quad f^+ = 4$$



$$6M_0\theta = FL\theta + FL\theta \quad f^+ = 3 \leftarrow$$



$$4M_0\theta = FL\theta/2 \quad f^+ = 8$$

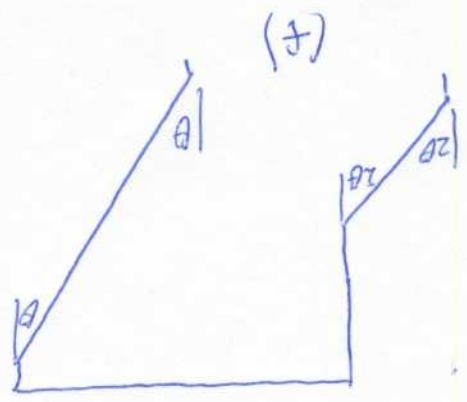
$$f_+ = 4$$

$$= \frac{2}{3} FL\theta$$

$$M_c = \frac{F}{2}(2\theta L) + \frac{F}{2}(2\theta L)$$

$$M_c = 6 M_0 \theta$$

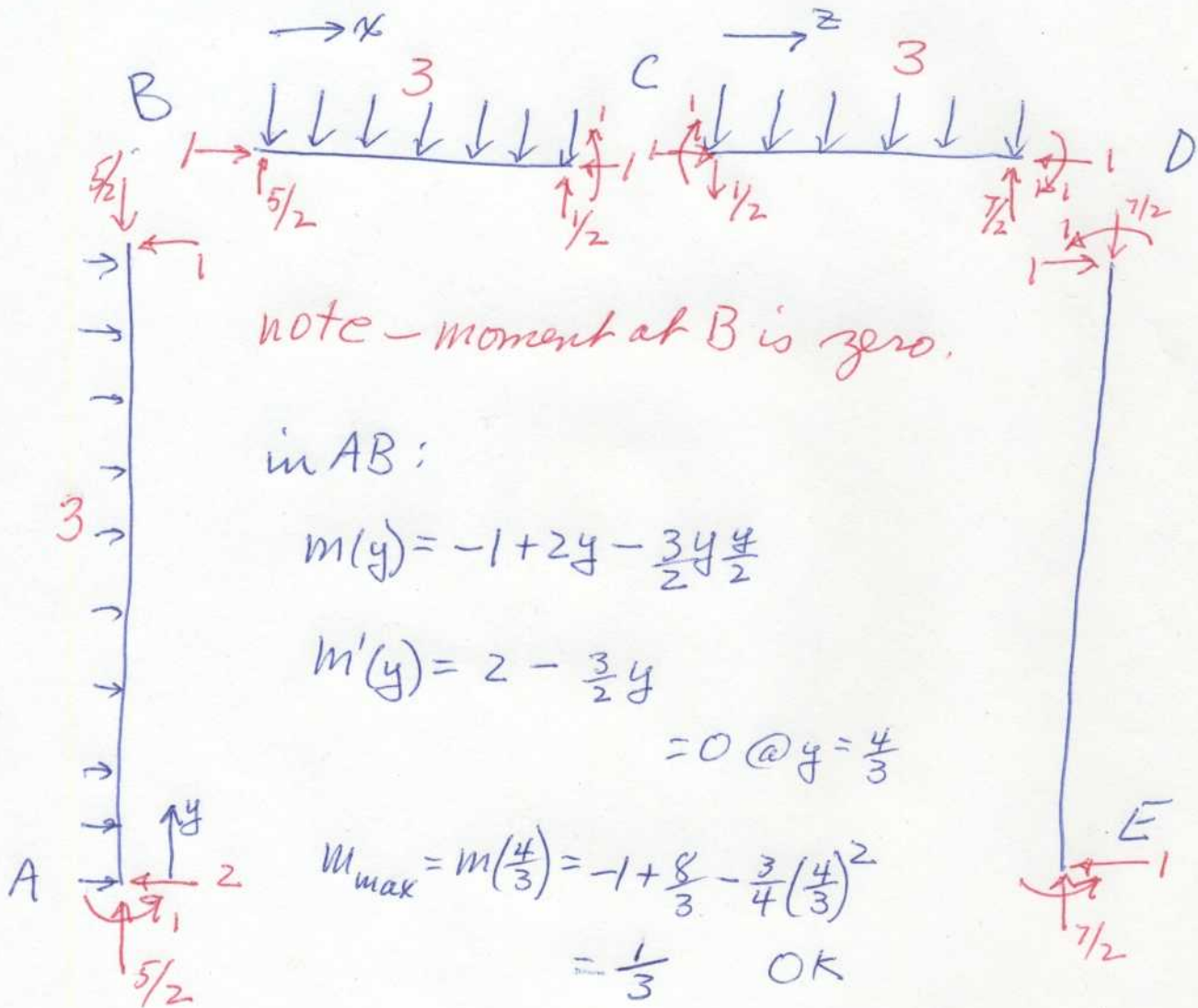
note different notations



5/2

No point in considering (c)+(d), etc
(no int. work "savings")

Check (d) for SA



BC

$$m(x) = \frac{2}{5}x - 3x^2$$

$$m'(x) = \frac{2}{5} - 3x$$

$$= 0 @ x = \frac{2}{15}$$

$$m\left(\frac{2}{15}\right) = \frac{2}{25} - \frac{3}{25} \left(\frac{2}{15}\right)^2 = \frac{2}{25} - \frac{2}{36} = \frac{2}{25}$$

∴ not SA

CD

$$m(z) = 1 - \frac{z}{2} - 3z^2$$

$$m'(z) = -\frac{1}{2} - 3z$$

$$= 0 \text{ only for } z = -\frac{1}{6}$$

ie, no extremum in $0 < z < 1$

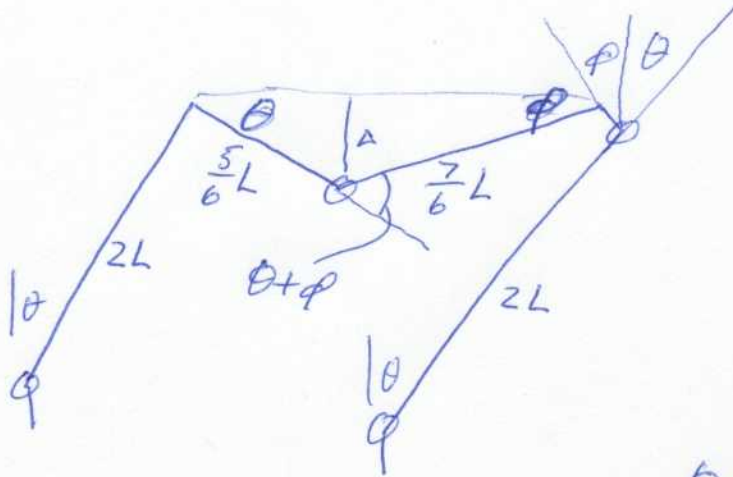
if f^+ is reduced by a factor of $\frac{24}{25}$

$$f^- = \frac{24}{25}(3) = \frac{72}{25} = 2.880 \text{ wa.l.B.}$$

$$\text{or } 2.880 \leq f^0 \leq 3.000$$

5/4

Assume a beam+panel mechanism
with hinge at $\frac{5}{6}L$



$$\Delta = \frac{5}{6}L\theta = \frac{1}{6}L\phi$$

$$\phi = \frac{5}{7}\theta$$

$$\theta + \phi = \frac{12}{7}\theta$$

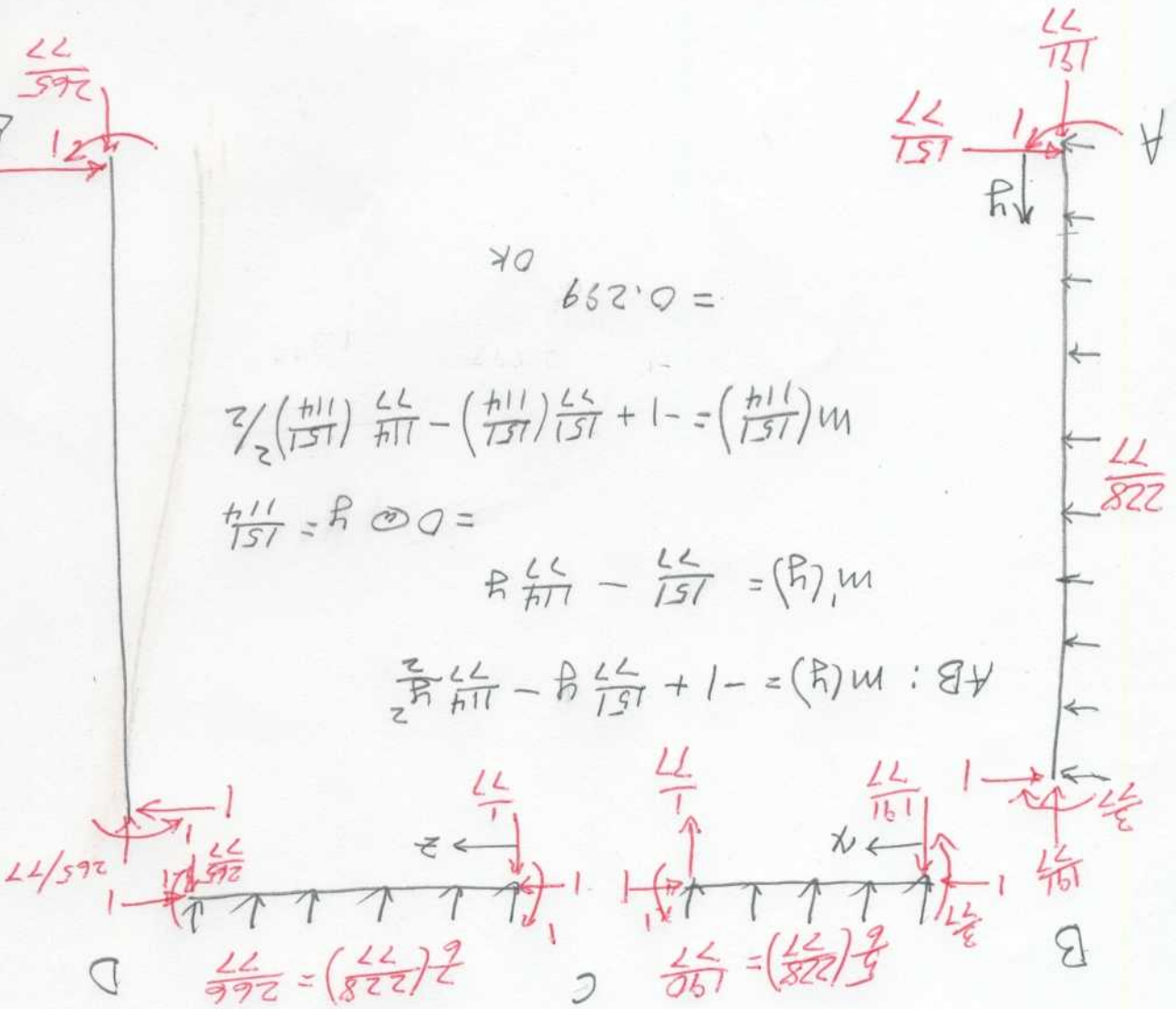
$$M_0 \theta \left(1 + \frac{12}{7} + \frac{12}{7} + 1\right) = F \left(\frac{2L\theta}{2}\right) + 2F \left(\frac{\frac{5}{6}L\theta}{2}\right)$$

$$f^+ = \frac{228}{77} = 2.96104$$

Check for SA

side load = $\frac{228}{114}$ (top) ; intensity = $\frac{77}{114}$

top " = $2 \times \frac{228}{77}$; " " = $\frac{228}{77}$



BC

$$m(x) = -\frac{3}{77} + \frac{191}{77}x - \frac{228}{77} \frac{x^2}{2} \quad \left(0 \leq x \leq \frac{5}{6}\right)$$

$$m'(x) = \frac{191}{77} - \frac{228}{77}x$$

$$= 0 \quad @ \quad x = \frac{191}{228} > \frac{5}{6}$$

$\therefore m$ is monotonic in BC

\therefore extreme m at ends

$$CD: m(z) = 1 + \frac{1}{77}z - \frac{228}{77} \frac{z^2}{2} \quad \left(0 \leq z \leq \frac{7}{6}\right)$$

$$m'(z) = \frac{1}{77} - \frac{228}{77}z$$

$$= 0 \quad @ \quad z = \frac{1}{228}$$

$$m\left(\frac{1}{228}\right) = 1 + \frac{1}{77}\left(\frac{1}{228}\right) - \frac{228}{77}\left(\frac{1}{228}\right)^2/2$$

$$= \frac{35113}{35112} > 1 \text{ (barely)}$$

$$\therefore f^- = \frac{35112}{35113} \times \frac{228}{77} = 2.96095$$

$$2.96095 \leq f^0 \leq 2.96104$$

less than 0.003% spread