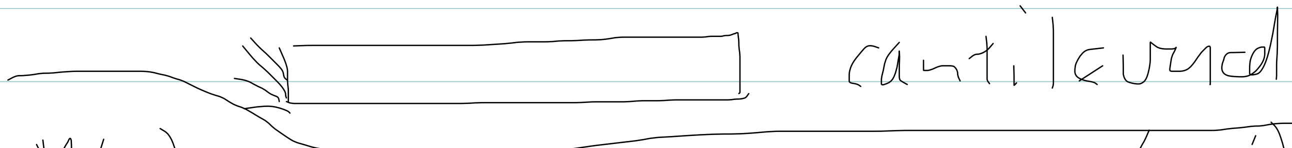
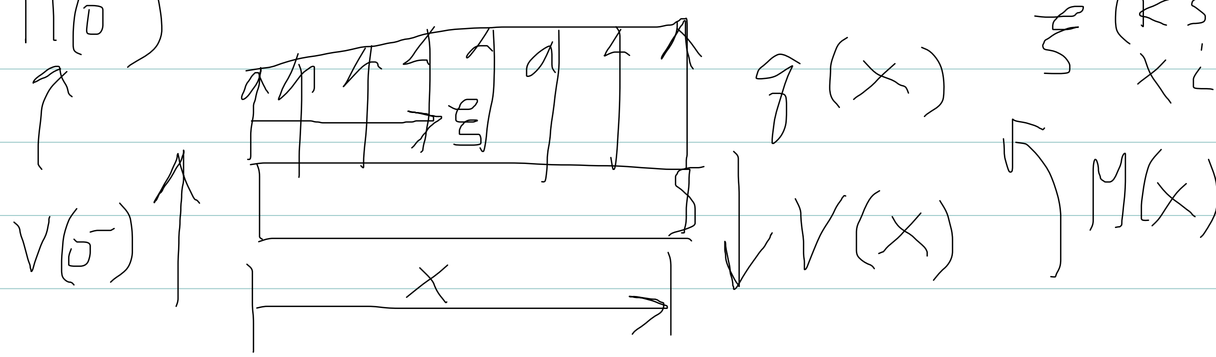
SYEN 3379
Shear Moment Diagrams

simply supported



cantilevered



ξ (ksi)
xi

$V(0^-)$, $M(0^-)$ are known.

$$\sum F = 0 =$$

$$V(0^-) - V(x) + \int_0^x q(\xi)\, d\xi$$

$$V(x) = V(0^-) + \int_0^x q(\xi)\, d\xi$$

$$\frac{dV}{dx} = \frac{d}{dx} \int_0^x q(\xi)\, d\xi = q(x)$$

fundamental theorem of calculus

$$\sum M_0 = -xV(x) + M(x) - M(0^-) + \underline{\int_0^x \xi q(\xi)\, d\xi} = 0$$

$$-V(x) - x\frac{dV}{dx} + \frac{dM}{dx} + x q(x) = 0$$

$$\frac{dM}{dx} = V(x) + \underline{x q(x)} - \underline{x q(x)}$$

$$\frac{dM}{dx} = V(x)$$

$$M(x) - M(0^-) = \int_0^x V(\xi)\, d\xi$$

$$\frac{dV}{dx} = q(x)$$

$$\frac{dM}{dx} = V(x)$$

$$V(x) = V(0^-) + \int_0^x q(\xi)\, d\xi$$

$$M(x) = M(0^-) + \int_0^x V(\xi)\, d\xi$$

Distributed Load $q(x)$

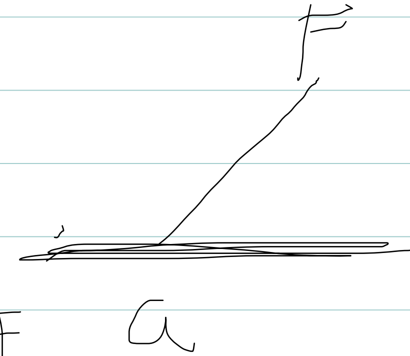
point load at $x = a$

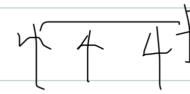
$$\underline{q(x) = F\,\delta(x-a)}$$

$\delta(x)$ = Dirac Delta function

$$\underline{F(a)} = \int_{-\infty}^{+\infty} F(x)\,\delta(x-a)\,dx$$

$$q(x) = F(x-a)$$



$$q(x) = F$$ 

Concentrated Moment

$$q(x) = M\,\delta'(x-a)$$

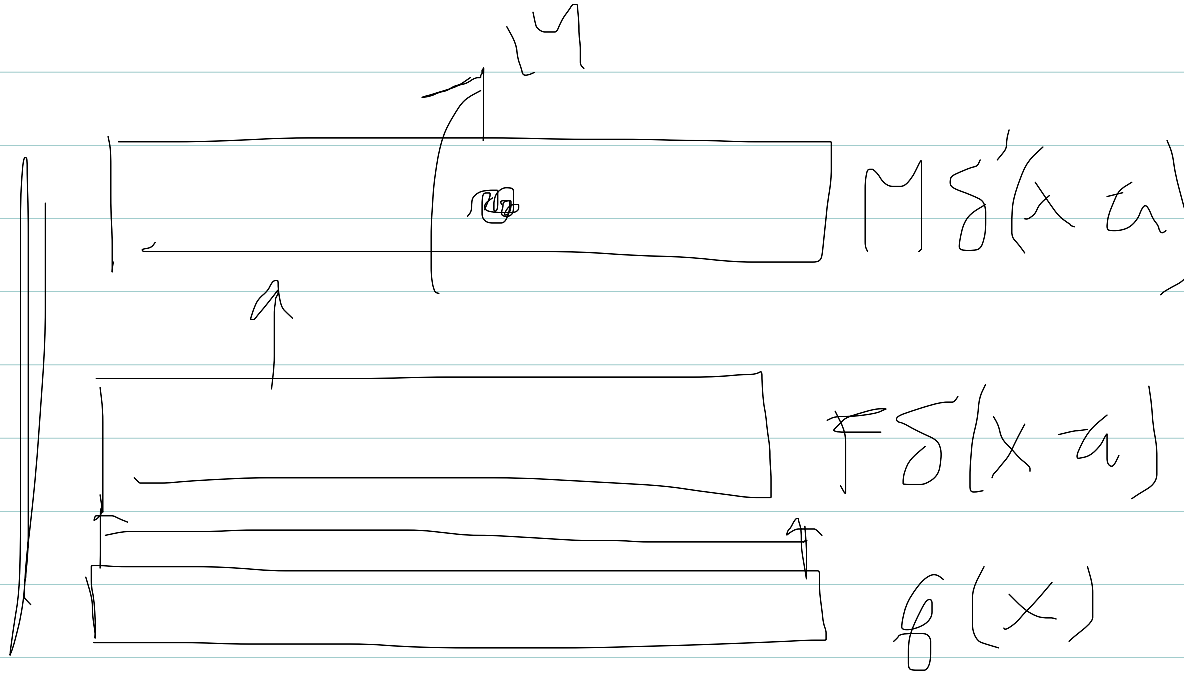
$$\delta' = \frac{d\delta}{dx}$$

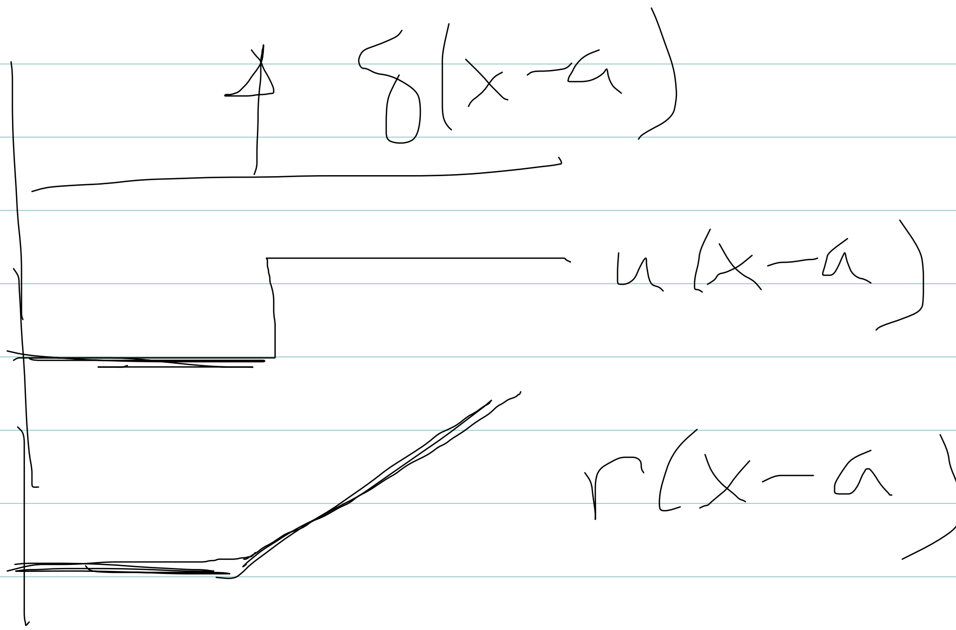
$$\langle x-a\rangle^{2} = \delta'(x-a)$$

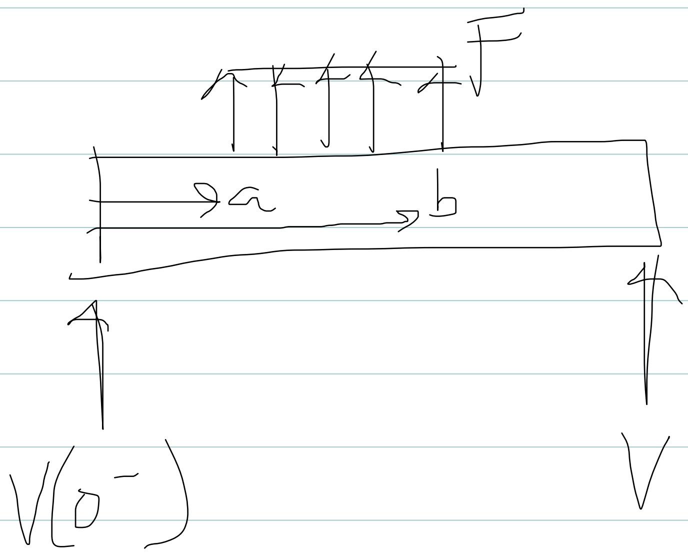
$$\langle x-a\rangle^{-1} = \delta(x-a)$$

$$\langle x-a\rangle^{0} = u(x-a) \text{ step}$$

$$\langle x-a\rangle^{-1} = r(x-a) \text{ ramp}$$


M
Mδ'(x-a)
Fδ(x-a)
q(x)


δ(x-a)
u(x-a)
r(x-a)



$$q(x) = V(0^-)\delta(x) + F u(x-a) - F u(x-b)$$

$$\frac{dV}{dx} = q(x)$$

$$\delta = \begin{cases} 1 & x = a \\ 0 & x \neq a \end{cases}$$

$$\delta(x-a) = \begin{cases} 1 & x = a \\ 0 & x \neq a \end{cases}$$

$$u(x-a) = \begin{cases} 1 & x \geq a \\ 0 & x < a \end{cases}$$

$$\delta(x) = \int \delta'(x)\,dx$$

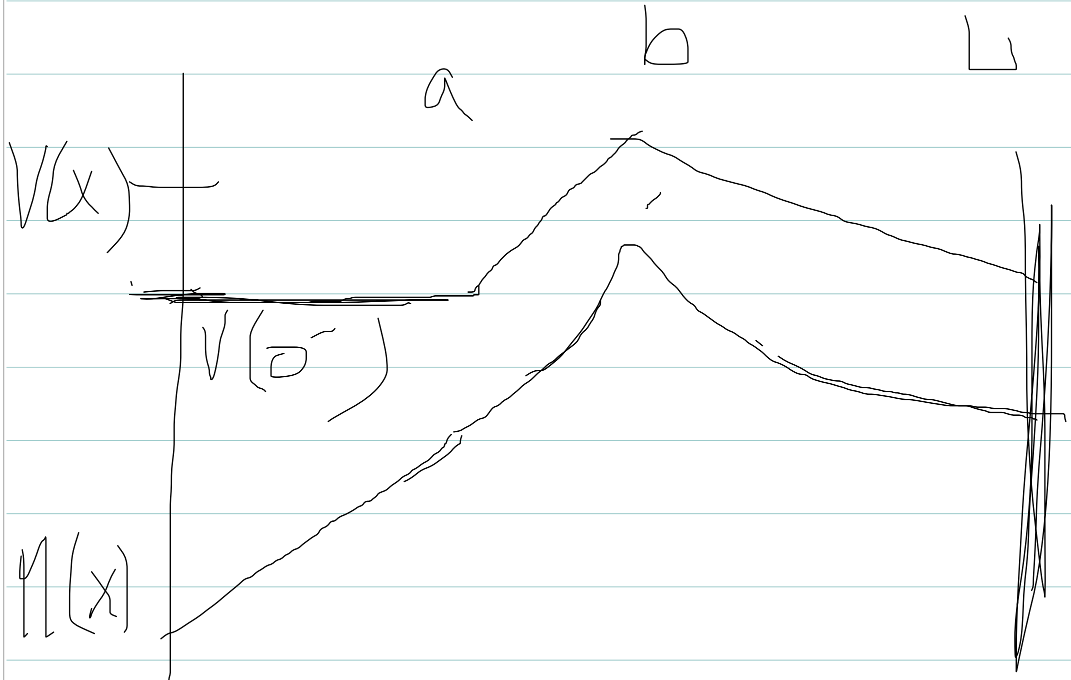
$$u(x) = \int \delta(x)\,dx$$

$$r(x) = \int u(x)\,dx$$

$$p(x) = \int r(x)\,dx$$

$$V(x) = V(0^-)u(x) + F\left(r(x-a) - r(x-b)\right)$$

$$M(x) = V(0^-)r(x) + F\left(\rho(x-a) - \rho(x-b)\right)$$



matlab

→ write

$\delta(x)$ $g(x)$

$u(x)$

$r(x)$

$p(x)$

homework →