CLASS # 29 - INTRODUCTION TO BENDING BEAMS

OBJECTIVES:
1. VISUALIZE LOADED BEAMS
2. DEFINE FLEXURAL RIGIDITY

READ:
CHAPTER 10 PHILPOT

1. DRAWING ELASTIC CURVES

As engineers, use "intuition" to draw deflected shape of loaded beams (elastic curve)

- FIXED SUPPORT restrains rotation & displacement
- PIN RESTRICT DISPLACEMENT but allow rotation

- MOMENT DIAGRAMS tell us a lot about elastic curve
(1) Note that point E is not at load point.

(2) Moment - Curvature Relationship

Relate moment, M, to radius of curvature, ρ:

3 Coordinates: X, Y, θ
(Same coordinates used for deriving flexure formula)

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\[ \varepsilon = \frac{ds'}{dx} - \frac{dx}{dx} \]

\[ = \frac{ds' - \rho d\theta}{\rho d\theta} \]

\[ = \frac{(p-y) d\theta - \rho d\theta}{\rho d\theta} \]

\[ \varepsilon = \frac{-y}{\rho} \]

\[ \frac{1}{P} = -\frac{\varepsilon}{y} \]

\[ \sigma = E \varepsilon \]

\[ \sigma = \frac{My}{I} \]

\[ \frac{1}{P} = \frac{M}{EI} \]

**EI** - referred to as "flexural rigidity"

**P** - usually a large number