I. Calculate the moment when the tension crack has progressed
(1) 3.0 inches  \textit{answer: ? in-kips}
(2) 3.5 inches  \textit{answer: ? in-kips}
(3) 5.0 inches  \textit{answer: 318 in-kips}
(4) 6.0 inches  \textit{answer: ? in-kips}
from the bottom of the cross-section shown below.

\[ f'_{c} = 4 \text{ ksi} \]
\[ f_{y} = 60 \text{ ksi} \]
\[ f_{r} = 530 \text{ psi} \]

II. Calculate the moment when the reinforcement first reaches the yield point for the section in the figure above. \textit{Assume the concrete to remain linear elastic.} Check to see if the concrete actually remains linear elastic (Hint: does the stress in compression concrete exceed 0.5f'_{c}). \textit{Ignore tension in concrete.}

\textit{answer: ? in-kips}

III. A rectangular beam made using concrete with compressive strength \( f'_{c} = 4,000 \text{ psi} \) and steel with \( f_{y} = 60,000 \text{ psi} \) has width \( b = 24 \text{ in.} \), total depth \( h = 18 \text{ in.} \), and effective depth \( d = 15.5 \text{ in.} \). Concrete modulus of rupture \( f_{r} = 475 \text{ psi} \). The elastic modulus of the steel and concrete are, respectively 29,000 ksi and 3,600 ksi. The tensile steel is 5 No. 11 bars.

(1) Find the maximum service moment that can be resisted without stressing the concrete higher than 0.5\( f'_{c} \) or the steel 0.40 \( f_{y} \).

(2) Determine whether this beam will show flexural cracking before reaching the service load calculated in (a).