I. Calculate the moment when the tension crack has progressed
(1) 3.0 inches \( \text{answer: } \) 
(2) 3.5 inches \( \text{answer: } \) 
(3) 5.0 inches \( \text{answer: } 318 \text{ in-kips} \) 
(4) 6.0 inches \( \text{answer: } \) 
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. 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 \( 0.5f_c' \)). Ignore tension in concrete.

\( \text{answer: } \) 

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 \( 0.5f_c' \) or the steel 0.40 \( f_y \).

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