1. (35 points) An open-loop transfer function is given as,

$$G(s) = \frac{1}{s^3 + 2.0s^2 + 3.00504s + 7.00504}$$
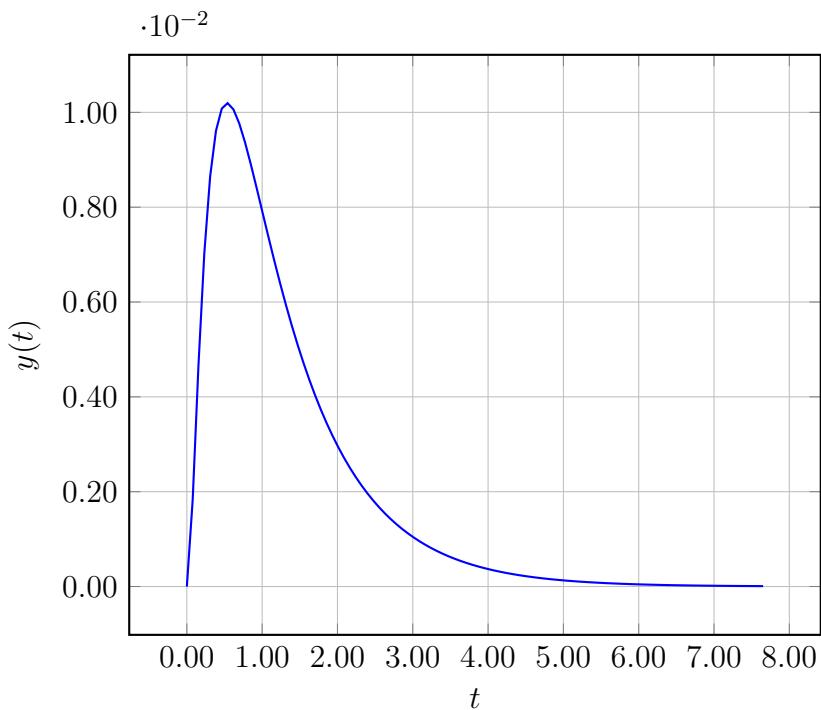
which of the following PI-controllers stabilizes the system in a closed-loop unit feedback structure?

    A. $F(s) = -9.97981 + \frac{1.01009}{s}$

    B. $F(s) = -2.51009 + \frac{0.50504}{s}$

    C. $F(s) = 0.53029 + \frac{1.01009}{s}$

    D. $F(s) = -9.96971 + \frac{2.51009}{s}$

    E. $F(s) = 0.52019 + \frac{2.51009}{s}$
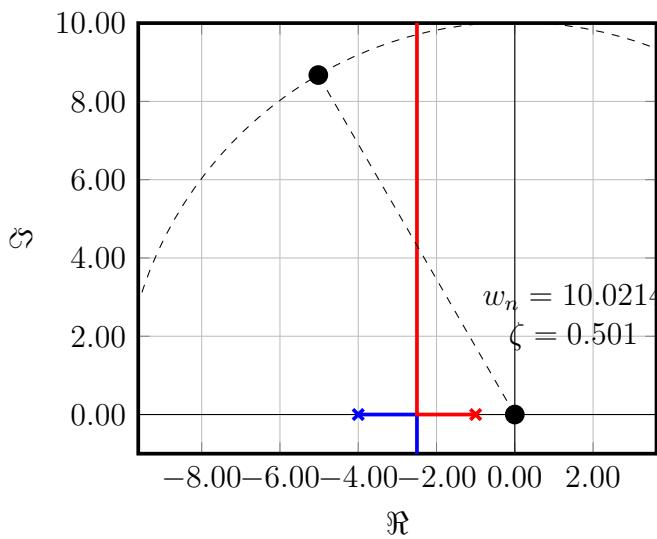
2. (35 points) Which one of the following unit impulse responses corresponds to a system that does not overshoot when subjected to a unit step input?

A.
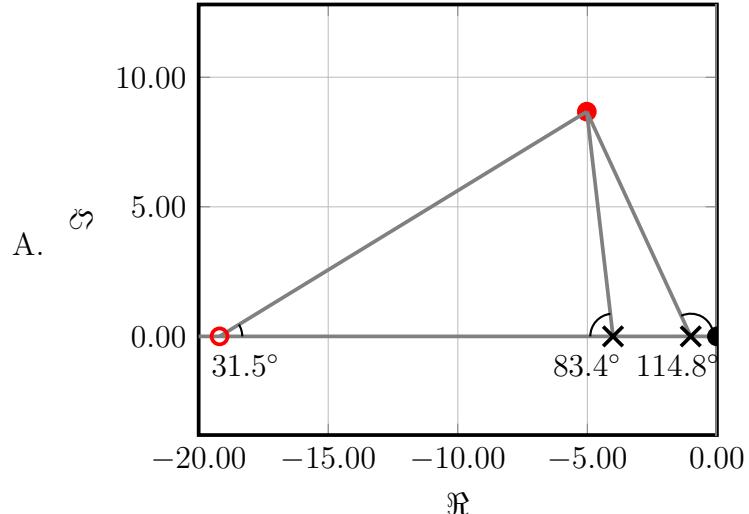
B.
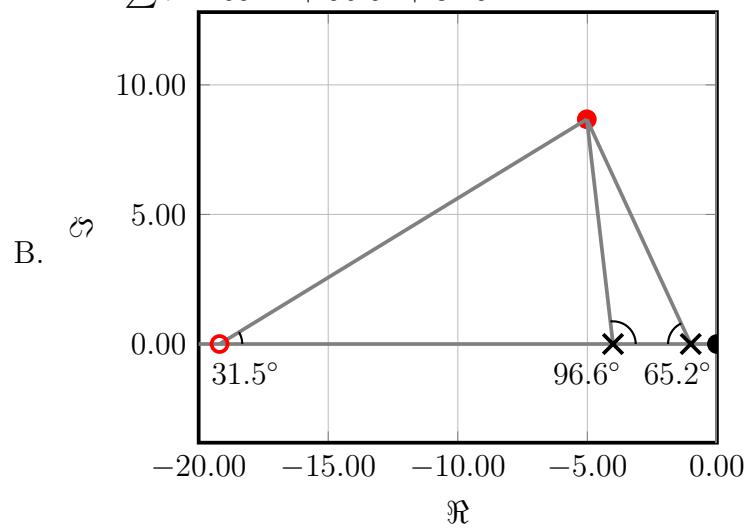
3. (30 points) A design point on the root-locus plot for a P-type controller is shown below. A zero is added so that the root-locus passes through this design point. Which of the following represents the correct angle condition for this design?

$w_n = 10.021$
$\zeta = 0.501$
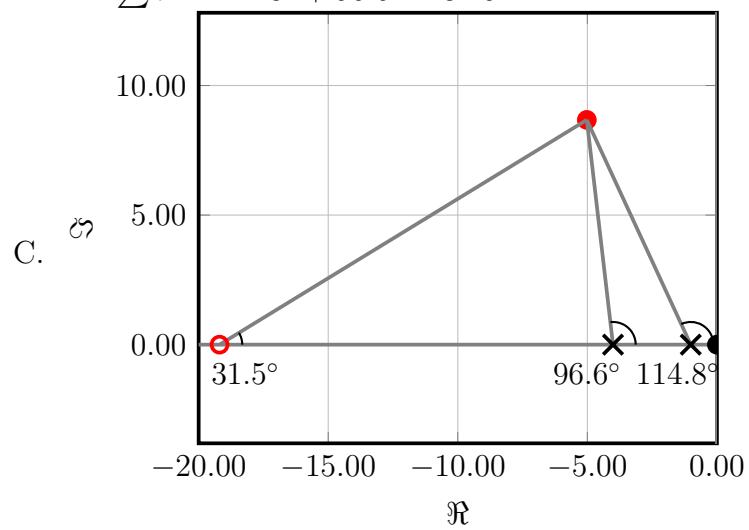
A. $\sum \theta = 114.8° + 83.4° + 31.5°$
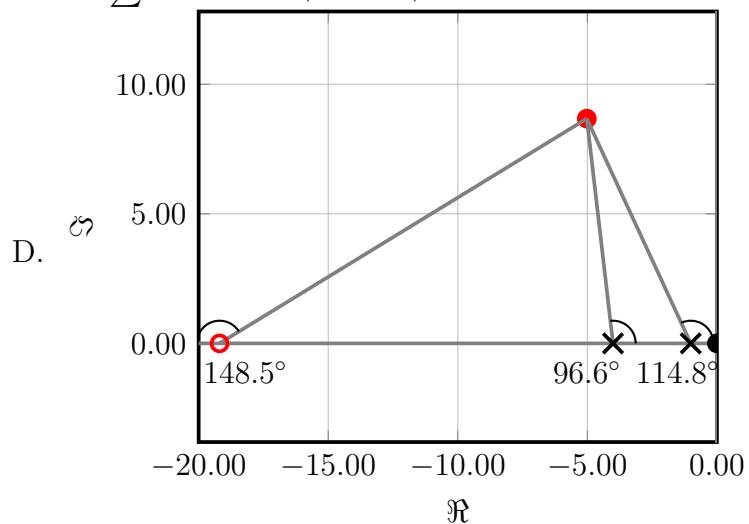
B. $\sum \theta = 65.2° + 96.6° + 31.5°$

C. $\sum \theta = 114.8° + 96.6° - 31.5°$

$\sum \theta = 114.8° + 96.6° + 148.5°$

D.

$\sum \theta = 114.8° + 96.6° + 31.5°$

E.