1. (35 points) An open-loop transfer function is given by,
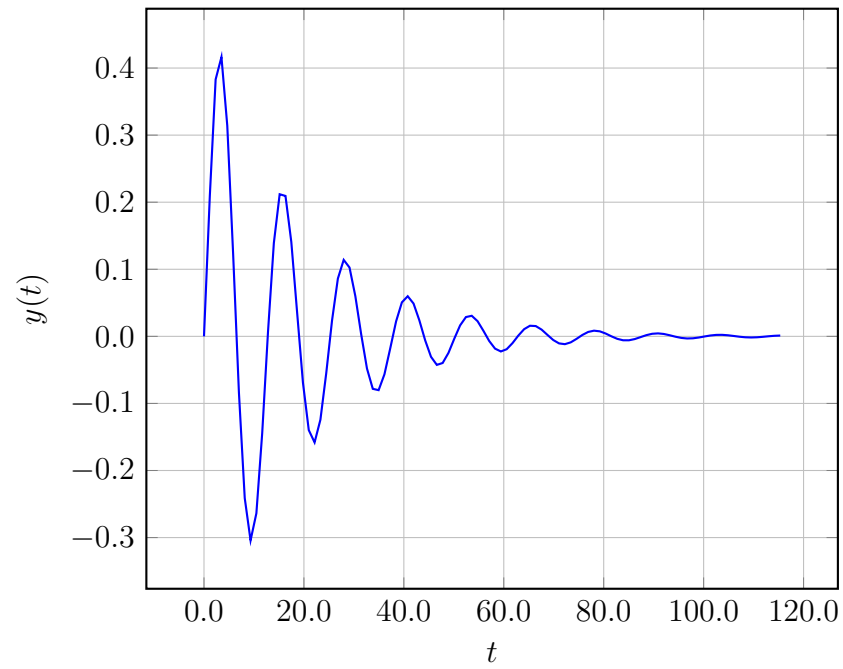
$$G(s) = \frac{1}{s^3 + 2.0s^2 + 3.00504s + 7.00504}$$

Which of the following PI controllers stabilizes the system in a unit-feedback closed-loop configuration?
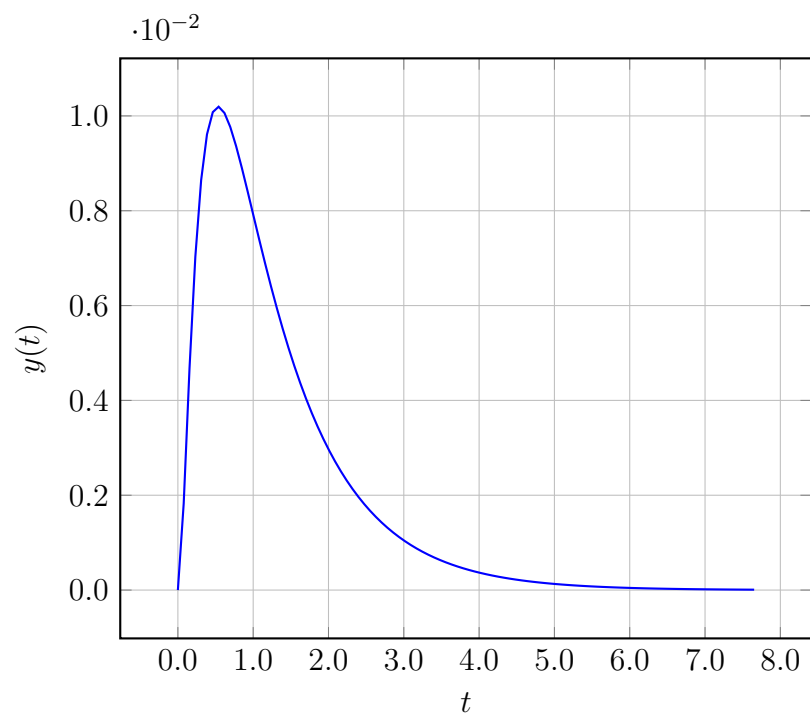
A. $F(s) = -9.97981 + \frac{1.01009}{s}$

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?
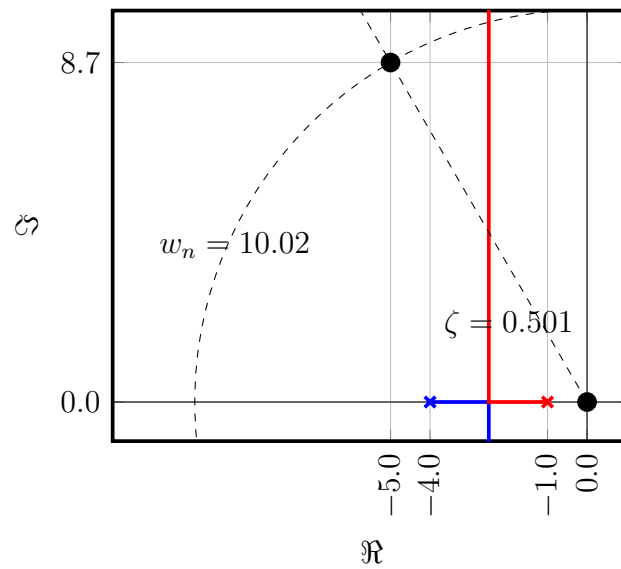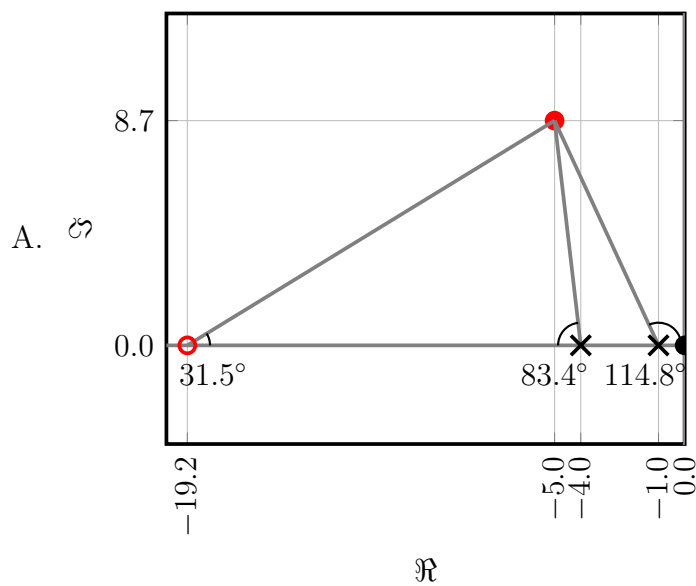
A.

B.

3. (30 points) A design point on the root-locus plot for a P-type controller is shown below.
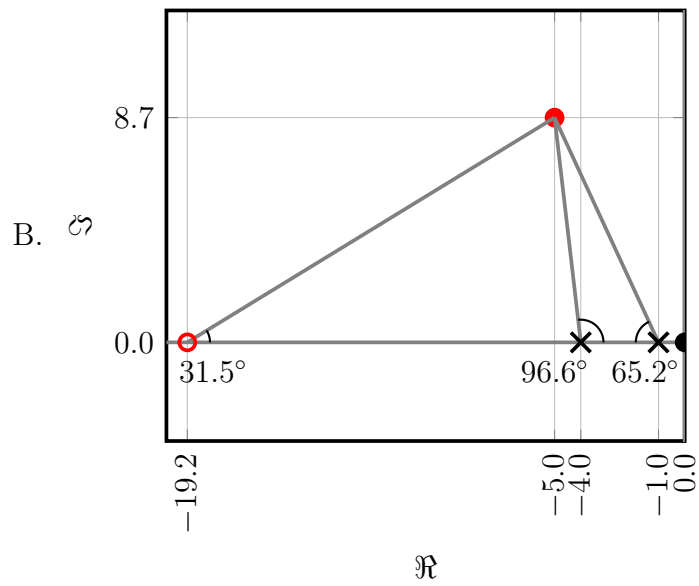

$w_n = 10.02$

$\zeta = 0.501$

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?
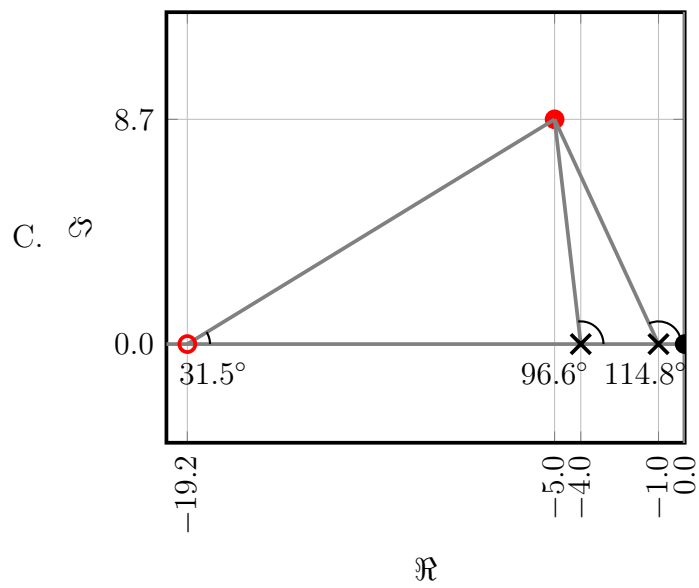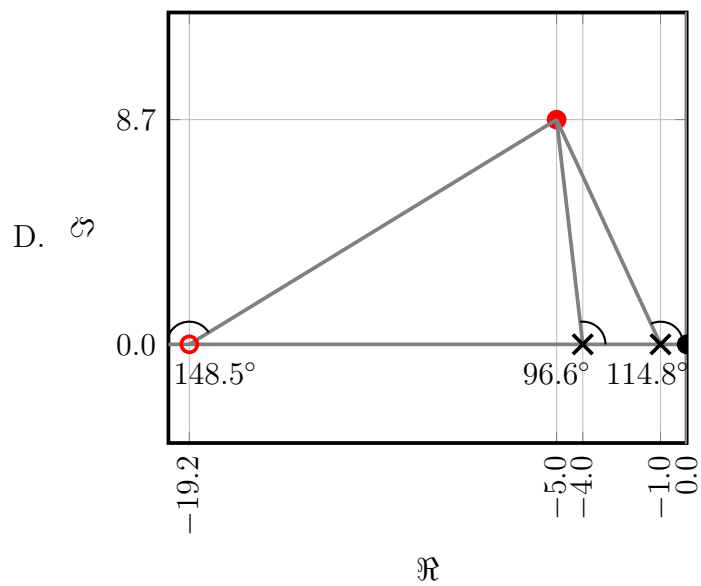
$$\sum \theta = 114.8° + 83.4° + 31.5° =$$

A.

$31.5°$ $83.4°$ $114.8°$

$$\sum \theta = 65.2° + 96.6° + 31.5° =$$

B.

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

C.

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

D.

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

E.