1. (35 points) An open-loop transfer function is given by,
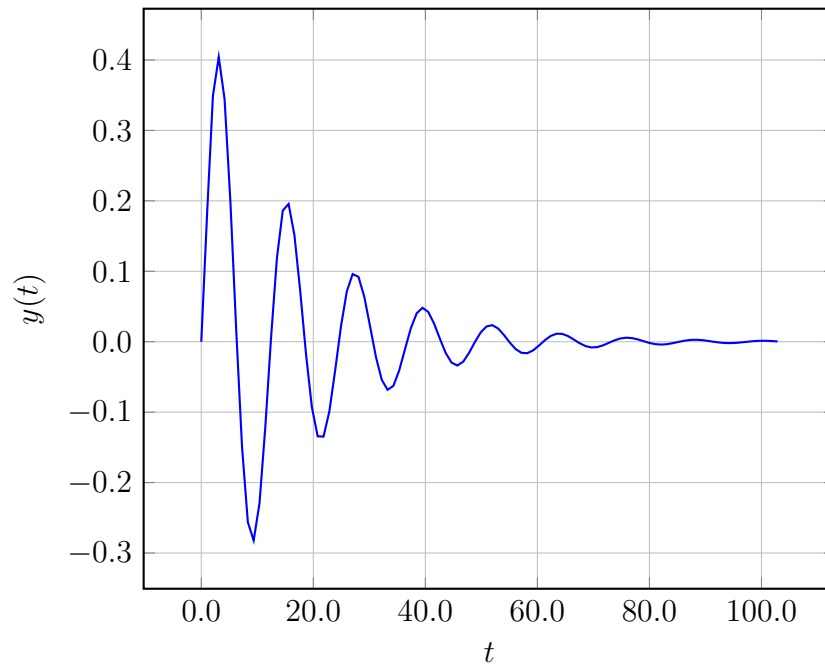
$$G(s) = \frac{1}{s^3 + 2.0s^2 + 3.02019s + 7.02019}$$

Which of the following PI controllers stabilizes the system in a unit-feedback closed-loop configuration?
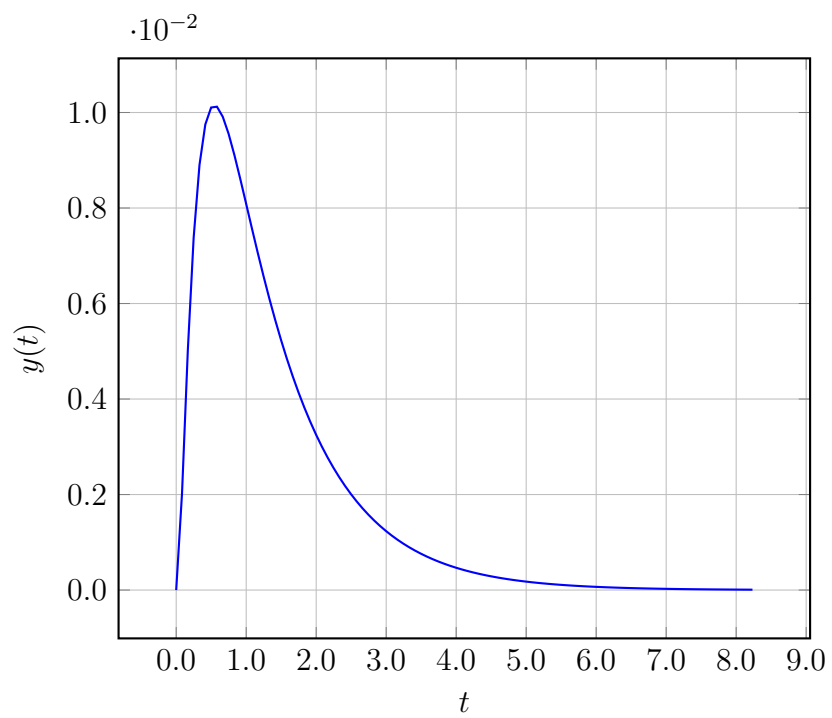
A. $F(s) = -2.54039 + \frac{0.52019}{s}$

B. $F(s) = -9.8788 + \frac{2.54039}{s}$

C. $F(s) = -9.9192 + \frac{1.04039}{s}$

D. $F(s) = 0.5808 + \frac{2.54039}{s}$

E. $F(s) = 0.6212 + \frac{1.04039}{s}$

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?
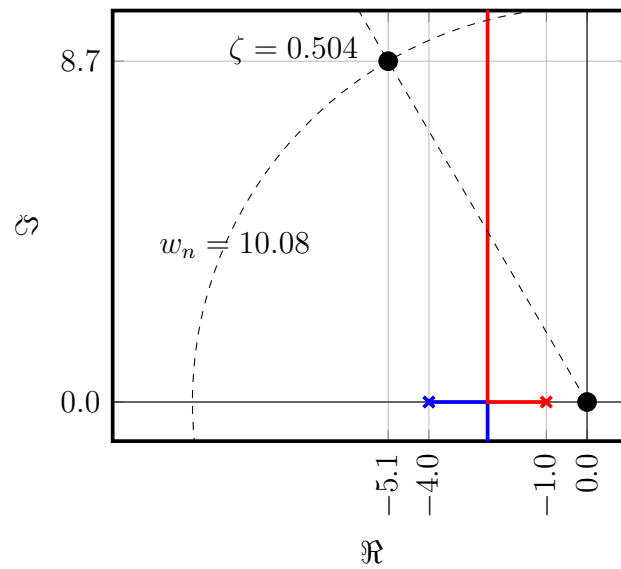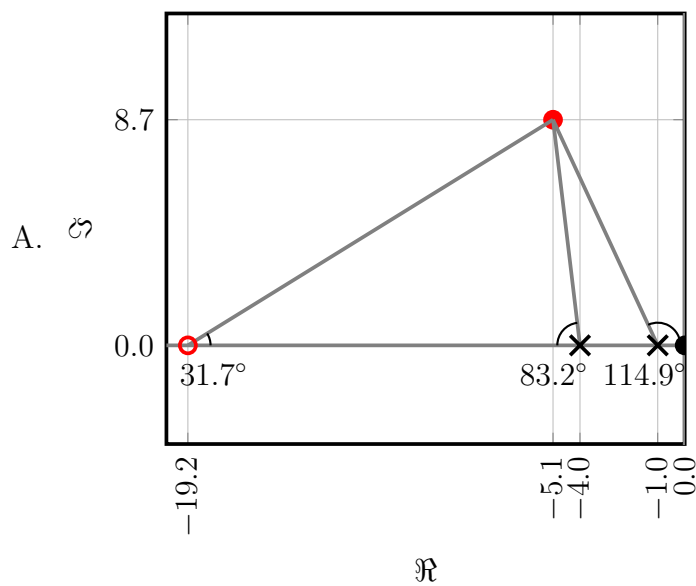
A.

B.

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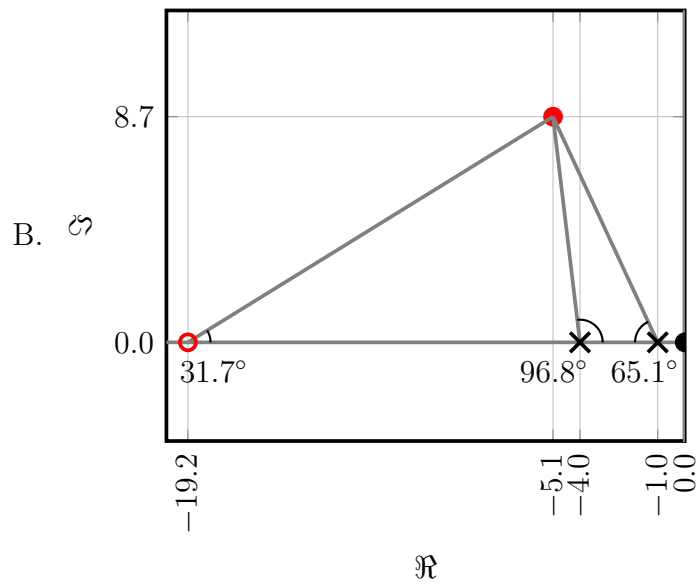

A zero is added so that the root-locus passes through this design point. Which of the following represents the correct angle condition for this design?
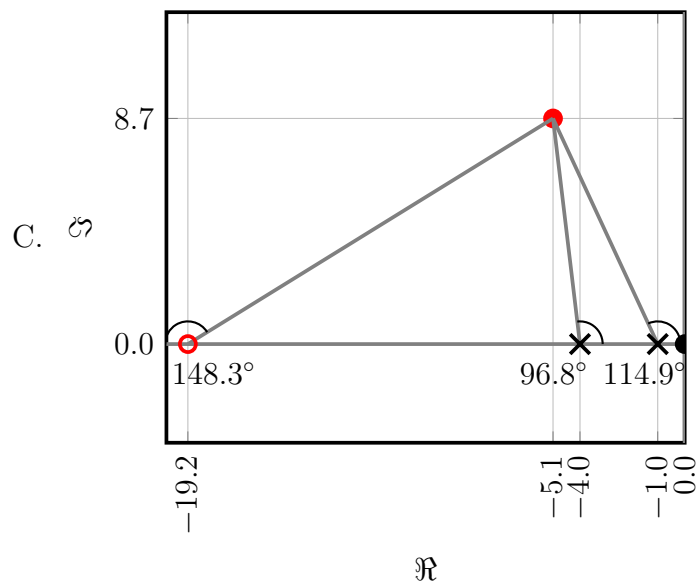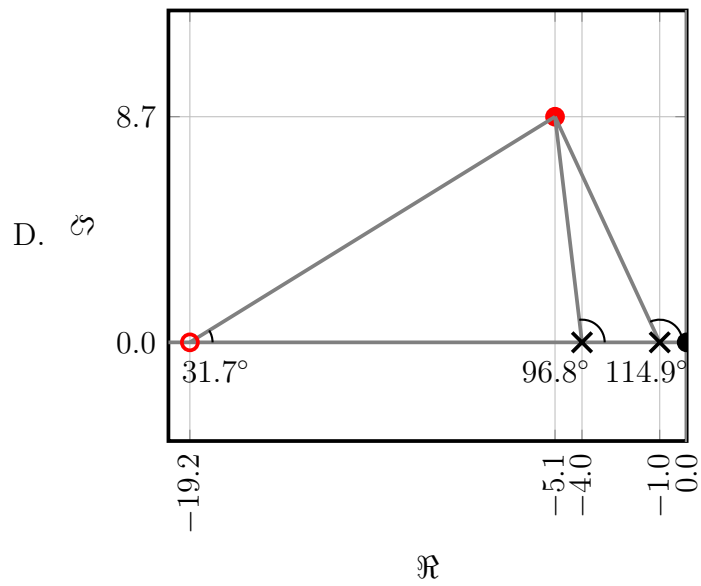
$$\sum \theta = 114.9° + 83.2° + 31.7° =$$

A.

B.

$$\sum \theta = 65.1° + 96.8° + 31.7° =$$

C.

$$\sum \theta = 114.9° + 96.8° + 148.3° =$$

$\sum \theta = 114.9° + 96.8° + 31.7° =$

D.

$\sum \theta = 114.9° + 96.8° - 31.7° =$

E.