1. (35 points) An open-loop transfer function is given by,
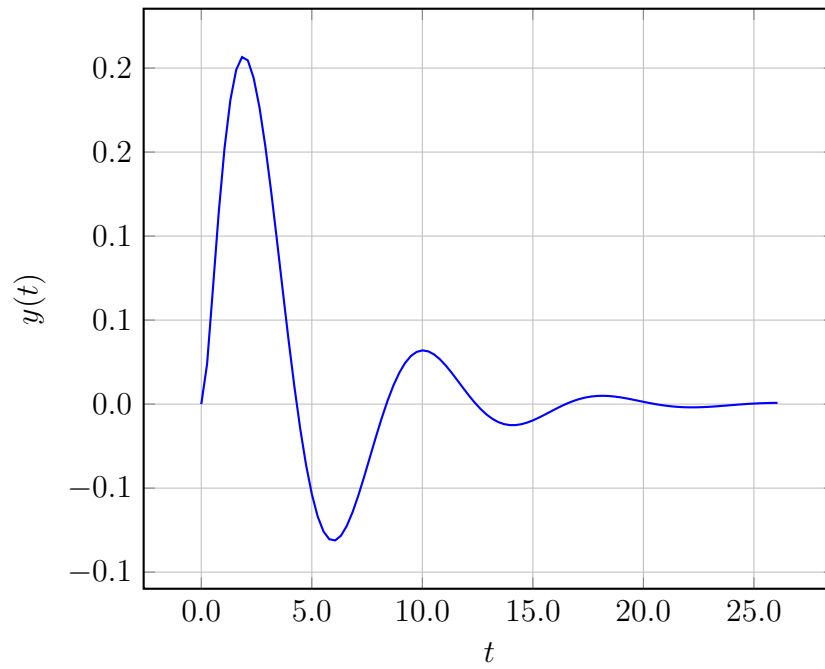
$$G(s) = \frac{1}{s^3 + 2.0s^2 + 3.30807s + 7.30807}$$

Which of the following PI controllers stabilizes the system in a unit-feedback closed-loop configuration?
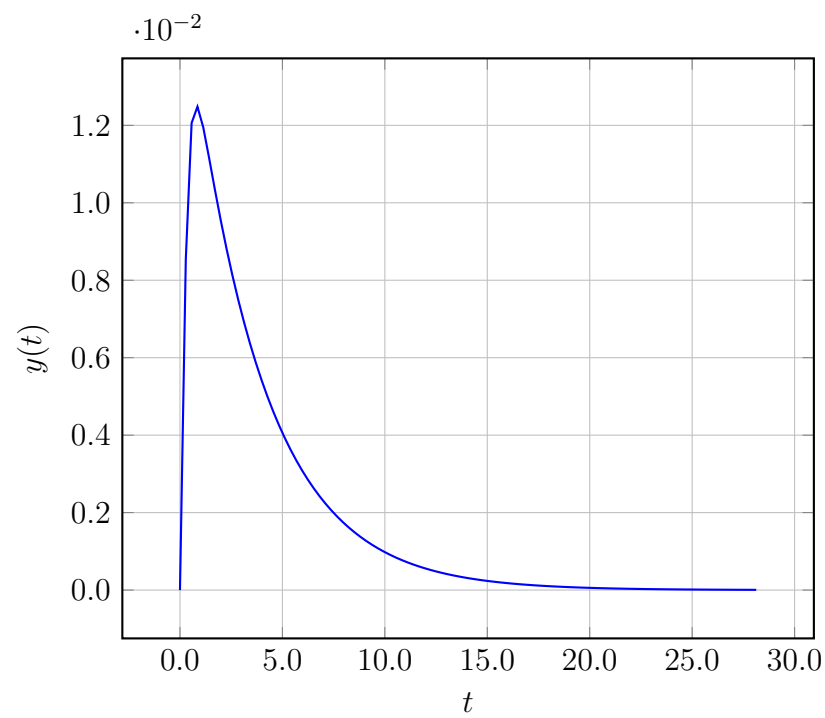
A. $F(s) = -8.76768 + \frac{1.61615}{s}$

B. $F(s) = 1.73232 + \frac{3.11615}{s}$

C. $F(s) = -3.11615 + \frac{0.80807}{s}$

D. $F(s) = 2.34848 + \frac{1.61615}{s}$

E. $F(s) = -8.15152 + \frac{3.11615}{s}$

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?
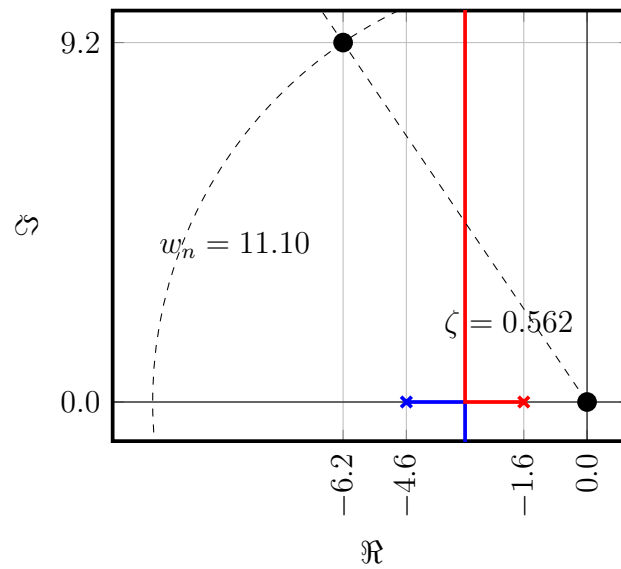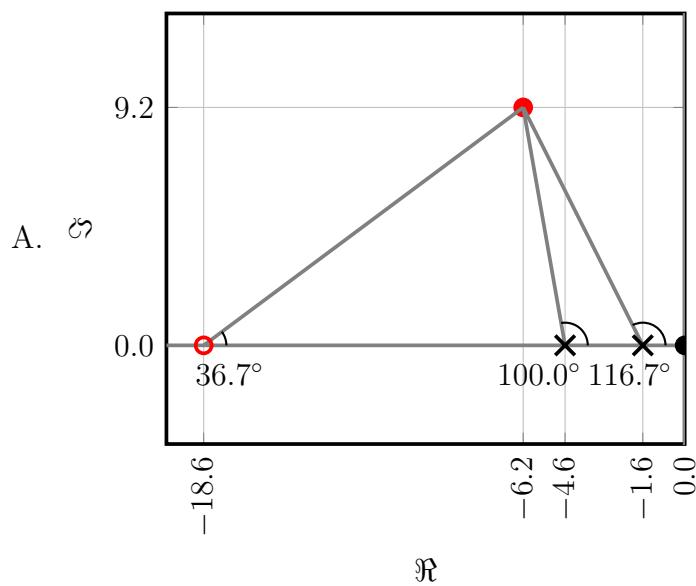
A.

B.

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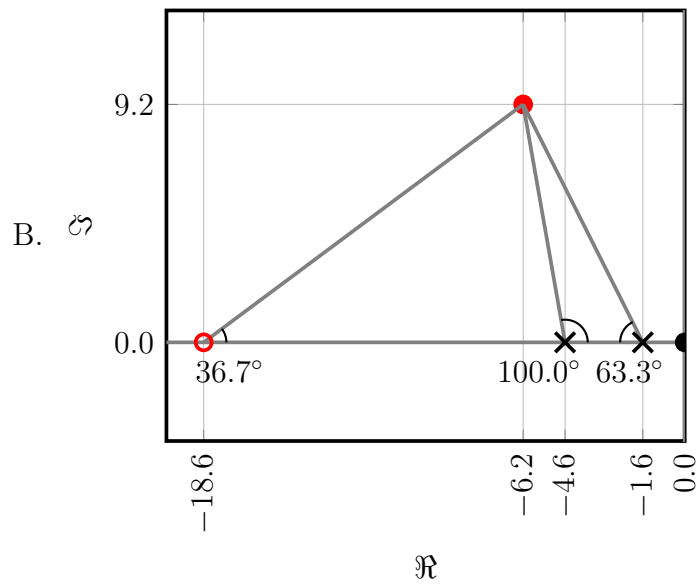

A zero is added so that the root-locus passes through this design point. Which of the following represents the correct angle condition for this design?
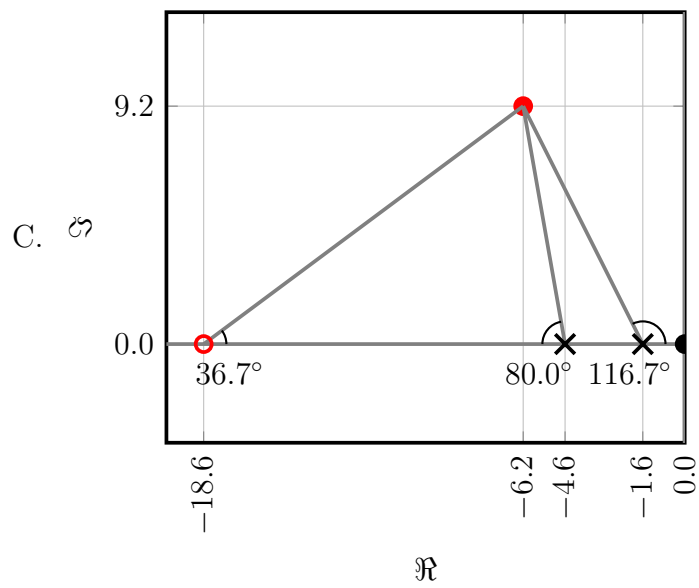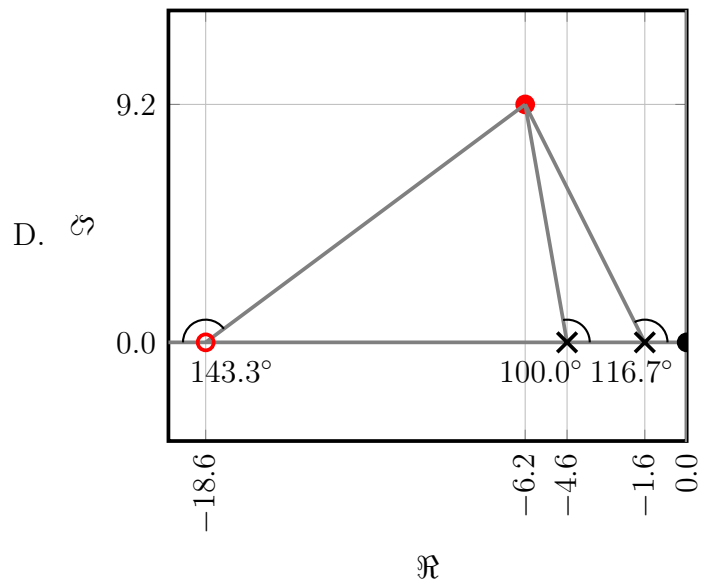
$$\sum \theta = 116.7° + 100.0° - 36.7° =$$

A.

B. $$\sum \theta = 63.3° + 100.0° + 36.7° =$$

C. $$\sum \theta = 116.7° + 80.0° + 36.7° =$$

$$\sum \theta = 116.7° + 100.0° + 143.3° =$$

D.

$$\sum \theta = 116.7° + 100.0° + 36.7° =$$

E.