1. (35 points) An open-loop transfer function is given by,
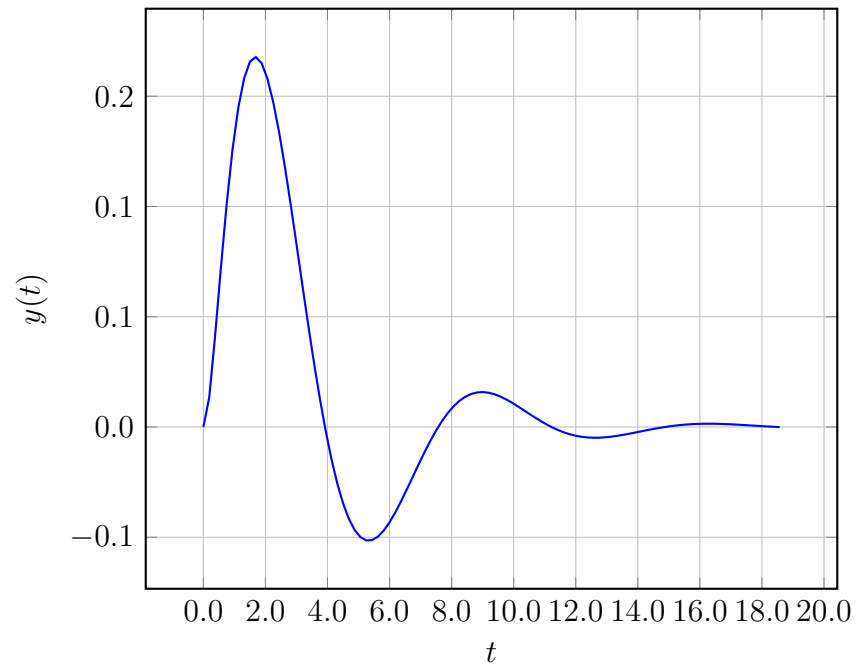
$$G(s) = \frac{1}{s^3 + 2.0s^2 + 3.41919s + 7.41919}$$

Which of the following PI controllers stabilizes the system in a unit-feedback closed-loop configuration?
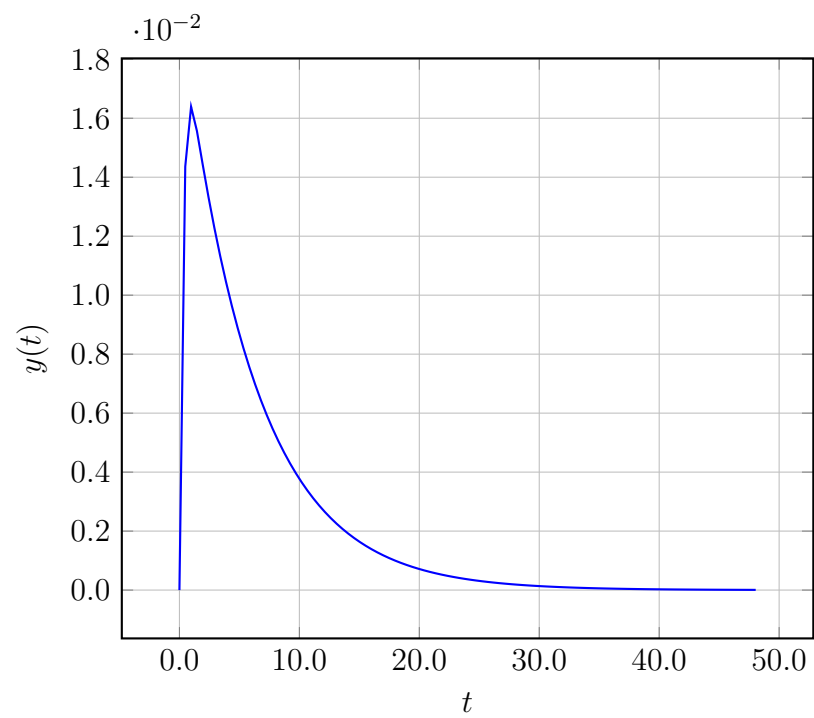
    A. $F(s) = 2.17676 + \frac{3.33838}{s}$

    B. $F(s) = 3.01514 + \frac{1.83838}{s}$

    C. $F(s) = -3.33838 + \frac{0.91919}{s}$

    D. $F(s) = -8.32324 + \frac{1.83838}{s}$

    E. $F(s) = -7.48486 + \frac{3.33838}{s}$

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?
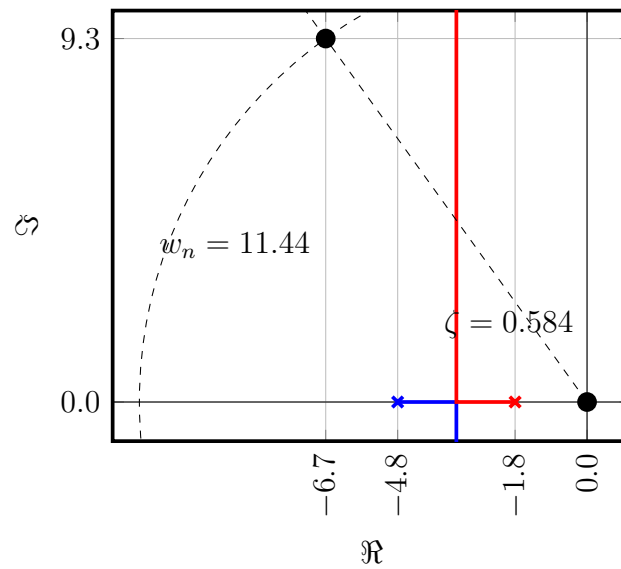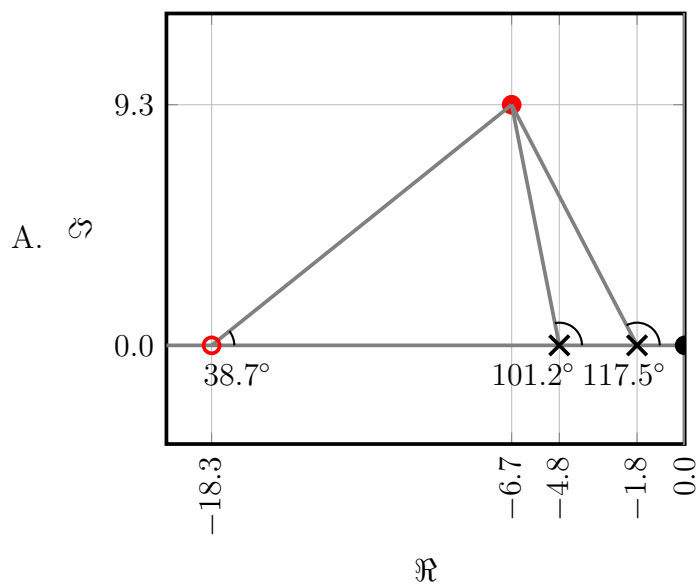
A.

B.

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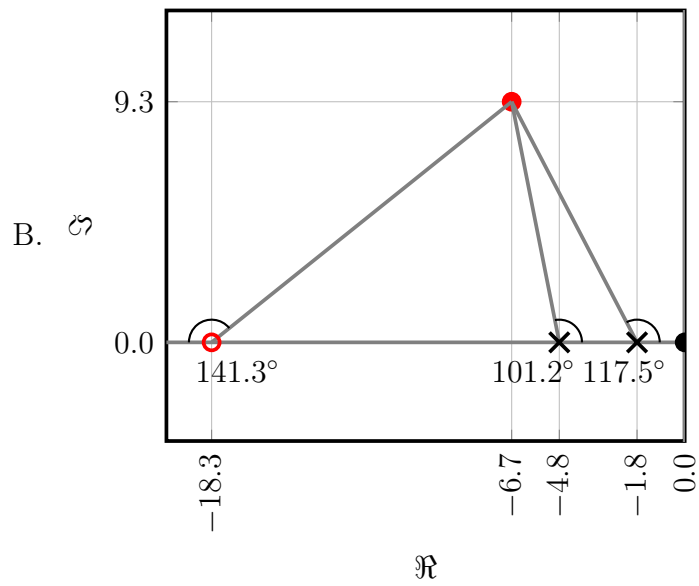

A zero is added so that the root-locus passes through this design point. Which of the following represents the correct angle condition for this design?
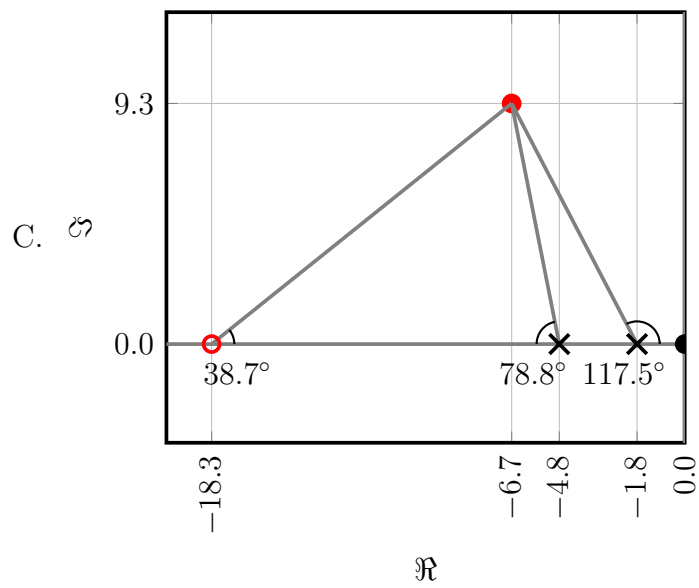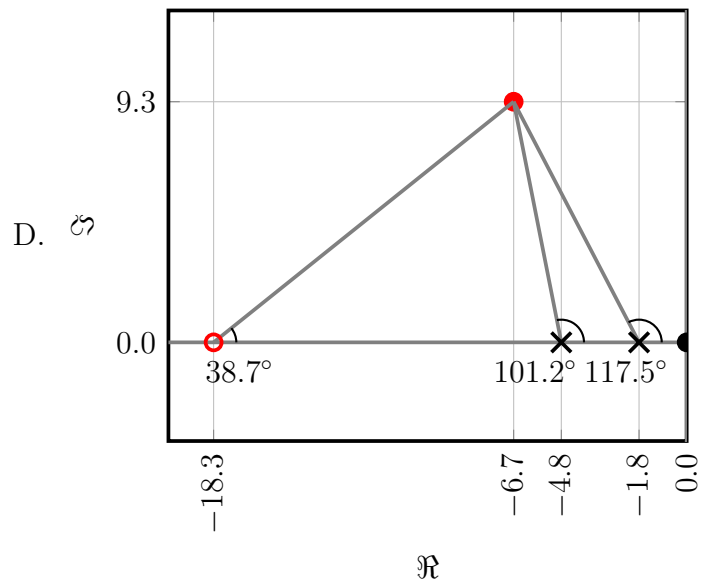
$$\sum \theta = 117.5° + 101.2° - 38.7° =$$

A.

$$\sum \theta = 117.5° + 101.2° + 141.3° =$$

B.

$$\sum \theta = 117.5° + 78.8° + 38.7° =$$

C.

$$\sum \theta = 117.5° + 101.2° + 38.7° =$$

D.

$$\sum \theta = 62.5° + 101.2° + 38.7° =$$

E.