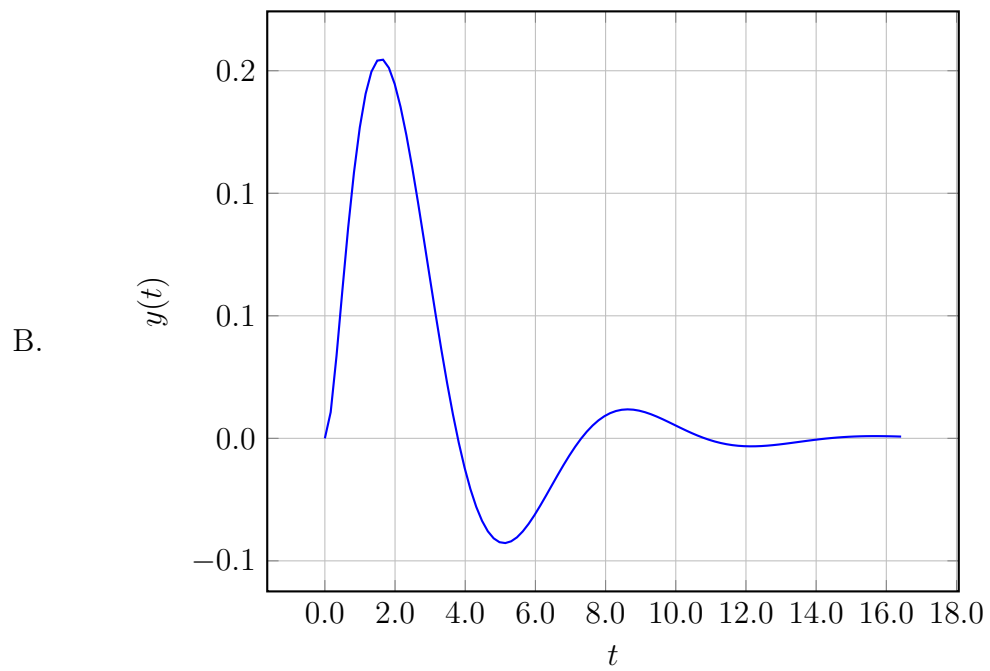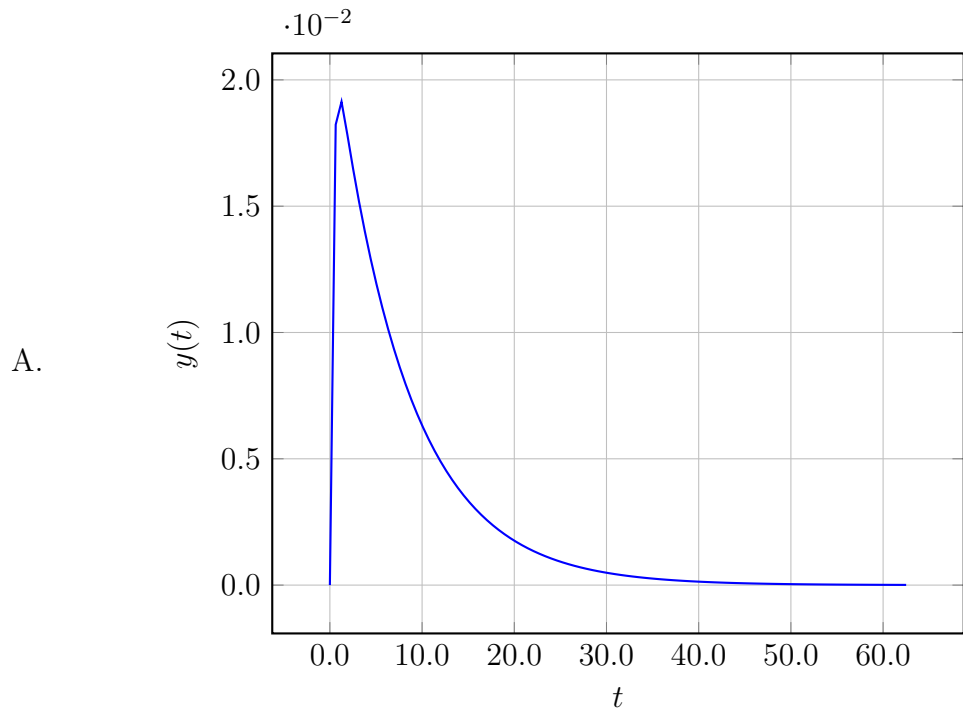1. (35 points) An open-loop transfer function is given by,

$$G(s) = \frac{1}{s^3 + 2.0s^2 + 3.46465s + 7.46465}$$
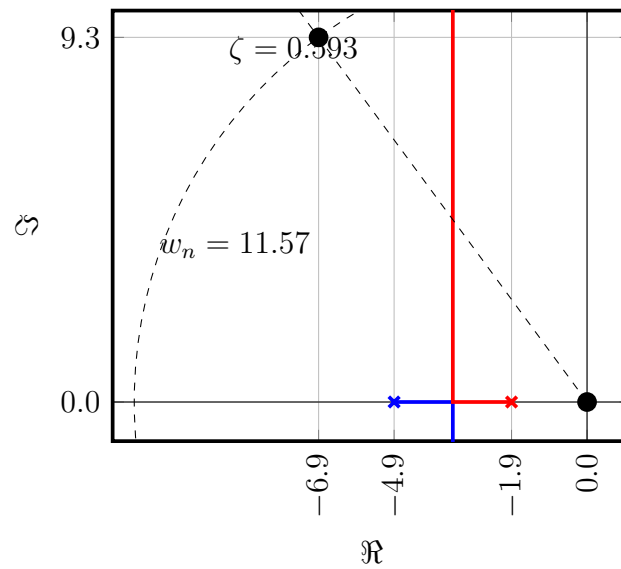
Which of the following PI controllers stabilizes the system in a unit-feedback closed-loop configuration?

   A. $F(s) = -7.21213 + \frac{3.42929}{s}$

   B. $F(s) = -3.42929 + \frac{0.96465}{s}$

   C. $F(s) = 3.28787 + \frac{1.92929}{s}$

   D. $F(s) = 2.35858 + \frac{3.42929}{s}$

   E. $F(s) = -8.14142 + \frac{1.92929}{s}$

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?
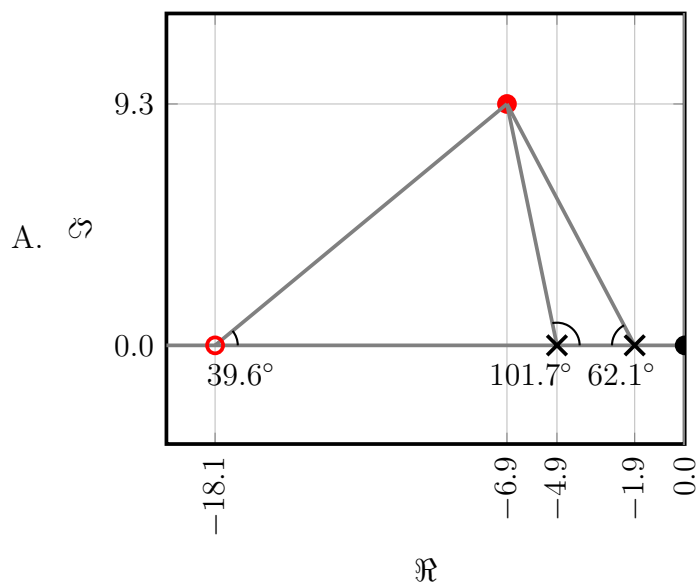
A.

B.

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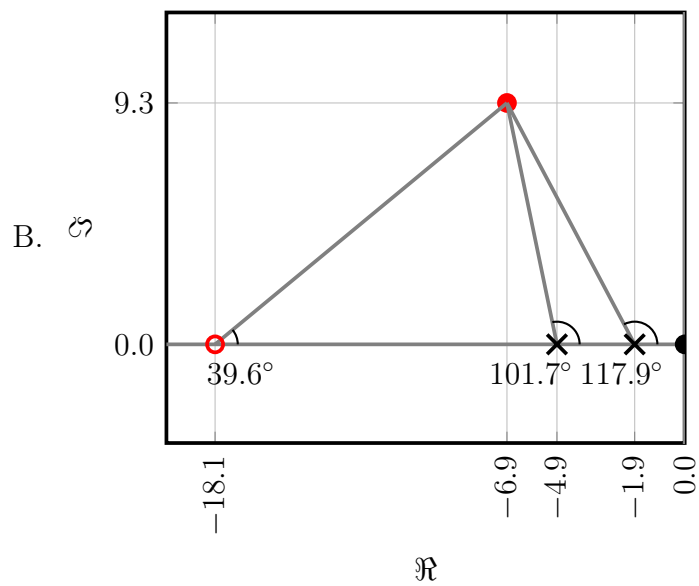

A zero is added so that the root-locus passes through this design point. Which of the following represents the correct angle condition for this design?
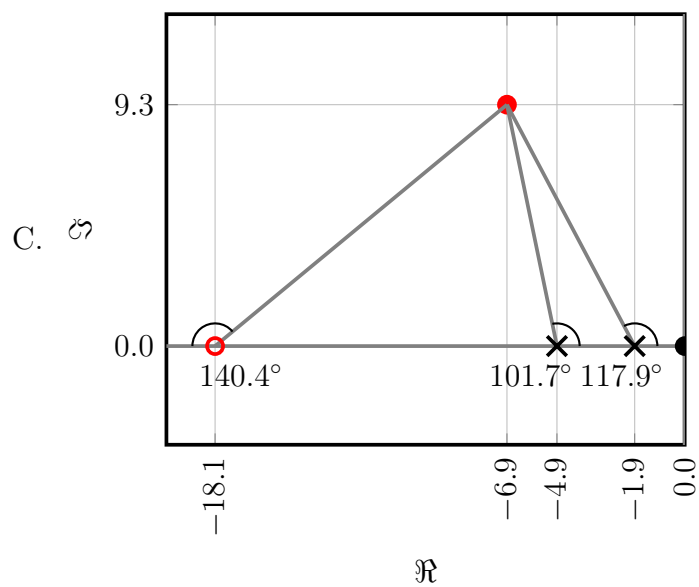
$$\sum \theta = 62.1° + 101.7° + 39.6° =$$

A.

$$\sum \theta = 117.9° + 101.7° - 39.6° =$$

B.

$$\sum \theta = 117.9° + 101.7° + 140.4° =$$

C.

$$\sum \theta = 117.9° + 78.3° + 39.6° =$$

D.

$$\sum \theta = 117.9° + 101.7° + 39.6° =$$

E.