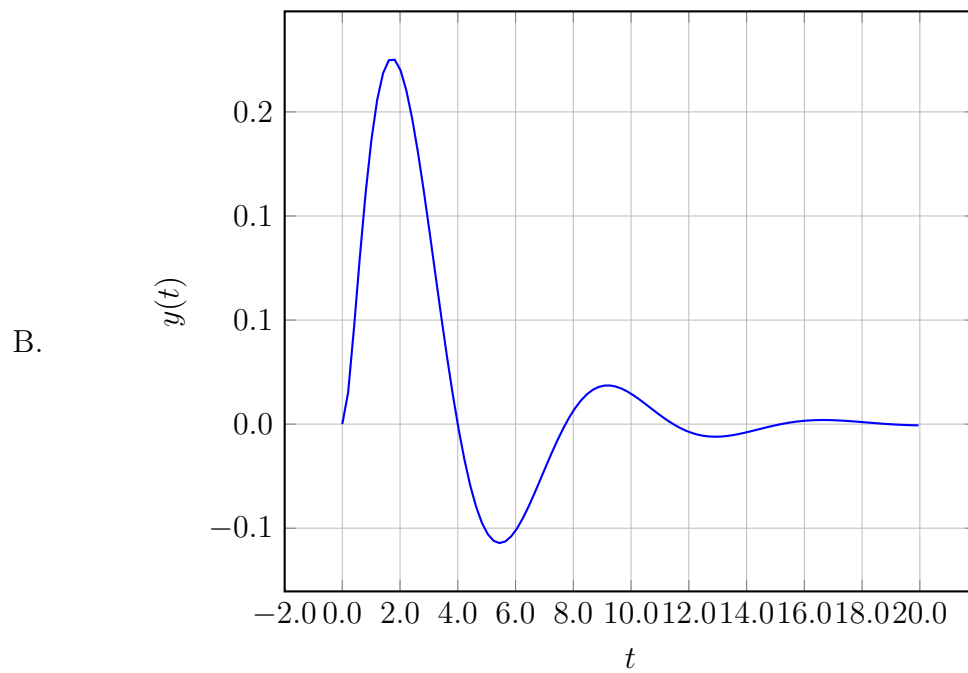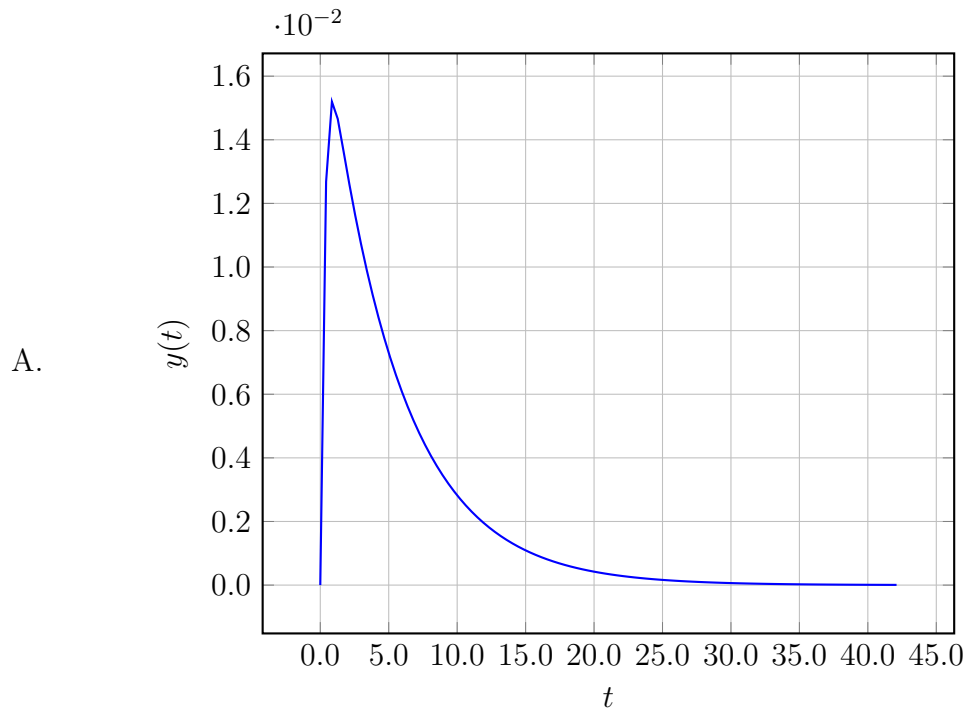1. (35 points) An open-loop transfer function is given by,

$$G(s) = \frac{1}{s^3 + 2.0s^2 + 3.39394s + 7.39394}$$
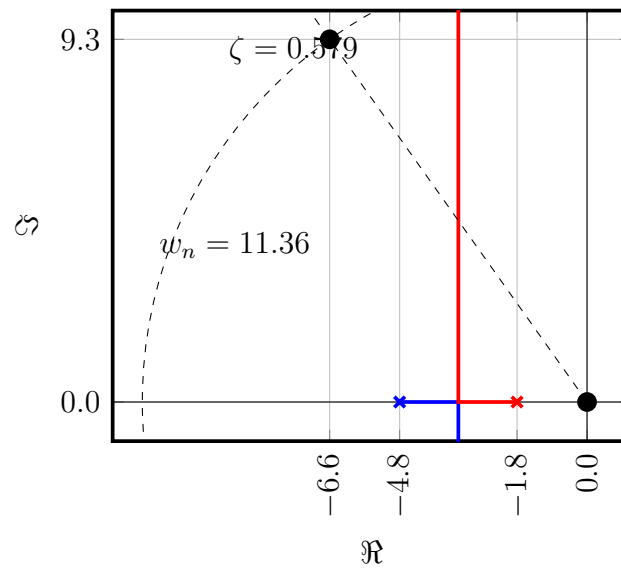
Which of the following PI controllers stabilizes the system in a unit-feedback closed-loop configuration?

A. $F(s) = 2.07574 + \frac{3.28787}{s}$

B. $F(s) = 2.86363 + \frac{1.78787}{s}$

C. $F(s) = -7.63637 + \frac{3.28787}{s}$

D. $F(s) = -3.28787 + \frac{0.89394}{s}$

E. $F(s) = -8.42426 + \frac{1.78787}{s}$

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?
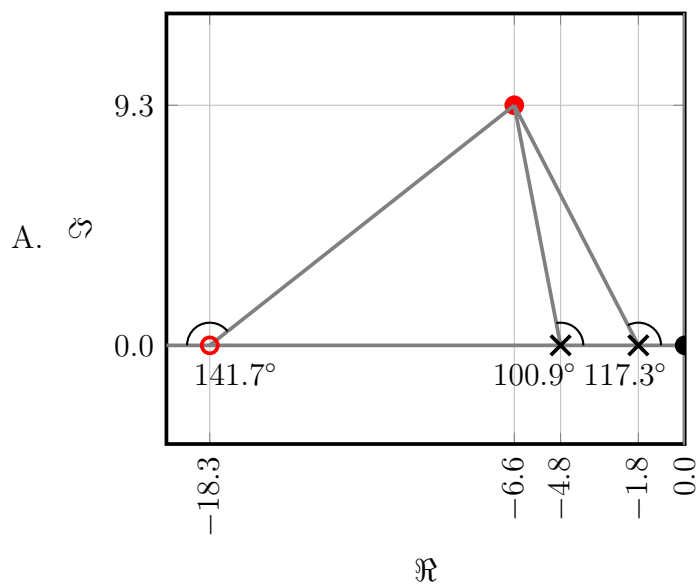
A.

B.

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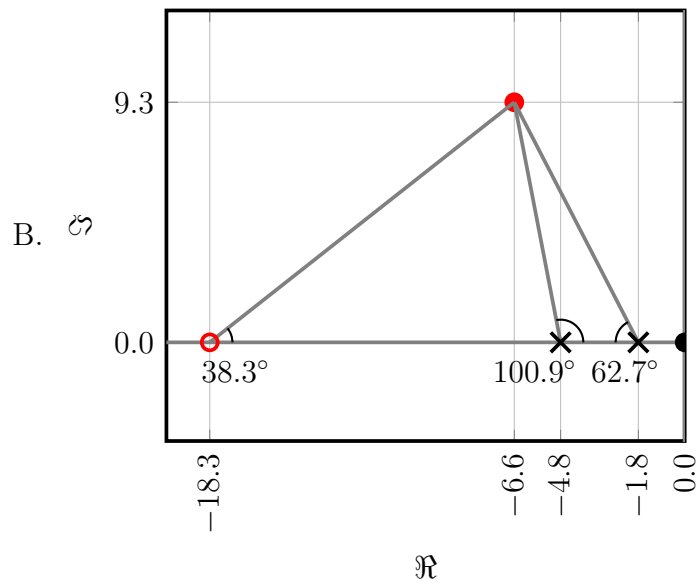

A zero is added so that the root-locus passes through this design point. Which of the following represents the correct angle condition for this design?
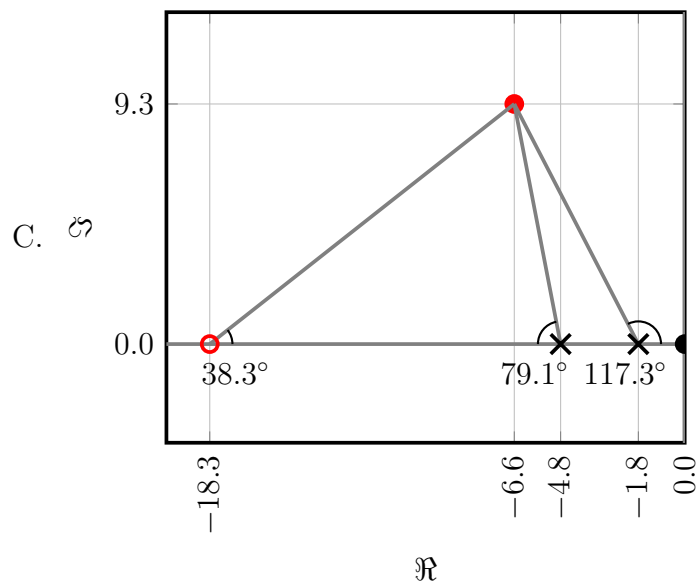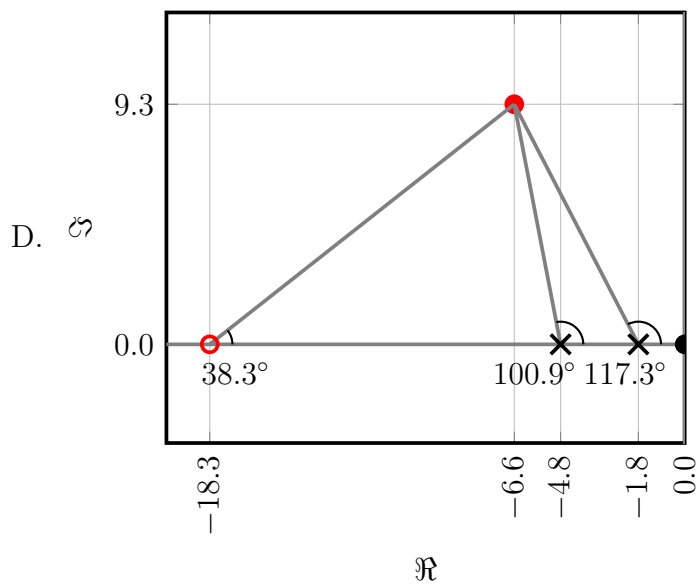
$$\sum \theta = 117.3° + 100.9° + 141.7° =$$

A.

$$\sum \theta = 62.7° + 100.9° + 38.3° =$$

B.

$$\sum \theta = 117.3° + 79.1° + 38.3° =$$

C.

$$\sum \theta = 117.3° + 100.9° + 38.3° =$$

D.

$$\sum \theta = 117.3° + 100.9° - 38.3° =$$

E.