

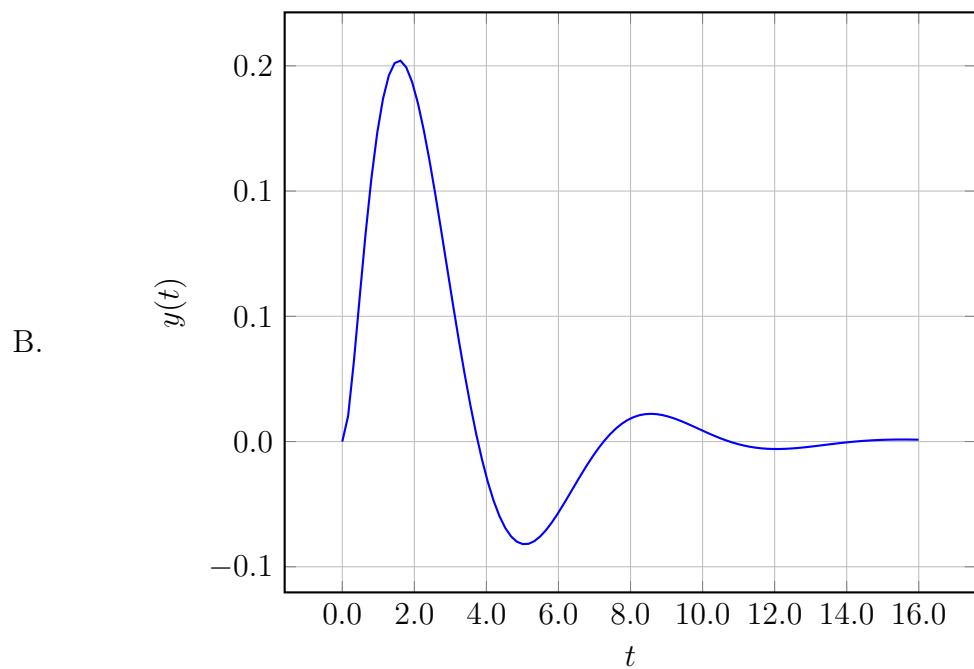
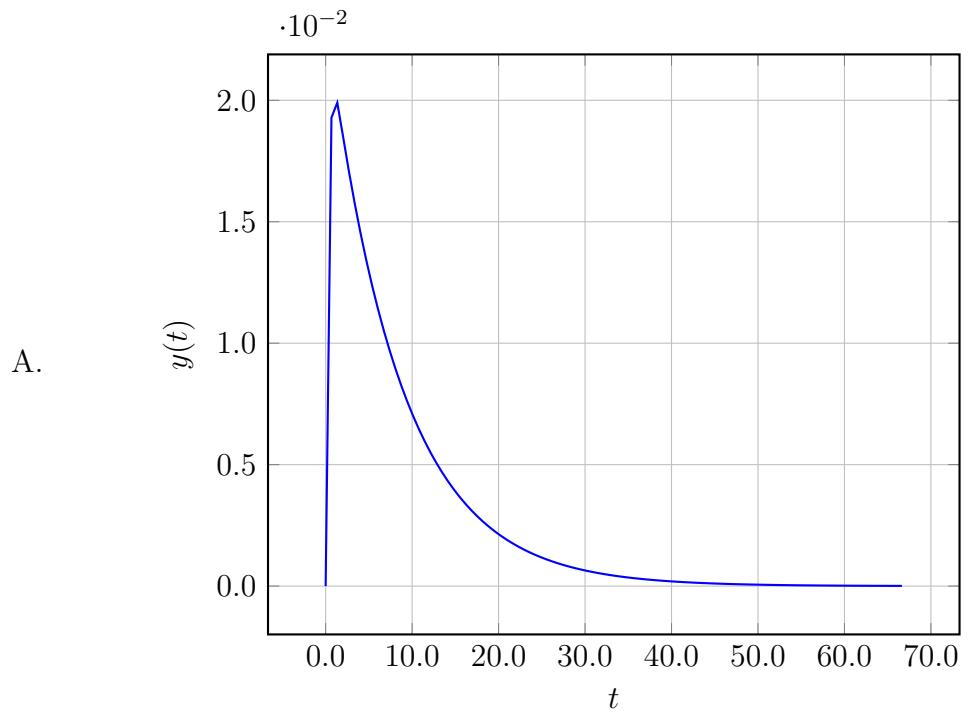
1. (35 points) An open-loop transfer function is given by,

$$G(s) = \frac{1}{s^3 + 2.0s^2 + 3.47475s + 7.47475}$$

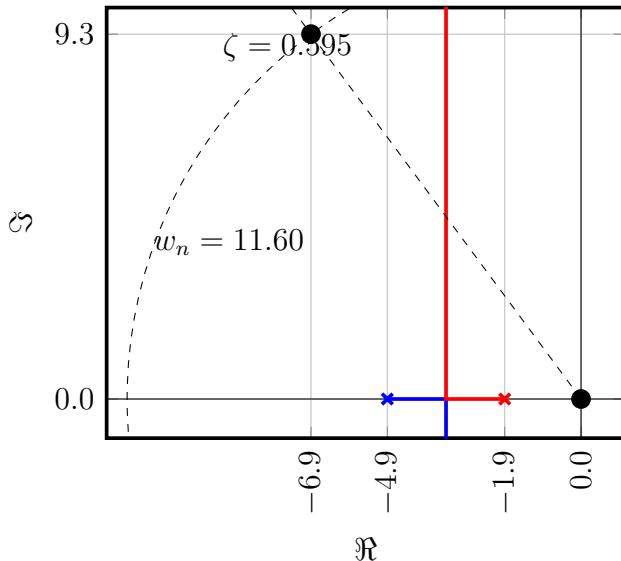
Which of the following PI controllers stabilizes the system in a unit-feedback closed-loop configuration?

- A.  $F(s) = -3.4495 + \frac{0.97475}{s}$
- B.  $F(s) = 2.39899 + \frac{3.4495}{s}$
- C.  $F(s) = -7.15152 + \frac{3.4495}{s}$
- D.  $F(s) = -8.10101 + \frac{1.9495}{s}$
- E.  $F(s) = 3.34848 + \frac{1.9495}{s}$

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?

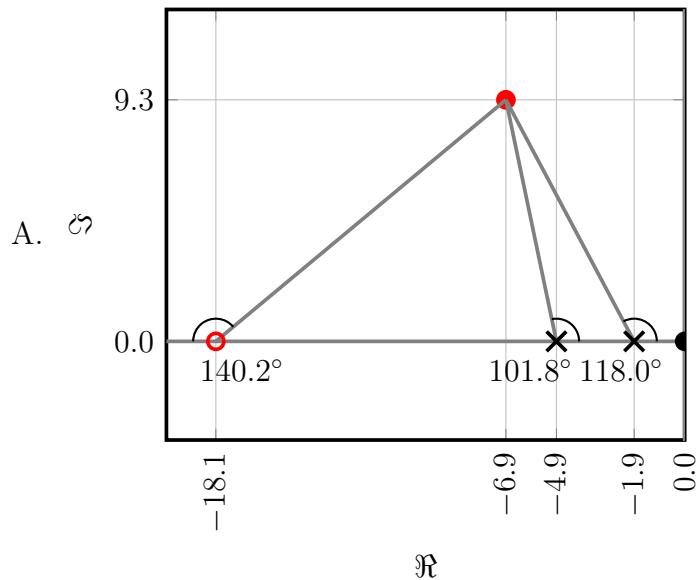


3. (30 points) A design point on the root-locus plot for a P-type controller is shown below.

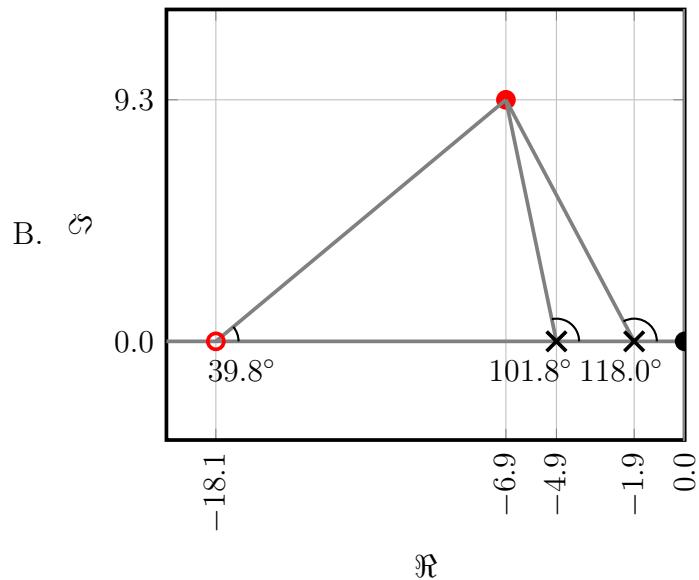


A zero is added so that the root-locus passes through this design point. Which of the following represents the correct angle condition for this design?

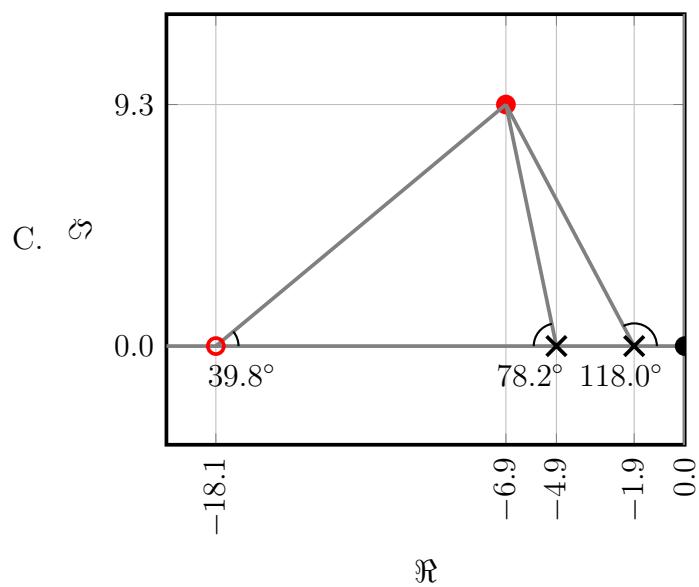
$$\sum \theta = 118.0^\circ + 101.8^\circ + 140.2^\circ =$$



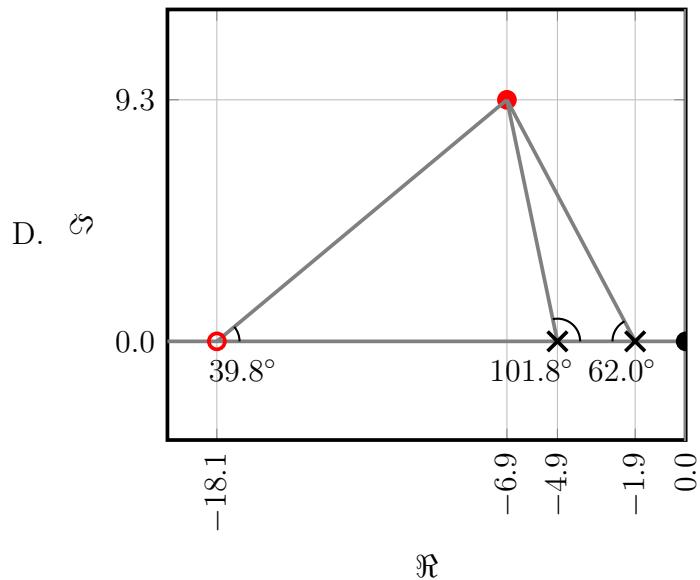
$$\sum \theta = 118.0^\circ + 101.8^\circ - 39.8^\circ =$$



$$\sum \theta = 118.0^\circ + 78.2^\circ + 39.8^\circ =$$



$$\sum \theta = 62.0^\circ + 101.8^\circ + 39.8^\circ =$$



$$\sum \theta = 118.0^\circ + 101.8^\circ + 39.8^\circ =$$

