

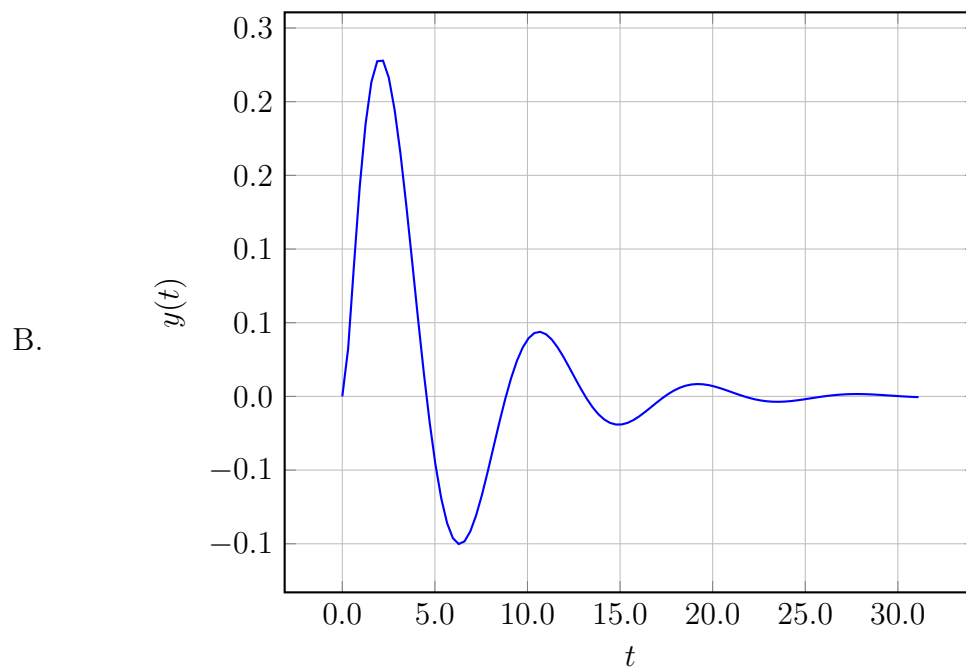
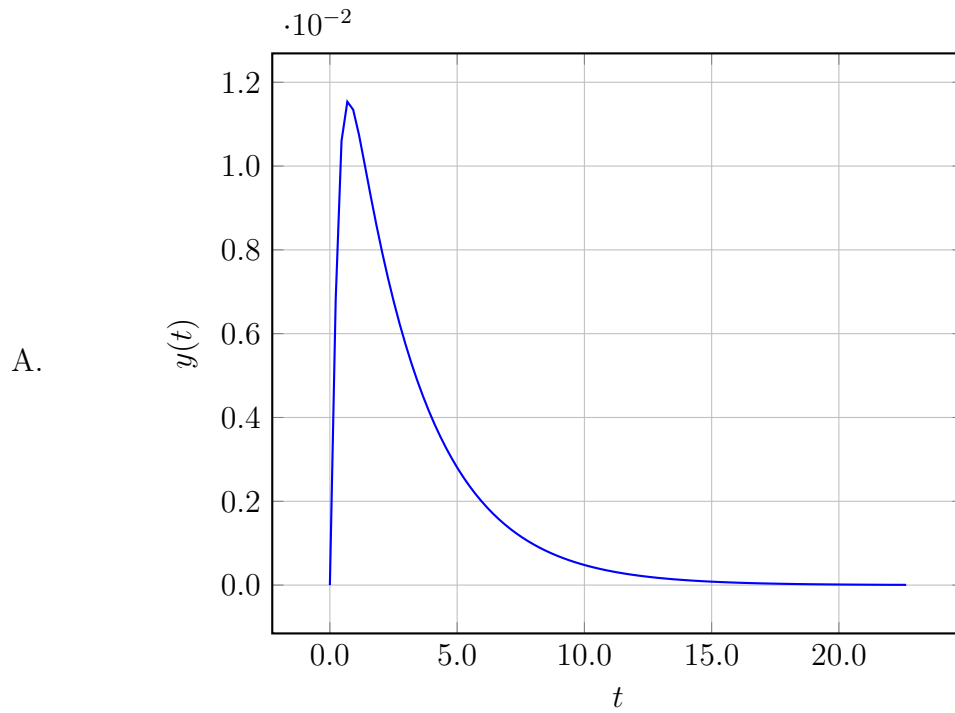
1. (35 points) An open-loop transfer function is given by,

$$G(s) = \frac{1}{s^3 + 2.0s^2 + 3.25757s + 7.25757}$$

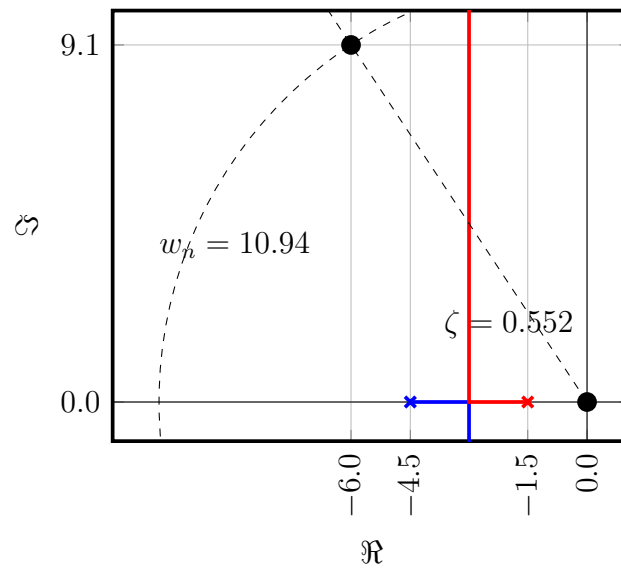
Which of the following PI controllers stabilizes the system in a unit-feedback closed-loop configuration?

- A. $F(s) = -8.96971 + \frac{1.51514}{s}$
- B. $F(s) = 1.53029 + \frac{3.01514}{s}$
- C. $F(s) = -3.01514 + \frac{0.75757}{s}$
- D. $F(s) = -8.45456 + \frac{3.01514}{s}$
- E. $F(s) = 2.04544 + \frac{1.51514}{s}$

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?

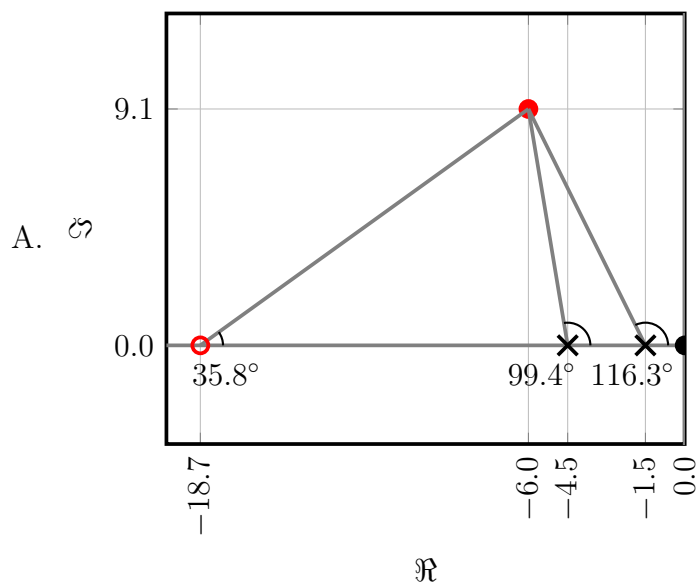


3. (30 points) A design point on the root-locus plot for a P-type controller is shown below.

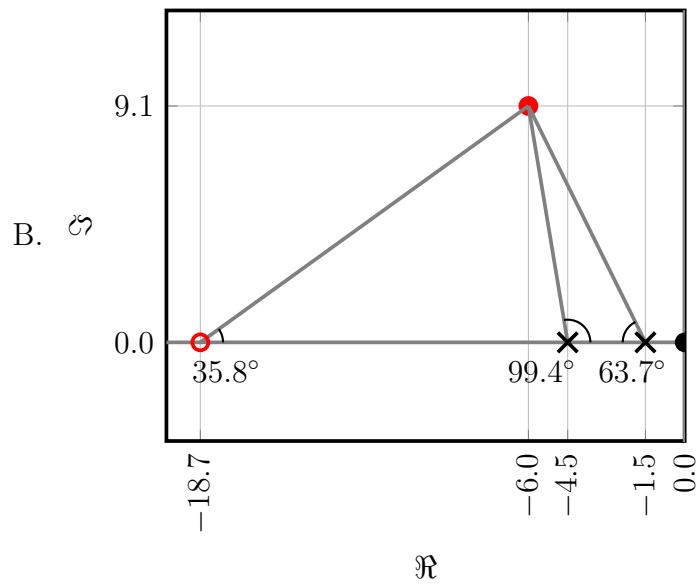


A zero is added so that the root-locus passes through this design point. Which of the following represents the correct angle condition for this design?

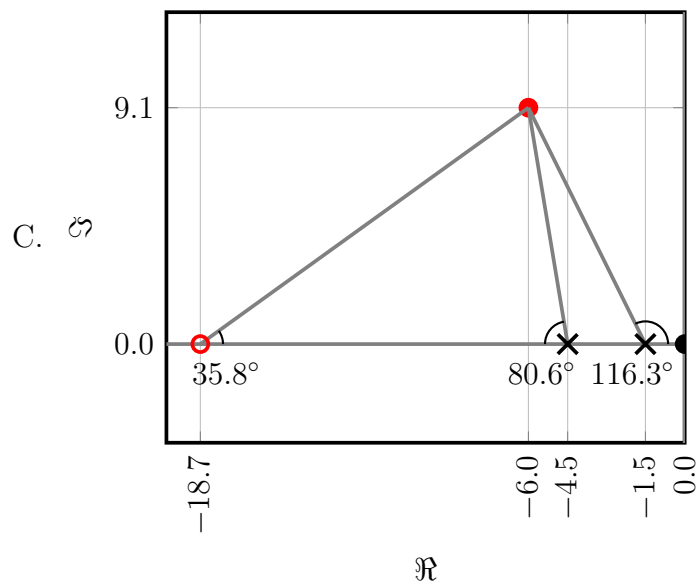
$$\sum \theta = 116.3^\circ + 99.4^\circ - 35.8^\circ =$$



$$\sum \theta = 63.7^\circ + 99.4^\circ + 35.8^\circ =$$



$$\sum \theta = 116.3^\circ + 80.6^\circ + 35.8^\circ =$$



$$\sum \theta = 116.3^\circ + 99.4^\circ + 144.2^\circ =$$

