

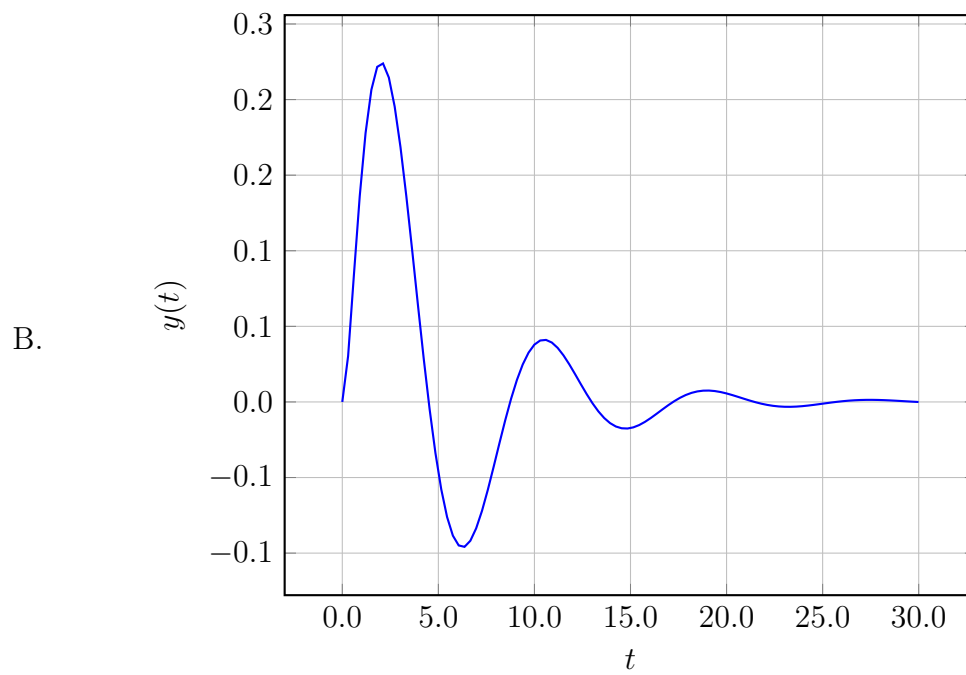
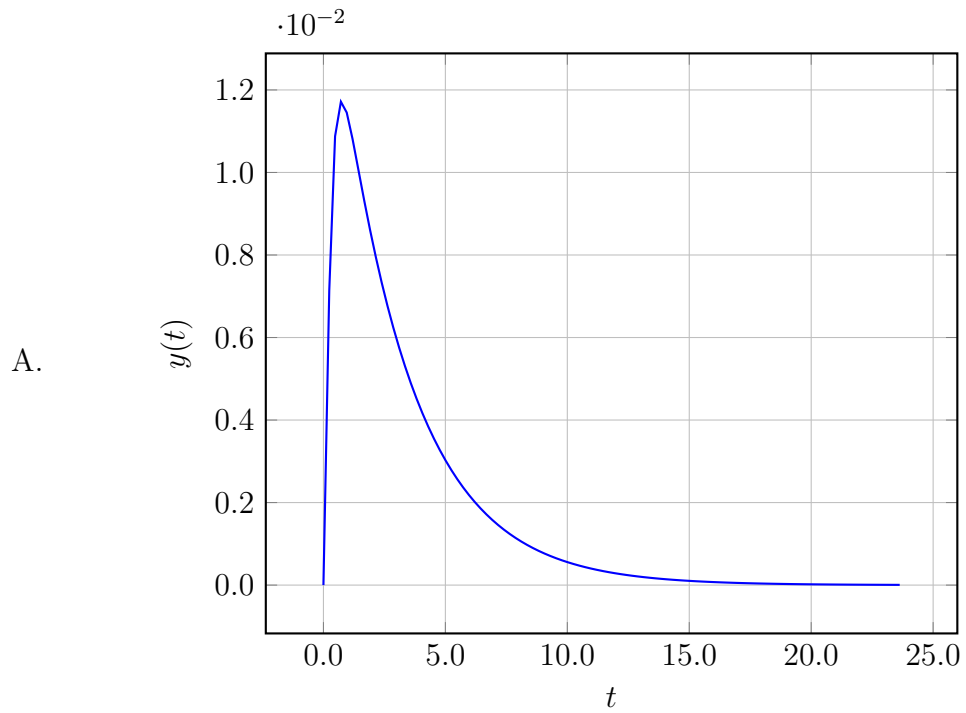
1. (35 points) An open-loop transfer function is given by,

$$G(s) = \frac{1}{s^3 + 2.0s^2 + 3.26767s + 7.26767}$$

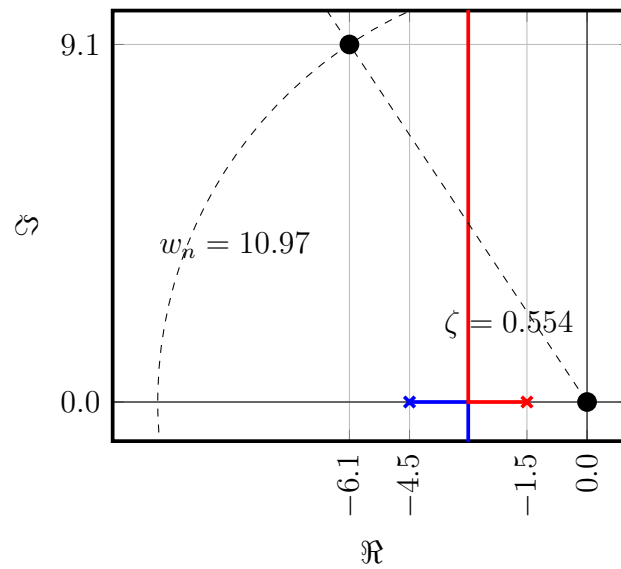
Which of the following PI controllers stabilizes the system in a unit-feedback closed-loop configuration?

- A. $F(s) = 1.5707 + \frac{3.03534}{s}$
- B. $F(s) = -8.9293 + \frac{1.53534}{s}$
- C. $F(s) = -3.03534 + \frac{0.76767}{s}$
- D. $F(s) = -8.39395 + \frac{3.03534}{s}$
- E. $F(s) = 2.10605 + \frac{1.53534}{s}$

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?

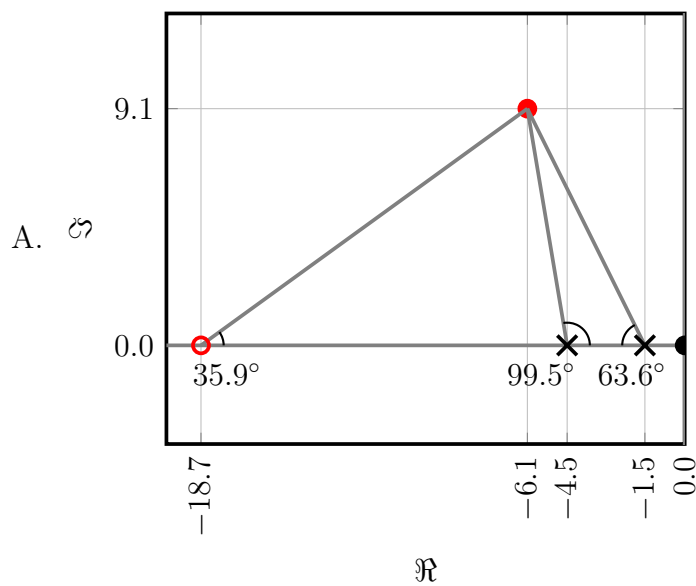


3. (30 points) A design point on the root-locus plot for a P-type controller is shown below.

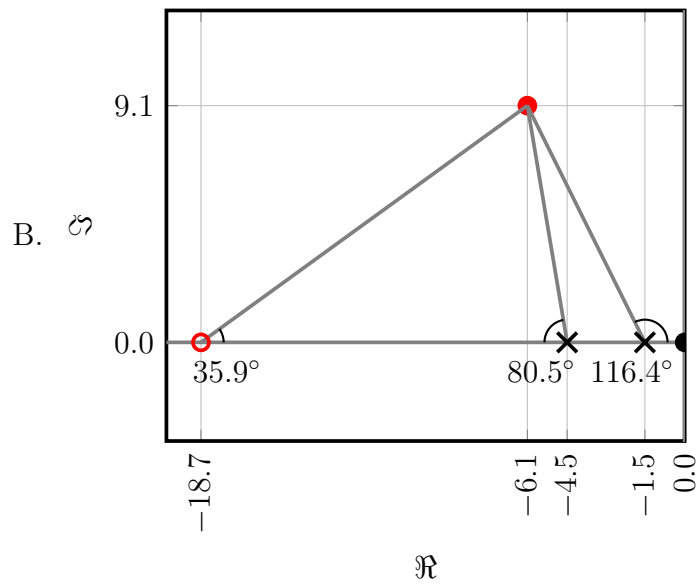


A zero is added so that the root-locus passes through this design point. Which of the following represents the correct angle condition for this design?

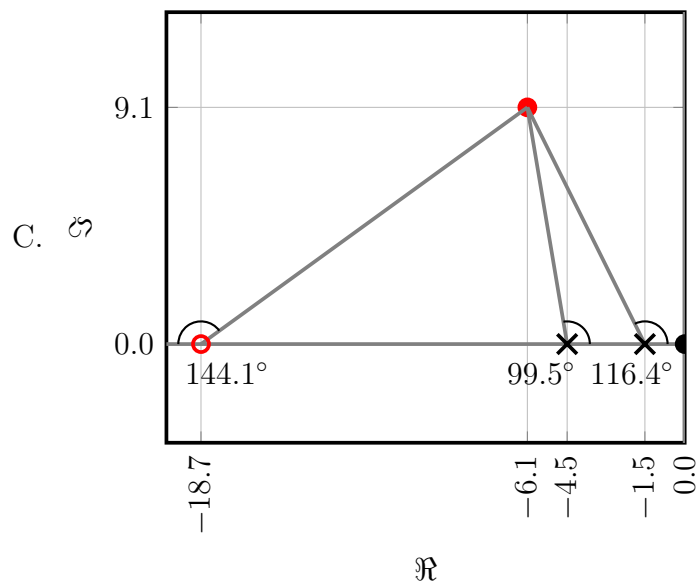
$$\sum \theta = 63.6^\circ + 99.5^\circ + 35.9^\circ =$$



$$\sum \theta = 116.4^\circ + 80.5^\circ + 35.9^\circ =$$



$$\sum \theta = 116.4^\circ + 99.5^\circ + 144.1^\circ =$$



$$\sum \theta = 116.4^\circ + 99.5^\circ - 35.9^\circ =$$

