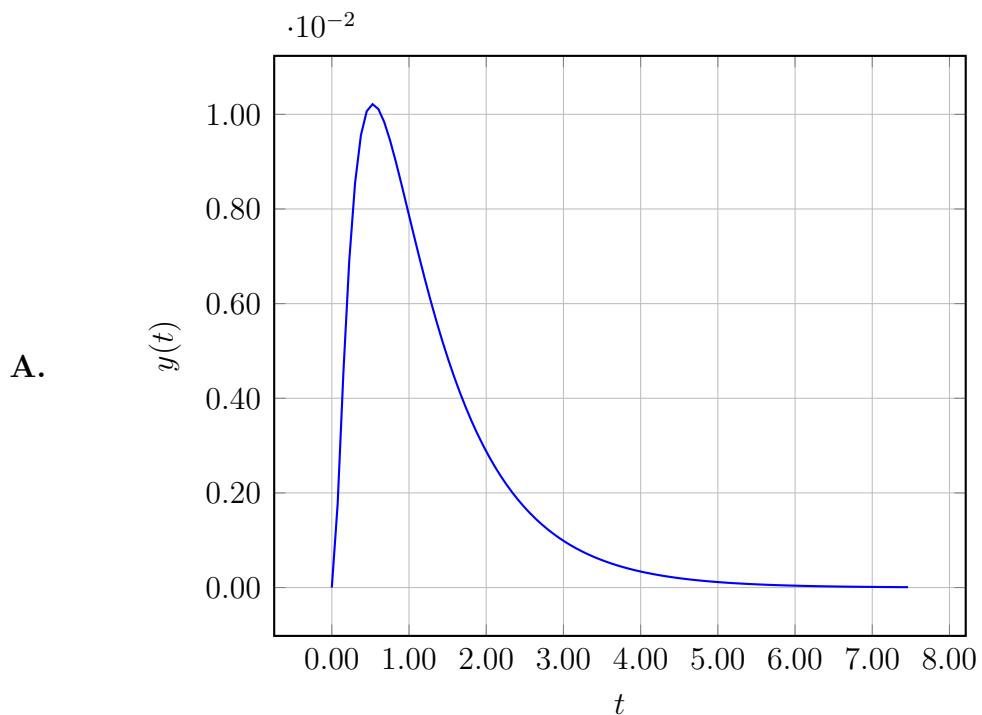


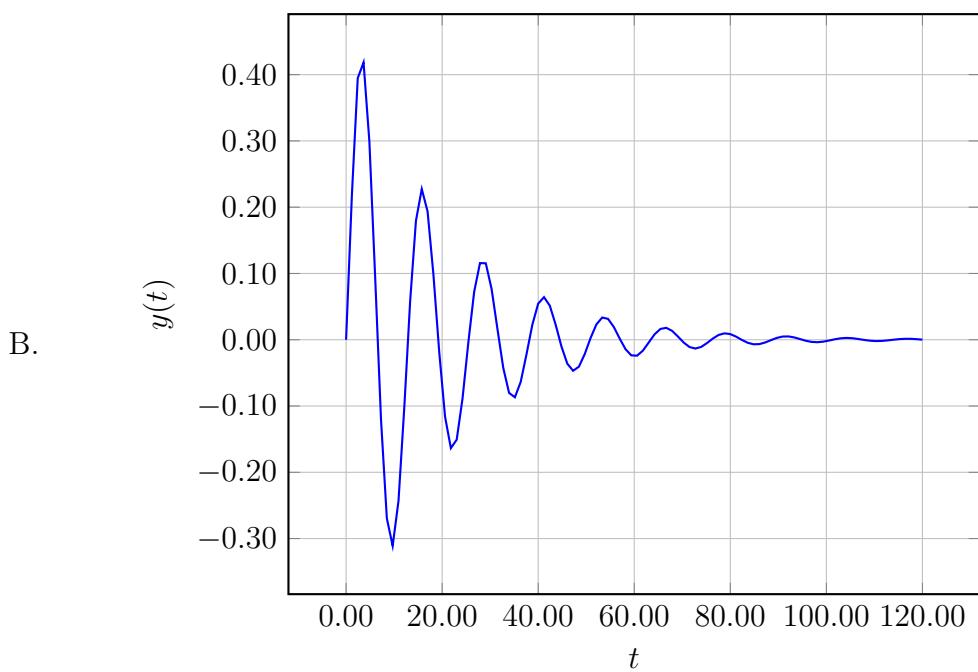
1. (35 points) An open-loop transfer function is given as,

$$G(s) = \frac{1}{s^3 + 2.0s^2 + 3.0s + 7.0}$$

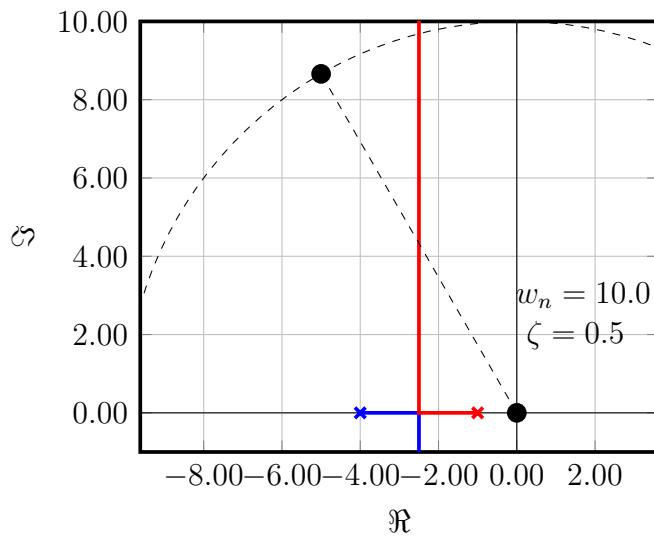
which of the following PI-controllers stabilizes the system in a closed-loop unit feedback structure?

- A.  $F(s) = 0.5 + \frac{1.0}{s}$
  - B.  $F(s) = -10.0 + \frac{1.0}{s}$
  - C.  $F(s) = -10.0 + \frac{2.5}{s}$
  - D.  $F(s) = 0.5 + \frac{2.5}{s}$
  - E.  $F(s) = -2.5 + \frac{0.5}{s}$
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?

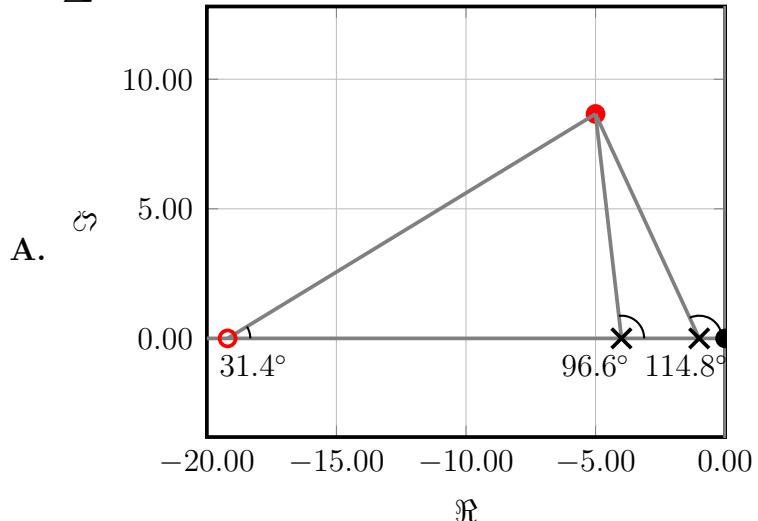




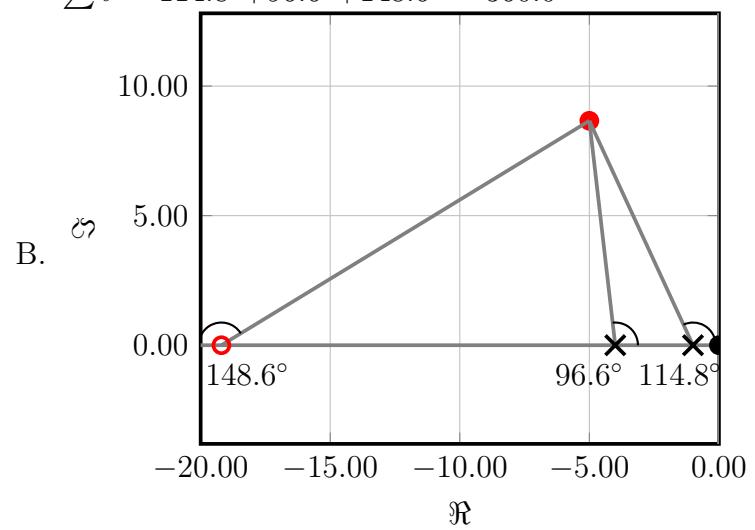
3. (30 points) A design point on the root-locus plot for a P-type controller is shown below. A zero is added so that the root-locus passes through this design point. Which of the following represents the correct angle condition for this design?



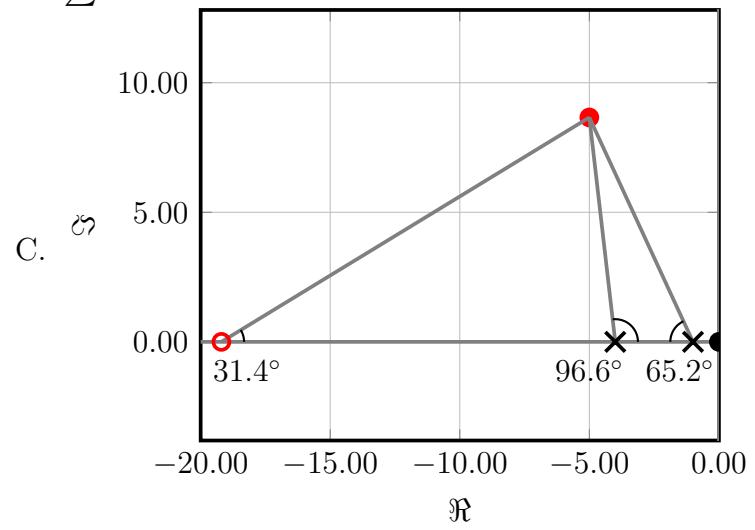
$$\sum \theta = 114.8^\circ + 96.6^\circ - 31.4^\circ = 180.0^\circ$$



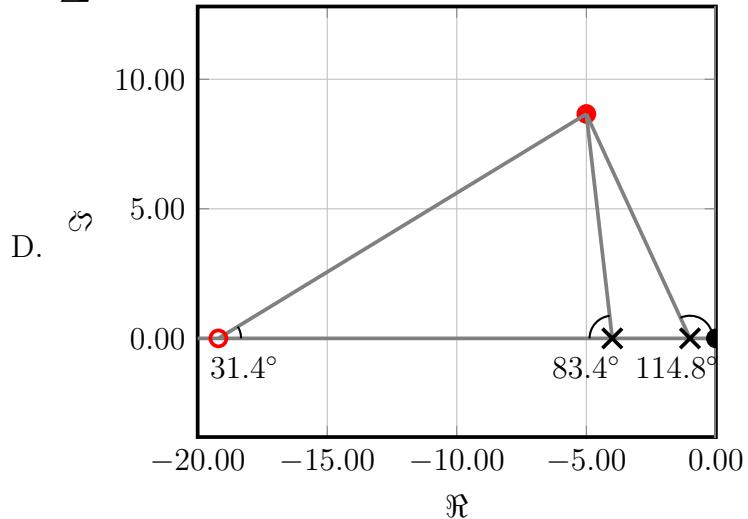
$$\sum \theta = 114.8^\circ + 96.6^\circ + 148.6^\circ = 360.0^\circ$$



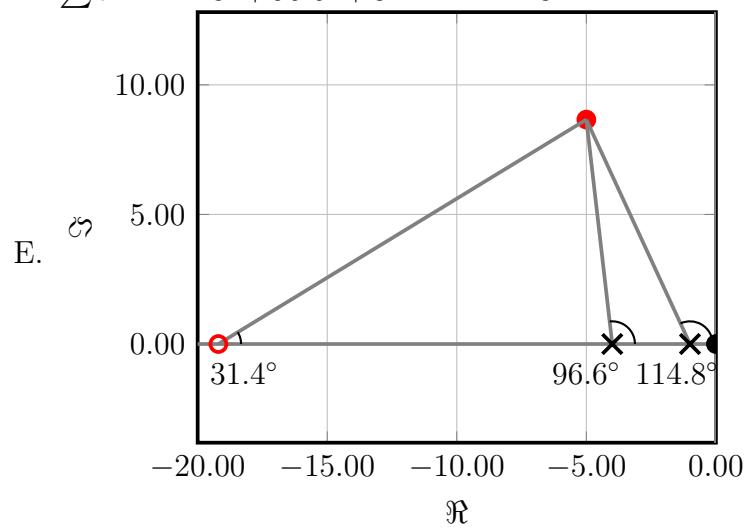
$$\sum \theta = 65.2^\circ + 96.6^\circ + 31.4^\circ = 193.2^\circ$$



$$\sum \theta = 114.8^\circ + 83.4^\circ + 31.4^\circ = 229.6^\circ$$



$$\sum \theta = 114.8^\circ + 96.6^\circ + 31.4^\circ = 242.8^\circ$$



Q	A
1	E
2	A
3	A