

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

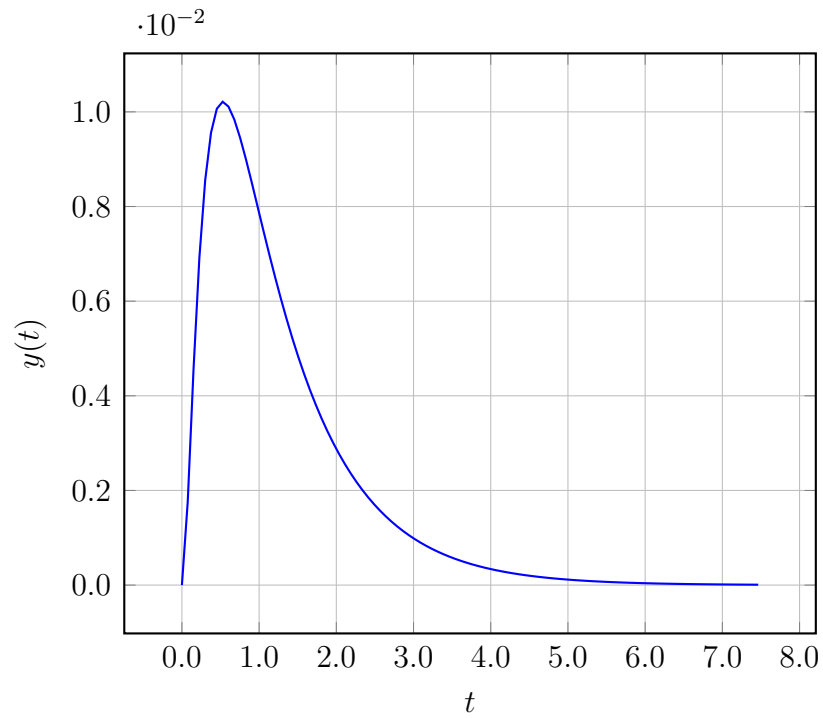
$$G(s) = \frac{1}{s^3 + 2.0s^2 + 3.0s + 7.0}$$

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

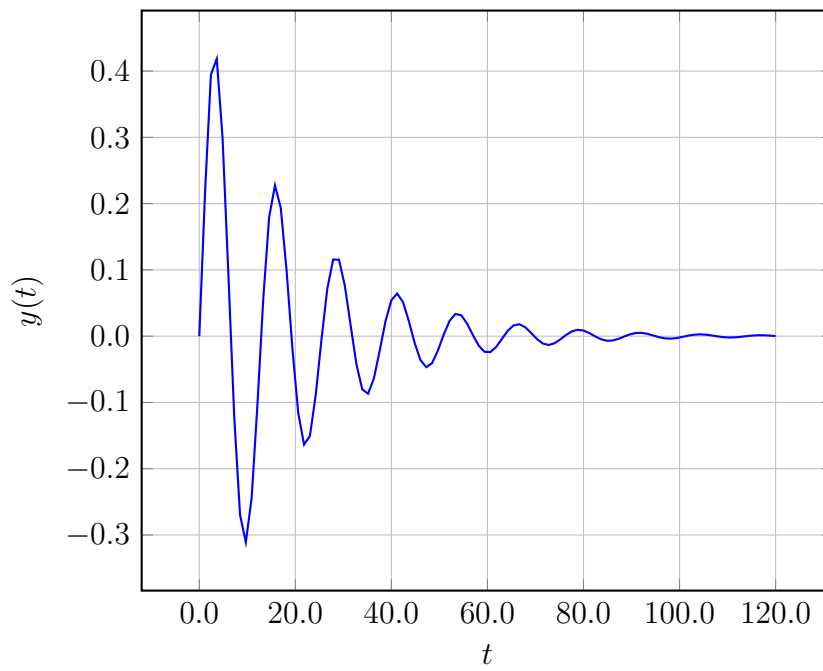
- A. $F(s) = 0.5 + \frac{1.0}{s}$
- B. $F(s) = -10.0 + \frac{1.0}{s}$
- C. $F(s) = -10.0 + \frac{2.5}{s}$
- D. $F(s) = 0.5 + \frac{2.5}{s}$
- E.** $F(s) = -2.5 + \frac{0.5}{s}$

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?

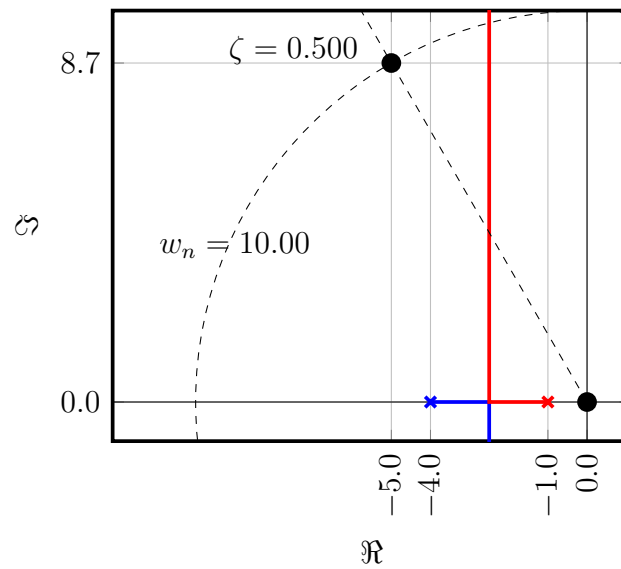
A.



B.

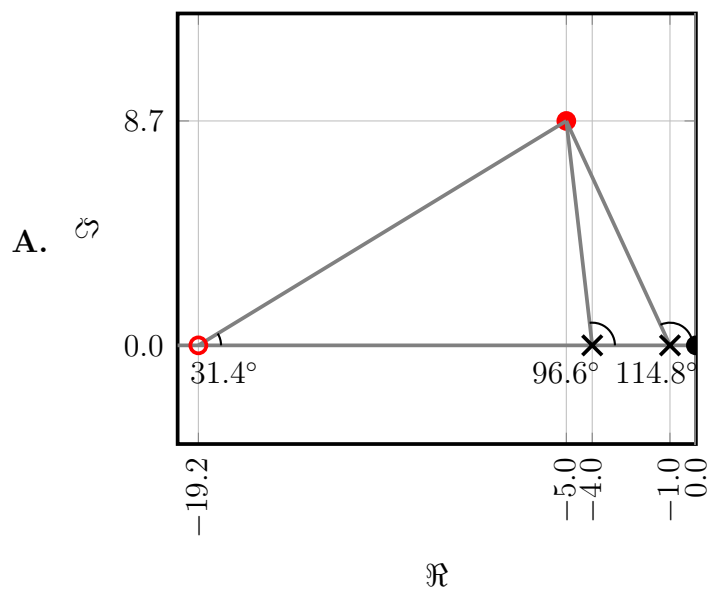


3. (30 points) A design point on the root-locus plot for a P-type controller is shown below.

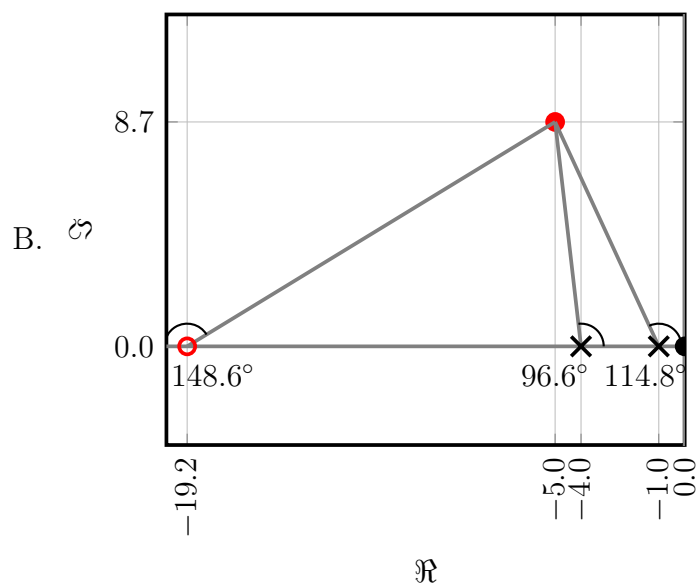


A zero is added so that the root-locus passes through this design point. Which of the following represents the correct angle condition for this design?

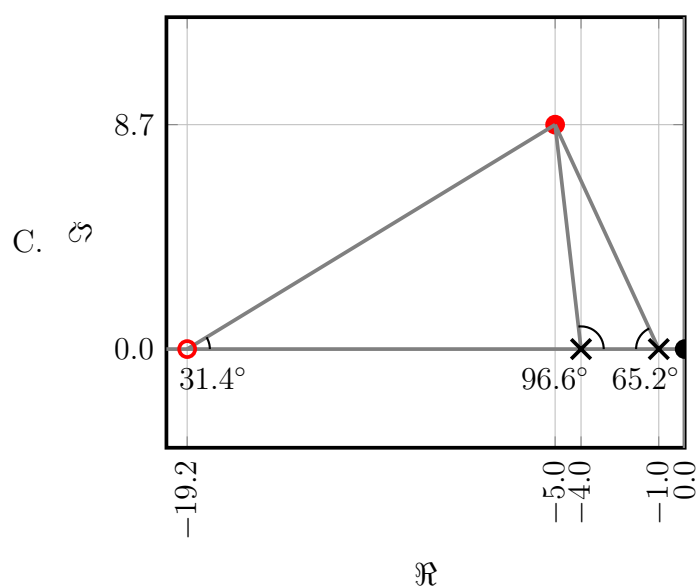
$$\sum \theta = 114.8^\circ + 96.6^\circ - 31.4^\circ = 180.0^\circ$$



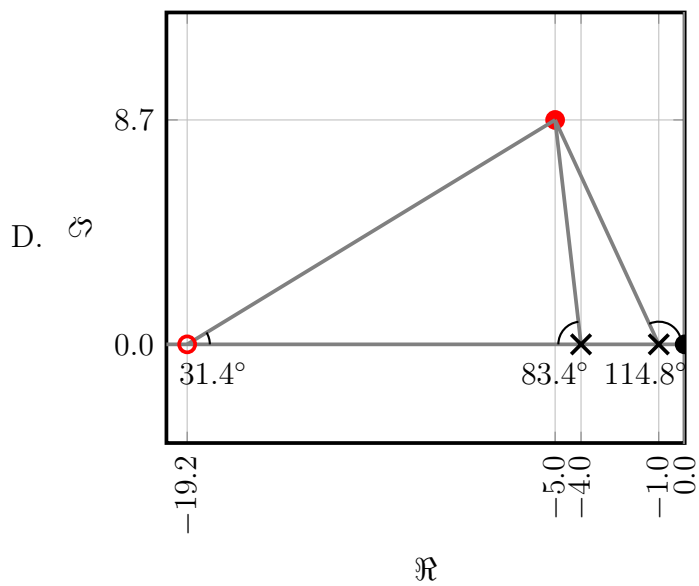
$$\sum \theta = 114.8^\circ + 96.6^\circ + 148.6^\circ = 360.0^\circ$$



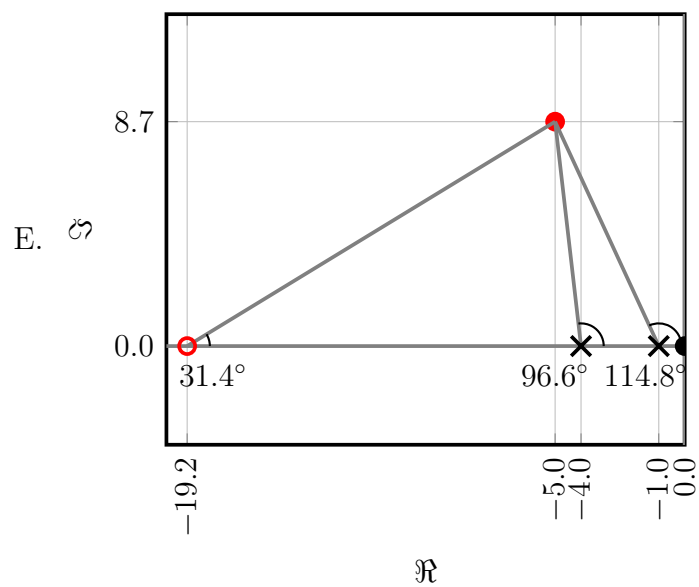
$$\sum \theta = 65.2^\circ + 96.6^\circ + 31.4^\circ = 193.2^\circ$$



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



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



Q	A
1	E
2	A
3	A