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. $F(s) = -10.0 + \frac{1.0}{s}$

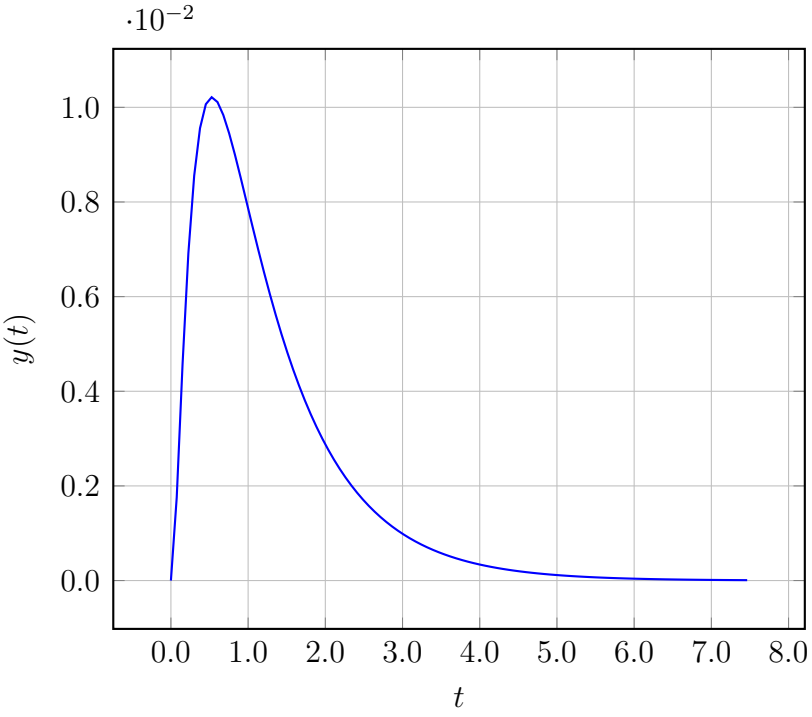
C. $F(s) = -10.0 + \frac{2.5}{s}$

D. $F(s) = 0.5 + \frac{2.5}{s}$

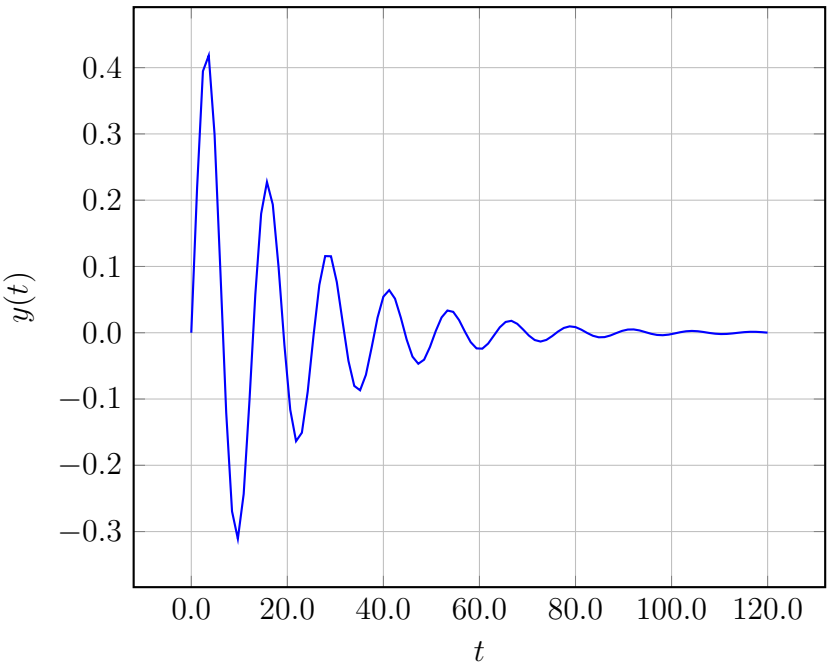
E. $F(s) = -2.5 + \frac{0.5}{s}$

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?

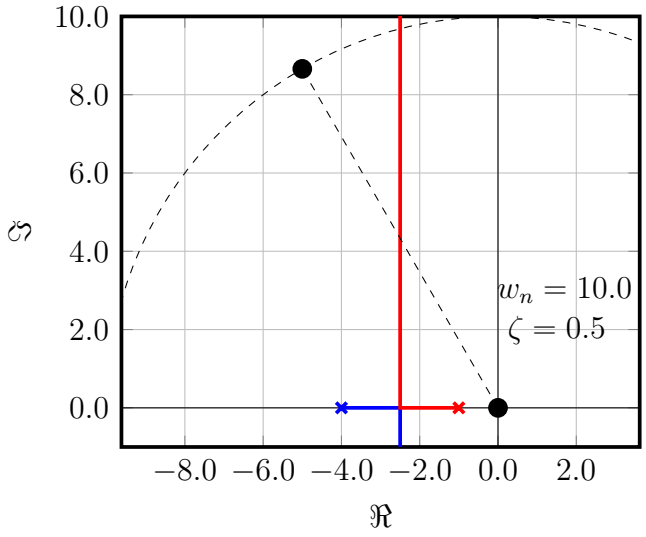
A.



B.

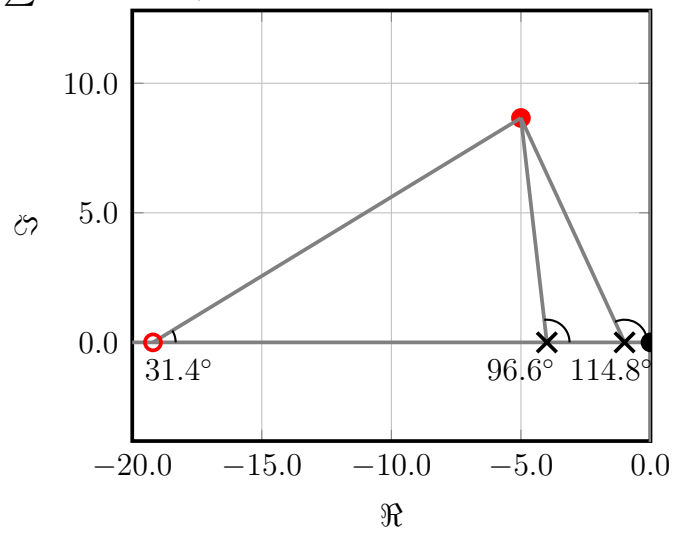


3. (30 points) A design point on the root-locus plot for a P-type controller is shown below. A zero is added so that the root-locus passes through this design point. Which of the following represents the correct angle condition for this design?



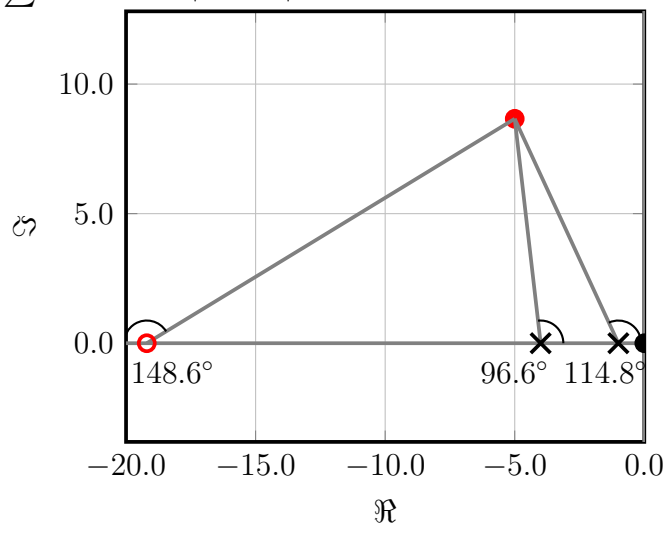
A.

$$\sum \theta = 114.8° + 96.6° - 31.4° = 180.0°$$



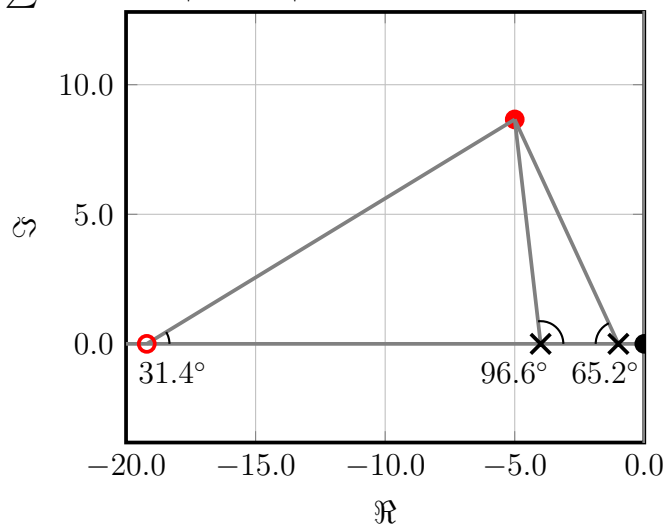
B.

$$\sum \theta = 114.8° + 96.6° + 148.6° = 360.0°$$



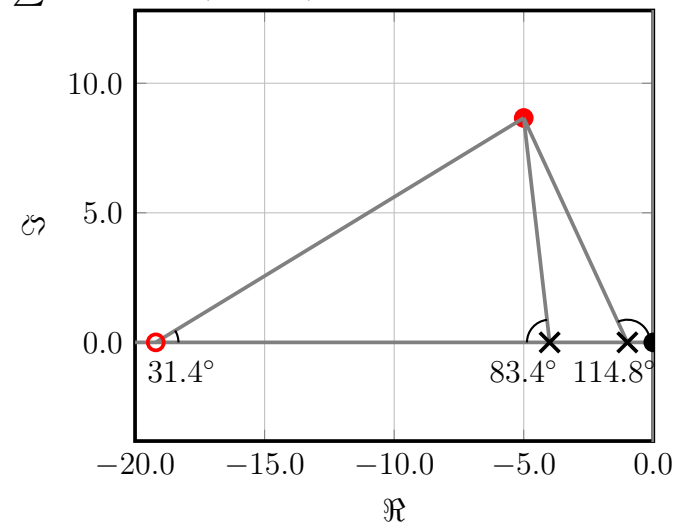
C.

$$\sum \theta = 65.2° + 96.6° + 31.4° = 193.2°$$



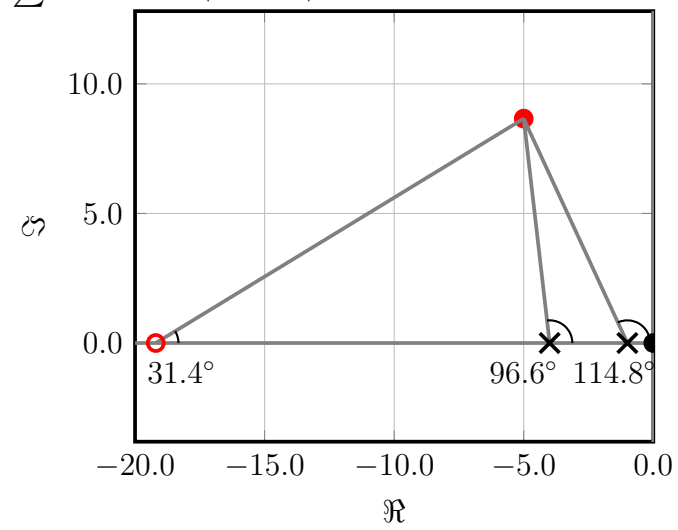
D.

$$\sum \theta = 114.8° + 83.4° + 31.4° = 229.6°$$



E.

$$\sum \theta = 114.8° + 96.6° + 31.4° = 242.8°$$



Q	A
1	E
2	A
3	A