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

$$G(s) = \frac{1}{s^3 + 2.0s^2 + 3.02019s + 7.02019}$$

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

A. $F(s) = -2.54039 + \frac{0.52019}{s}$

B. $F(s) = -9.8788 + \frac{2.54039}{s}$

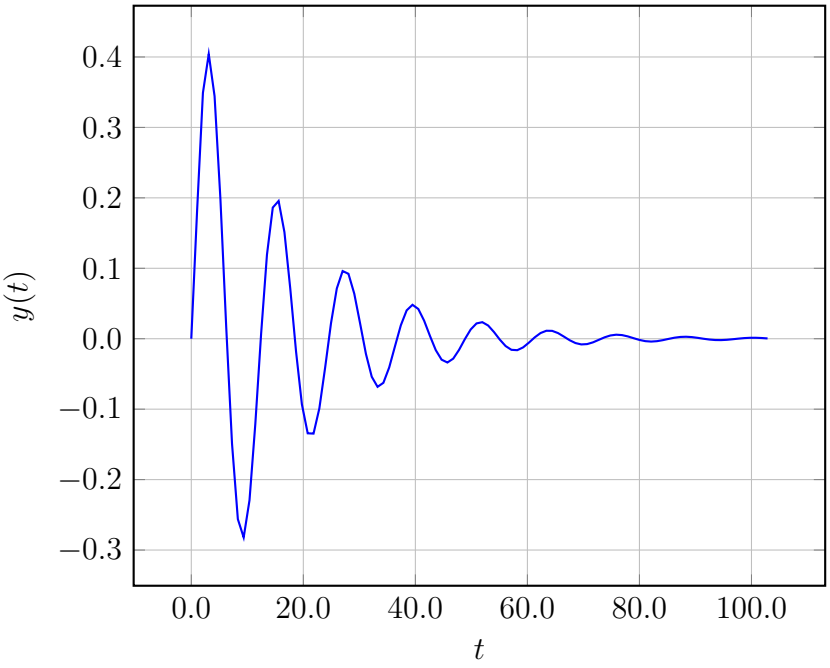
C. $F(s) = -9.9192 + \frac{1.04039}{s}$

D. $F(s) = 0.5808 + \frac{2.54039}{s}$

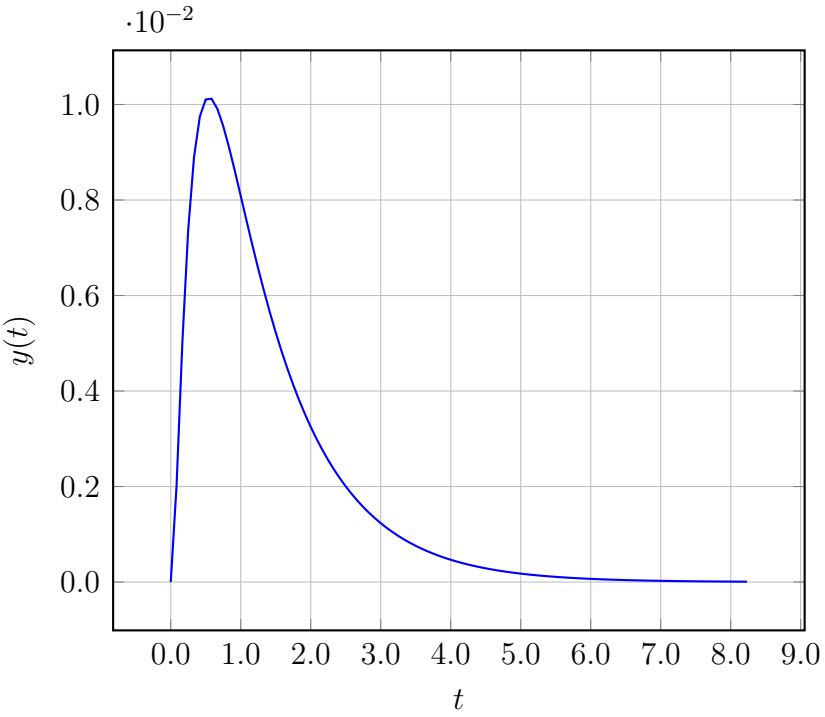
E. $F(s) = 0.6212 + \frac{1.04039}{s}$

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?

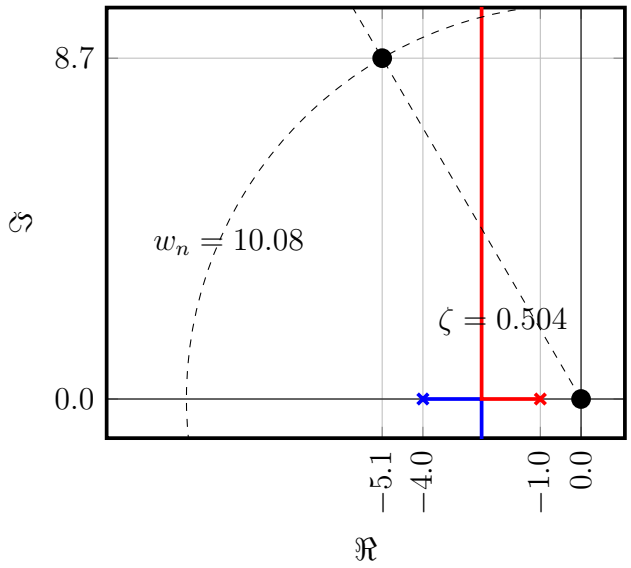
A.



B.



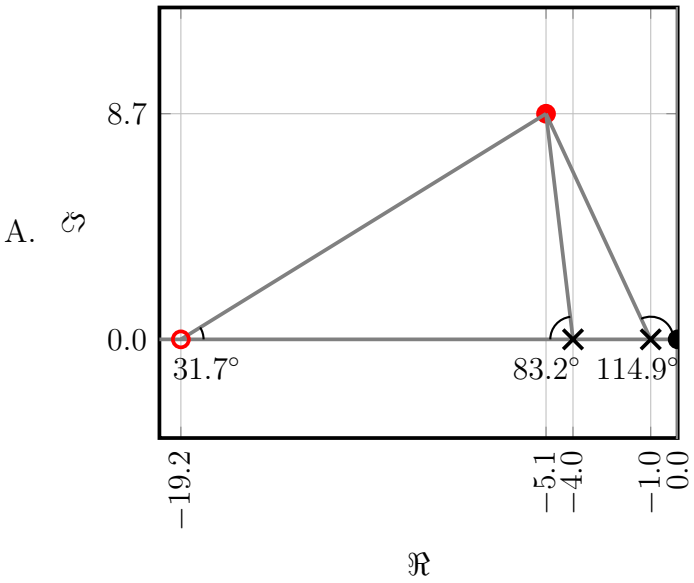
3. (30 points) A design point on the root-locus plot for a P-type controller is shown below.



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?

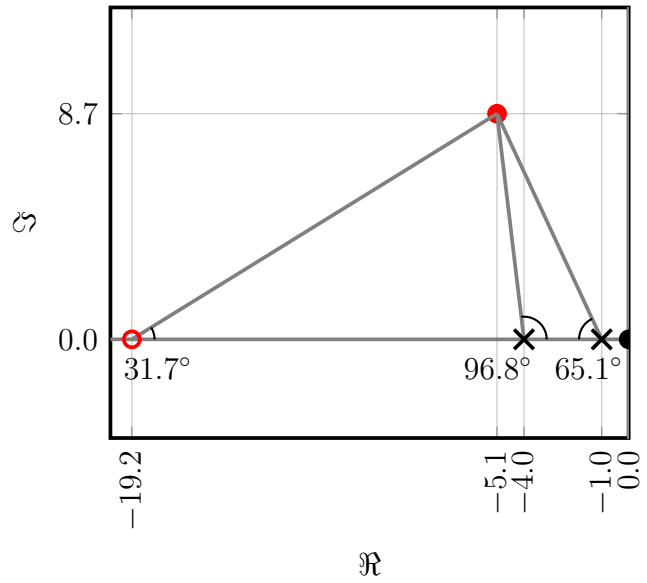
$$\sum \theta = 114.9^\circ + 83.2^\circ + 31.7^\circ = 229.8^\circ$$

A.



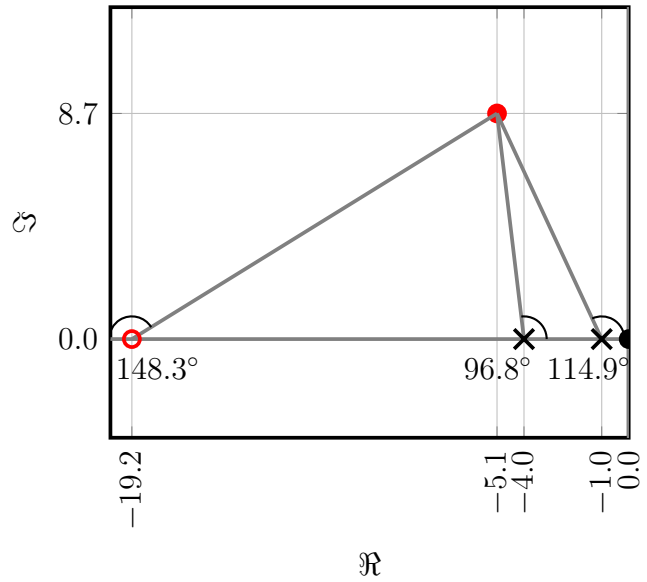
$$\sum \theta = 65.1^\circ + 96.8^\circ + 31.7^\circ = 193.6^\circ$$

B.



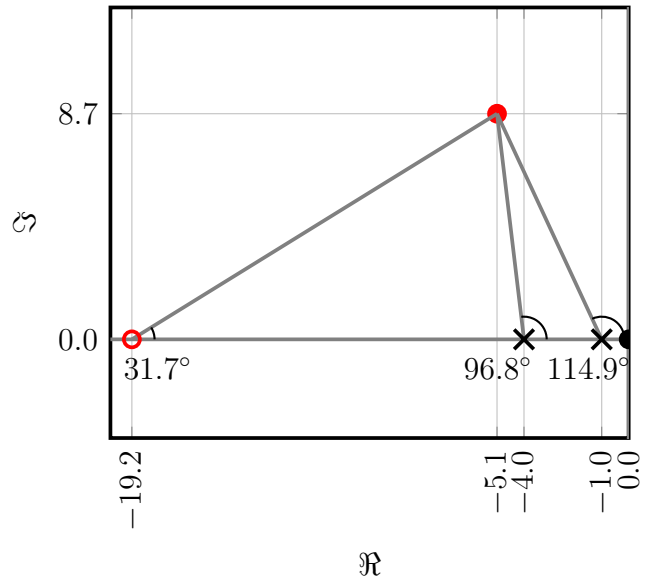
$$\sum \theta = 114.9^\circ + 96.8^\circ + 148.3^\circ = 360.0^\circ$$

C.



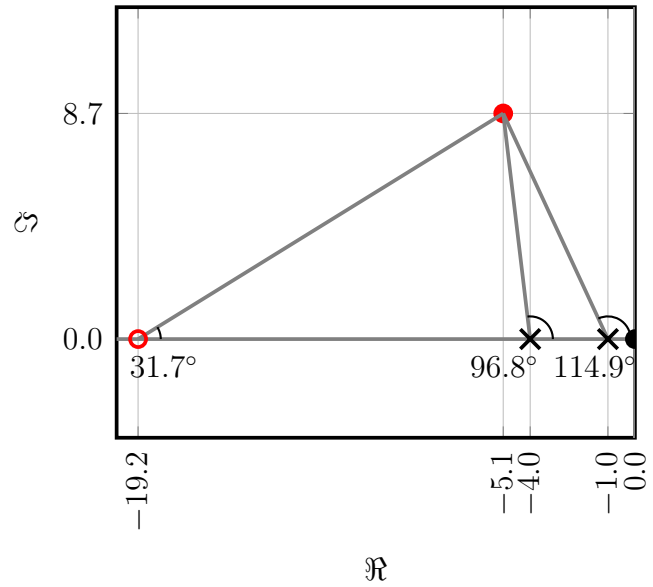
$$\sum \theta = 114.9° + 96.8° + 31.7° = 243.4°$$

D.



$$\sum \theta = 114.9° + 96.8° - 31.7° = 180.0°$$

E.



Q	A
1	A
2	B
3	E