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

$$G(s) = \frac{1}{s^3 + 2.0s^2 + 3.1515s + 7.1515}$$

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

A. $F(s) = 1.40909 + \frac{1.30302}{s}$

B. $F(s) = -9.09091 + \frac{2.80302}{s}$

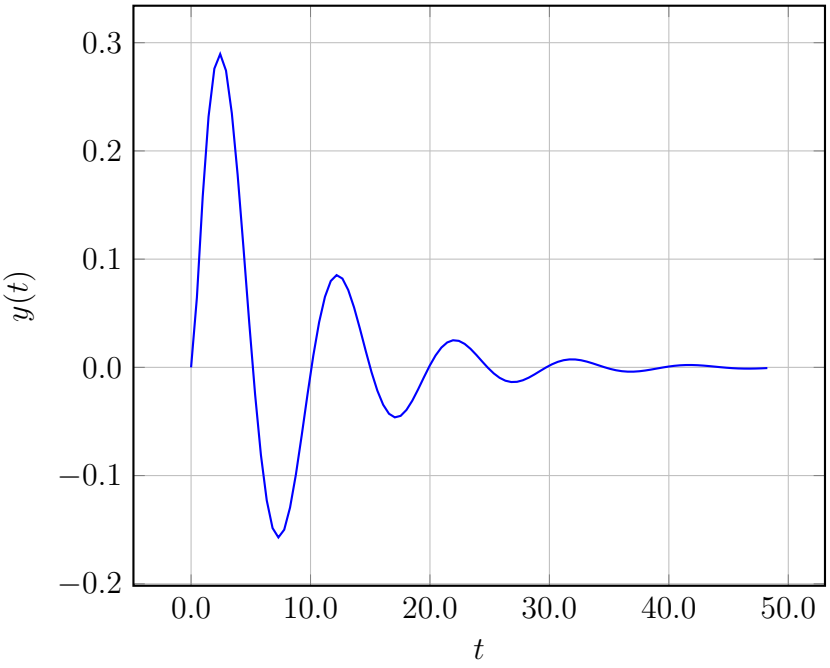
C. $F(s) = -9.39395 + \frac{1.30302}{s}$

D. $F(s) = 1.10605 + \frac{2.80302}{s}$

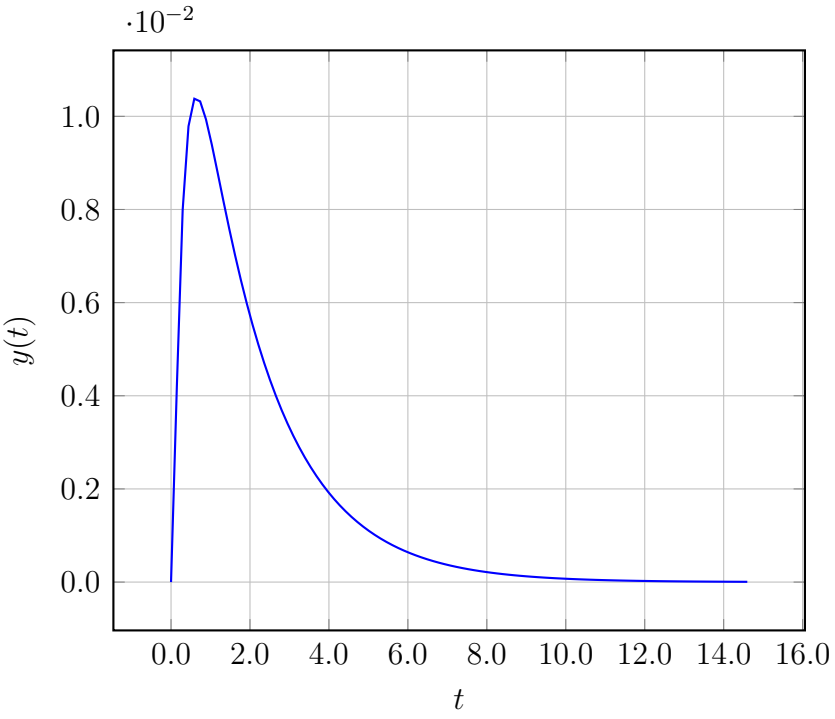
E. $F(s) = -2.80302 + \frac{0.6515}{s}$

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?

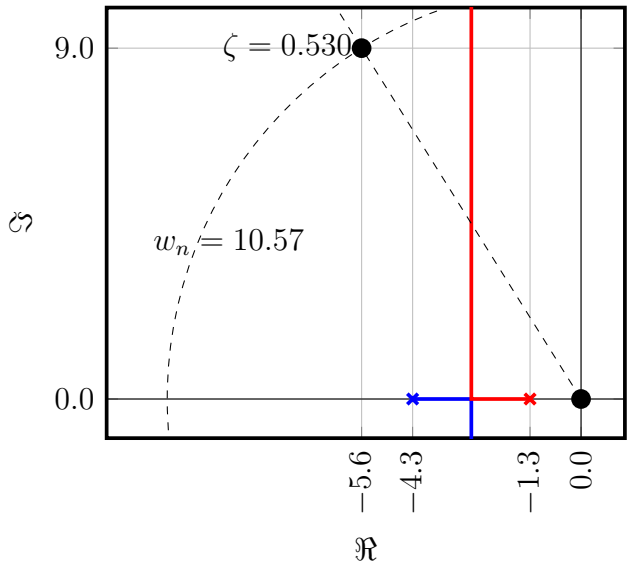
A.



B.



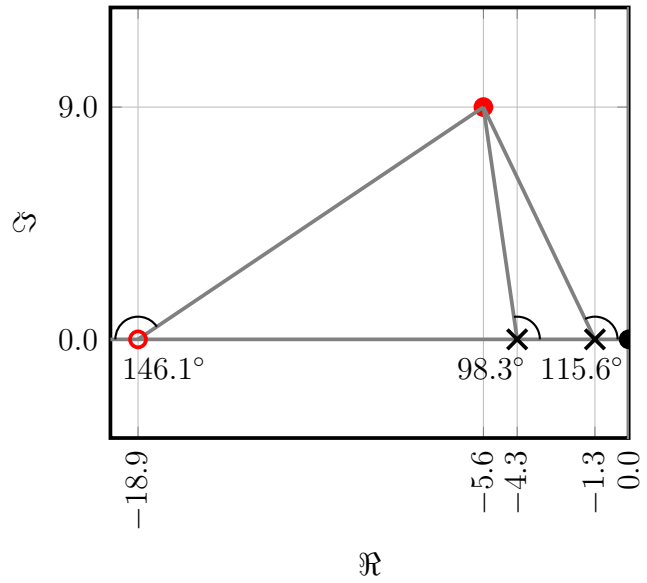
3. (30 points) A design point on the root-locus plot for a P-type controller is shown below.



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?

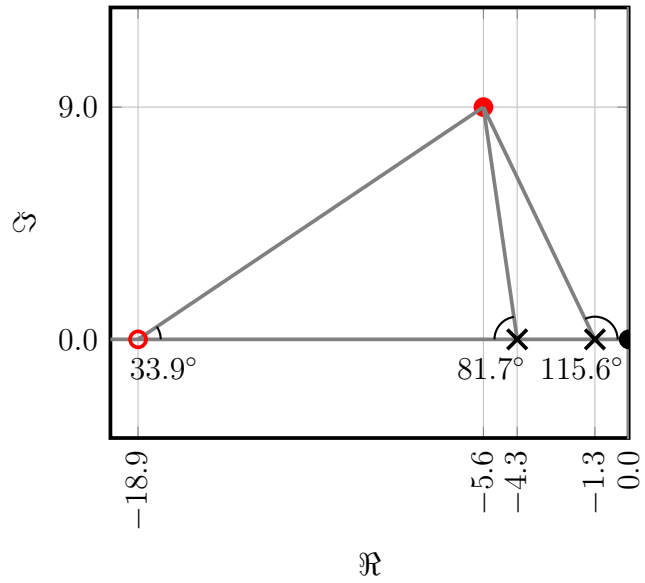
$$\sum \theta = 115.6^\circ + 98.3^\circ + 146.1^\circ = 360.0^\circ$$

A.



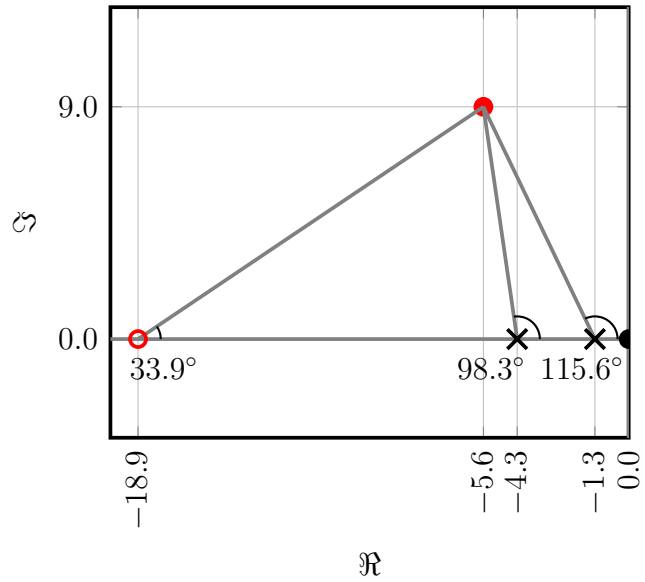
$$\sum \theta = 115.6^\circ + 81.7^\circ + 33.9^\circ = 231.3^\circ$$

B.



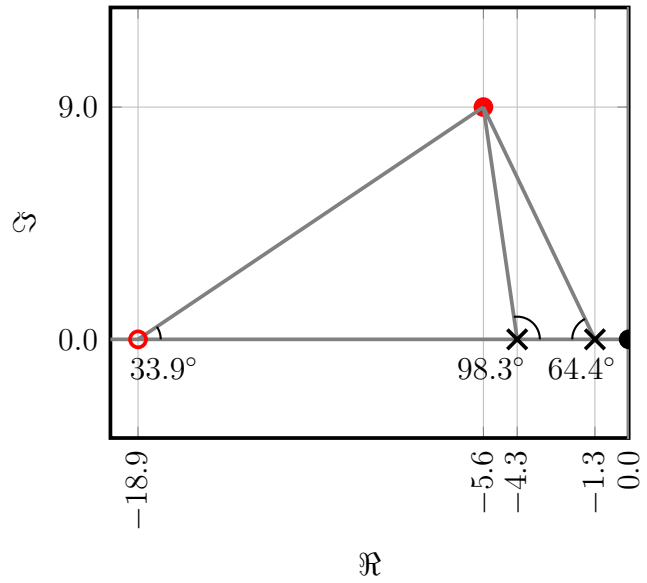
$$\sum \theta = 115.6^\circ + 98.3^\circ + 33.9^\circ = 247.8^\circ$$

C.



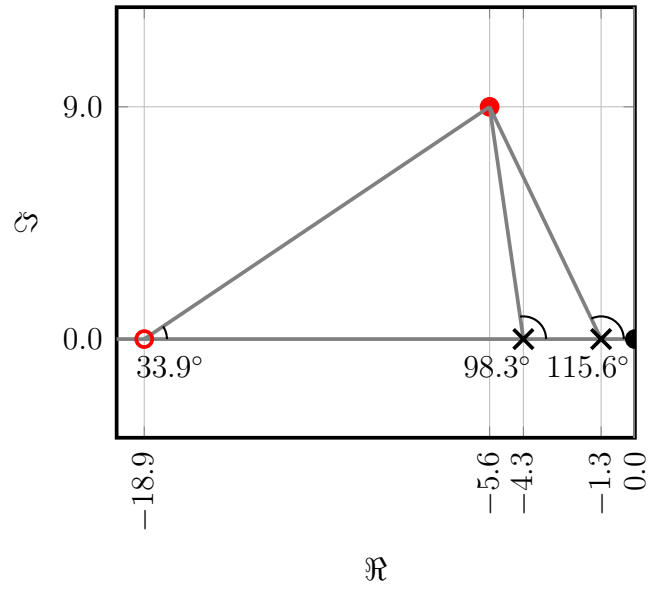
$$\sum \theta = 64.4^\circ + 98.3^\circ + 33.9^\circ = 196.5^\circ$$

D.



$$\sum \theta = 115.6^\circ + 98.3^\circ - 33.9^\circ = 180.0^\circ$$

E.



Q	A
1	E
2	B
3	E