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

$$G(s) = \frac{1}{s^3 + 2.0s^2 + 3.18181s + 7.18181}$$

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

A. $F(s) = -9.27274 + \frac{1.36363}{s}$

B. $F(s) = -8.9091 + \frac{2.86363}{s}$

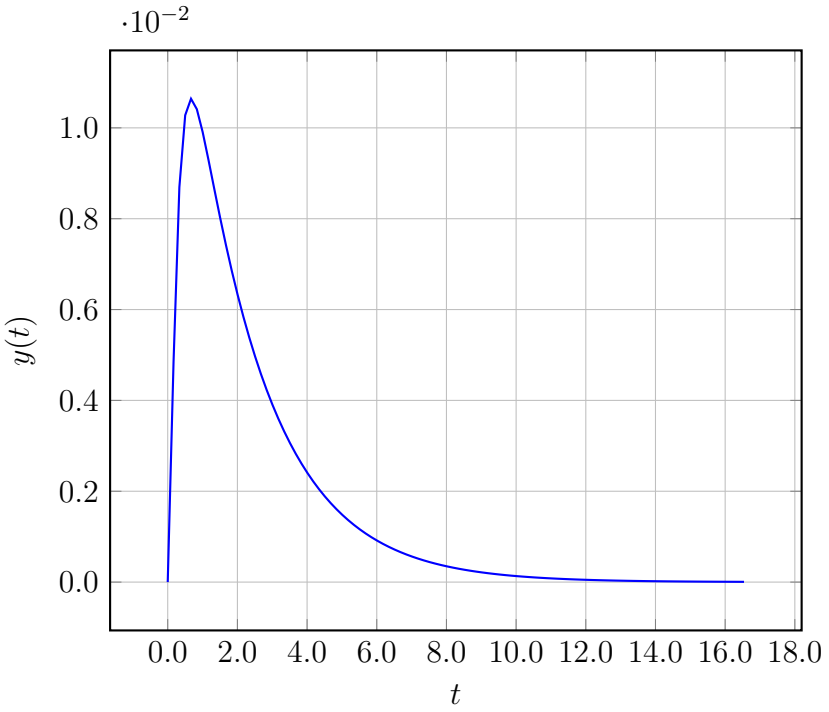
C. $F(s) = 1.5909 + \frac{1.36363}{s}$

D. $F(s) = -2.86363 + \frac{0.68181}{s}$

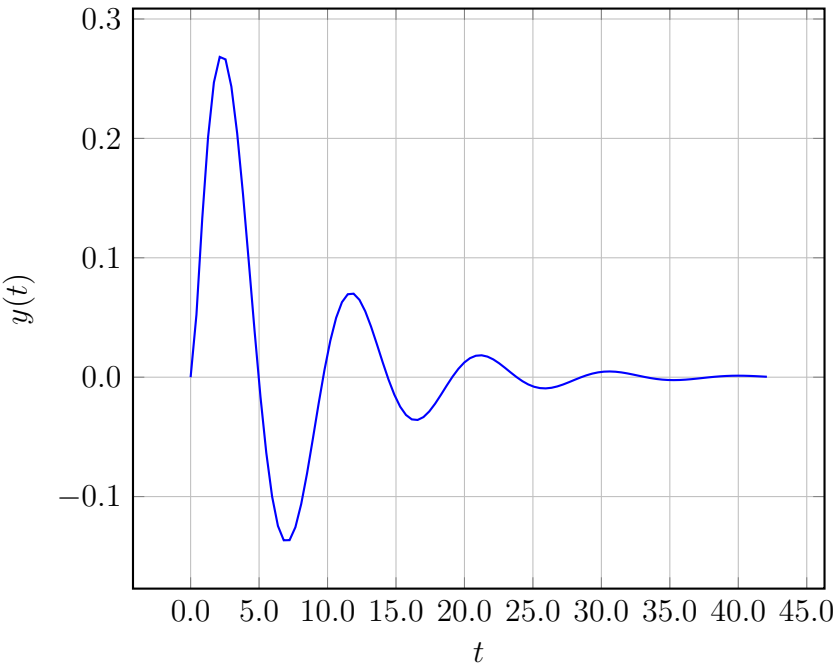
E. $F(s) = 1.22726 + \frac{2.86363}{s}$

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?

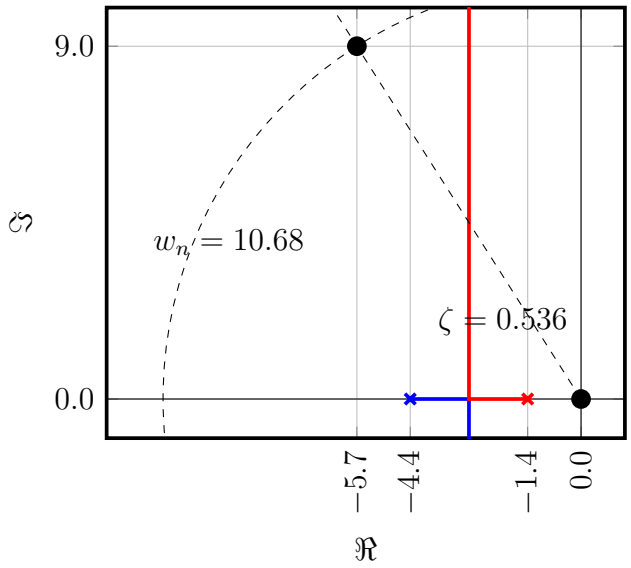
A.



B.



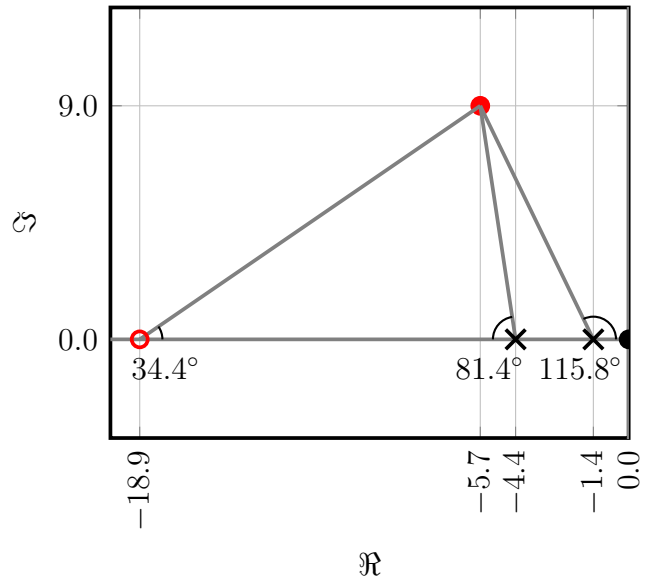
3. (30 points) A design point on the root-locus plot for a P-type controller is shown below.



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?

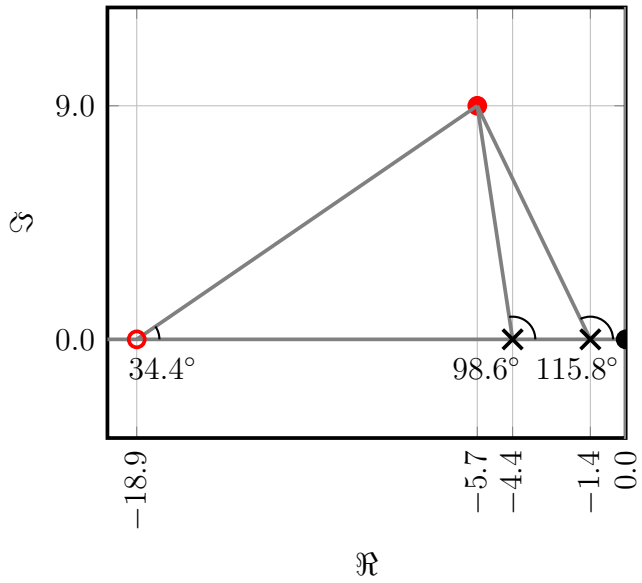
$$\sum \theta = 115.8^\circ + 81.4^\circ + 34.4^\circ =$$

A.



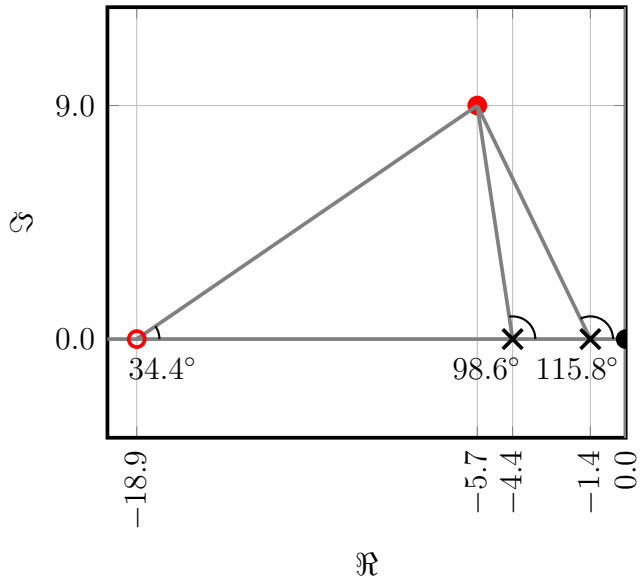
$$\sum \theta = 115.8° + 98.6° - 34.4° =$$

B.



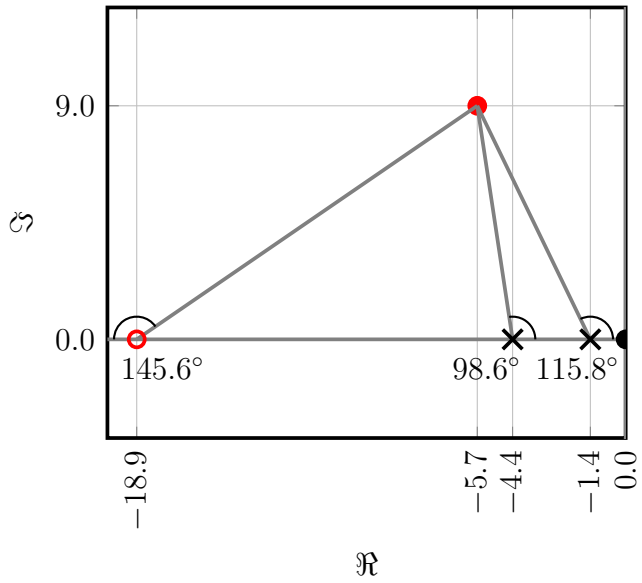
$$\sum \theta = 115.8° + 98.6° + 34.4° =$$

C.



$$\sum \theta = 115.8^\circ + 98.6^\circ + 145.6^\circ =$$

D.



$$\sum \theta = 64.2^\circ + 98.6^\circ + 34.4^\circ =$$

E.