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

$$G(s) = \frac{1}{s^3 + 2.0s^2 + 3.101s + 7.101}$$

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

A. $F(s) = 1.10605 + \frac{1.20201}{s}$

B. $F(s) = -9.39395 + \frac{2.70201}{s}$

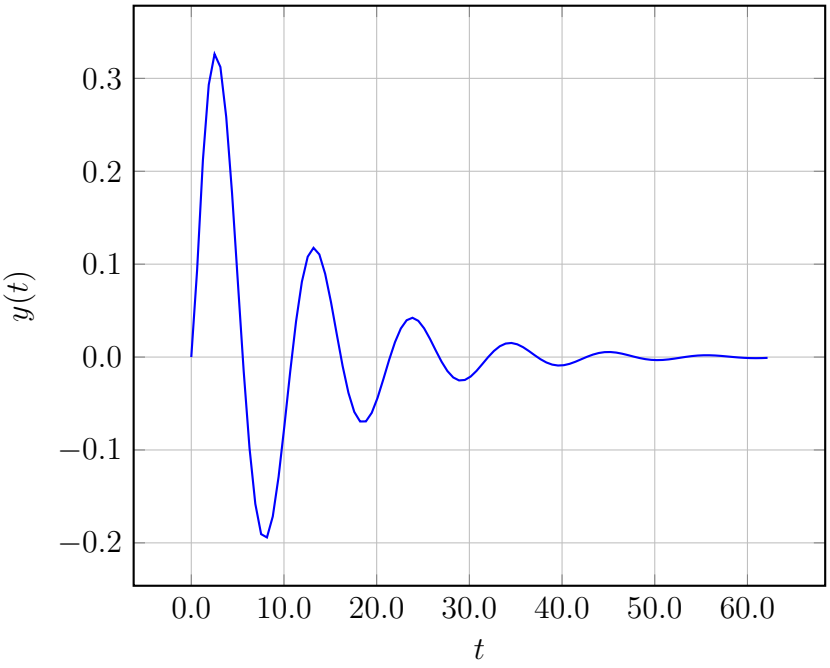
C. $F(s) = -9.59596 + \frac{1.20201}{s}$

D. $F(s) = -2.70201 + \frac{0.601}{s}$

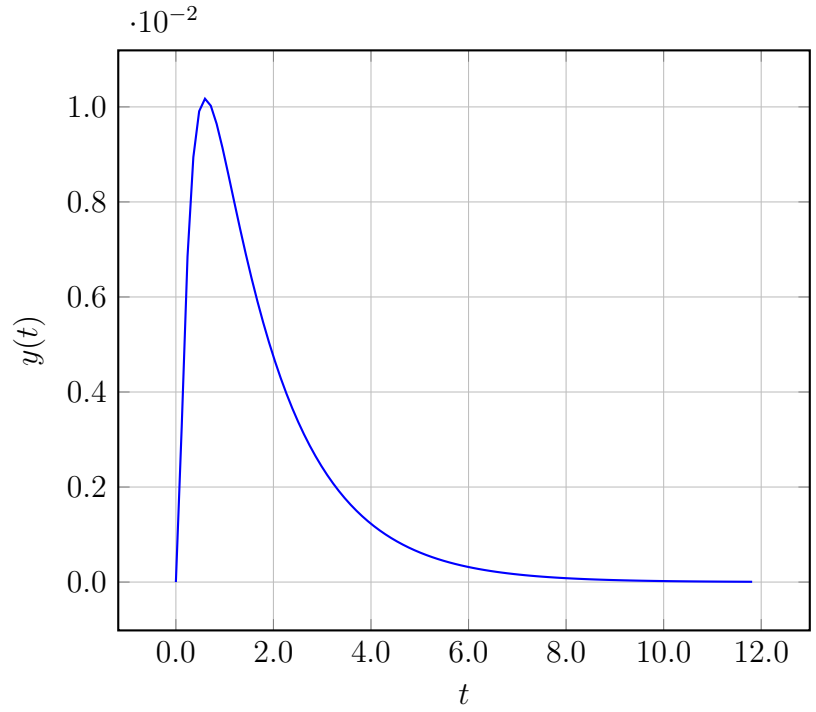
E. $F(s) = 0.90404 + \frac{2.70201}{s}$

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?

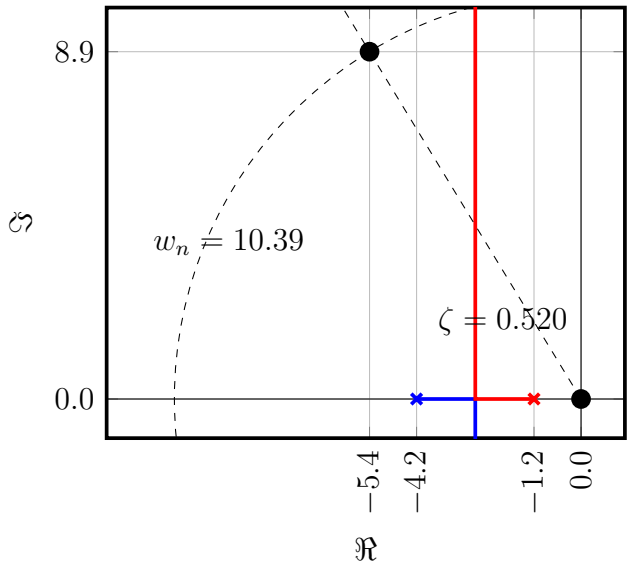
A.



B.



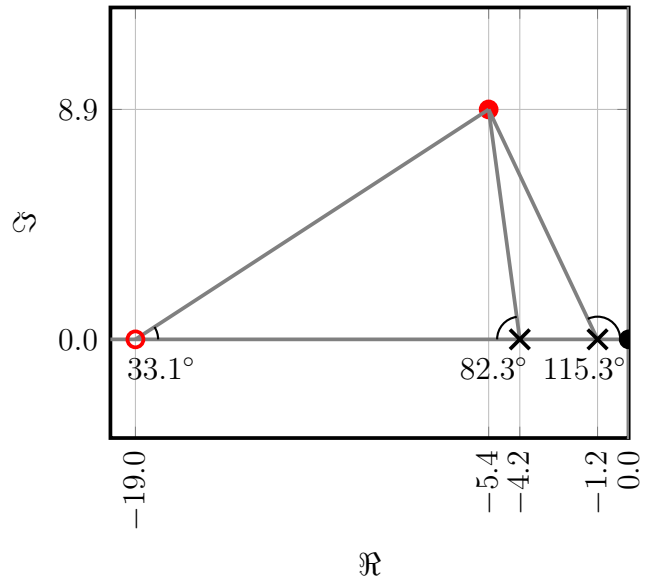
3. (30 points) A design point on the root-locus plot for a P-type controller is shown below.



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?

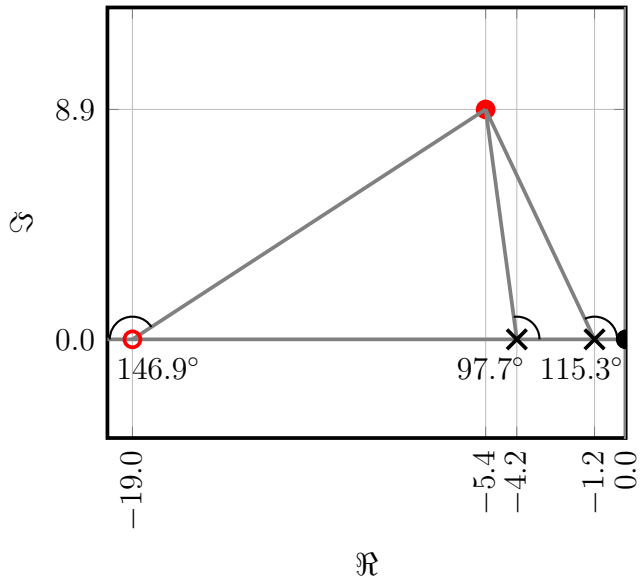
$$\sum \theta = 115.3^\circ + 82.3^\circ + 33.1^\circ =$$

A.



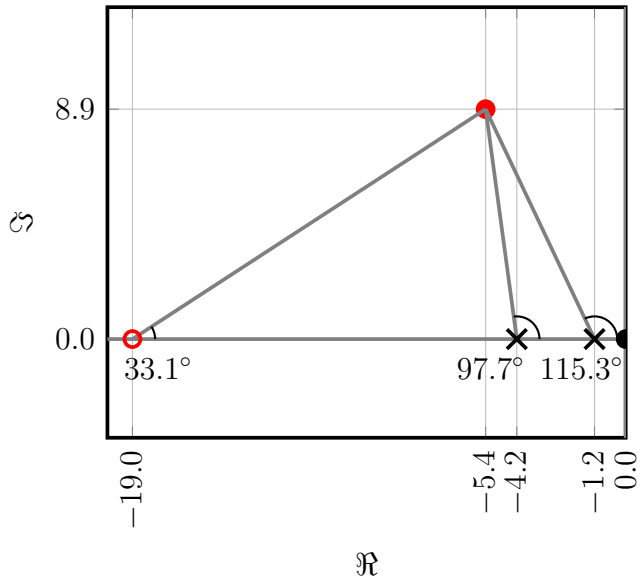
$$\sum \theta = 115.3° + 97.7° + 146.9° =$$

B.



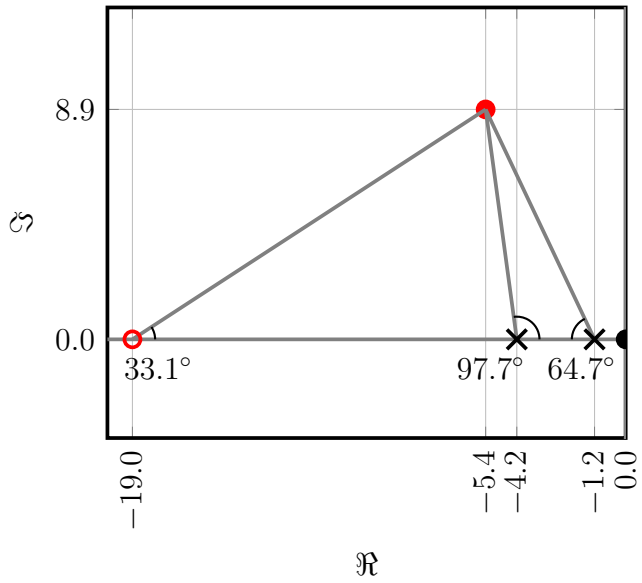
$$\sum \theta = 115.3° + 97.7° + 33.1° =$$

C.



$$\sum \theta = 64.7^\circ + 97.7^\circ + 33.1^\circ =$$

D.



$$\sum \theta = 115.3^\circ + 97.7^\circ - 33.1^\circ =$$

E.