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

$$G(s) = \frac{1}{s^3 + 2.0s^2 + 3.0909s + 7.0909}$$

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

A. $F(s) = 0.86363 + \frac{2.68181}{s}$

B. $F(s) = 1.04544 + \frac{1.18181}{s}$

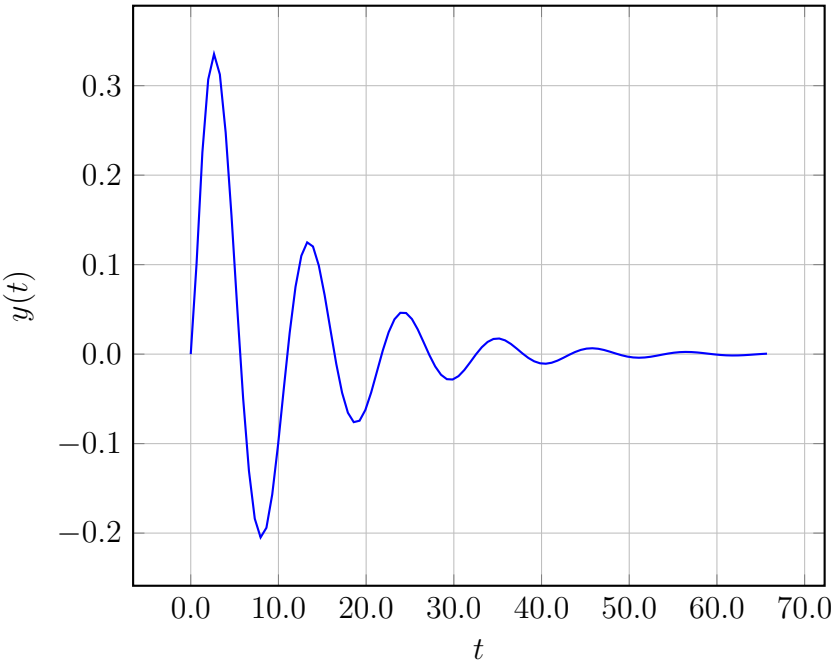
C. $F(s) = -9.45456 + \frac{2.68181}{s}$

D. $F(s) = -2.68181 + \frac{0.5909}{s}$

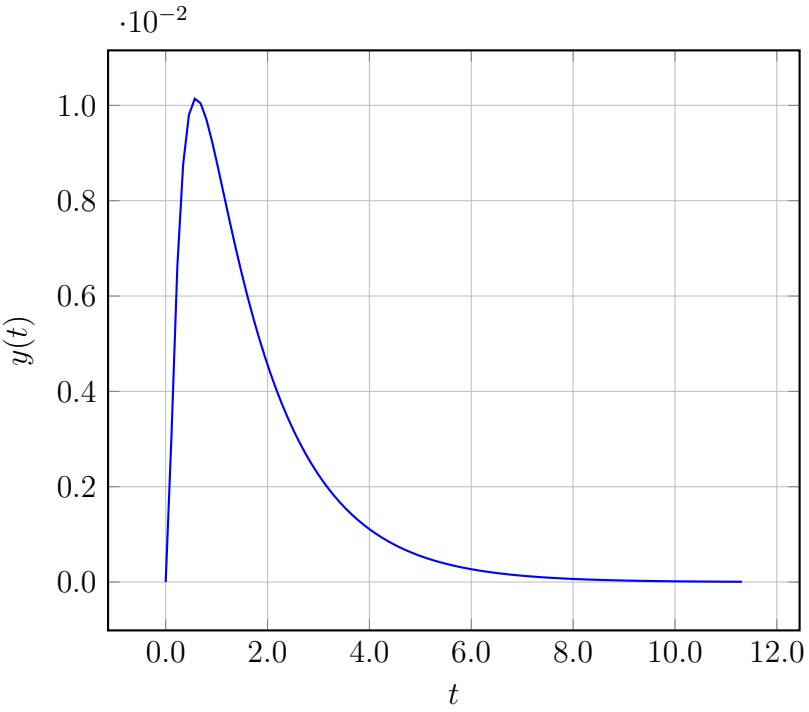
E. $F(s) = -9.63637 + \frac{1.18181}{s}$

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?

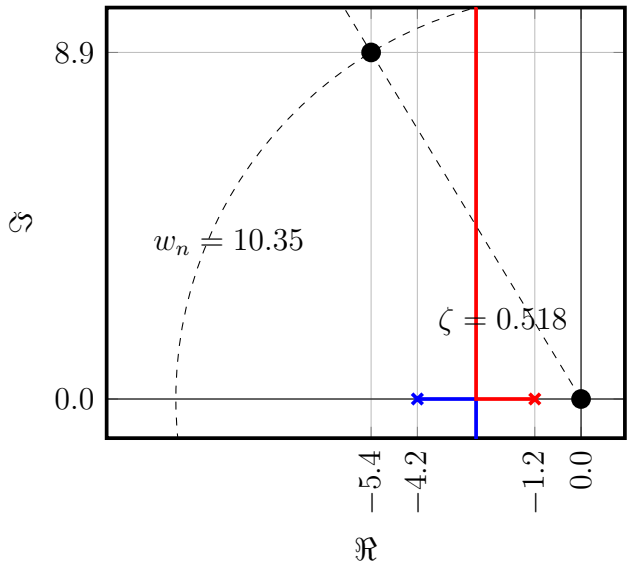
A.



B.



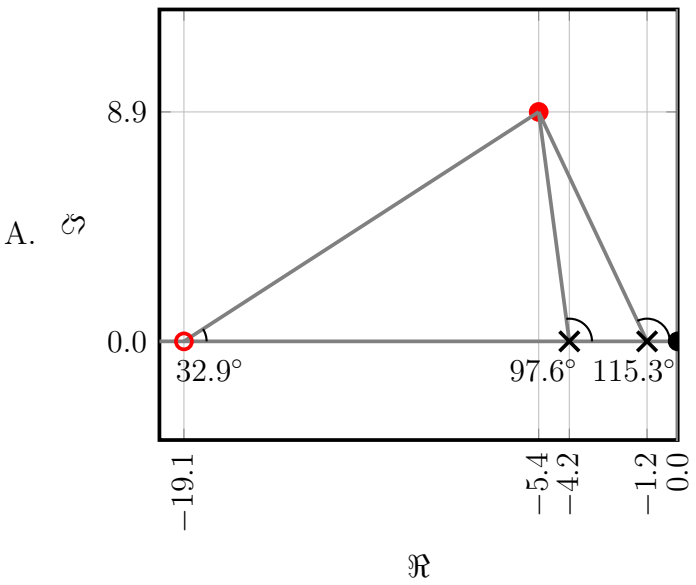
3. (30 points) A design point on the root-locus plot for a P-type controller is shown below.



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?

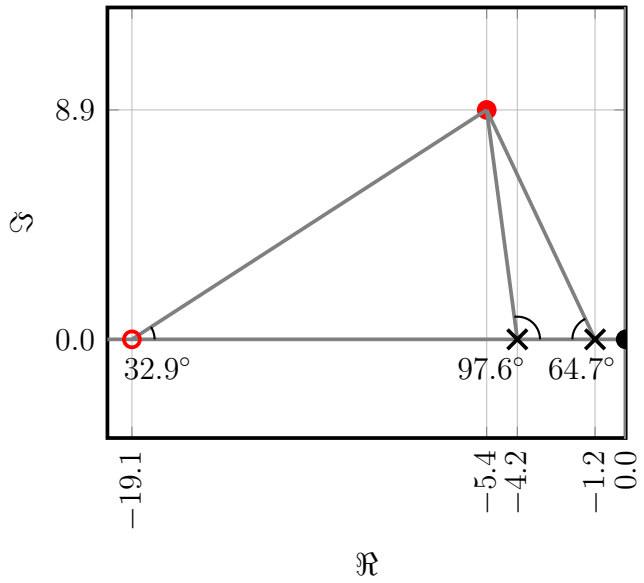
$$\sum \theta = 115.3^\circ + 97.6^\circ + 32.9^\circ =$$

A.



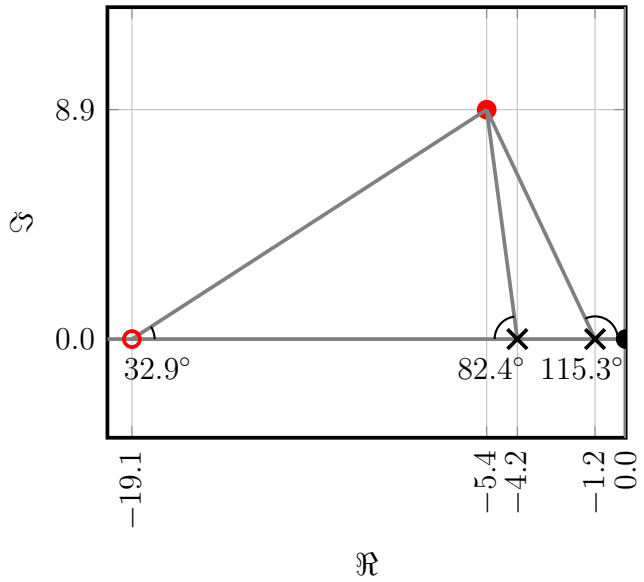
$$\sum \theta = 64.7^\circ + 97.6^\circ + 32.9^\circ =$$

B.



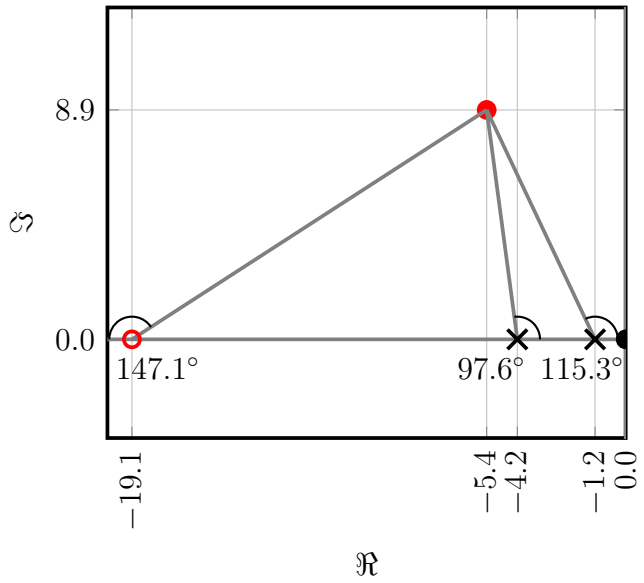
$$\sum \theta = 115.3^\circ + 82.4^\circ + 32.9^\circ =$$

C.



$$\sum \theta = 115.3^\circ + 97.6^\circ + 147.1^\circ =$$

D.



$$\sum \theta = 115.3^\circ + 97.6^\circ - 32.9^\circ =$$

E.