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

$$G(s) = \frac{1}{s^3 + 2.0s^2 + 3.22221s + 7.22221}$$

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

A. $F(s) = -2.94444 + \frac{0.72221}{s}$

B. $F(s) = 1.83333 + \frac{1.44444}{s}$

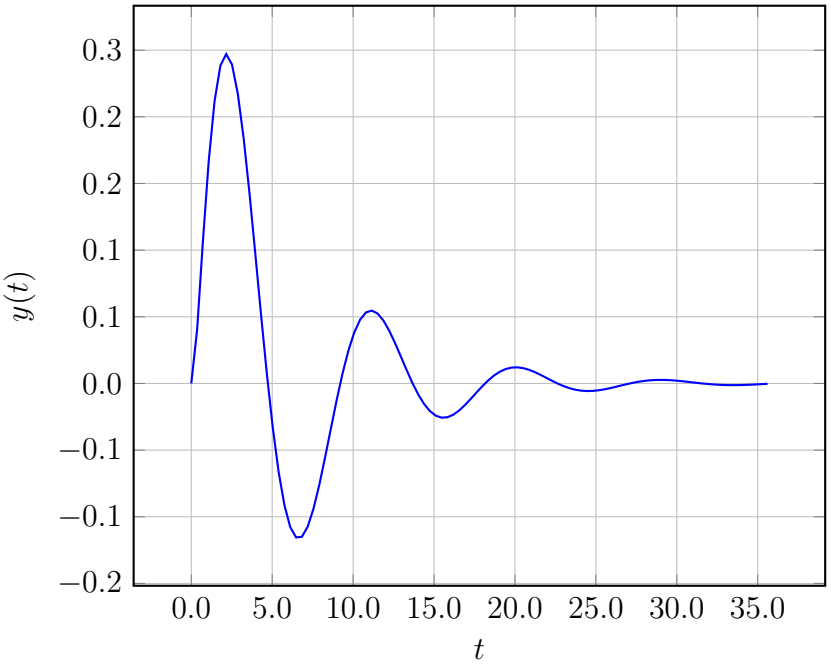
C. $F(s) = -8.66667 + \frac{2.94444}{s}$

D. $F(s) = 1.38889 + \frac{2.94444}{s}$

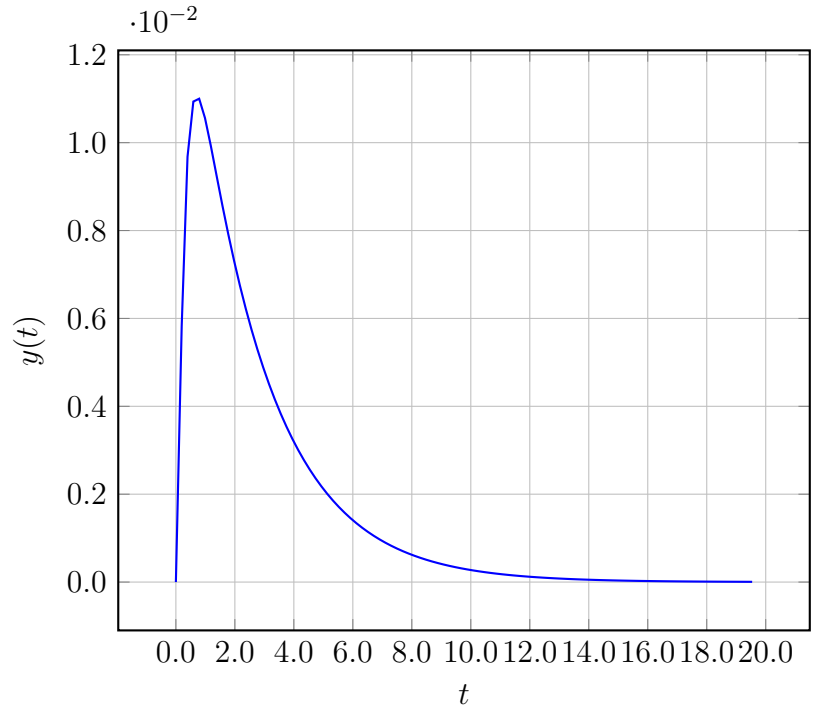
E. $F(s) = -9.11111 + \frac{1.44444}{s}$

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?

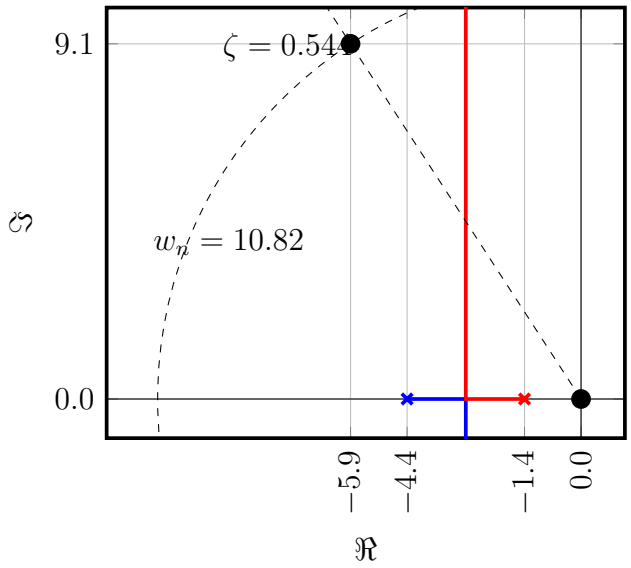
A.




B.



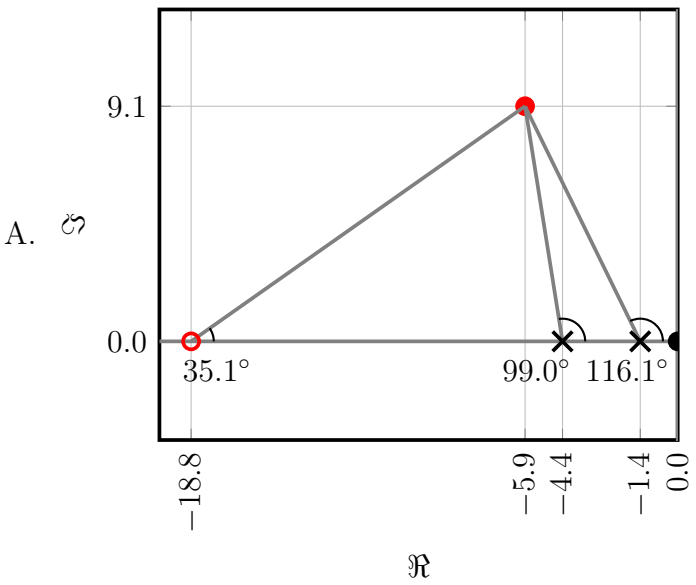
3. (30 points) A design point on the root-locus plot for a P-type controller is shown below.




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?

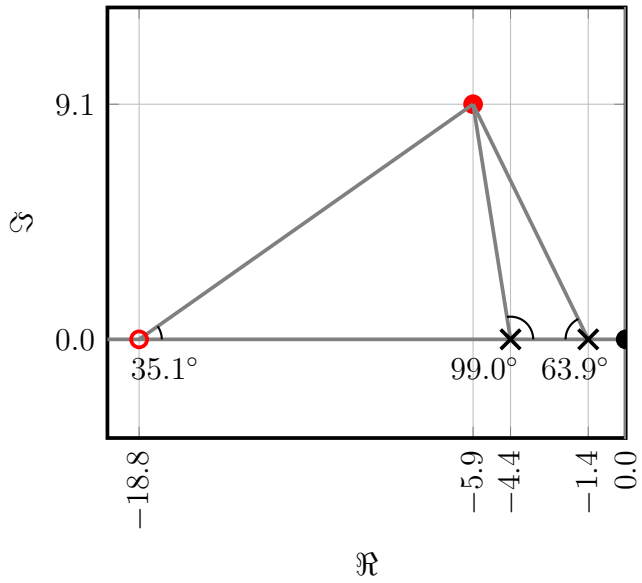
$$\sum \theta = 116.1^\circ + 99.0^\circ + 35.1^\circ =$$

A.



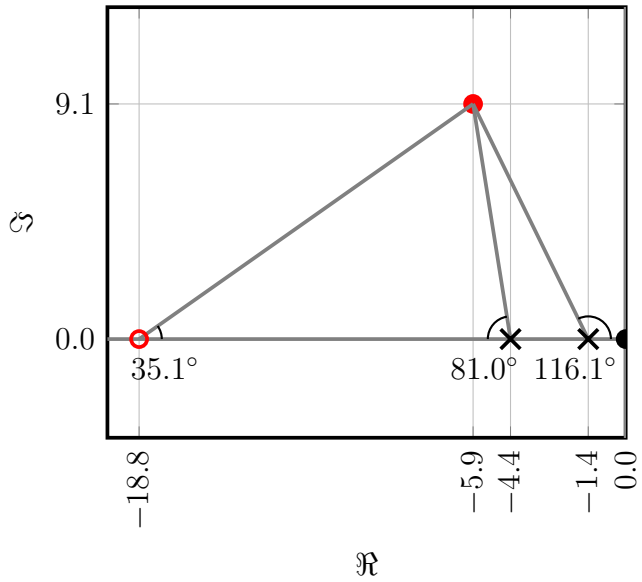
$$\sum \theta = 63.9^\circ + 99.0^\circ + 35.1^\circ =$$

B.



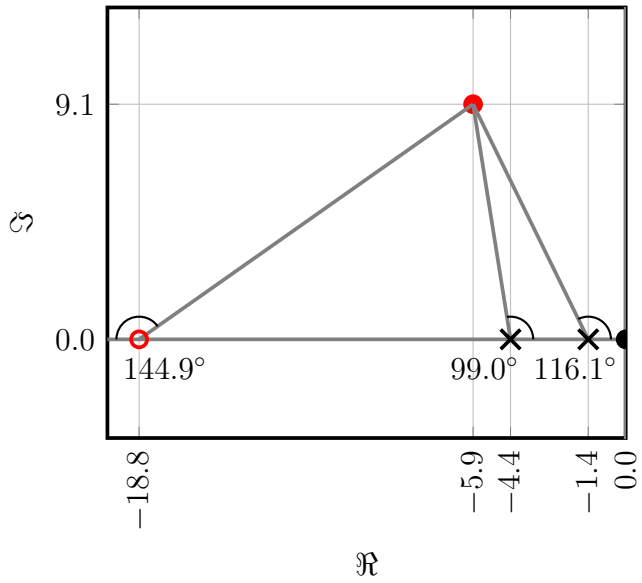

$$\sum \theta = 116.1^\circ + 81.0^\circ + 35.1^\circ =$$

C.



$$\sum \theta = 116.1^\circ + 99.0^\circ + 144.9^\circ =$$

D.




$$\sum \theta = 116.1^\circ + 99.0^\circ - 35.1^\circ =$$

E.