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

$$G(s) = \frac{1}{s^3 + 2.0s^2 + 3.31818s + 7.31818}$$

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

A. $F(s) = 1.77272 + \frac{3.13635}{s}$

B. $F(s) = -8.09091 + \frac{3.13635}{s}$

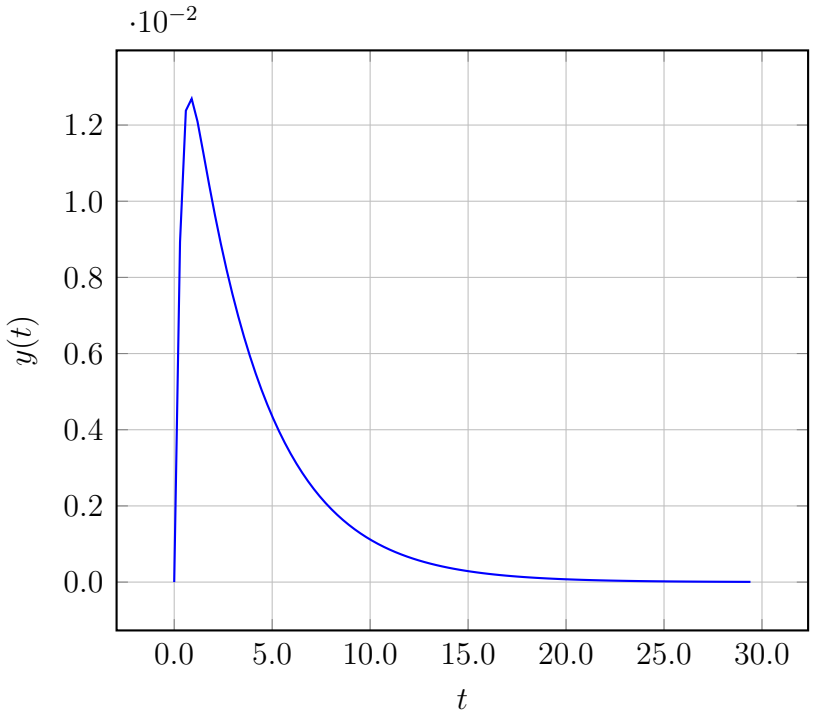
C. $F(s) = -3.13635 + \frac{0.81818}{s}$

D. $F(s) = 2.40909 + \frac{1.63635}{s}$

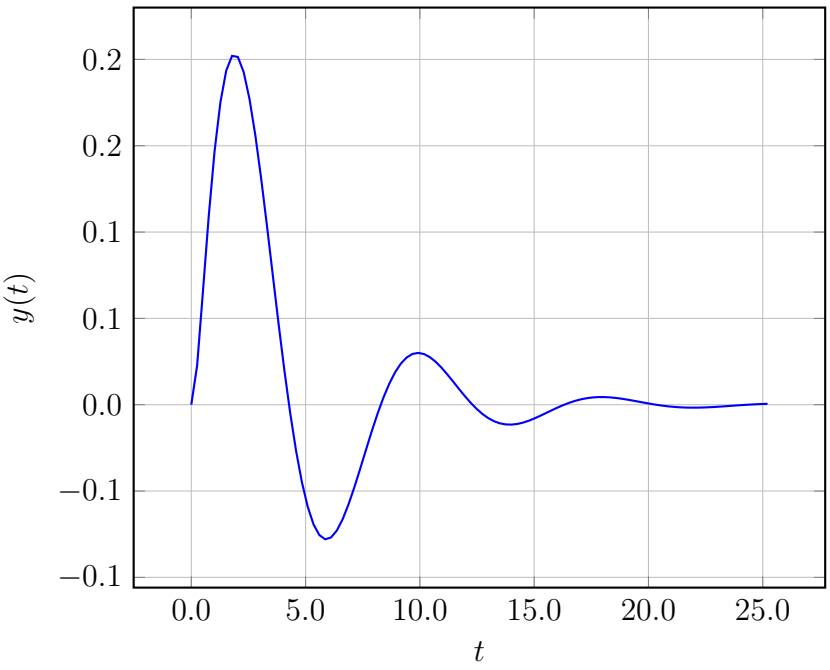
E. $F(s) = -8.72728 + \frac{1.63635}{s}$

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?

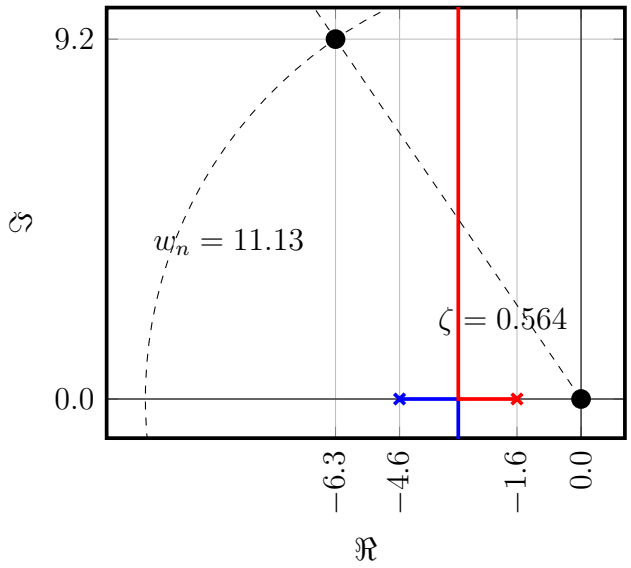
A.



B.



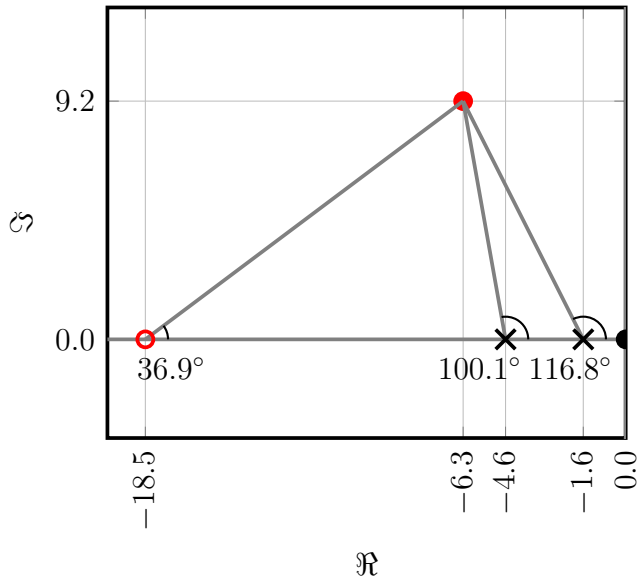
3. (30 points) A design point on the root-locus plot for a P-type controller is shown below.



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?

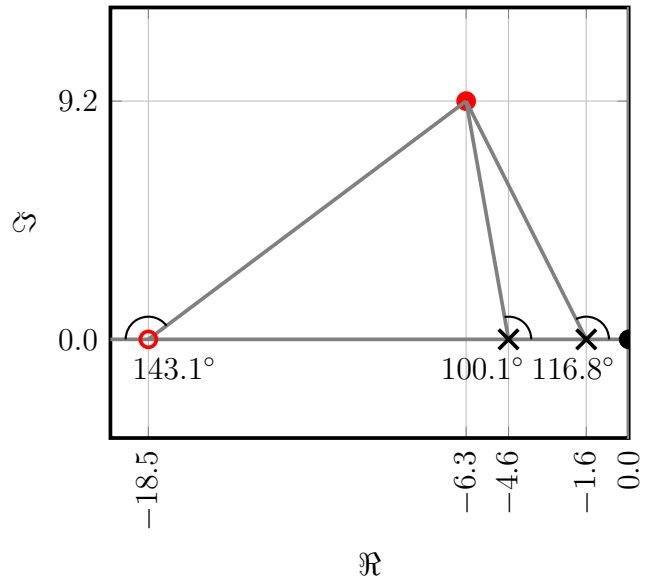
$$\sum \theta = 116.8^\circ + 100.1^\circ + 36.9^\circ = 253.7^\circ$$

A.



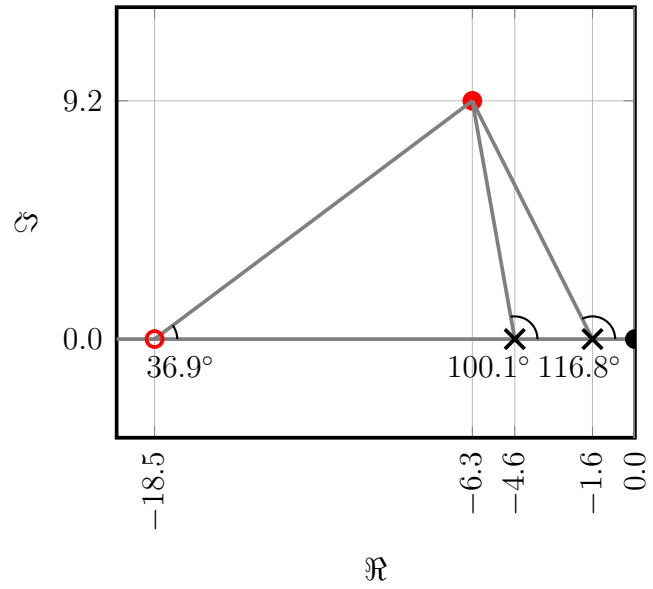
$$\sum \theta = 116.8^\circ + 100.1^\circ + 143.1^\circ = 360.0^\circ$$

B.



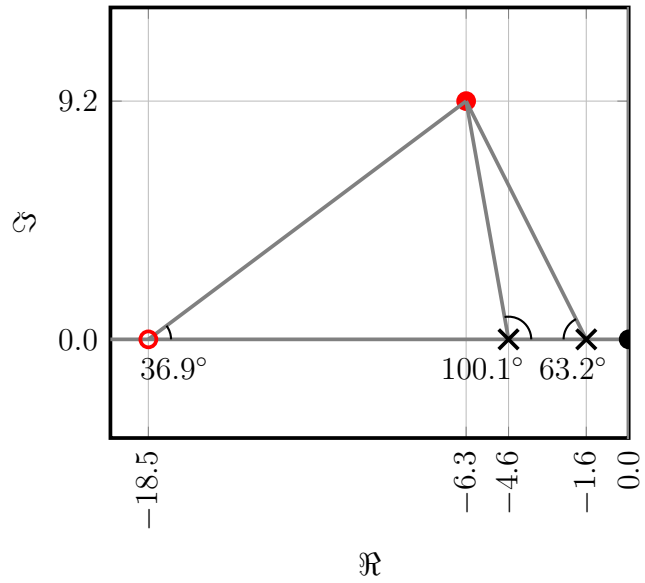
$$\sum \theta = 116.8^\circ + 100.1^\circ - 36.9^\circ = 180.0^\circ$$

C.



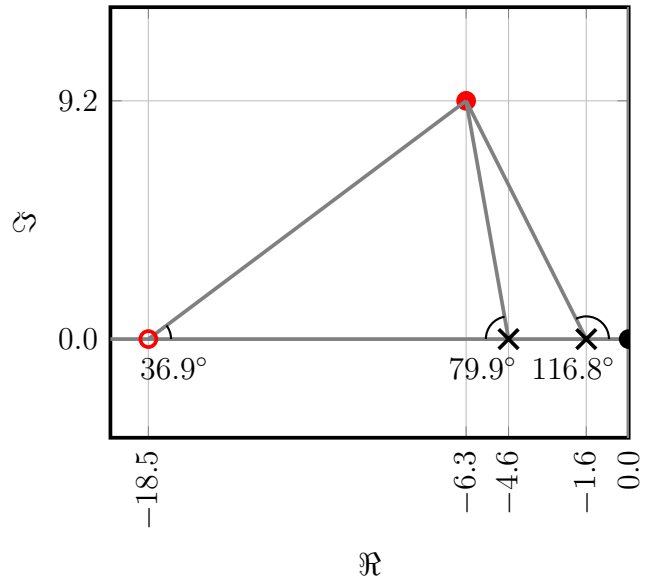
$$\sum \theta = 63.2^\circ + 100.1^\circ + 36.9^\circ = 200.2^\circ$$

D.



$$\sum \theta = 116.8^\circ + 79.9^\circ + 36.9^\circ = 233.5^\circ$$

E.



Q	A
1	C
2	A
3	C