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

$$G(s) = \frac{1}{s^3 + 2.0s^2 + 3.32828s + 7.32828}$$

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

A. $F(s) = 2.4697 + \frac{1.65656}{s}$

B. $F(s) = -3.15656 + \frac{0.82828}{s}$

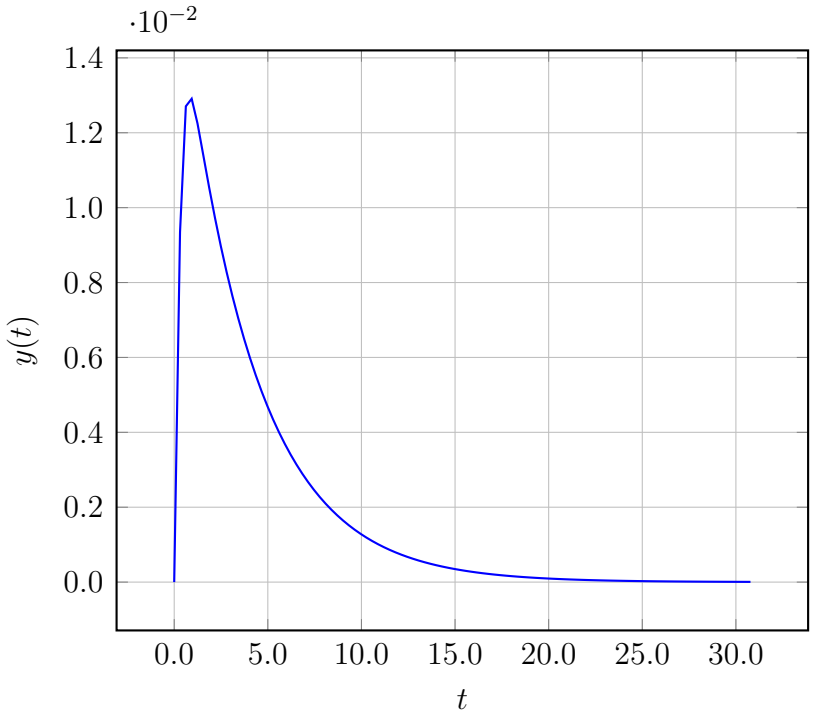
C. $F(s) = -8.68687 + \frac{1.65656}{s}$

D. $F(s) = -8.0303 + \frac{3.15656}{s}$

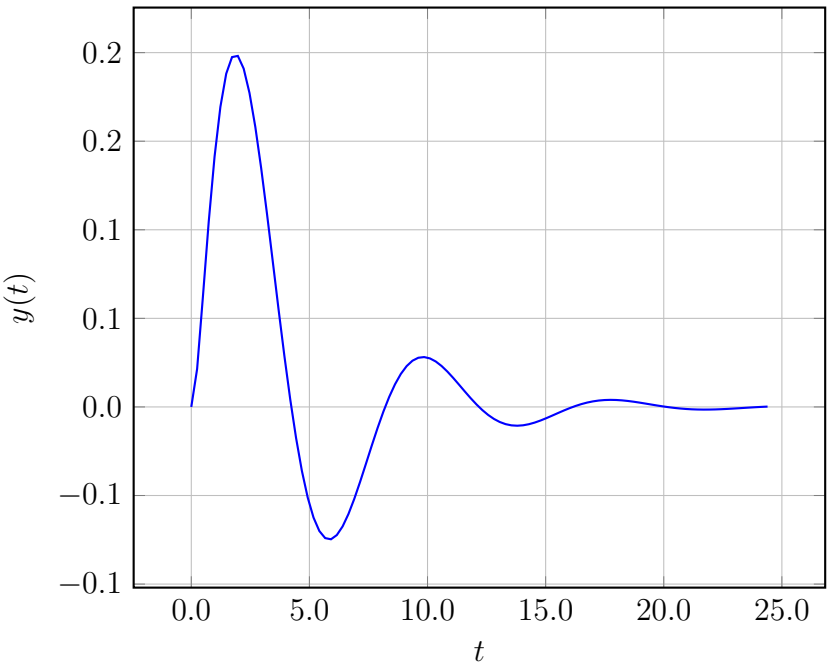
E. $F(s) = 1.81313 + \frac{3.15656}{s}$

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?

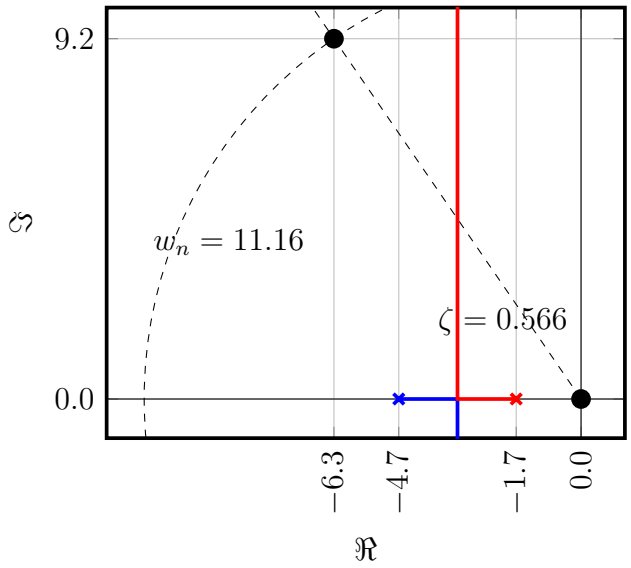
A.



B.



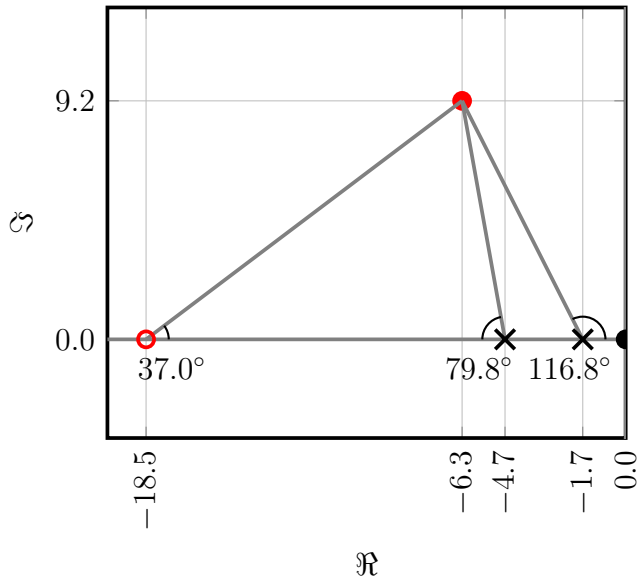
3. (30 points) A design point on the root-locus plot for a P-type controller is shown below.



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?

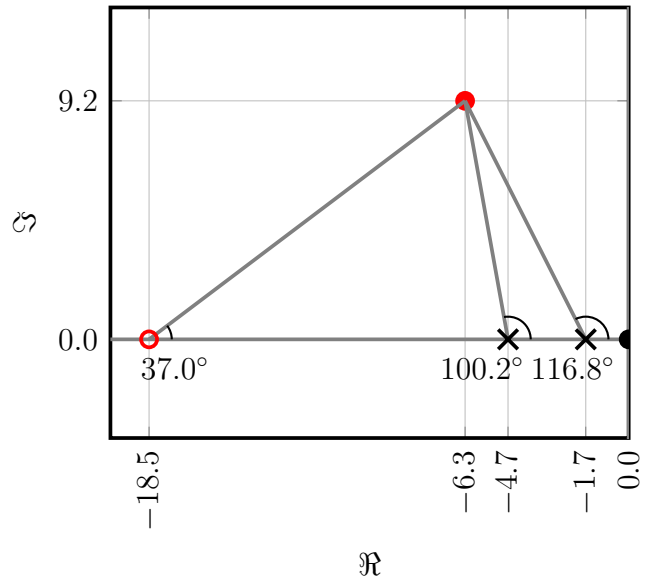
$$\sum \theta = 116.8^\circ + 79.8^\circ + 37.0^\circ = 233.7^\circ$$

A.



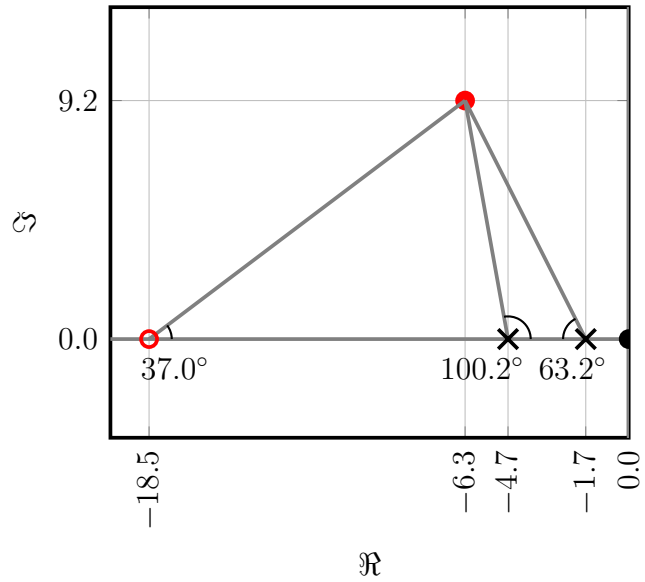
$$\sum \theta = 116.8^\circ + 100.2^\circ + 37.0^\circ = 254.1^\circ$$

B.



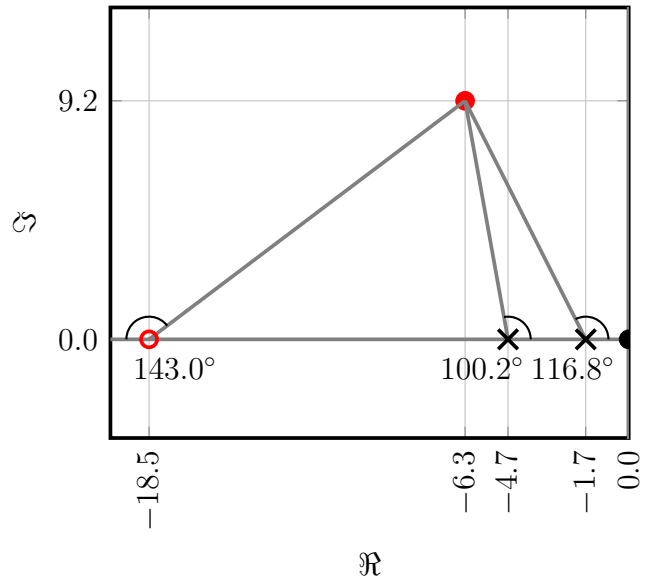
$$\sum \theta = 63.2^\circ + 100.2^\circ + 37.0^\circ = 200.4^\circ$$

C.



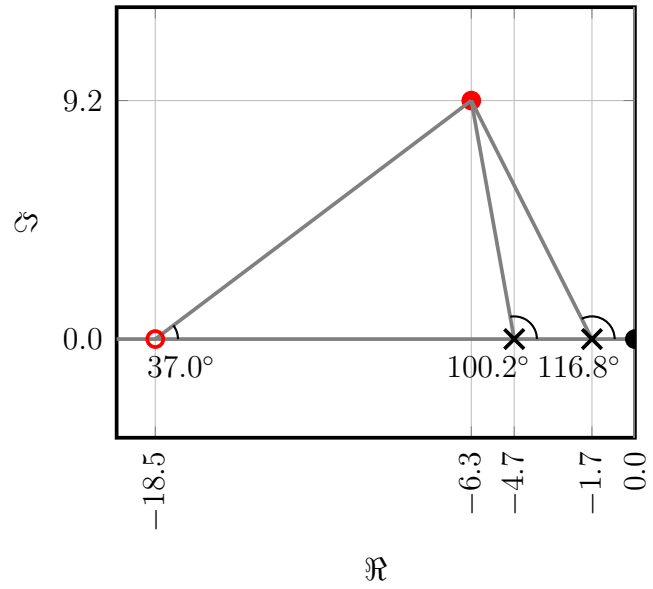
$$\sum \theta = 116.8^\circ + 100.2^\circ + 143.0^\circ = 360.0^\circ$$

D.



$$\sum \theta = 116.8^\circ + 100.2^\circ - 37.0^\circ = 180.0^\circ$$

E.



Q	A
1	B
2	A
3	E