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

$$G(s) = \frac{1}{s^3 + 2.0s^2 + 3.40909s + 7.40909}$$

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

A. $F(s) = -8.36365 + \frac{1.81818}{s}$

B. $F(s) = -3.31818 + \frac{0.90909}{s}$

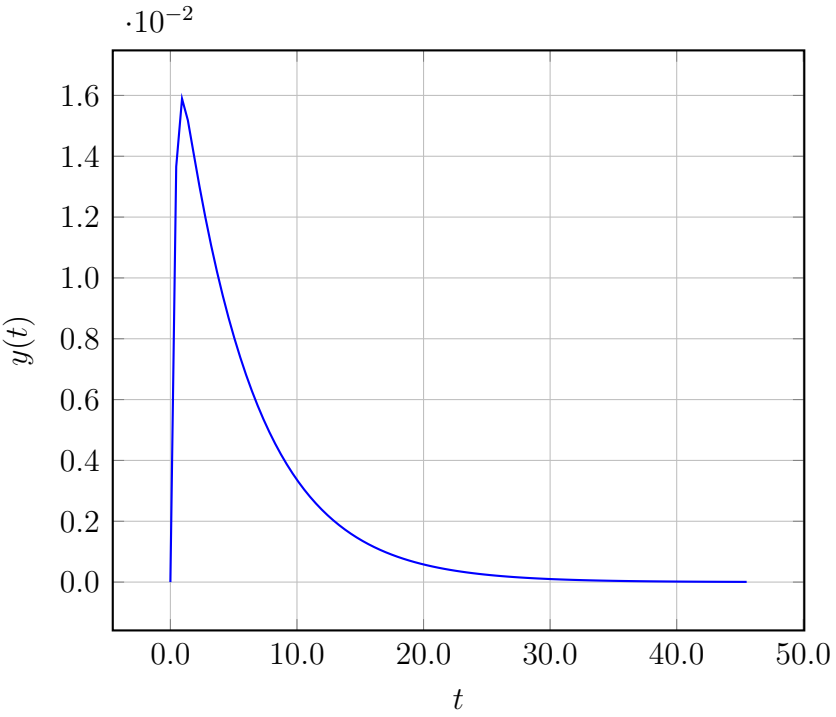
C. $F(s) = 2.95454 + \frac{1.81818}{s}$

D. $F(s) = 2.13635 + \frac{3.31818}{s}$

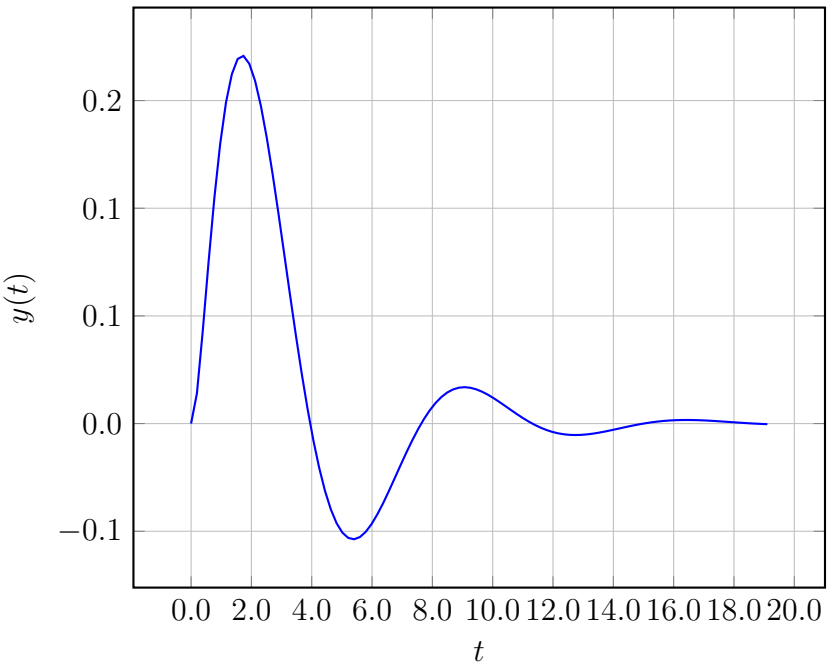
E. $F(s) = -7.54546 + \frac{3.31818}{s}$

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?

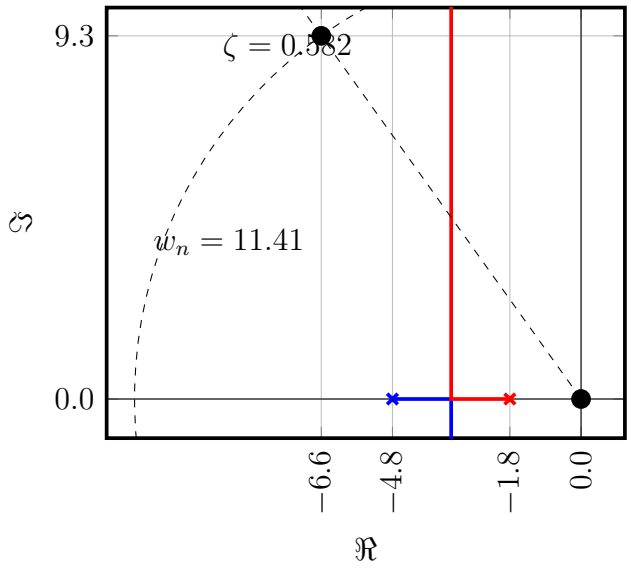
A.



B.



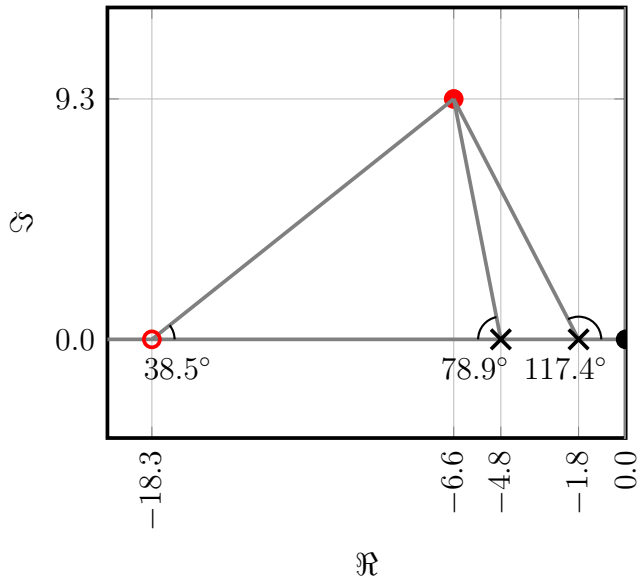
3. (30 points) A design point on the root-locus plot for a P-type controller is shown below.



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?

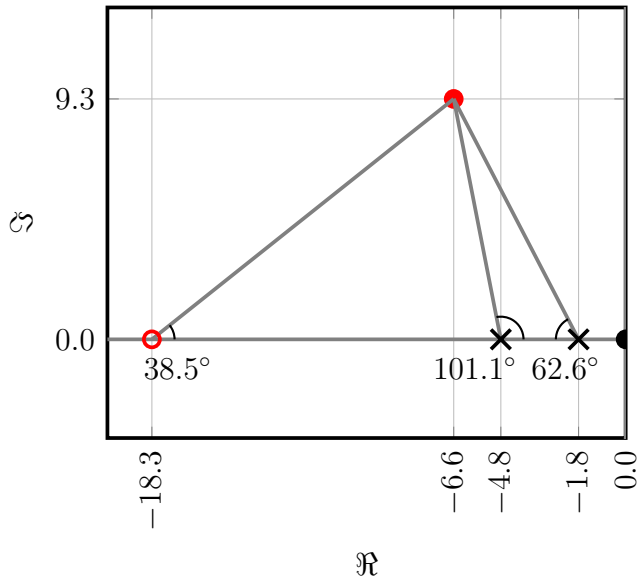
$$\sum \theta = 117.4^\circ + 78.9^\circ + 38.5^\circ = 234.9^\circ$$

A.



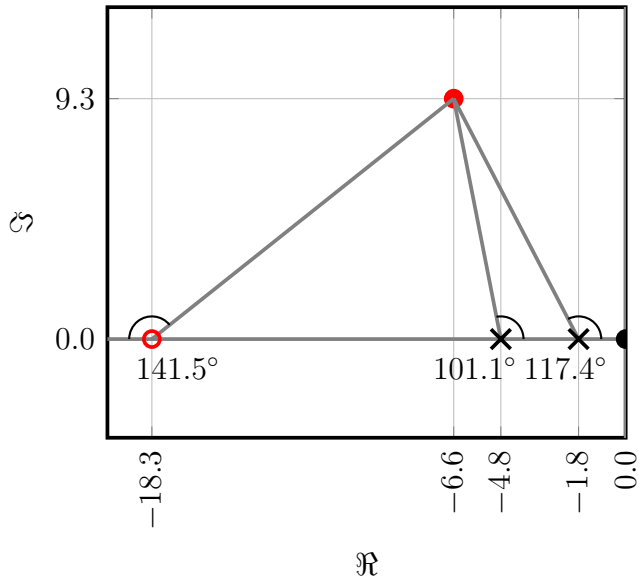
$$\sum \theta = 62.6^\circ + 101.1^\circ + 38.5^\circ = 202.2^\circ$$

B.



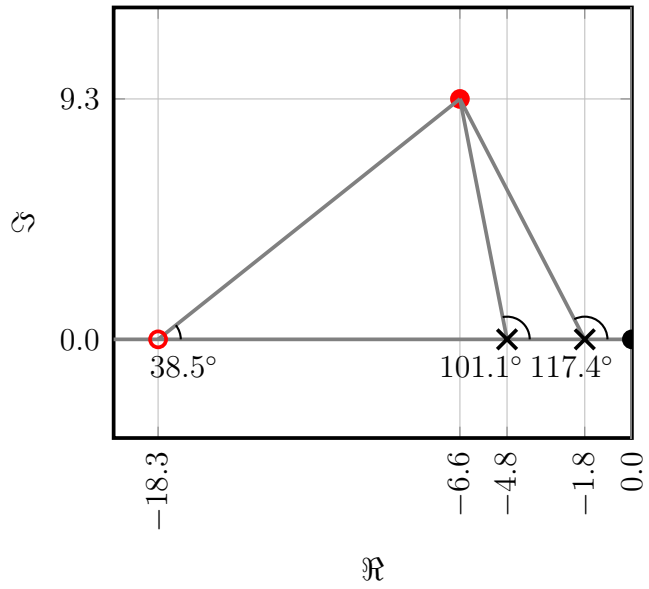
$$\sum \theta = 117.4^\circ + 101.1^\circ + 141.5^\circ = 360.0^\circ$$

C.



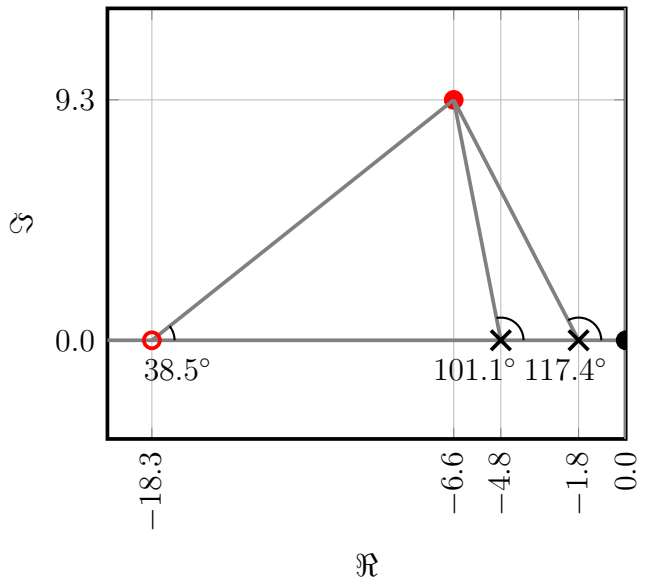
$$\sum \theta = 117.4^\circ + 101.1^\circ - 38.5^\circ = 180.0^\circ$$

D.



$$\sum \theta = 117.4^\circ + 101.1^\circ + 38.5^\circ = 257.1^\circ$$

E.



Q	A
1	B
2	A
3	D