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

$$G(s) = \frac{1}{s^3 + 2.0s^2 + 3.38889s + 7.38889}$$

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

A. $F(s) = -7.66667 + \frac{3.27777}{s}$

B. $F(s) = 2.05554 + \frac{3.27777}{s}$

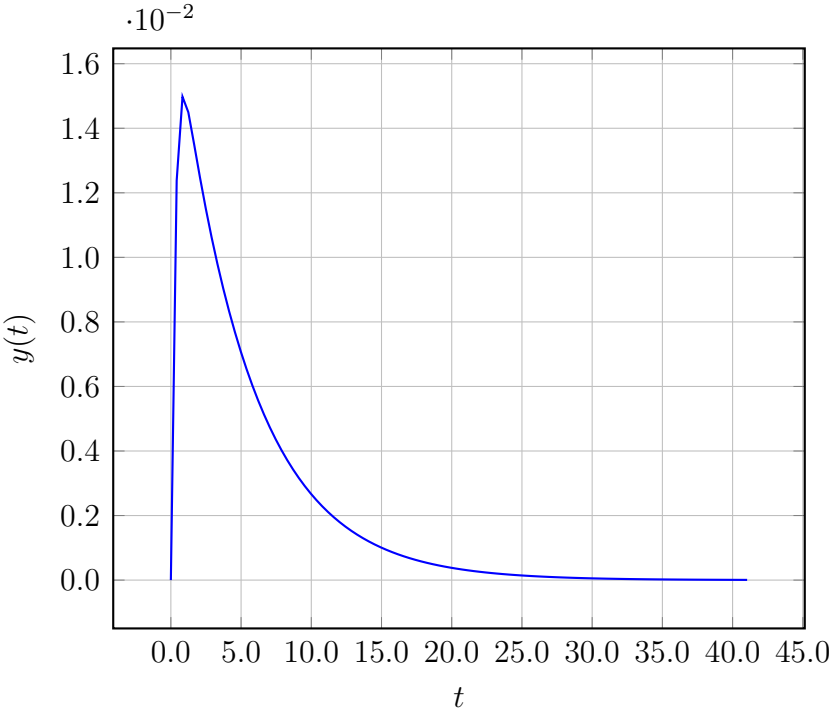
C. $F(s) = -3.27777 + \frac{0.88889}{s}$

D. $F(s) = -8.44446 + \frac{1.77777}{s}$

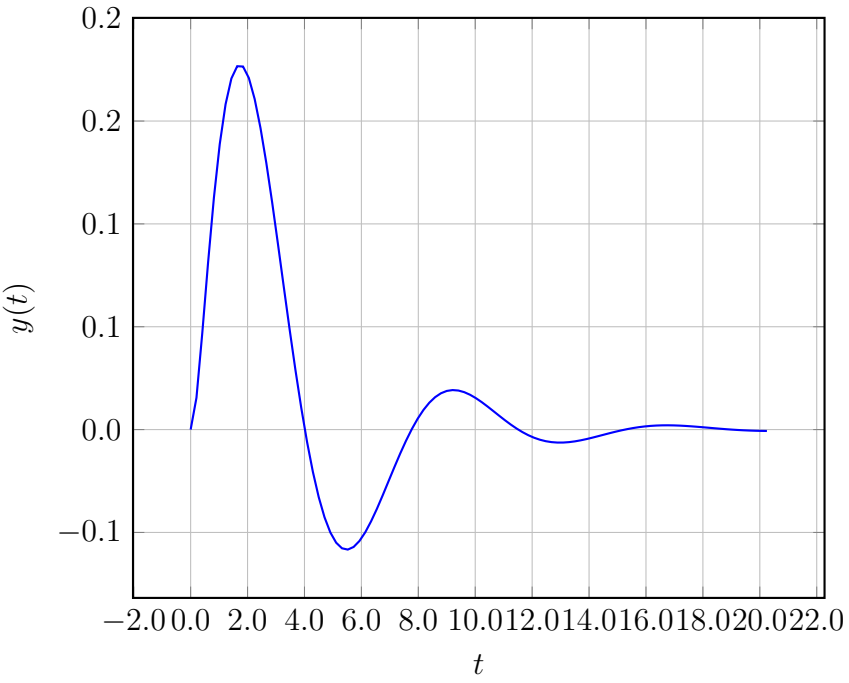
E. $F(s) = 2.83333 + \frac{1.77777}{s}$

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?

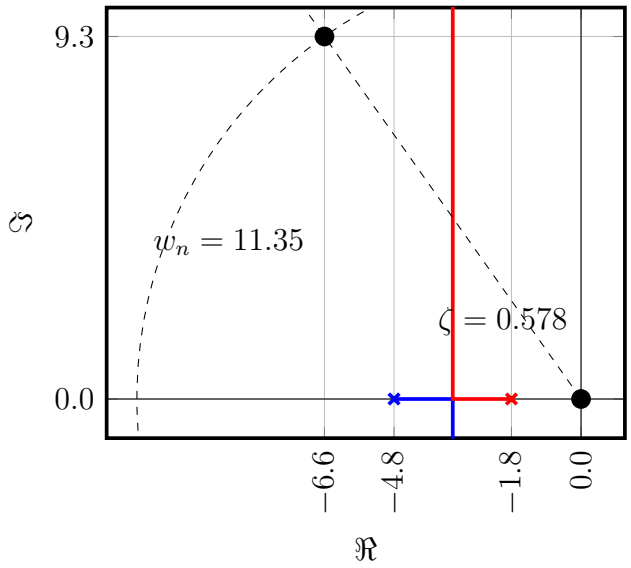
A.



B.

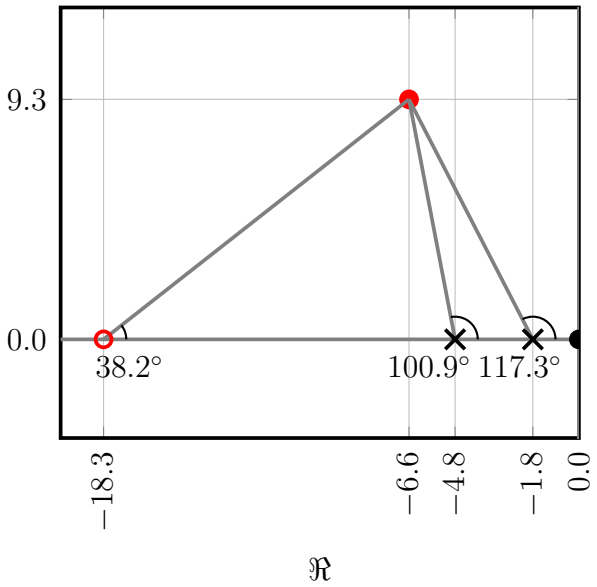


3. (30 points) A design point on the root-locus plot for a P-type controller is shown below.



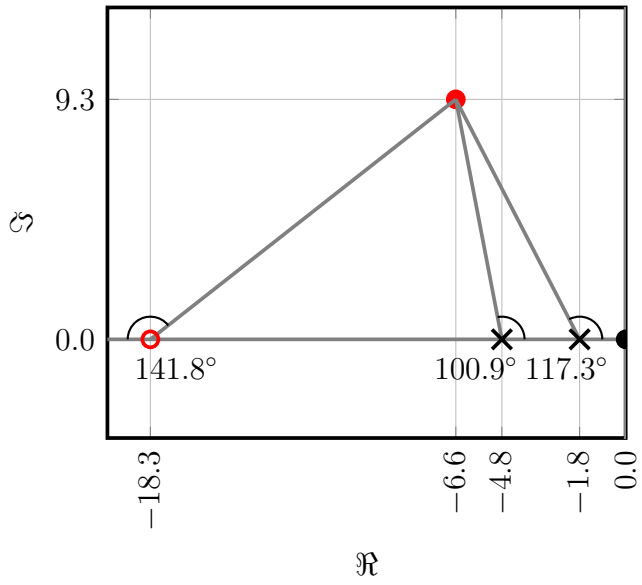
A zero is added so that the root-locus passes through this design point. Which of the following represents the correct angle condition for this design?

A. $\sum \theta = 117.3^\circ + 100.9^\circ - 38.2^\circ = 180.0^\circ$



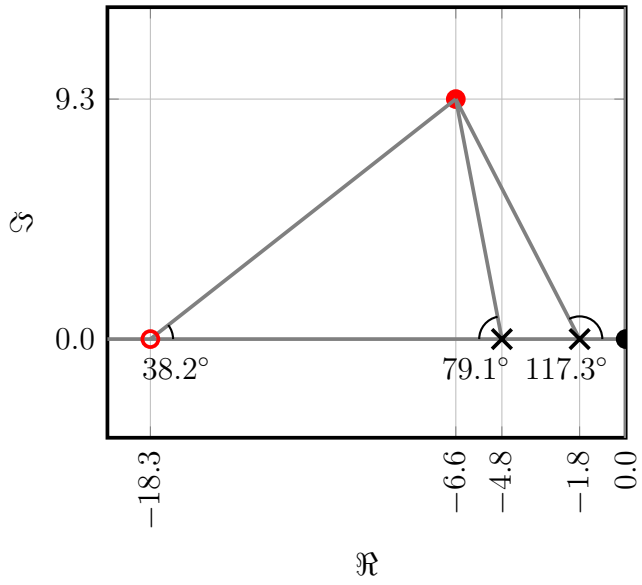
$$\sum \theta = 117.3^\circ + 100.9^\circ + 141.8^\circ = 360.0^\circ$$

B.



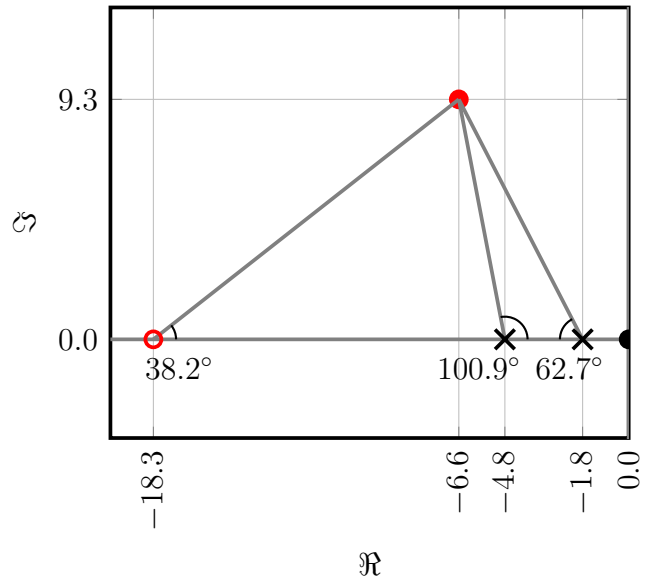
$$\sum \theta = 117.3^\circ + 79.1^\circ + 38.2^\circ = 234.6^\circ$$

C.



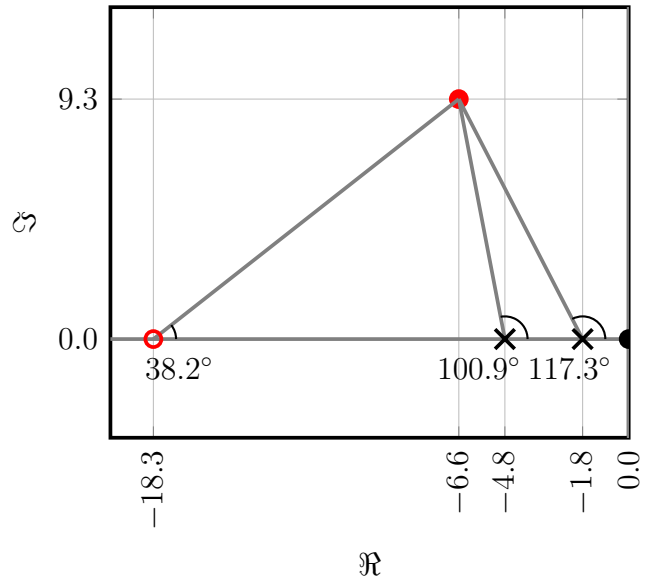
$$\sum \theta = 62.7^\circ + 100.9^\circ + 38.2^\circ = 201.7^\circ$$

D.



$$\sum \theta = 117.3^\circ + 100.9^\circ + 38.2^\circ = 256.3^\circ$$

E.



Q	A
1	C
2	A
3	A