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

$$G(s) = \frac{1}{s^3 + 2.0s^2 + 3.4495s + 7.4495}$$

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

A. $F(s) = -3.39899 + \frac{0.9495}{s}$

B. $F(s) = -7.30304 + \frac{3.39899}{s}$

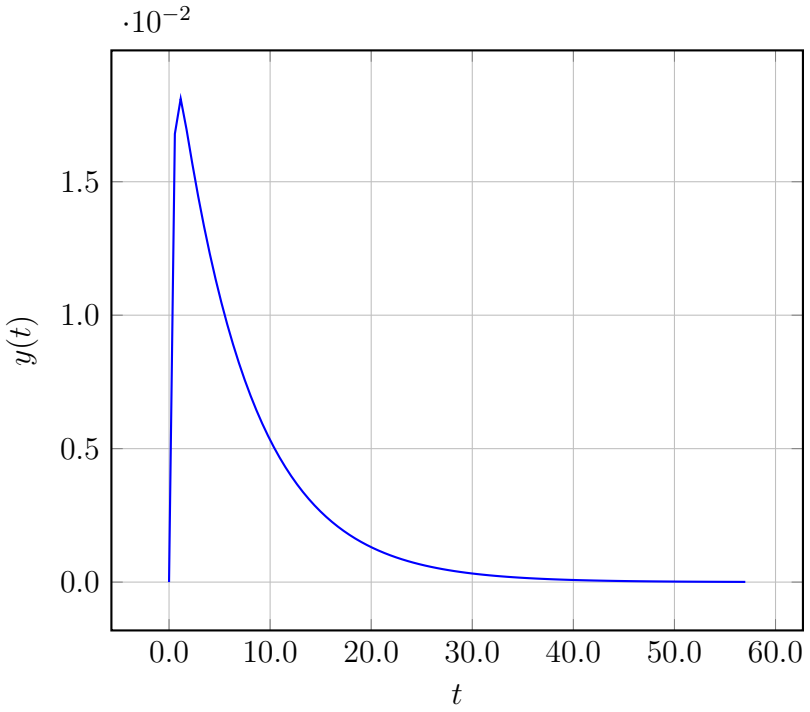
C. $F(s) = 3.19696 + \frac{1.89899}{s}$

D. $F(s) = -8.20203 + \frac{1.89899}{s}$

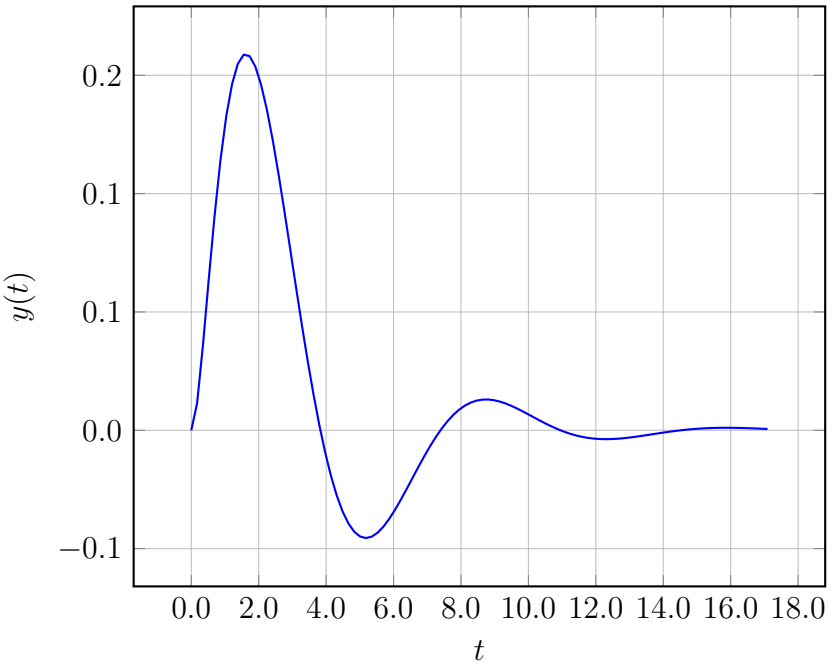
E. $F(s) = 2.29797 + \frac{3.39899}{s}$

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?

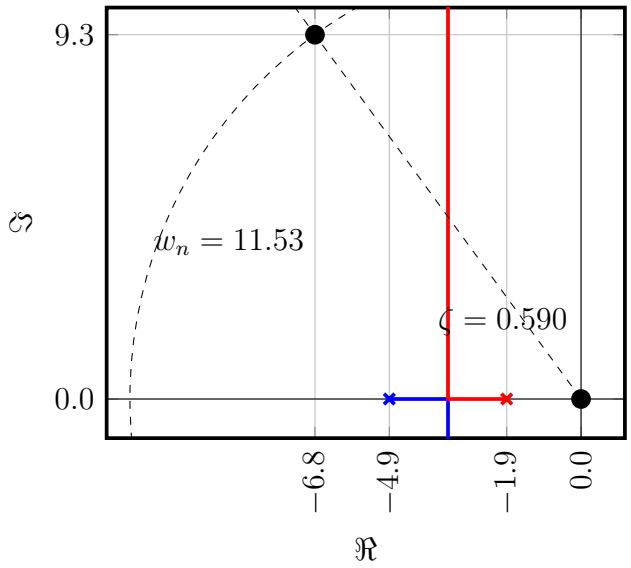
A.



B.



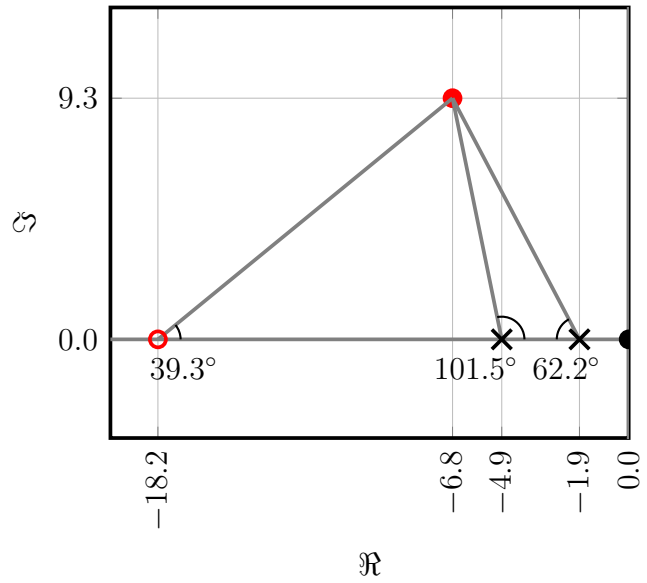
3. (30 points) A design point on the root-locus plot for a P-type controller is shown below.



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?

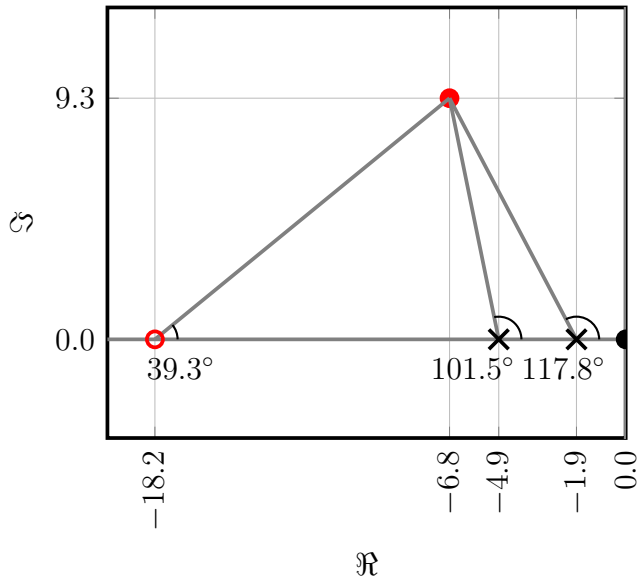
$$\sum \theta = 62.2^\circ + 101.5^\circ + 39.3^\circ =$$

A.



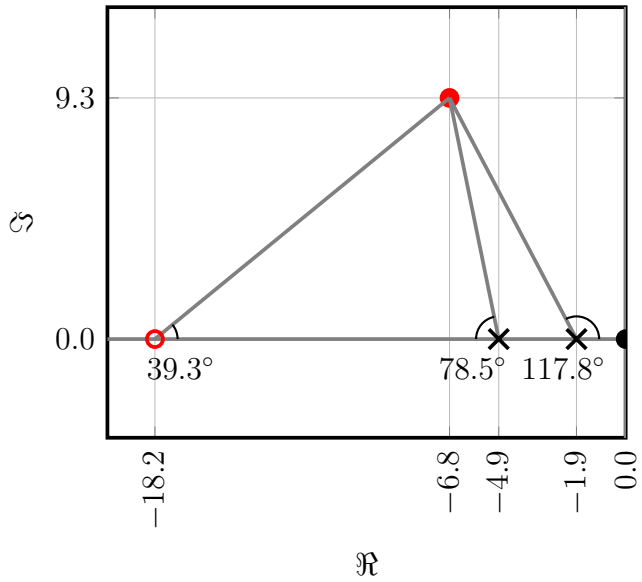
$$\sum \theta = 117.8^\circ + 101.5^\circ - 39.3^\circ =$$

B.



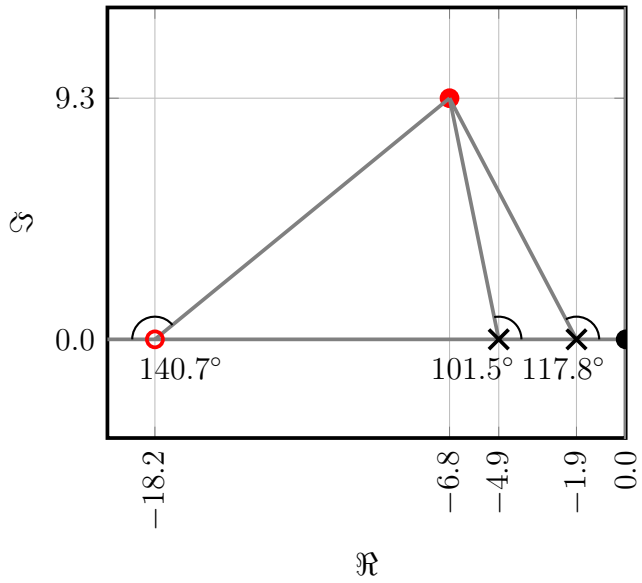
$$\sum \theta = 117.8^\circ + 78.5^\circ + 39.3^\circ =$$

C.



$$\sum \theta = 117.8° + 101.5° + 140.7° =$$

D.



$$\sum \theta = 117.8° + 101.5° + 39.3° =$$

E.