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

$$G(s) = \frac{1}{s^3 + 2.0s^2 + 3.20201s + 7.20201}$$

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

A. $F(s) = 1.71211 + \frac{1.40404}{s}$

B. $F(s) = 1.30807 + \frac{2.90404}{s}$

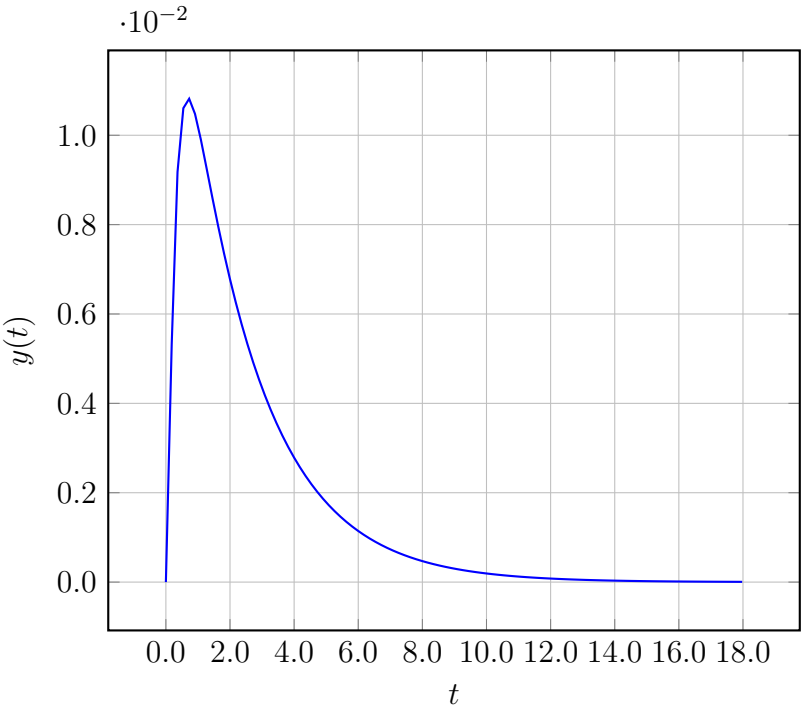
C. $F(s) = -8.78789 + \frac{2.90404}{s}$

D. $F(s) = -2.90404 + \frac{0.70201}{s}$

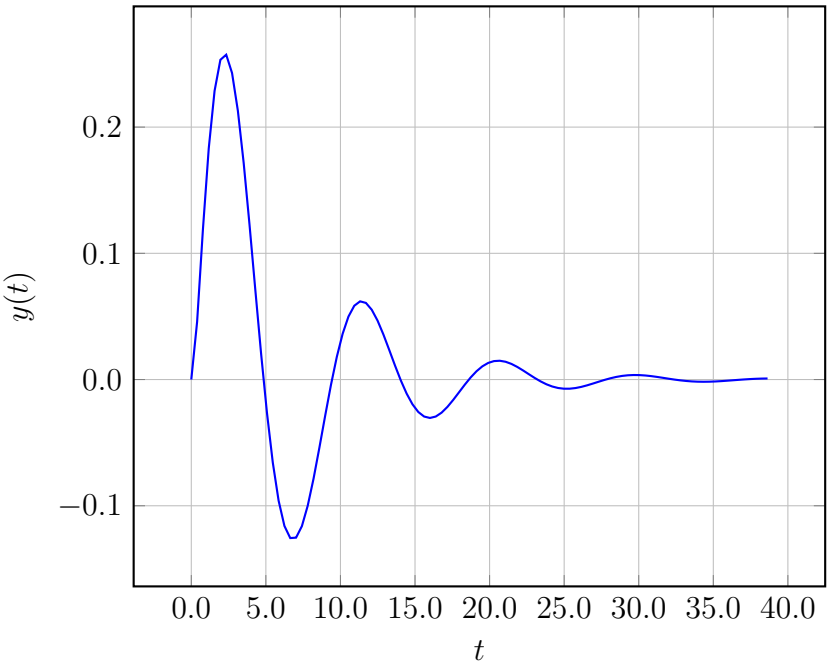
E. $F(s) = -9.19193 + \frac{1.40404}{s}$

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?

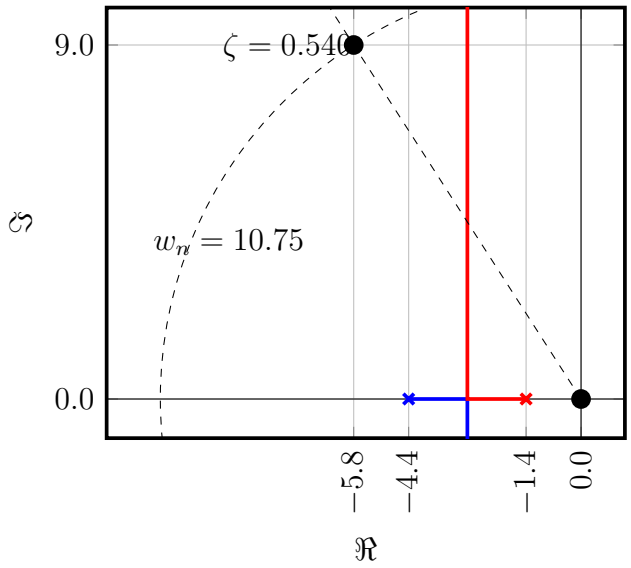
A.



B.



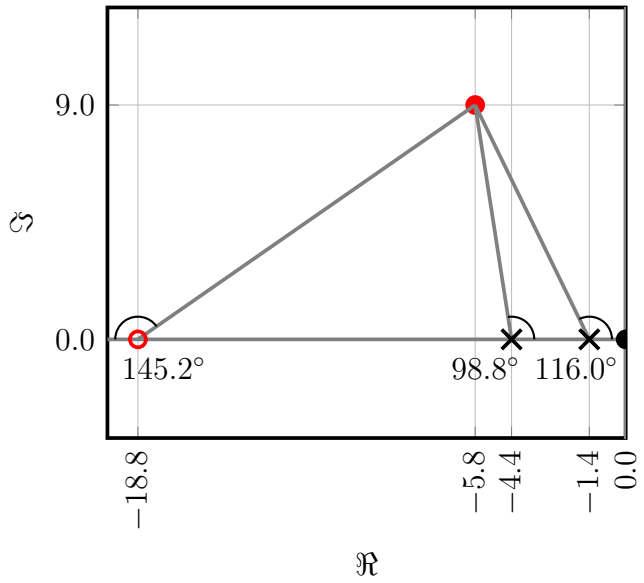
3. (30 points) A design point on the root-locus plot for a P-type controller is shown below.



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?

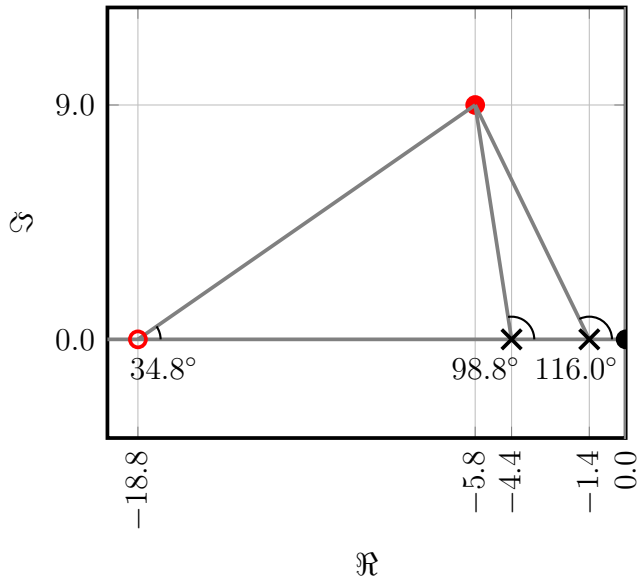
$$\sum \theta = 116.0^\circ + 98.8^\circ + 145.2^\circ =$$

A.



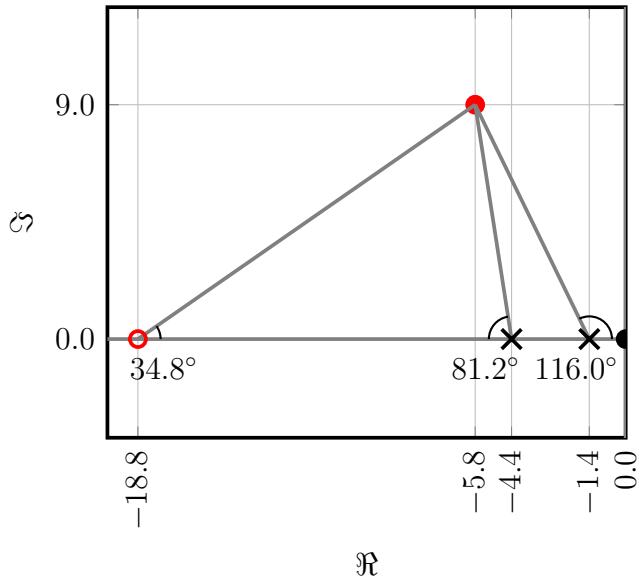
$$\sum \theta = 116.0° + 98.8° - 34.8° =$$

B.

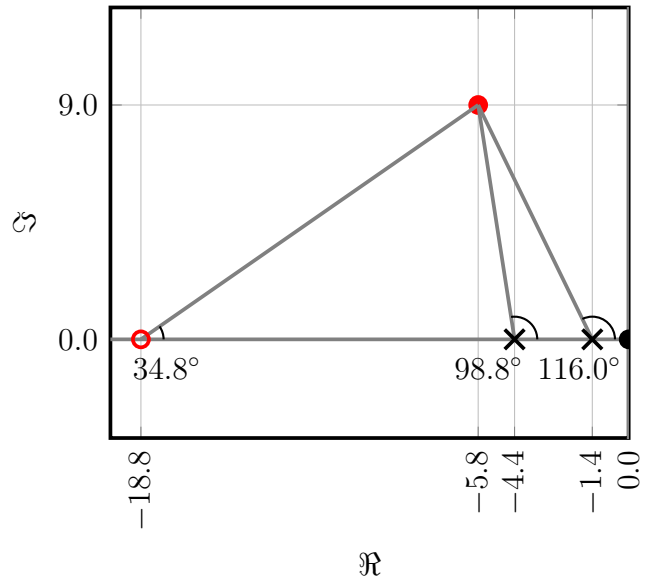


$$\sum \theta = 116.0° + 81.2° + 34.8° =$$

C.



D. $\sum \theta = 116.0° + 98.8° + 34.8° =$



E. $\sum \theta = 64.0° + 98.8° + 34.8° =$