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

$$G(s) = \frac{1}{s^3 + 2.0s^2 + 3.22726s + 7.22726}$$

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

A. $F(s) = 1.86363 + \frac{1.45454}{s}$

B. $F(s) = 1.40909 + \frac{2.95454}{s}$

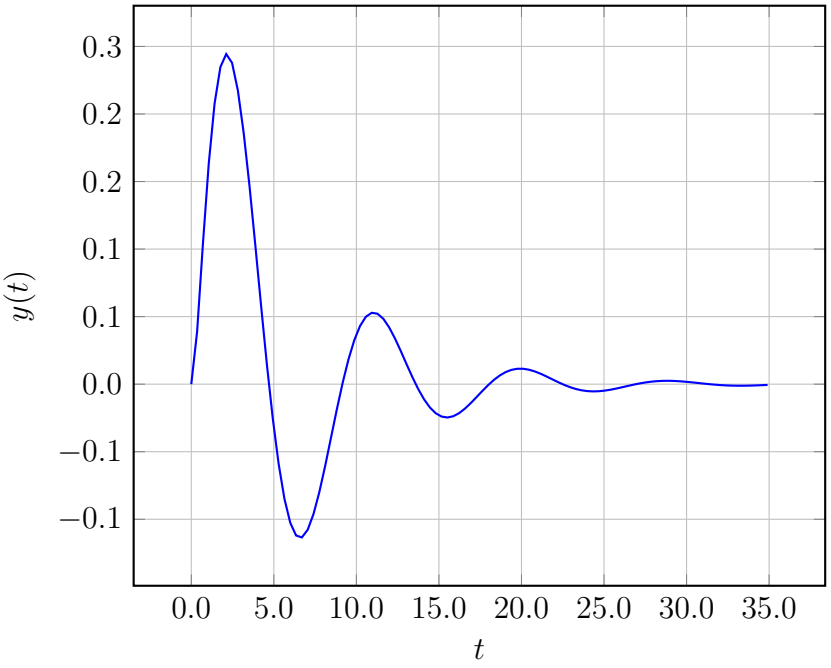
C. $F(s) = -2.95454 + \frac{0.72726}{s}$

D. $F(s) = -8.63637 + \frac{2.95454}{s}$

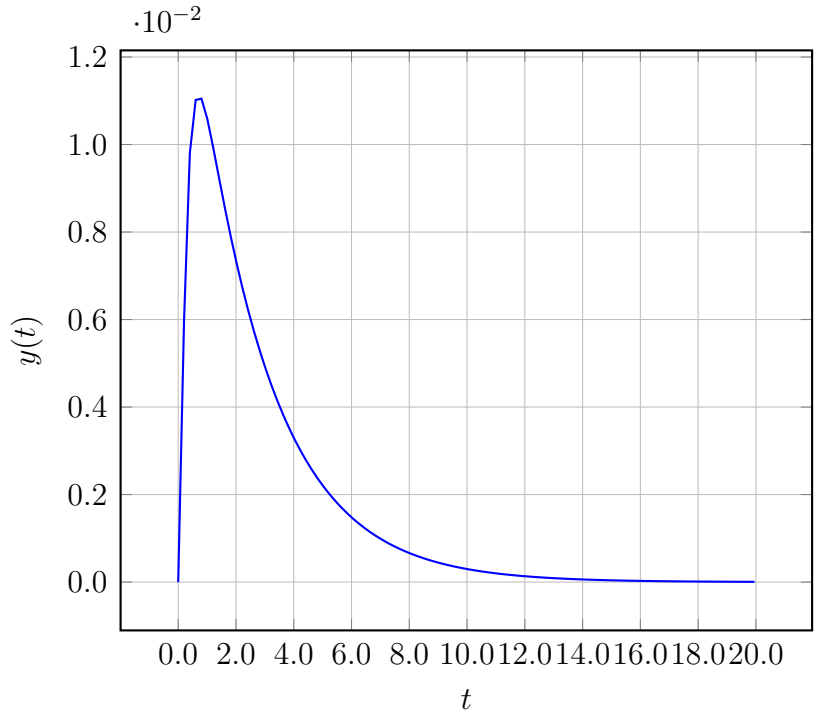
E. $F(s) = -9.09091 + \frac{1.45454}{s}$

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?

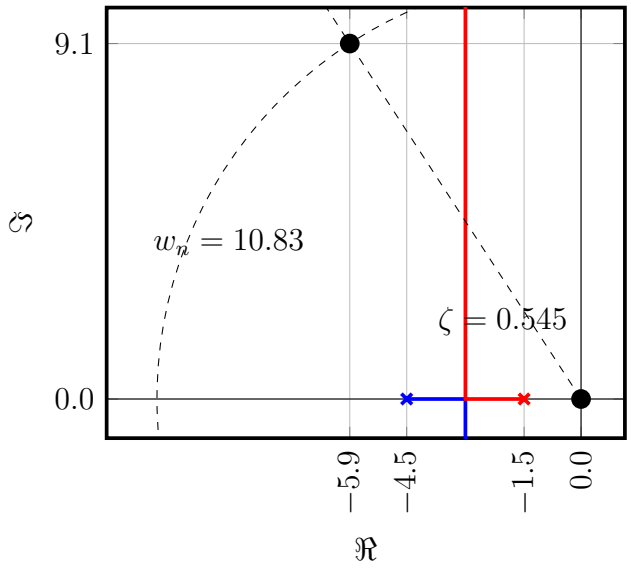
A.



B.



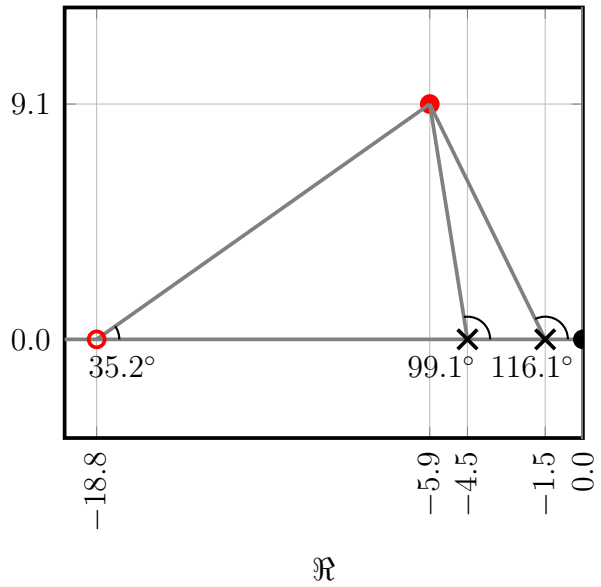
3. (30 points) A design point on the root-locus plot for a P-type controller is shown below.



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?

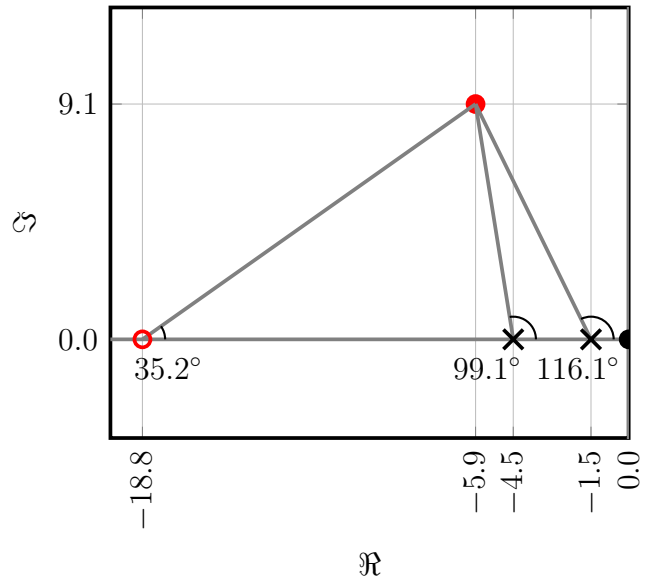
$$\sum \theta = 116.1^\circ + 99.1^\circ - 35.2^\circ = 180.0^\circ$$

A.



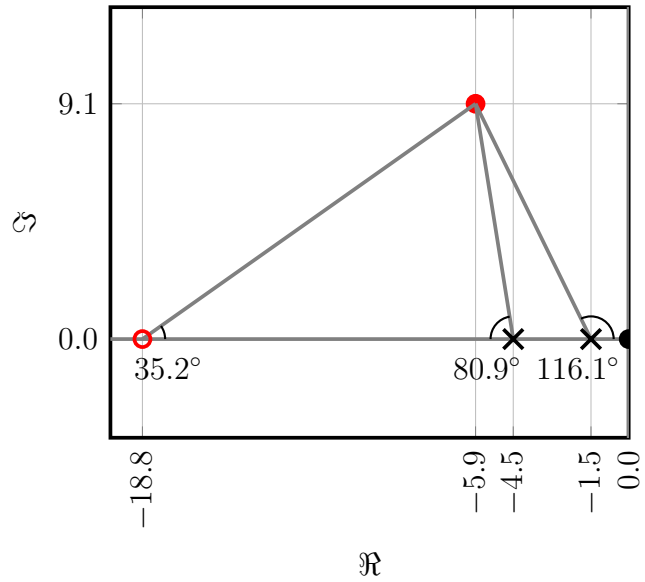
$$\sum \theta = 116.1^\circ + 99.1^\circ + 35.2^\circ = 250.5^\circ$$

B.



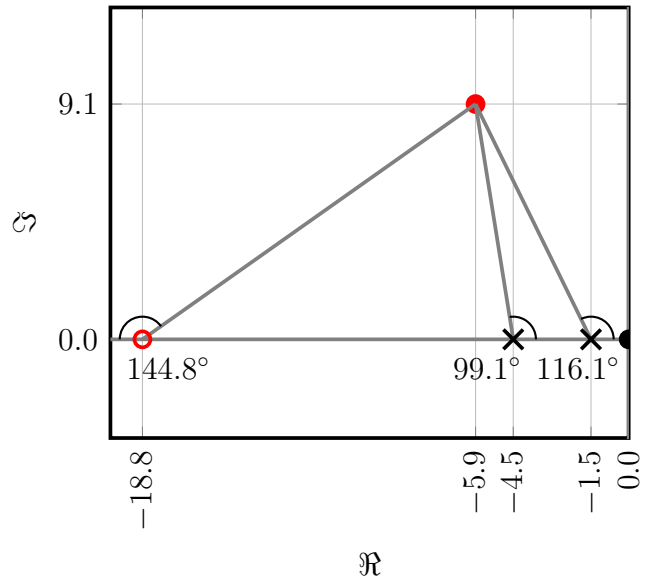
$$\sum \theta = 116.1^\circ + 80.9^\circ + 35.2^\circ = 232.3^\circ$$

C.



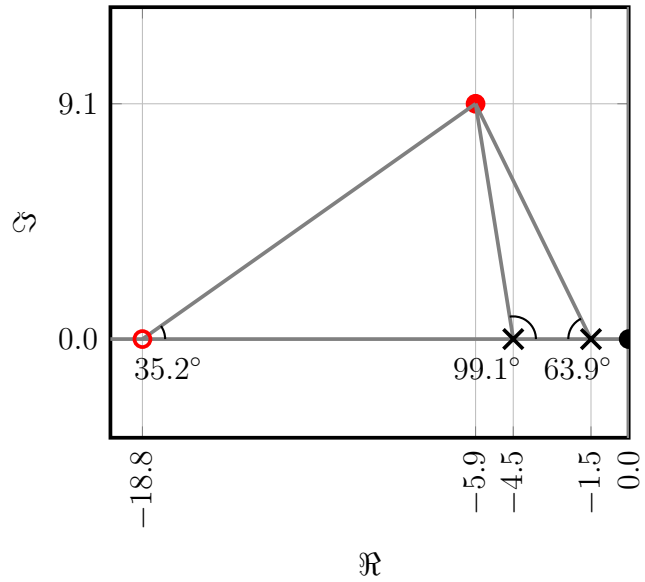
$$\sum \theta = 116.1^\circ + 99.1^\circ + 144.8^\circ = 360.0^\circ$$

D.



$$\sum \theta = 63.9^\circ + 99.1^\circ + 35.2^\circ = 198.2^\circ$$

E.



Q	A
1	C
2	B
3	A