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

$$G(s) = \frac{1}{s^3 + 2.0s^2 + 3.12625s + 7.12625}$$

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

A. $F(s) = 1.25757 + \frac{1.25252}{s}$

B. $F(s) = -9.24243 + \frac{2.75252}{s}$

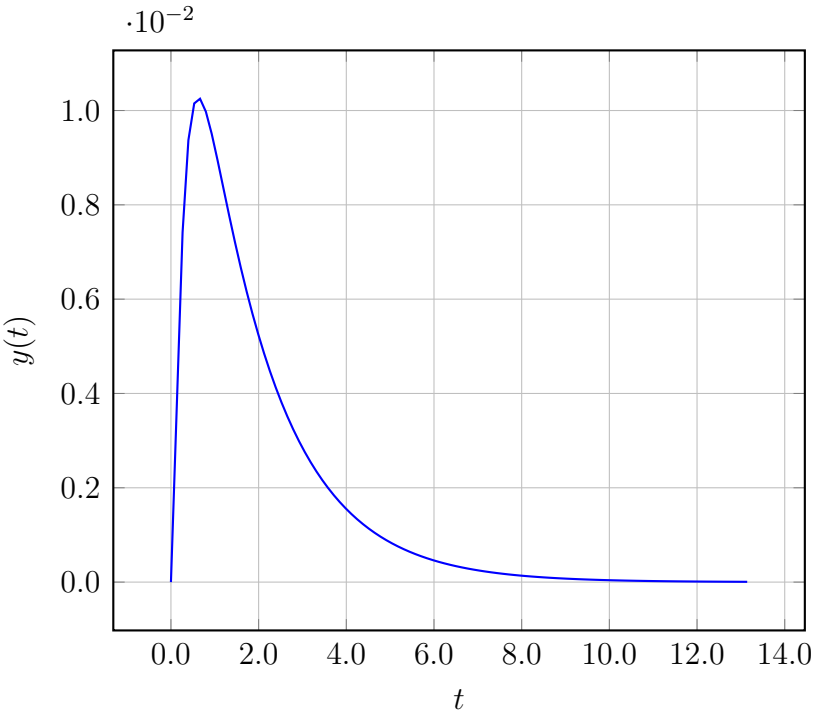
C. $F(s) = -2.75252 + \frac{0.62625}{s}$

D. $F(s) = -9.49496 + \frac{1.25252}{s}$

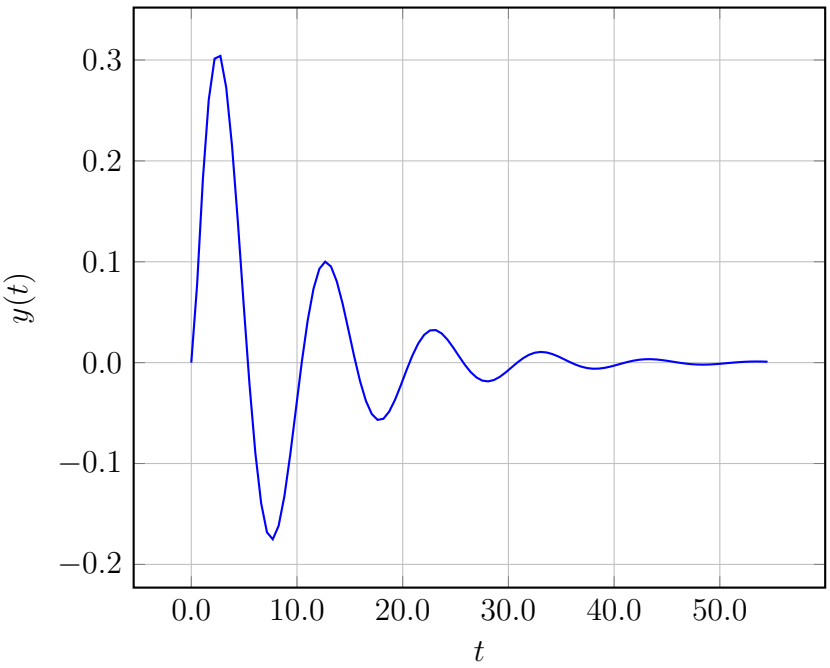
E. $F(s) = 1.00504 + \frac{2.75252}{s}$

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?

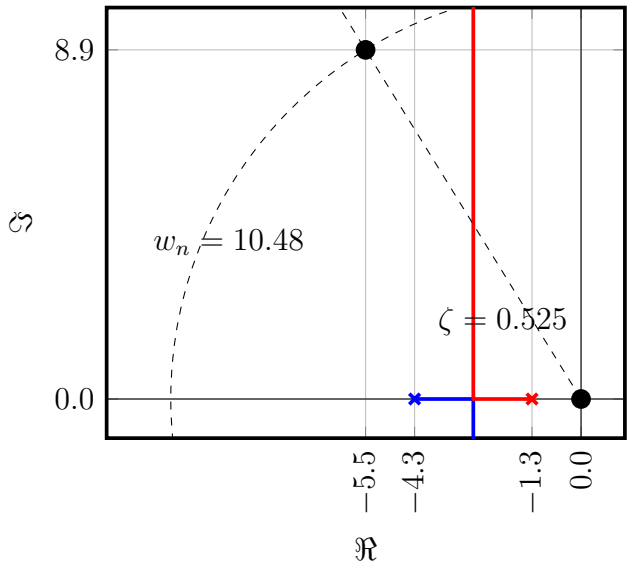
A.



B.



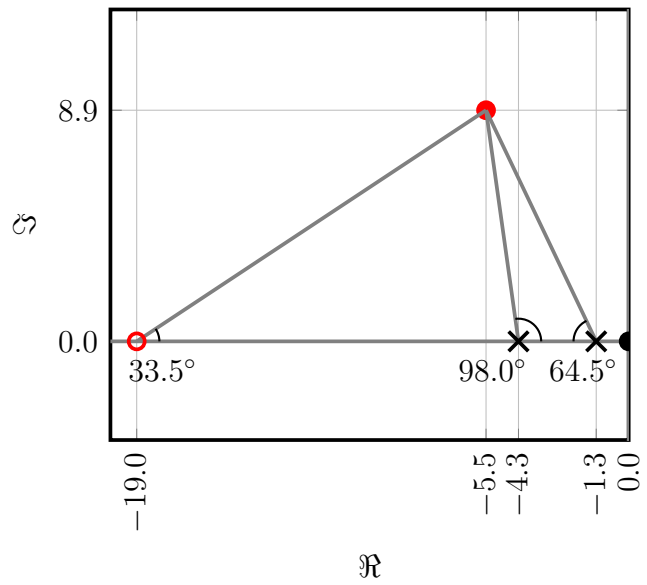
3. (30 points) A design point on the root-locus plot for a P-type controller is shown below.



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?

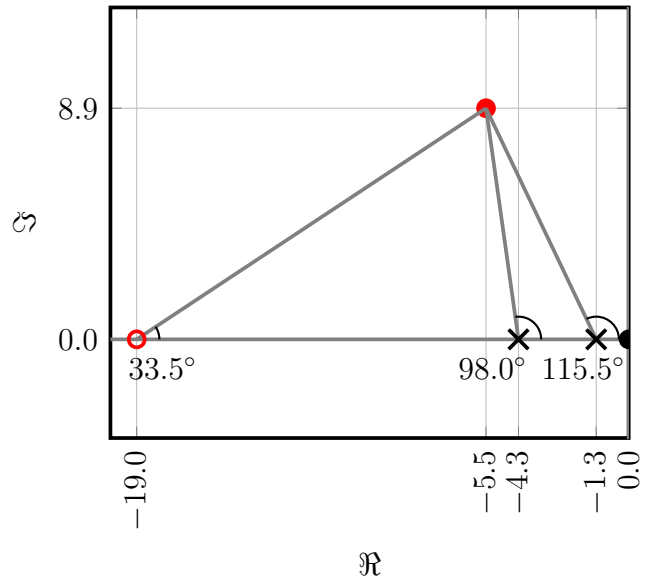
$$\sum \theta = 64.5^\circ + 98.0^\circ + 33.5^\circ = 196.0^\circ$$

A.



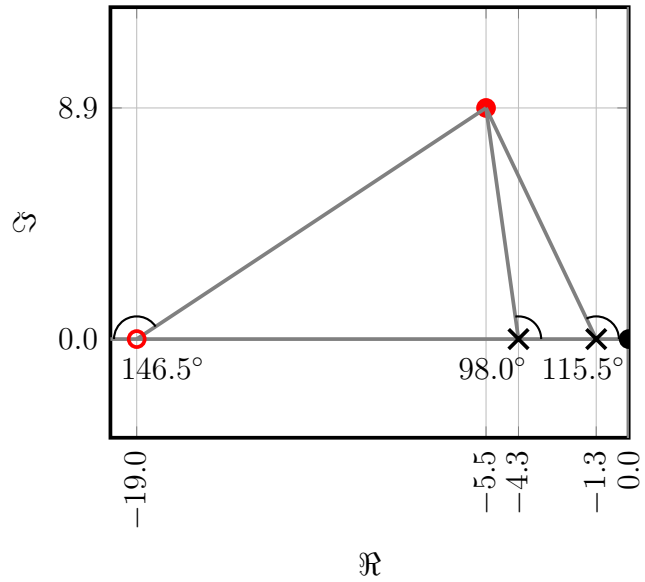
$$\sum \theta = 115.5^\circ + 98.0^\circ + 33.5^\circ = 247.0^\circ$$

B.



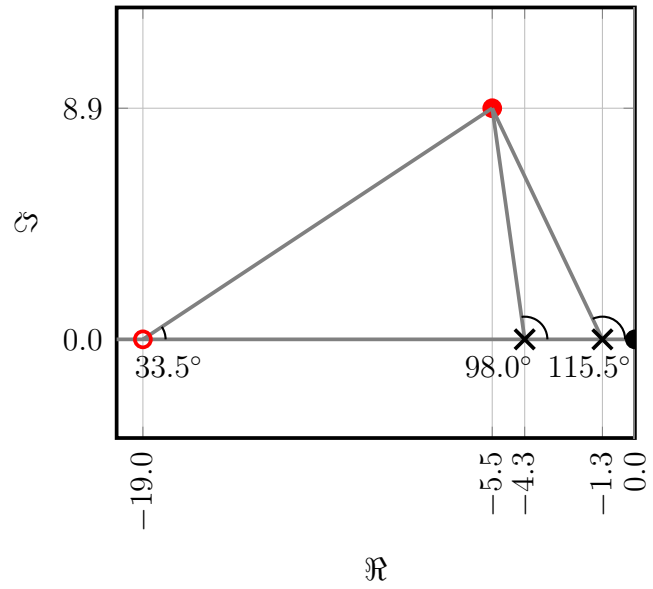
$$\sum \theta = 115.5^\circ + 98.0^\circ + 146.5^\circ = 360.0^\circ$$

C.



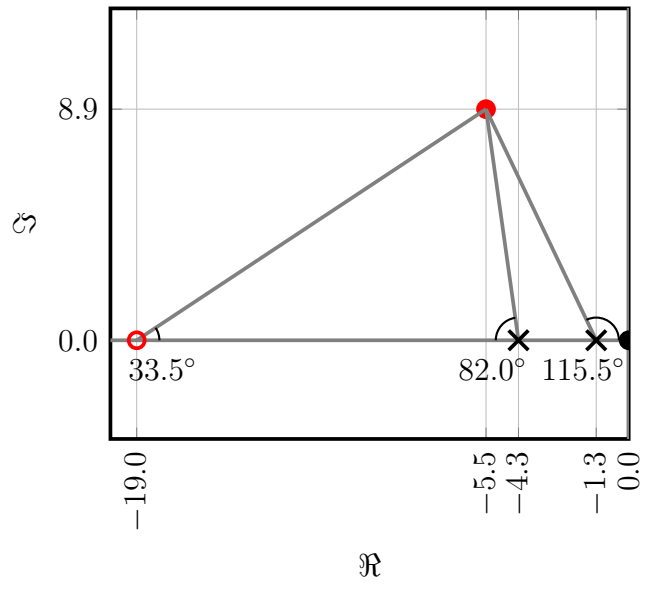
$$\sum \theta = 115.5^\circ + 98.0^\circ - 33.5^\circ = 180.0^\circ$$

D.



$$\sum \theta = 115.5^\circ + 82.0^\circ + 33.5^\circ = 231.0^\circ$$

E.



Q	A
1	C
2	A
3	D