

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

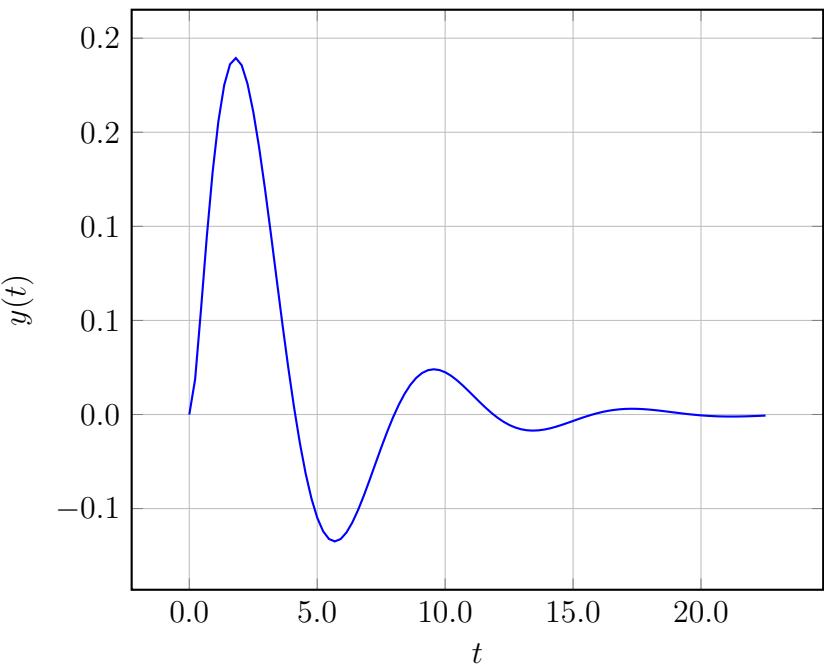
$$G(s) = \frac{1}{s^3 + 2.0s^2 + 3.35353s + 7.35353}$$

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

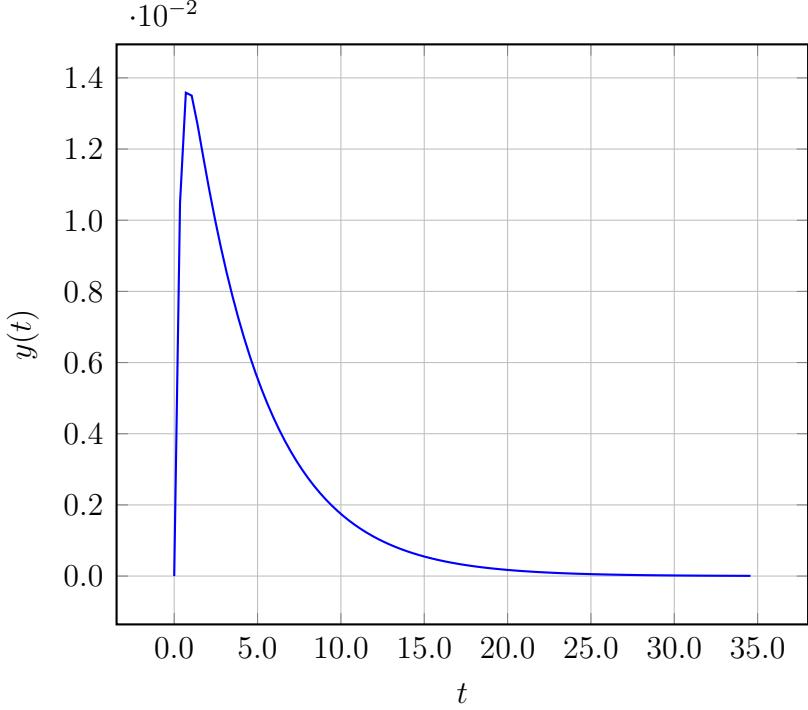
- A. $F(s) = 2.6212 + \frac{1.70706}{s}$
- B. $F(s) = -3.20706 + \frac{0.85353}{s}$
- C. $F(s) = -7.8788 + \frac{3.20706}{s}$
- D. $F(s) = 1.91414 + \frac{3.20706}{s}$
- E. $F(s) = -8.58586 + \frac{1.70706}{s}$

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?

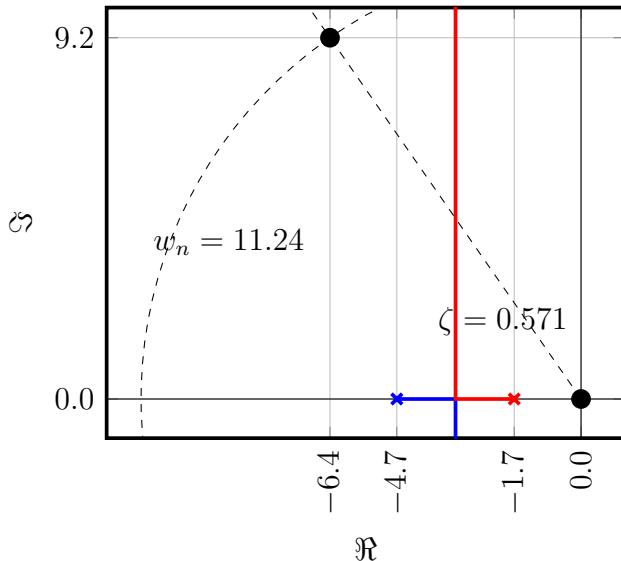
A.



B.

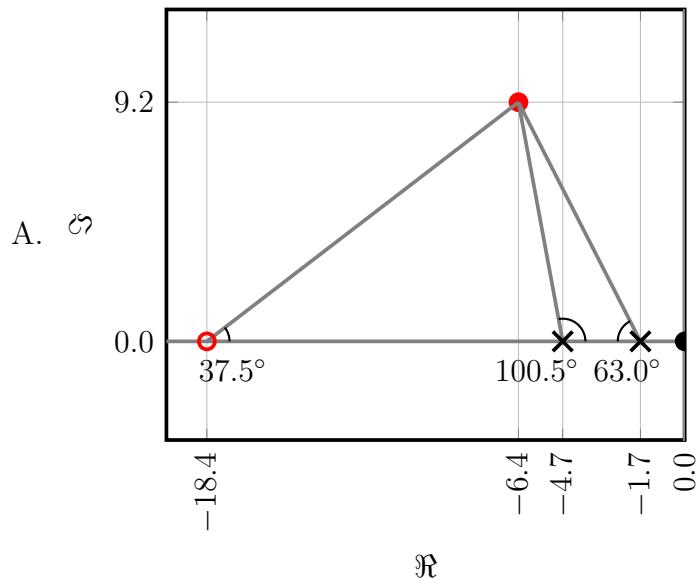


3. (30 points) A design point on the root-locus plot for a P-type controller is shown below.

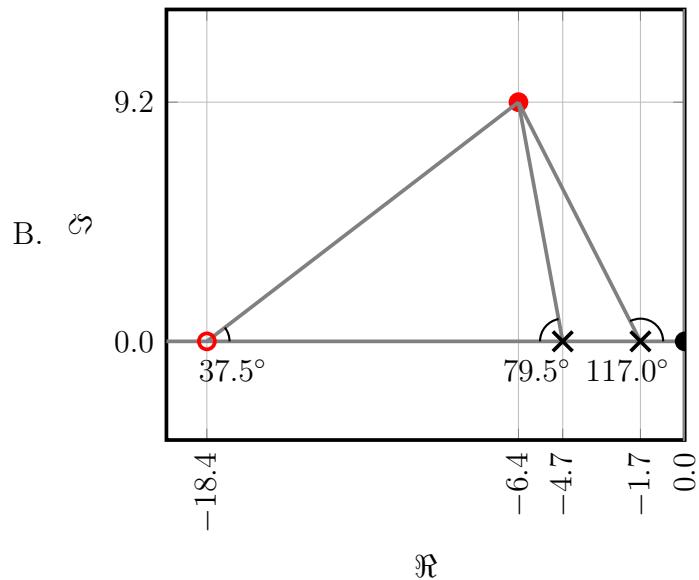


A zero is added so that the root-locus passes through this design point. Which of the following represents the correct angle condition for this design?

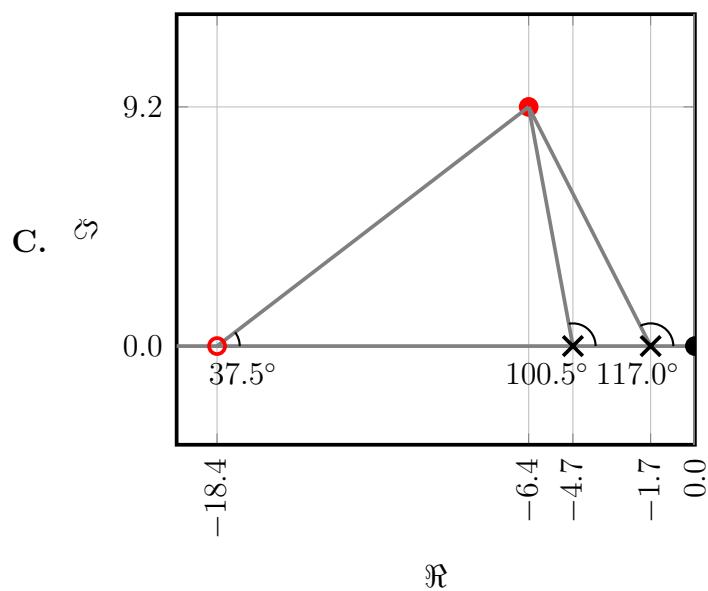
$$\sum \theta = 63.0^\circ + 100.5^\circ + 37.5^\circ = 201.0^\circ$$



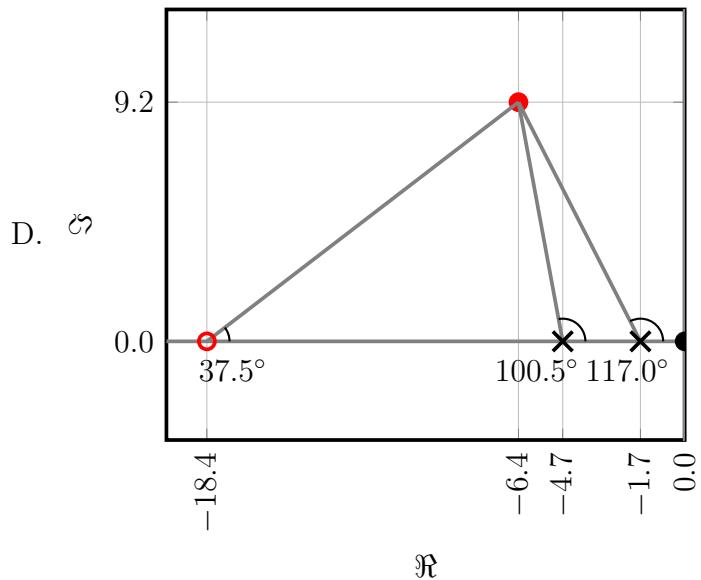
$$\sum \theta = 117.0^\circ + 79.5^\circ + 37.5^\circ = 234.0^\circ$$



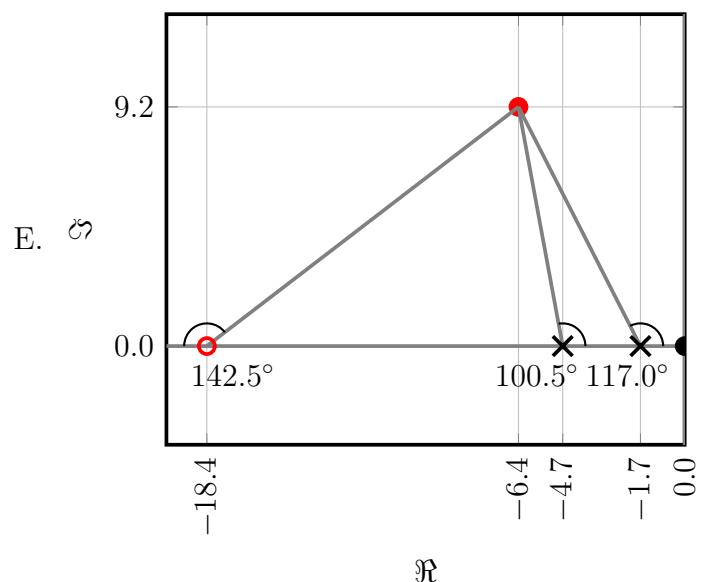
$$\sum \theta = 117.0^\circ + 100.5^\circ - 37.5^\circ = 180.0^\circ$$



$$\sum \theta = 117.0^\circ + 100.5^\circ + 37.5^\circ = 255.0^\circ$$



$$\sum \theta = 117.0^\circ + 100.5^\circ + 142.5^\circ = 360.0^\circ$$



| Q | A |
|---|---|
| 1 | B |
| 2 | B |
| 3 | C |