

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

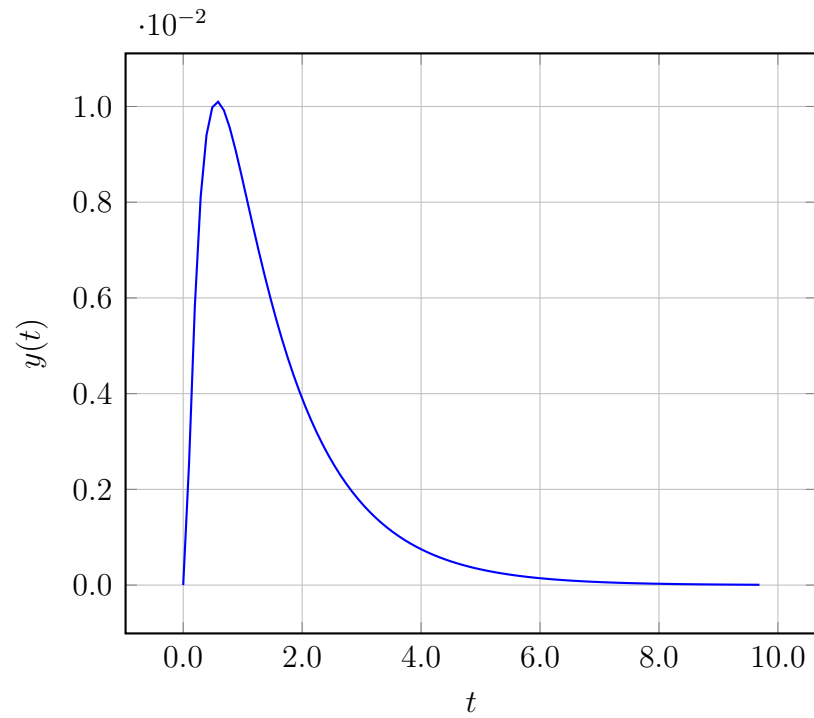
$$G(s) = \frac{1}{s^3 + 2.0s^2 + 3.05554s + 7.05554}$$

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

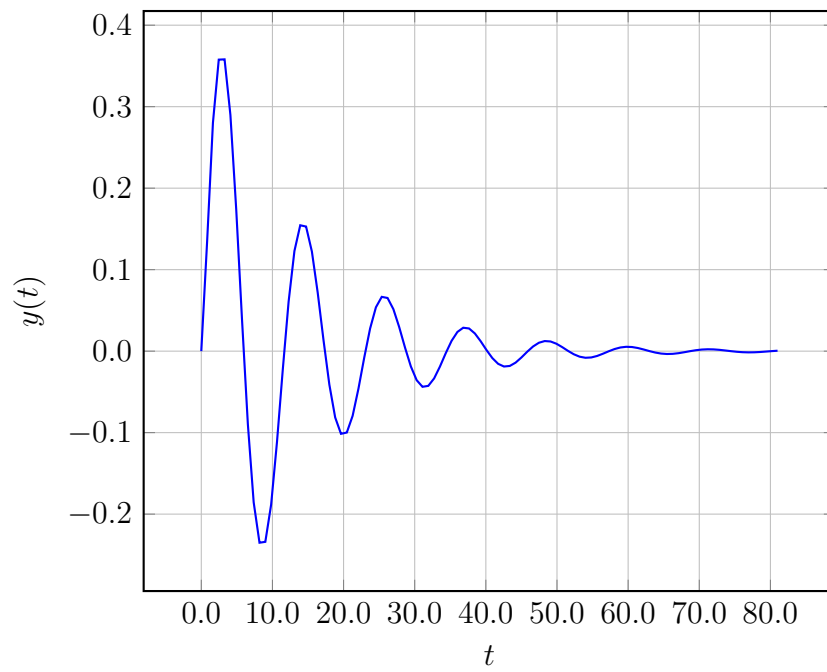
- A. $F(s) = -9.77779 + \frac{1.1111}{s}$
- B. $F(s) = -2.6111 + \frac{0.55554}{s}$**
- C. $F(s) = 0.83333 + \frac{1.1111}{s}$
- D. $F(s) = 0.72221 + \frac{2.6111}{s}$
- E. $F(s) = -9.66667 + \frac{2.6111}{s}$

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?

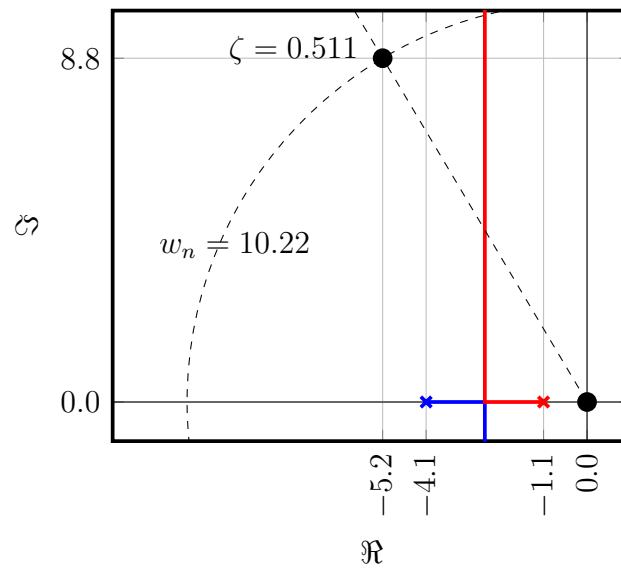
A.



B.

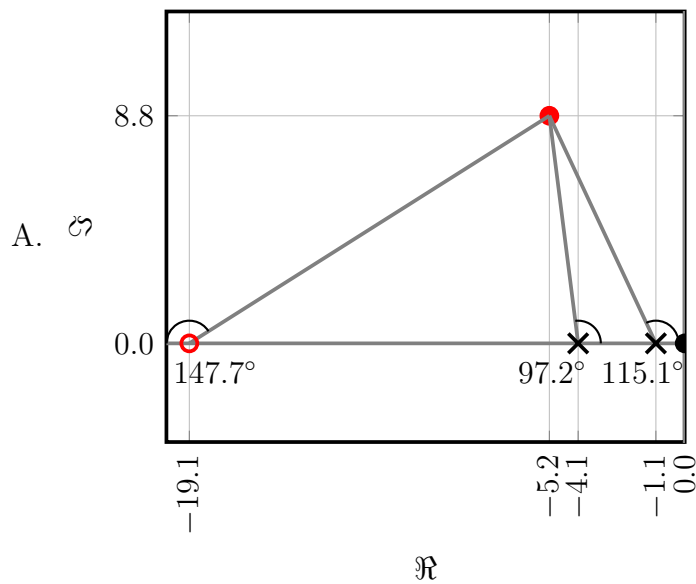


3. (30 points) A design point on the root-locus plot for a P-type controller is shown below.

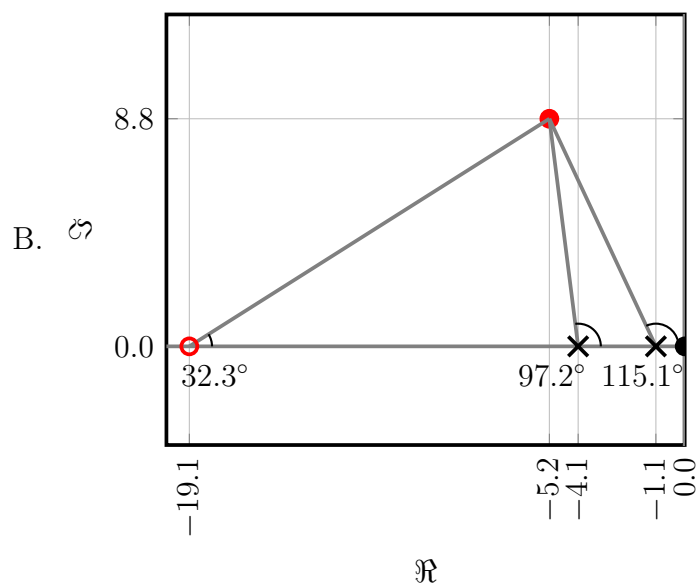


A zero is added so that the root-locus passes through this design point. Which of the following represents the correct angle condition for this design?

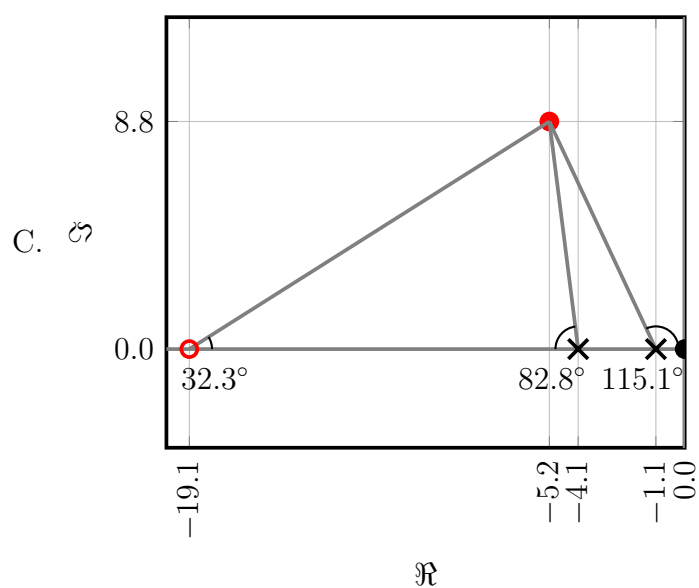
$$\sum \theta = 115.1^\circ + 97.2^\circ + 147.7^\circ = 360.0^\circ$$



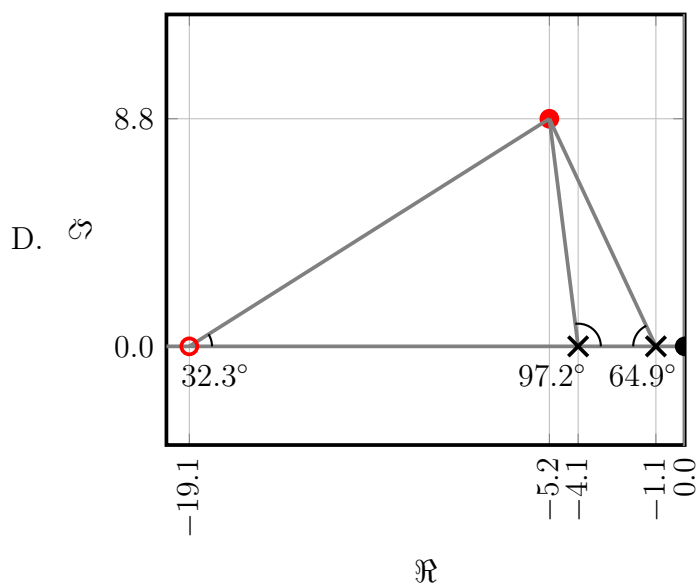
$$\sum \theta = 115.1^\circ + 97.2^\circ + 32.3^\circ = 244.6^\circ$$



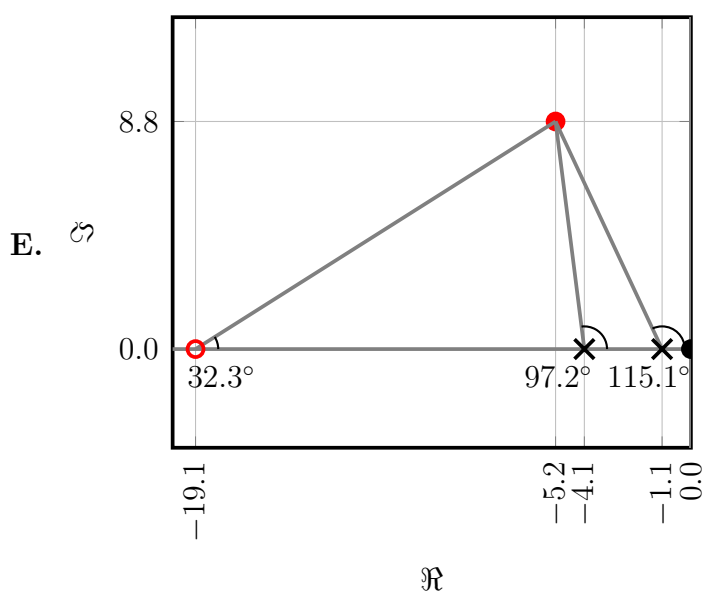
$$\sum \theta = 115.1^\circ + 82.8^\circ + 32.3^\circ = 230.2^\circ$$



$$\sum \theta = 64.9^\circ + 97.2^\circ + 32.3^\circ = 194.4^\circ$$



$$\sum \theta = 115.1^\circ + 97.2^\circ - 32.3^\circ = 180.0^\circ$$



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