

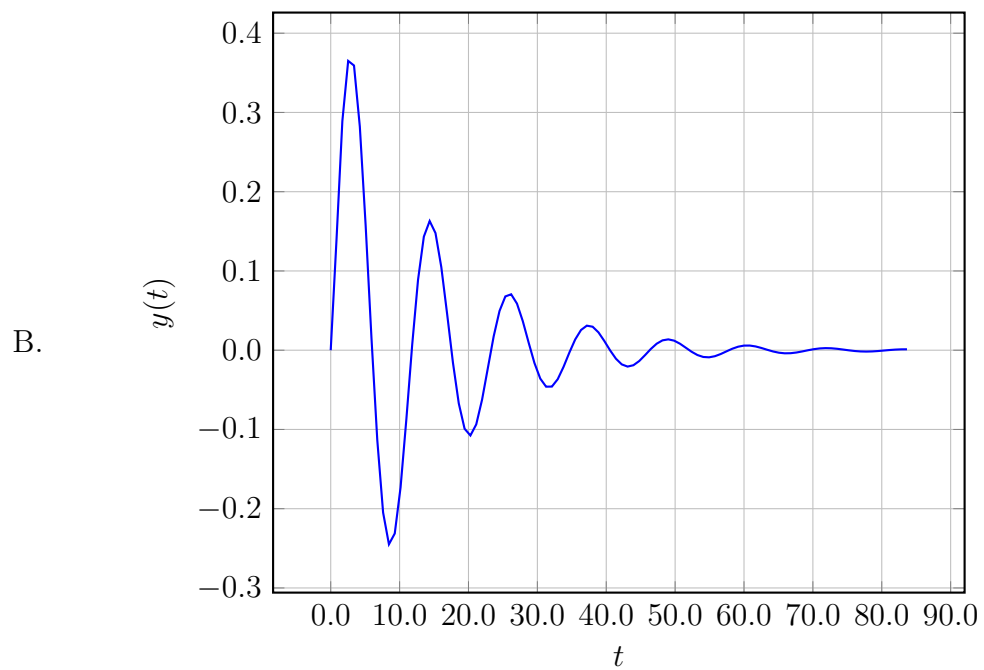
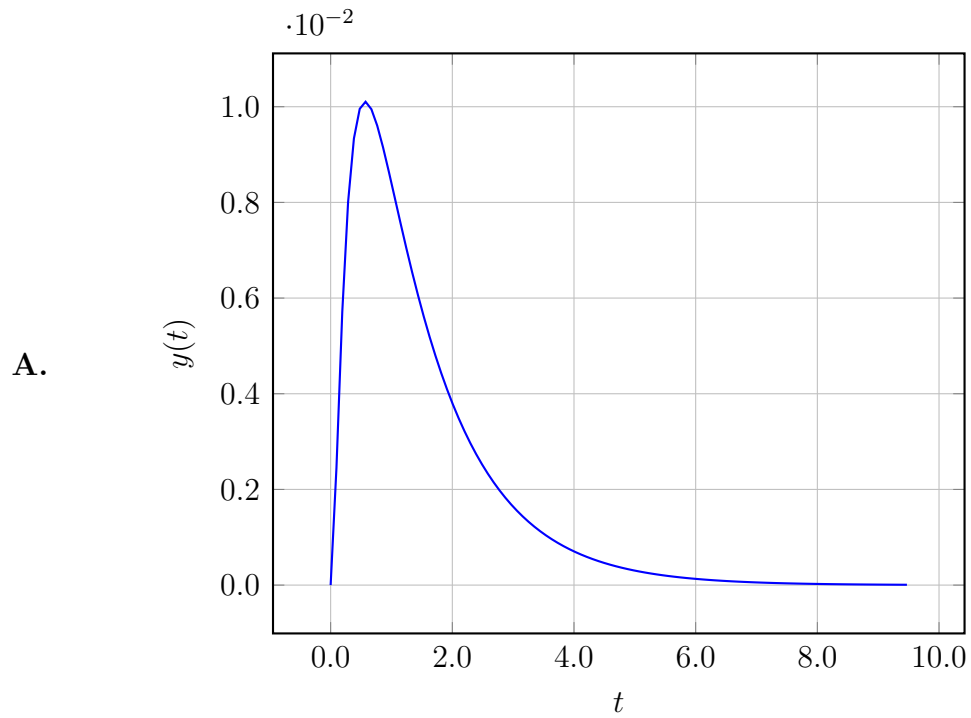
1. (35 points) An open-loop transfer function is given by,

$$G(s) = \frac{1}{s^3 + 2.0s^2 + 3.05049s + 7.05049}$$

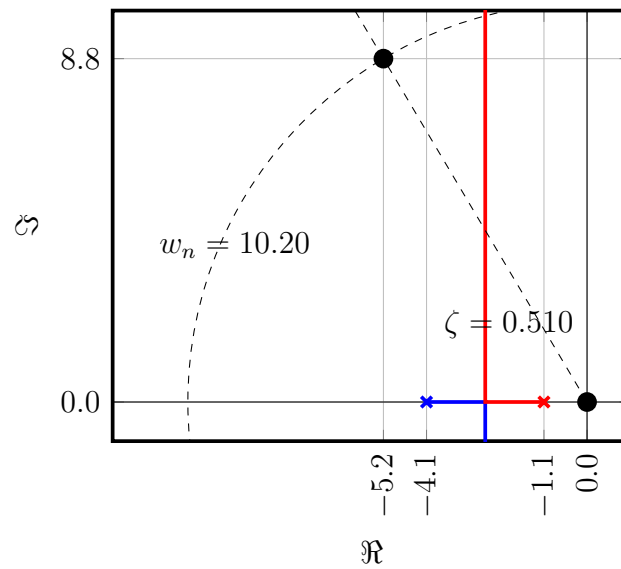
Which of the following PI controllers stabilizes the system in a unit-feedback closed-loop configuration?

- A. $F(s) = 0.80302 + \frac{1.101}{s}$
- B. $F(s) = -9.79799 + \frac{1.101}{s}$
- C. $F(s) = -9.69698 + \frac{2.601}{s}$
- D. $F(s) = 0.70201 + \frac{2.601}{s}$
- E.** $F(s) = -2.601 + \frac{0.55049}{s}$

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?

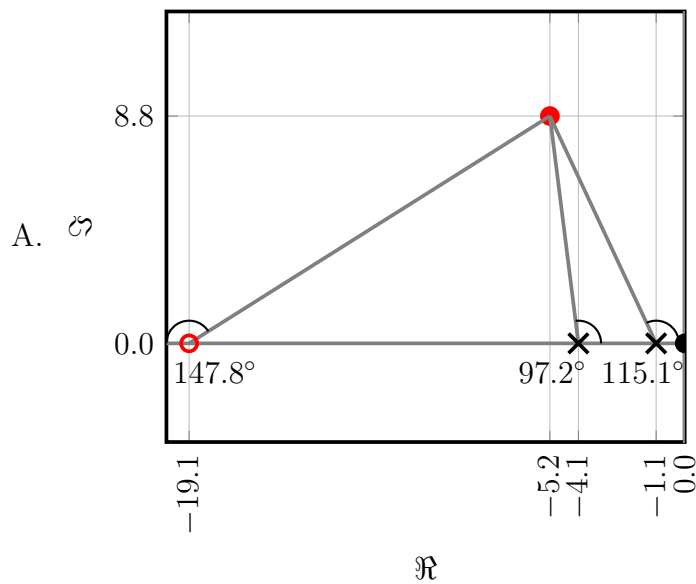


3. (30 points) A design point on the root-locus plot for a P-type controller is shown below.

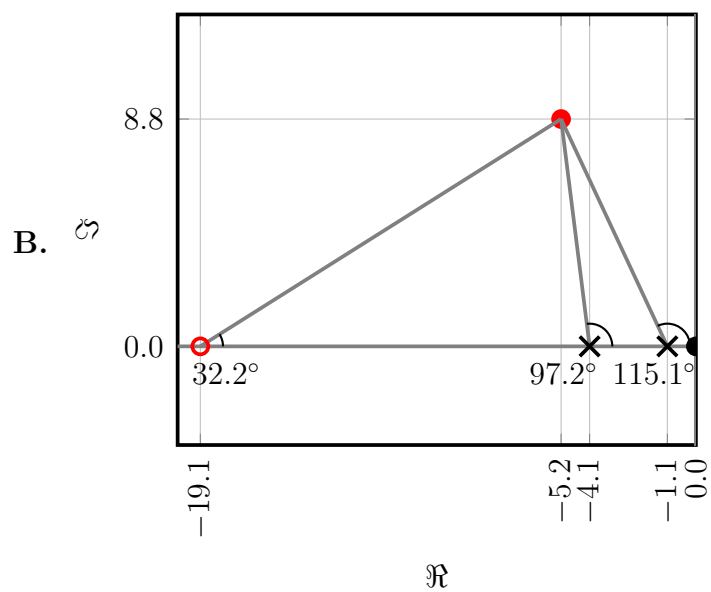


A zero is added so that the root-locus passes through this design point. Which of the following represents the correct angle condition for this design?

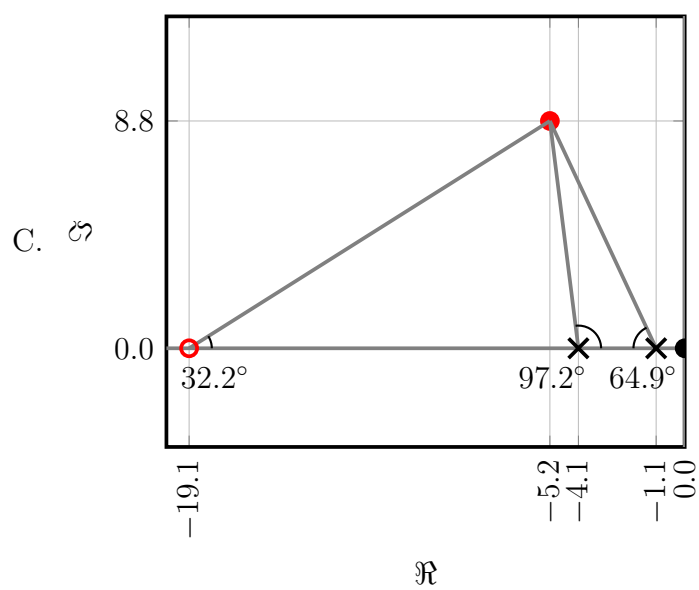
$$\sum \theta = 115.1^\circ + 97.2^\circ + 147.8^\circ = 360.0^\circ$$



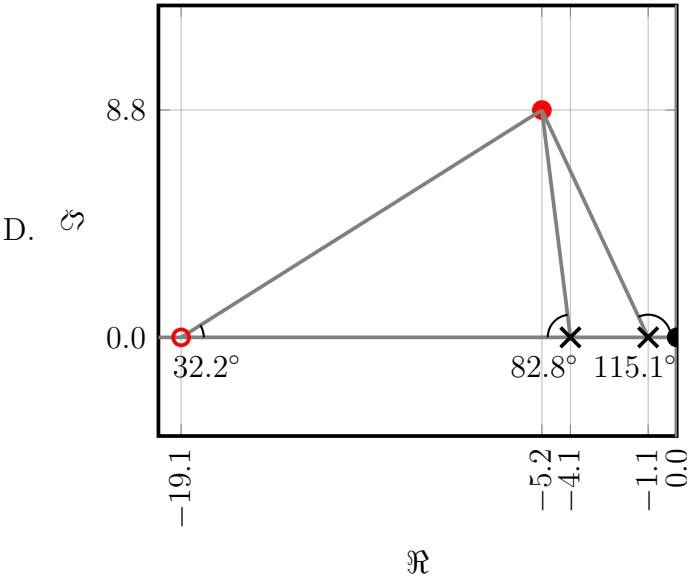
$$\sum \theta = 115.1^\circ + 97.2^\circ - 32.2^\circ = 180.0^\circ$$



$$\sum \theta = 64.9^\circ + 97.2^\circ + 32.2^\circ = 194.3^\circ$$



$$\sum \theta = 115.1^{\circ} + 82.8^{\circ} + 32.2^{\circ} = 230.1^{\circ}$$



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