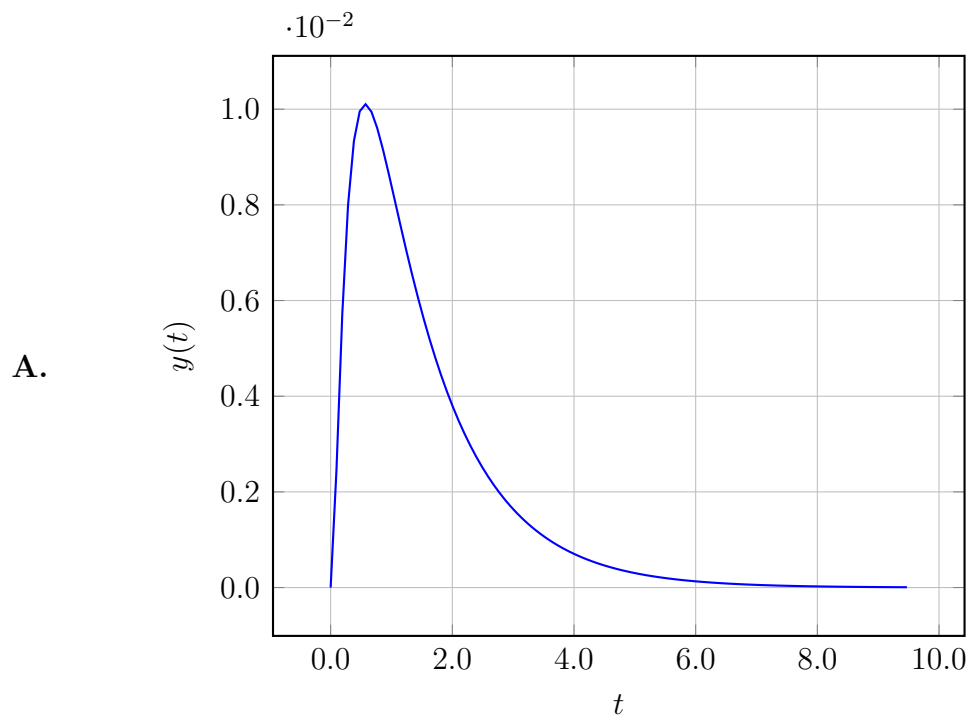


1. (35 points) An open-loop transfer function is given by,

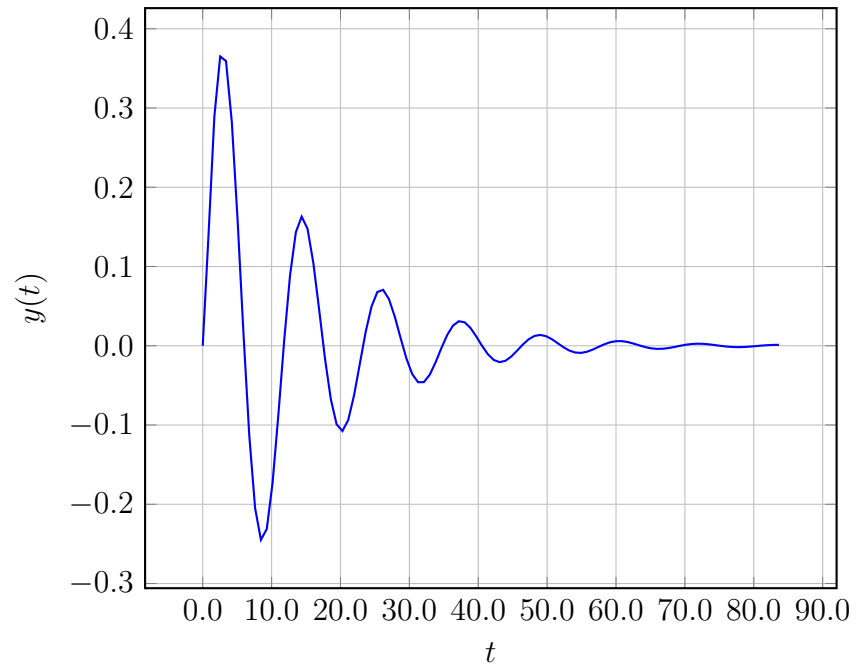
$$G(s) = \frac{1}{s^3 + 2.0s^2 + 3.05049s + 7.05049}$$

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

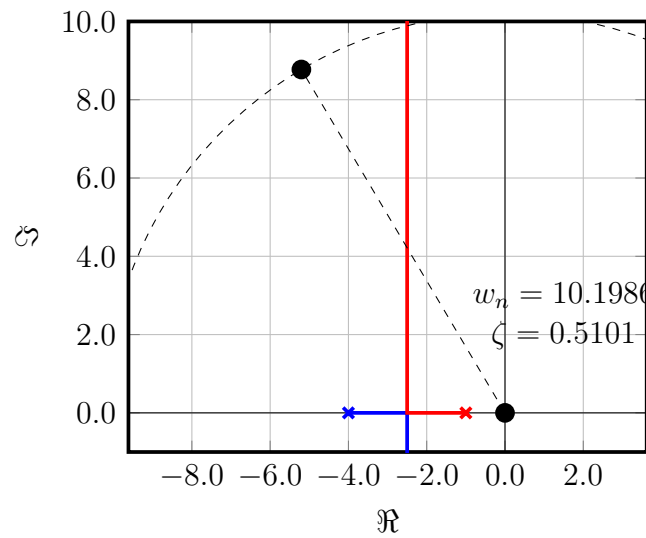
- A.  $F(s) = 0.80302 + \frac{1.101}{s}$
  - B.  $F(s) = -9.79799 + \frac{1.101}{s}$
  - C.  $F(s) = -9.69698 + \frac{2.601}{s}$
  - D.  $F(s) = 0.70201 + \frac{2.601}{s}$
  - E.  $F(s) = -2.601 + \frac{0.55049}{s}$
2. (35 points) Which one of the following unit impulse responses corresponds to a system that does not overshoot when subjected to a unit step input?



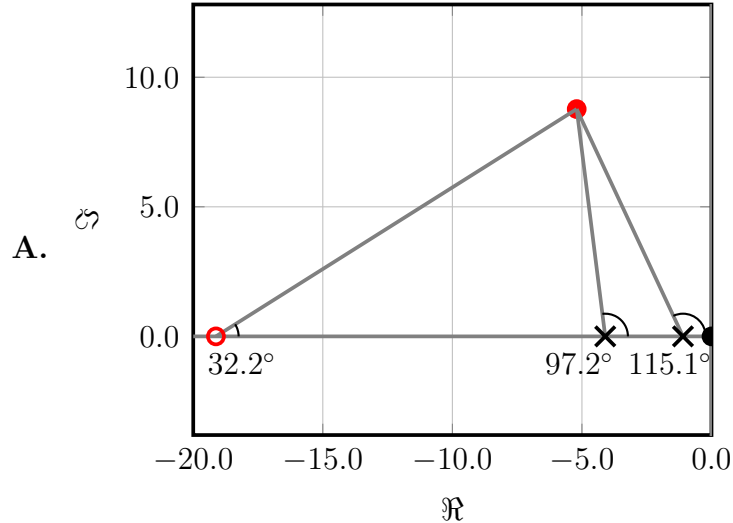
B.



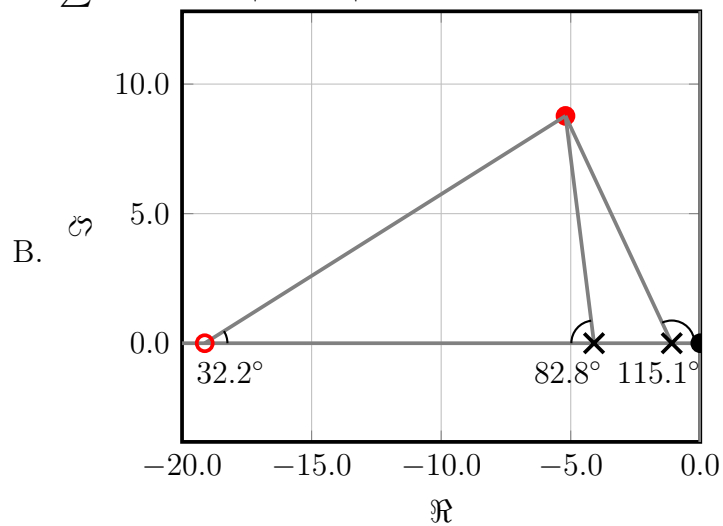
3. (30 points) A design point on the root-locus plot for a P-type controller is shown below. A zero is added so that the root-locus passes through this design point. Which of the following represents the correct angle condition for this design?



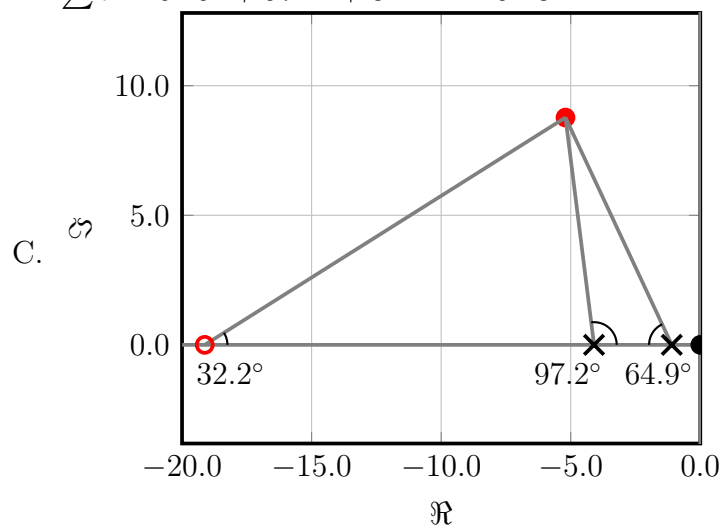
$$\sum \theta = 115.1^\circ + 97.2^\circ - 32.2^\circ = 180.0^\circ$$



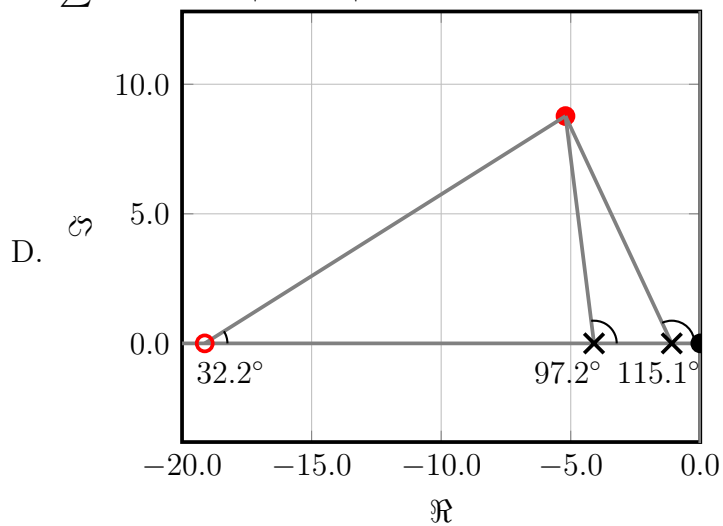
$$\sum \theta = 115.1^\circ + 82.8^\circ + 32.2^\circ = 230.1^\circ$$



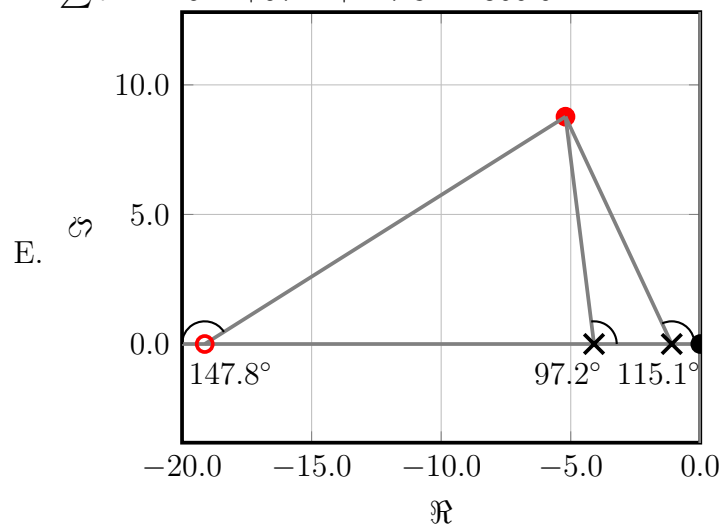
$$\sum \theta = 64.9^\circ + 97.2^\circ + 32.2^\circ = 194.3^\circ$$



$$\sum \theta = 115.1^\circ + 97.2^\circ + 32.2^\circ = 244.4^\circ$$



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



Q	A
1	E
2	A
3	A