

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

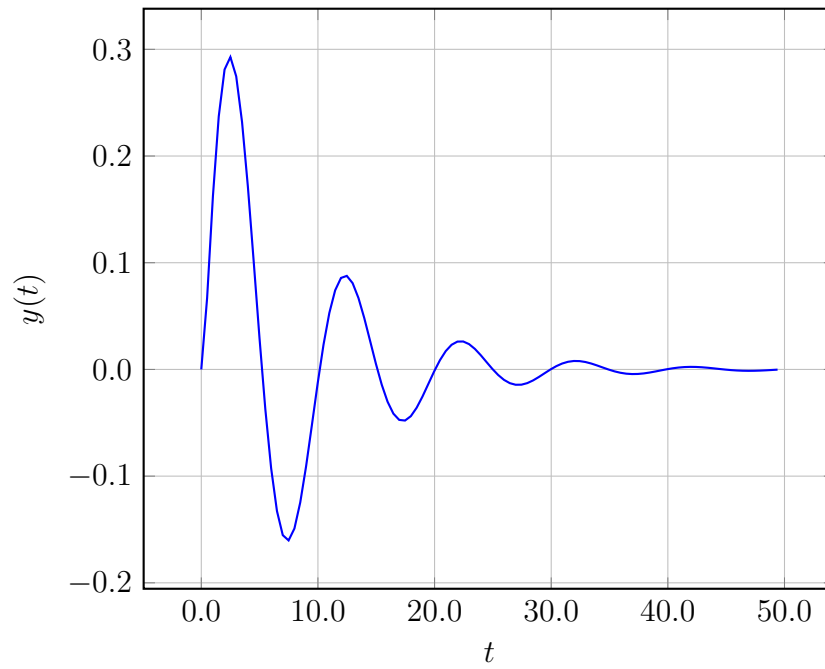
$$G(s) = \frac{1}{s^3 + 2.0s^2 + 3.14645s + 7.14645}$$

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

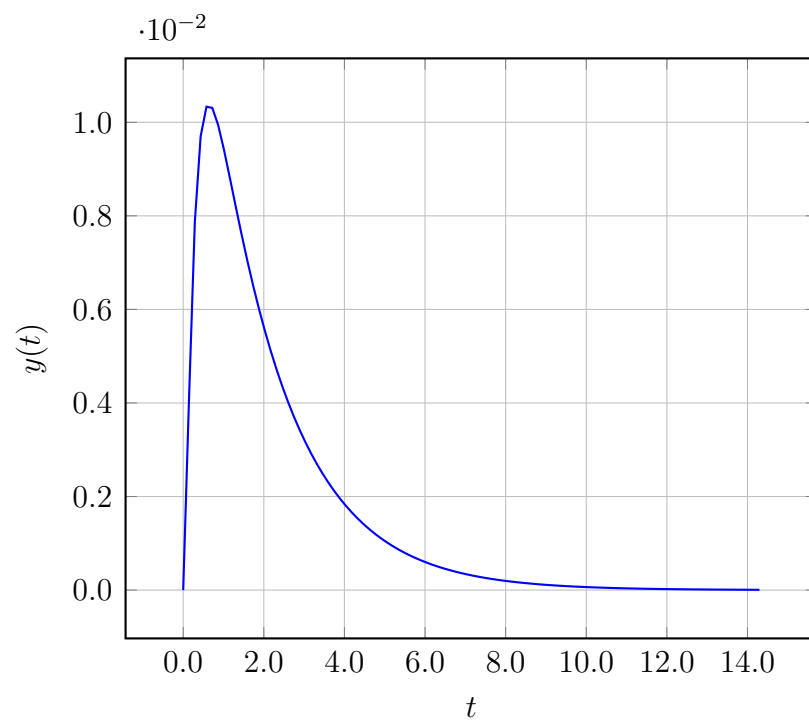
- A.  $F(s) = -2.79292 + \frac{0.64645}{s}$
- B.  $F(s) = 1.08585 + \frac{2.79292}{s}$
- C.  $F(s) = 1.37878 + \frac{1.29292}{s}$
- D.  $F(s) = -9.12122 + \frac{2.79292}{s}$
- E.  $F(s) = -9.41415 + \frac{1.29292}{s}$

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?

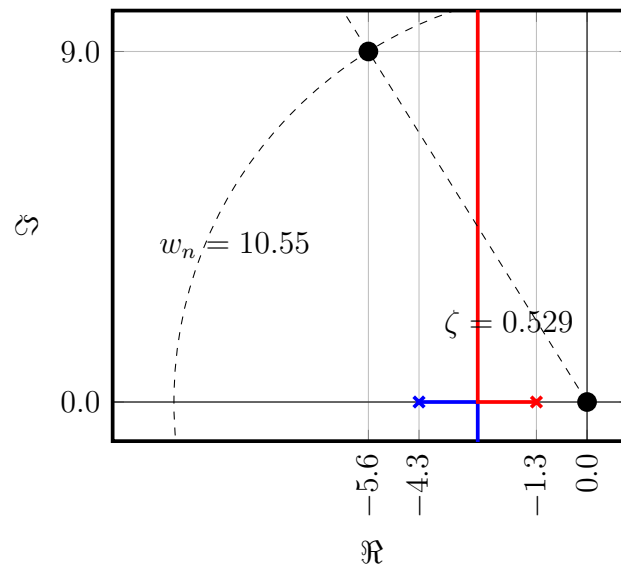
A.



B.

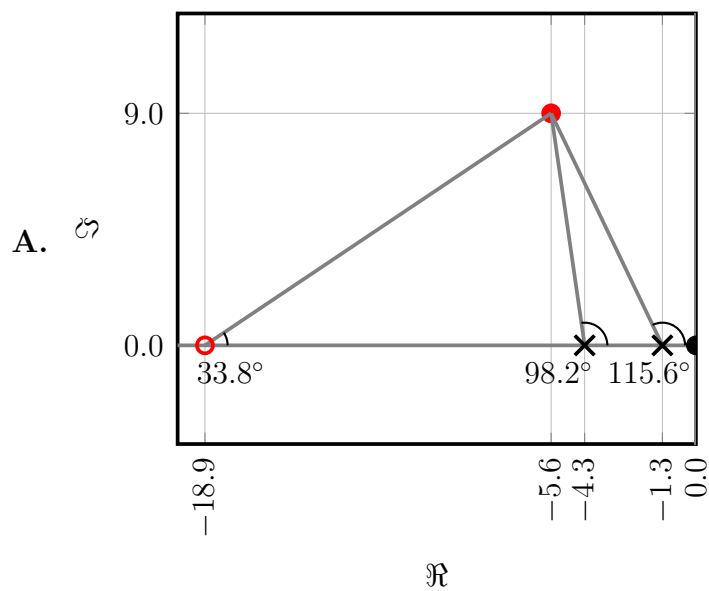


3. (30 points) A design point on the root-locus plot for a P-type controller is shown below.

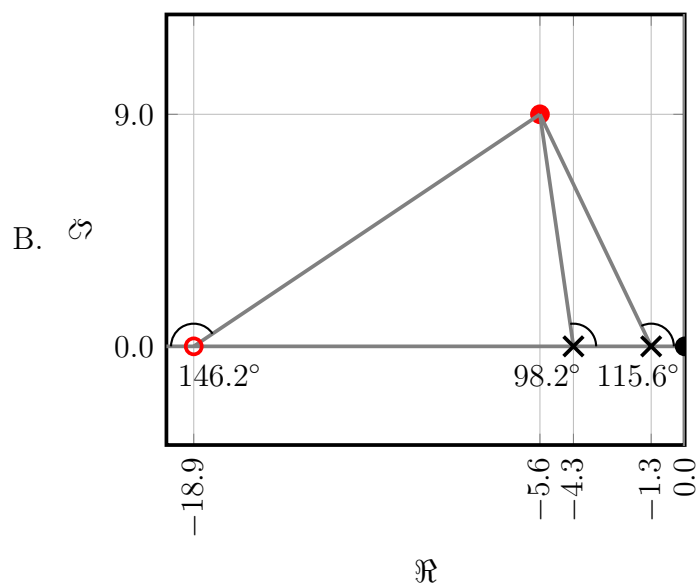


A zero is added so that the root-locus passes through this design point. Which of the following represents the correct angle condition for this design?

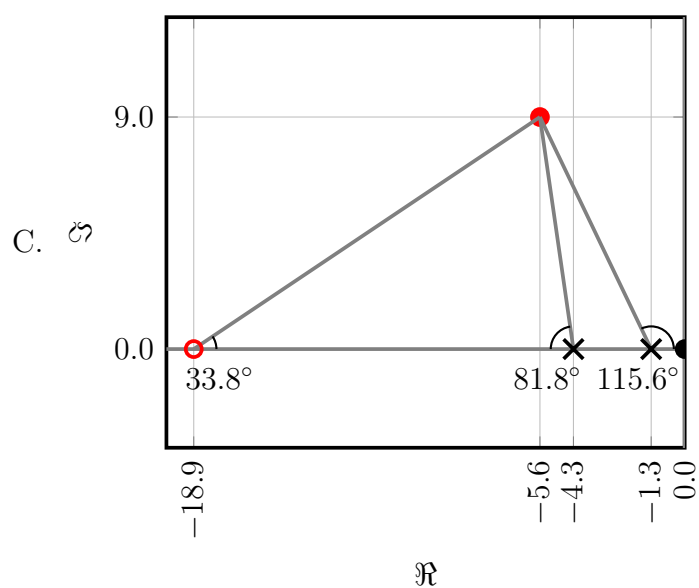
$$\sum \theta = 115.6^\circ + 98.2^\circ - 33.8^\circ = 180.0^\circ$$



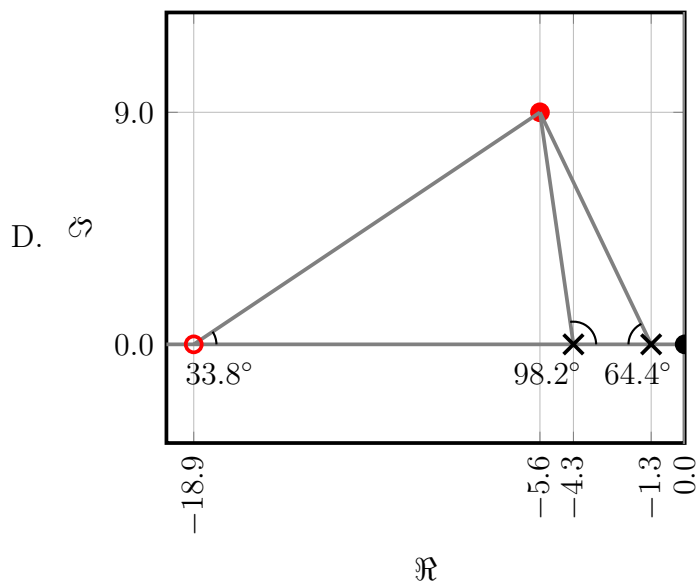
$$\sum \theta = 115.6^\circ + 98.2^\circ + 146.2^\circ = 360.0^\circ$$



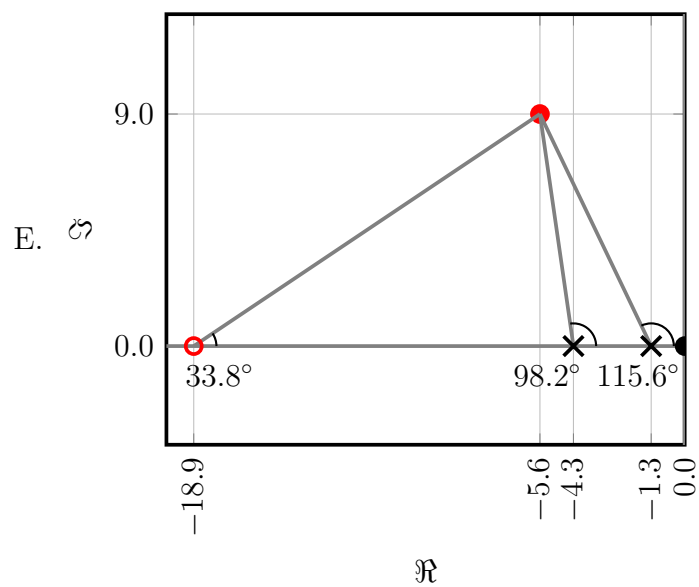
$$\sum \theta = 115.6^\circ + 81.8^\circ + 33.8^\circ = 231.2^\circ$$



$$\sum \theta = 64.4^\circ + 98.2^\circ + 33.8^\circ = 196.4^\circ$$



$$\sum \theta = 115.6^\circ + 98.2^\circ + 33.8^\circ = 247.7^\circ$$



Q	A
1	A
2	B
3	A