1. (35 points) An open-loop transfer function is given by,
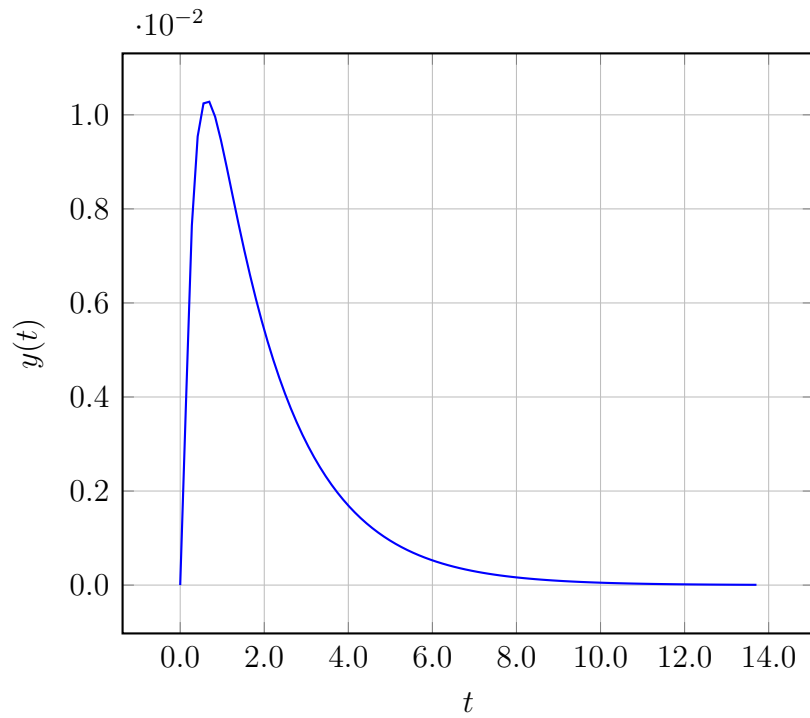
$$G(s) = \frac{1}{s^3 + 2.0s^2 + 3.13635s + 7.13635}$$

Which of the following PI controllers stabilizes the system in a unit-feedback closed-loop configuration?
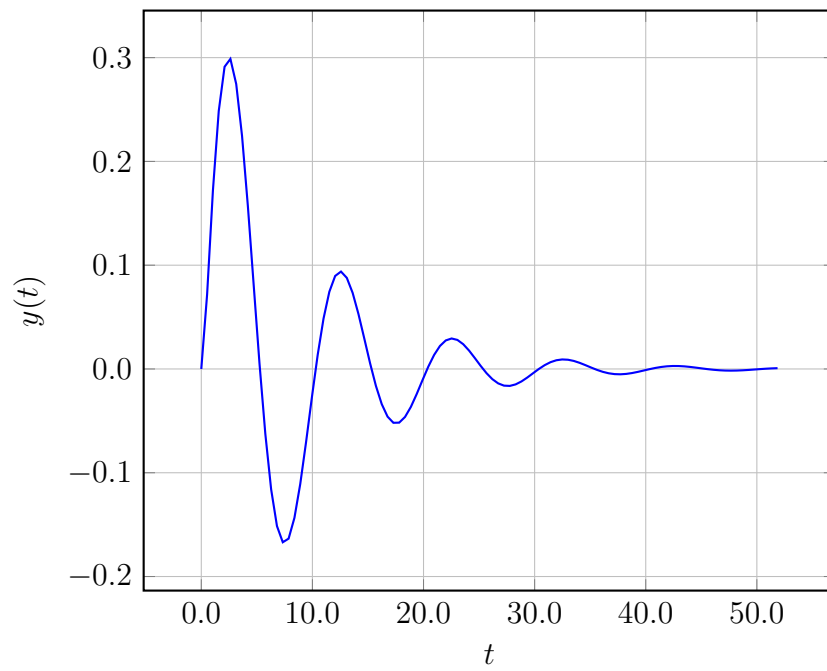
    A. $F(s) = -9.18182 + \frac{2.77272}{s}$

    B. $F(s) = -2.77272 + \frac{0.63635}{s}$

    C. $F(s) = -9.45456 + \frac{1.27272}{s}$

    D. $F(s) = 1.31818 + \frac{1.27272}{s}$

    E. $F(s) = 1.04544 + \frac{2.77272}{s}$

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?
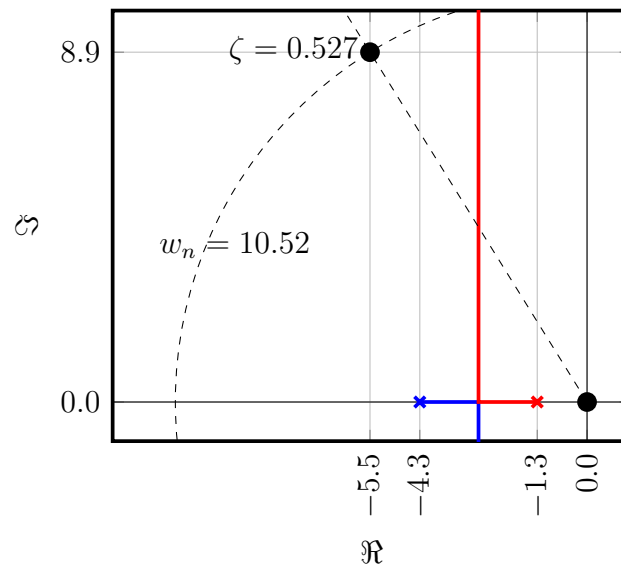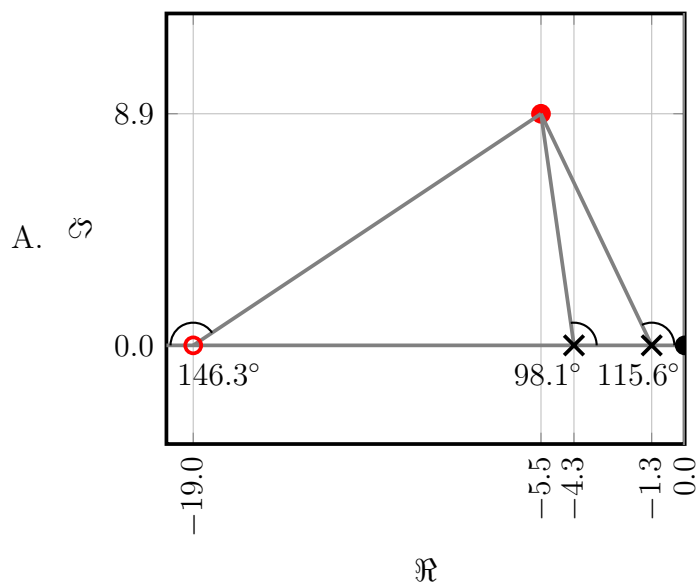
A.

B.

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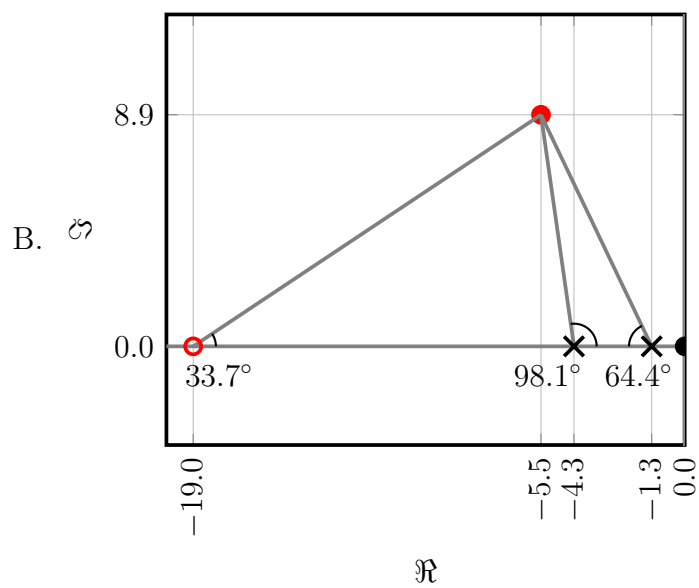

A zero is added so that the root-locus passes through this design point. Which of the following represents the correct angle condition for this design?
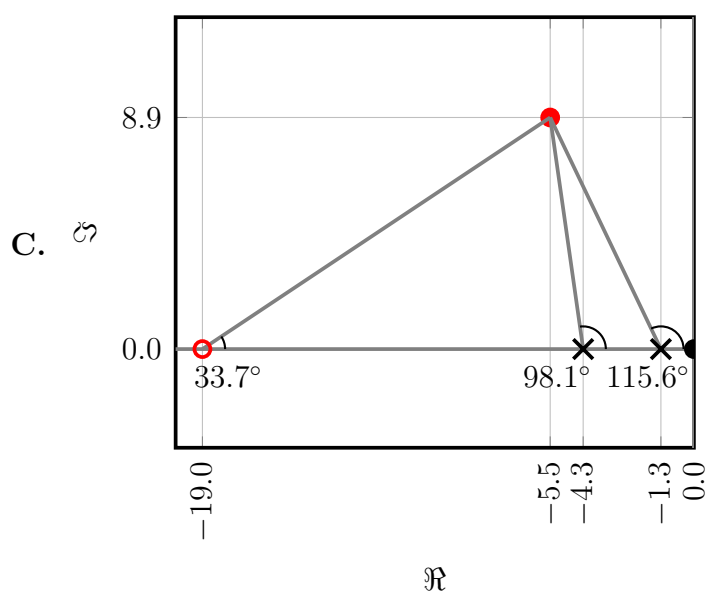
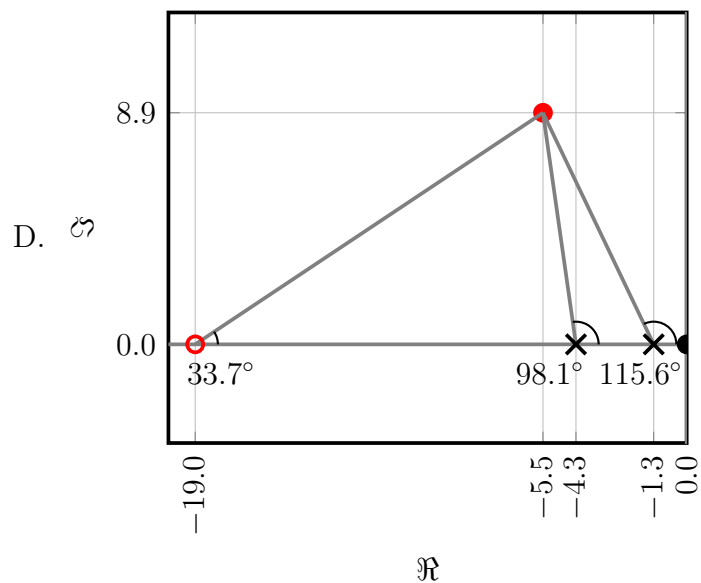$$\sum \theta = 115.6^\circ + 98.1^\circ + 146.3^\circ = 360.0^\circ$$
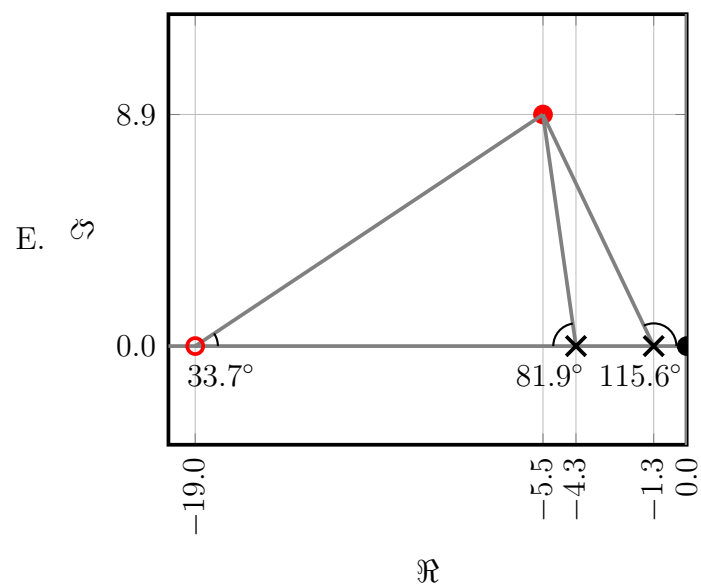
A.

B.

$$\sum \theta = 64.4° + 98.1° + 33.7° = 196.2°$$

C.

$$\sum \theta = 115.6° + 98.1° - 33.7° = 180.0°$$

$$\sum \theta = 115.6° + 98.1° + 33.7° = 247.3°$$

D.

$$\sum \theta = 115.6° + 81.9° + 33.7° = 231.1°$$

E.

Q	A
1	B
2	A
3	C