1. (35 points) An open-loop transfer function is given by,
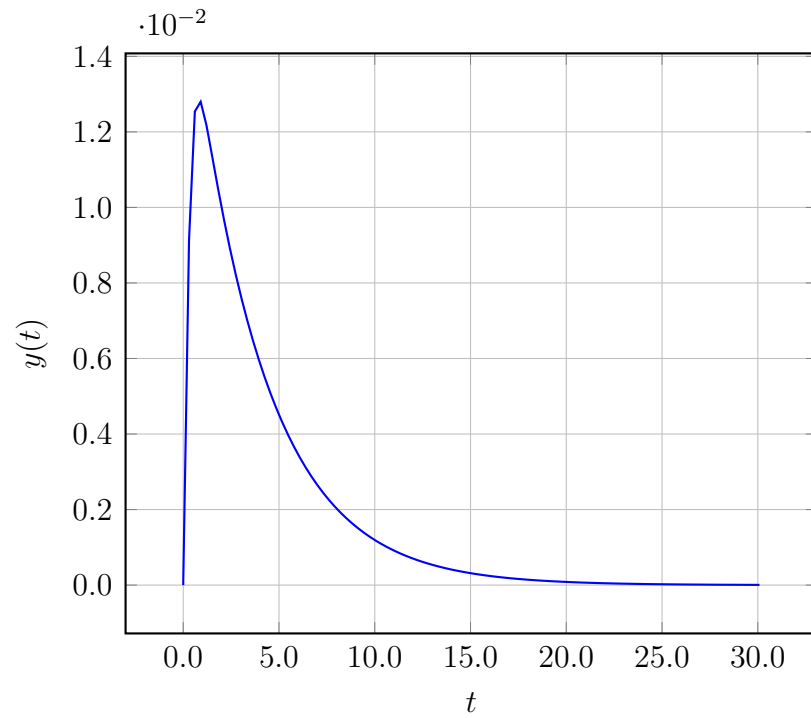
$$G(s) = \frac{1}{s^3 + 2.0s^2 + 3.32323s + 7.32323}$$

Which of the following PI controllers stabilizes the system in a unit-feedback closed-loop configuration?
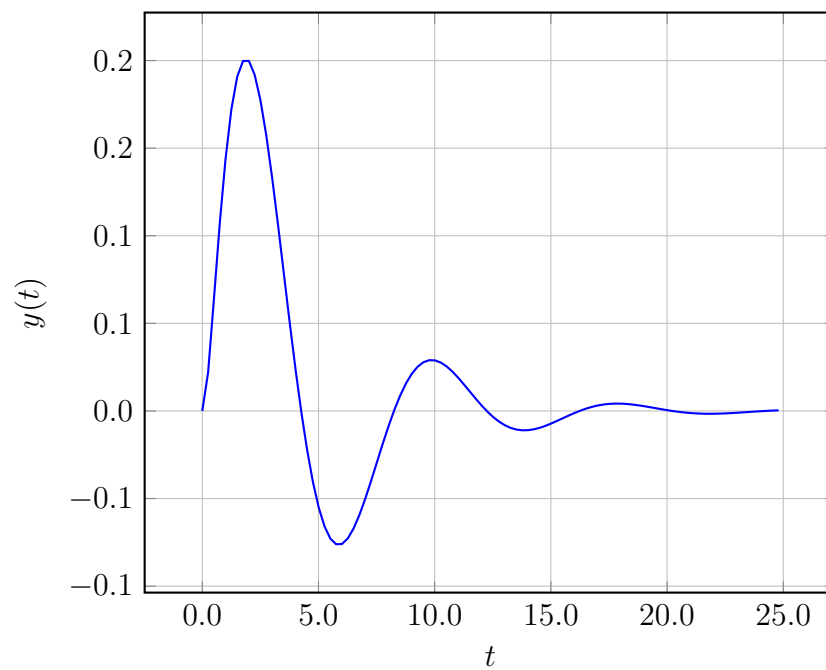
   A. $F(s) = -3.14645 + \frac{0.82323}{s}$

   B. $F(s) = -8.70708 + \frac{1.64645}{s}$

   C. $F(s) = -8.06061 + \frac{3.14645}{s}$

   D. $F(s) = 2.43939 + \frac{1.64645}{s}$

   E. $F(s) = 1.79292 + \frac{3.14645}{s}$

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?
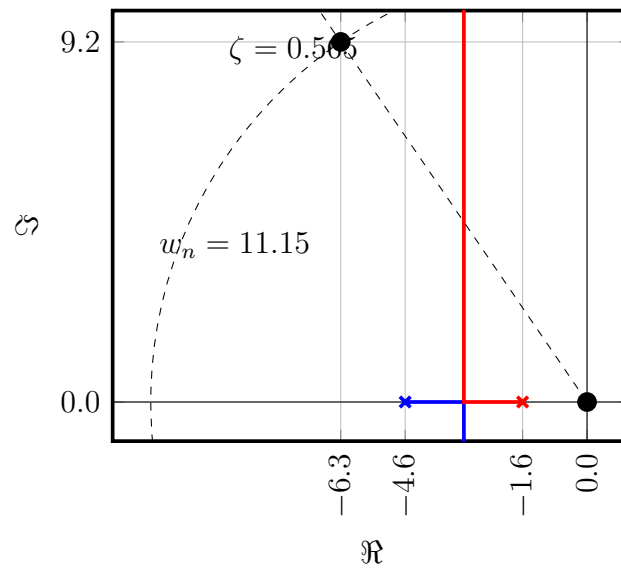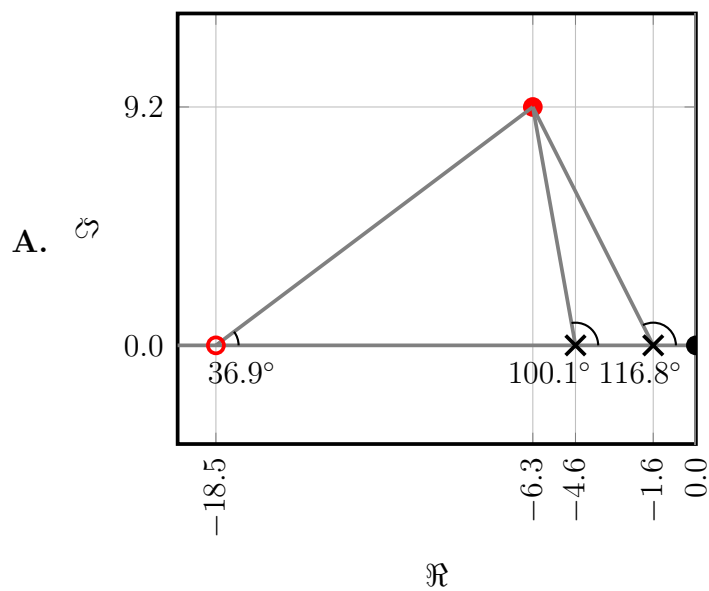
A.

B.

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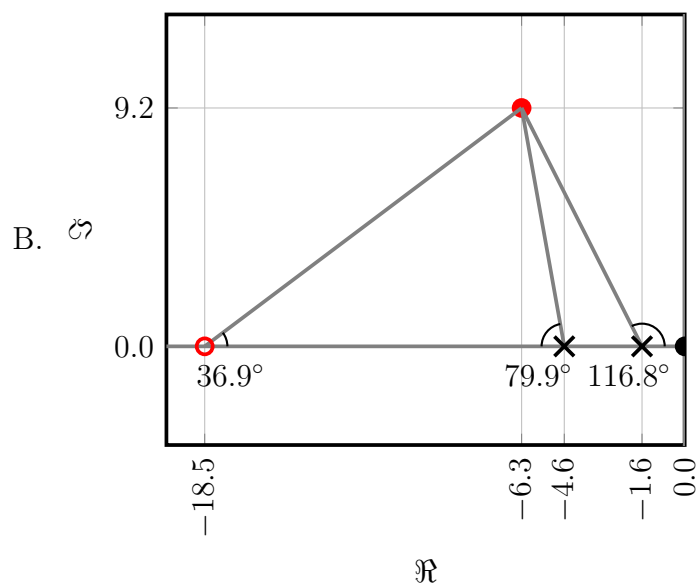

A zero is added so that the root-locus passes through this design point. Which of the following represents the correct angle condition for this design?
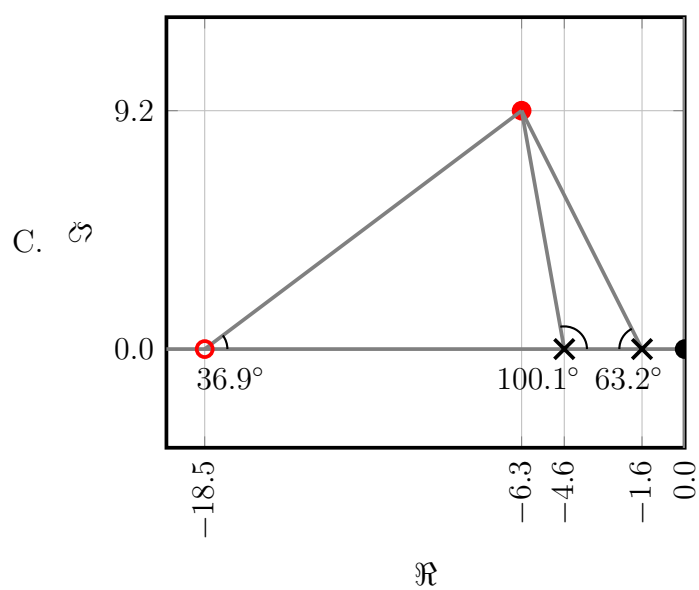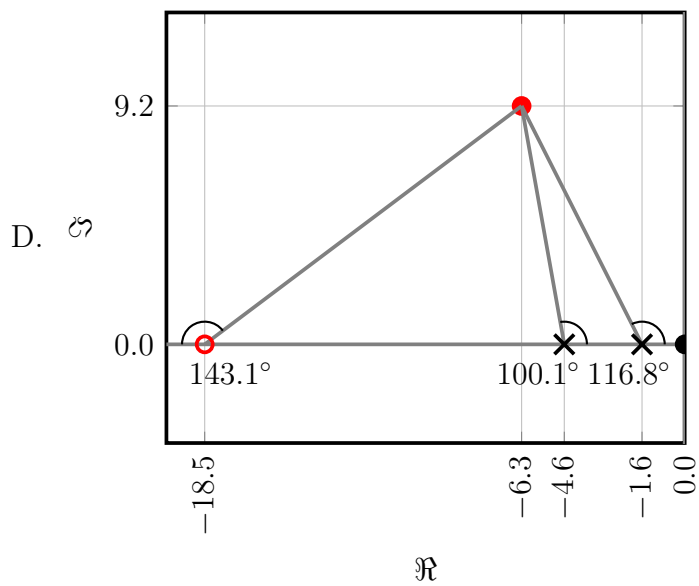
$$\sum \theta = 116.8° + 100.1° - 36.9° = 180.0°$$

A.

B.
$$\sum \theta = 116.8° + 79.9° + 36.9° = 233.6°$$

C.
$$\sum \theta = 63.2° + 100.1° + 36.9° = 200.3°$$

$$\sum \theta = 116.8° + 100.1° + 143.1° = 360.0°$$

D. $\Im$

9.2

0.0

143.1°   100.1° 116.8°

−18.5   −6.3 −4.6   −1.6 0.0

$\Re$

$$\sum \theta = 116.8° + 100.1° + 36.9° = 253.9°$$

E. $\Im$

9.2

0.0

36.9°   100.1° 116.8°

−18.5   −6.3 −4.6   −1.6 0.0

$\Re$

Q	A
1	A
2	A
3	A