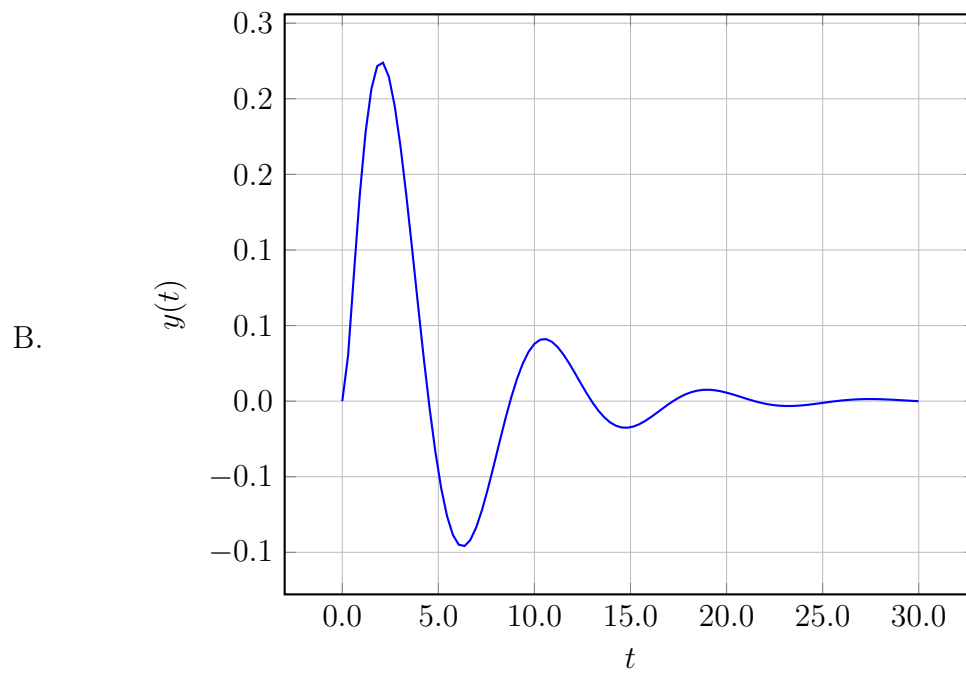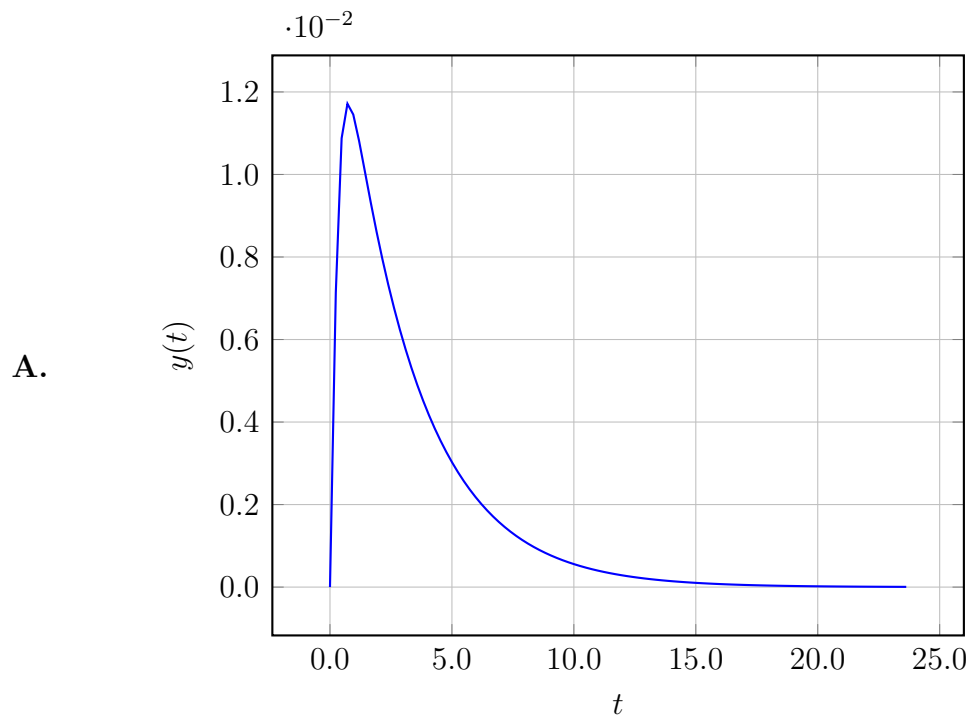1. (35 points) An open-loop transfer function is given by,

$$G(s) = \frac{1}{s^3 + 2.0s^2 + 3.26767s + 7.26767}$$
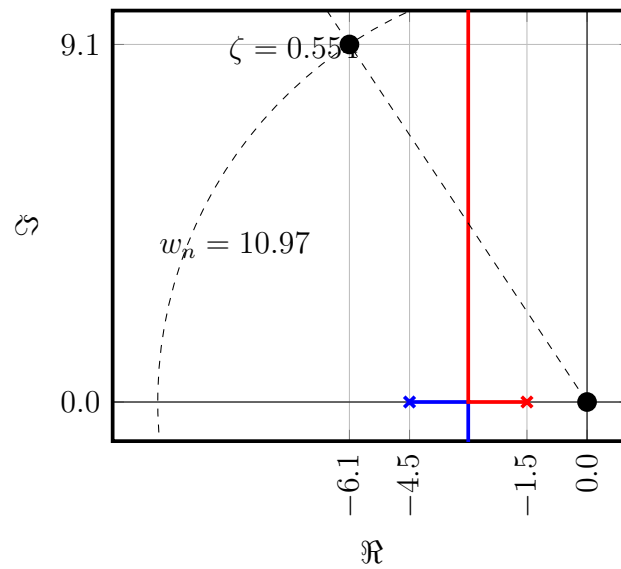
Which of the following PI controllers stabilizes the system in a unit-feedback closed-loop configuration?

    A. $F(s) = 1.5707 + \frac{3.03534}{s}$

    B. $F(s) = -8.9293 + \frac{1.53534}{s}$

    C. $F(s) = -3.03534 + \frac{0.76767}{s}$

    D. $F(s) = -8.39395 + \frac{3.03534}{s}$

    E. $F(s) = 2.10605 + \frac{1.53534}{s}$

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?
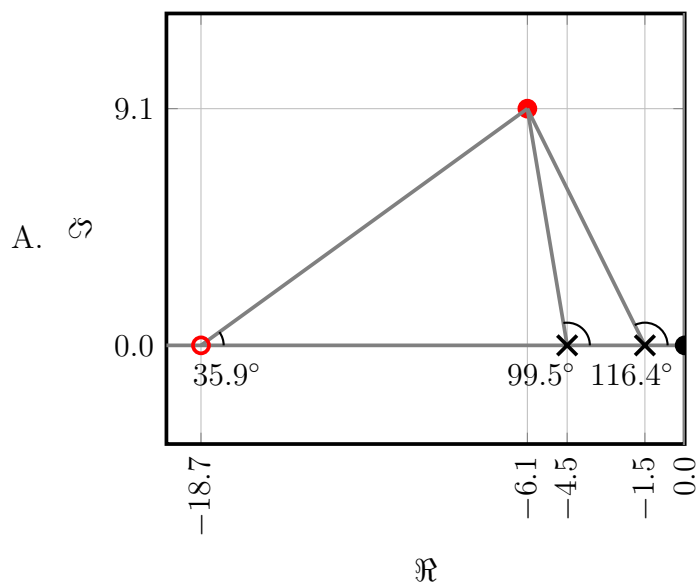
A.

B.

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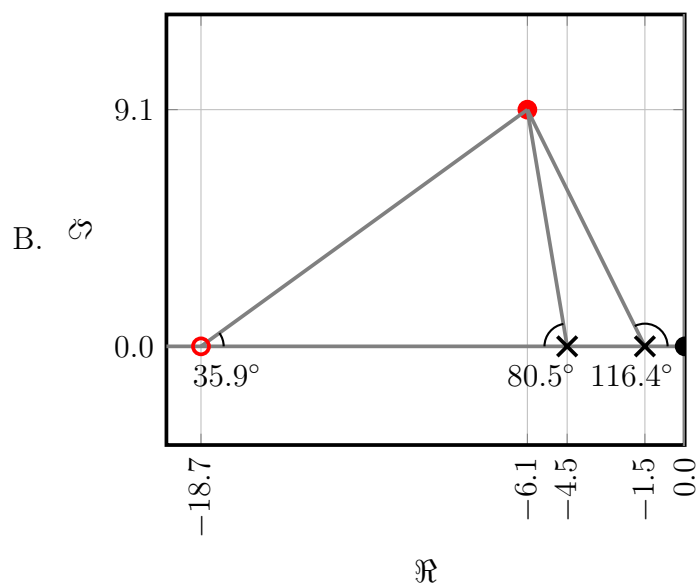

A zero is added so that the root-locus passes through this design point. Which of the following represents the correct angle condition for this design?
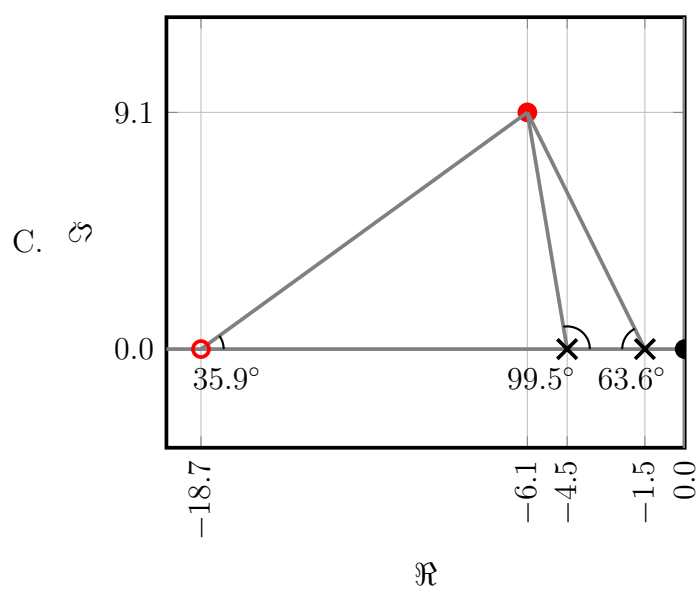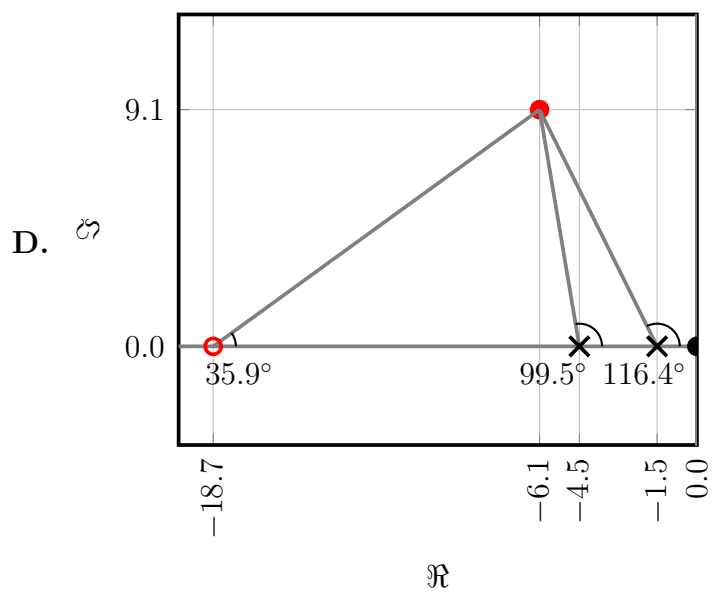
$$\sum \theta = 116.4° + 99.5° + 35.9° = 251.9°$$

A.

$$\sum \theta = 116.4°+80.5°+35.9° = 232.8°$$

B. $\Im$

9.1

0.0

35.9°   80.5° 116.4°

−18.7   −6.1 −4.5 −1.5 0.0

$\Re$

$$\sum \theta = 63.6° + 99.5° + 35.9° = 199.1°$$

C. $\Im$

9.1

0.0

35.9°   99.5°   63.6°

−18.7   −6.1 −4.5 −1.5 0.0

$\Re$

$$\sum \theta = 116.4° + 99.5° - 35.9° = 180.0°$$

D.

$$\sum \theta = 116.4° + 99.5° + 144.1° = 360.0°$$

E.

Q	A
1	C
2	A
3	D