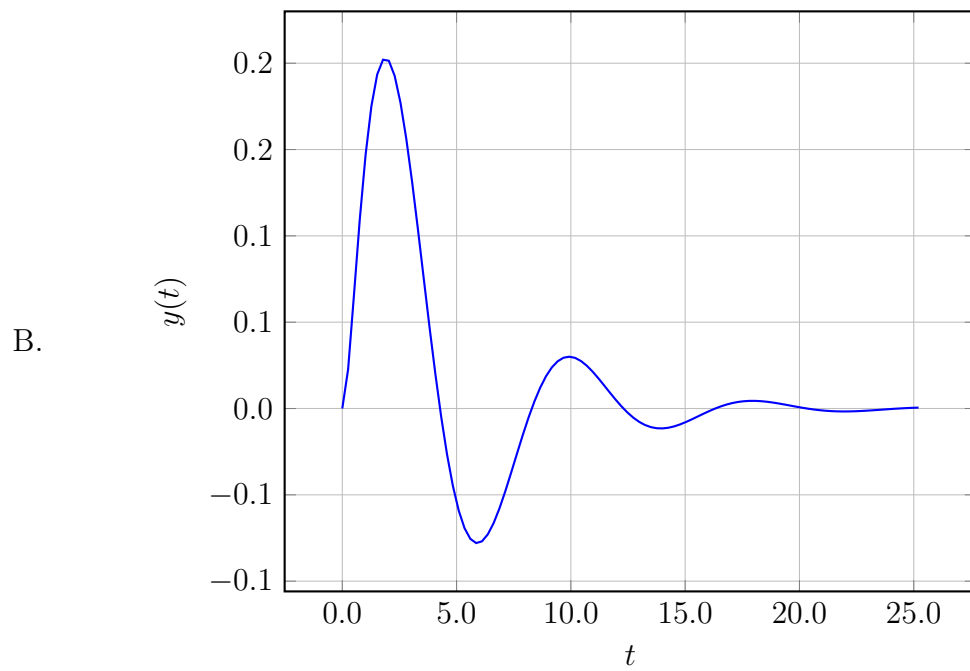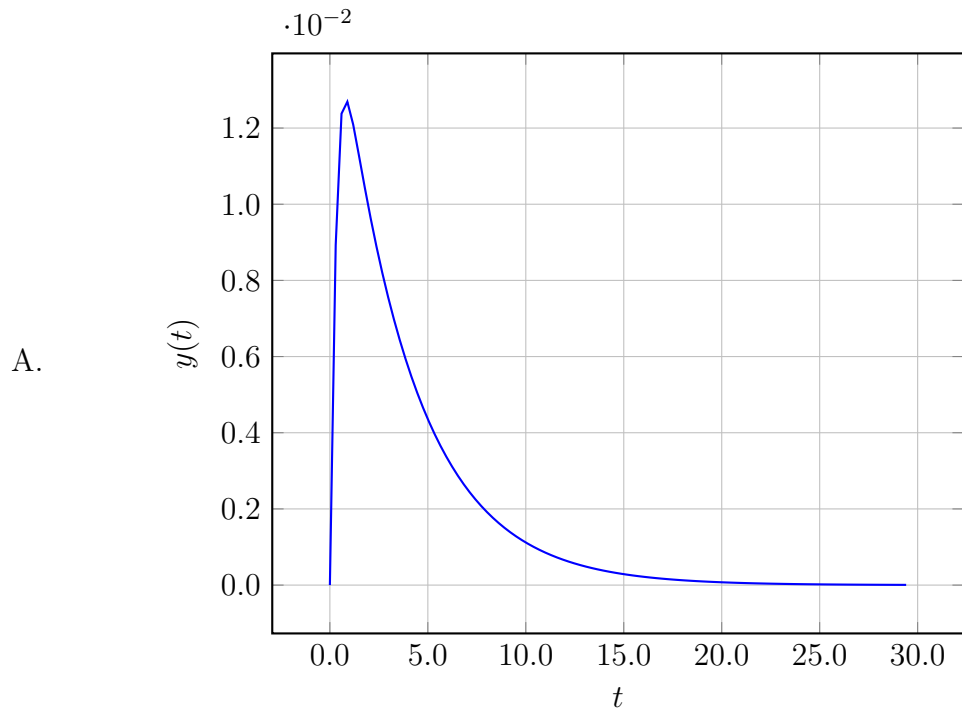1. (35 points) An open-loop transfer function is given by,

$$G(s) = \frac{1}{s^3 + 2.0s^2 + 3.31818s + 7.31818}$$
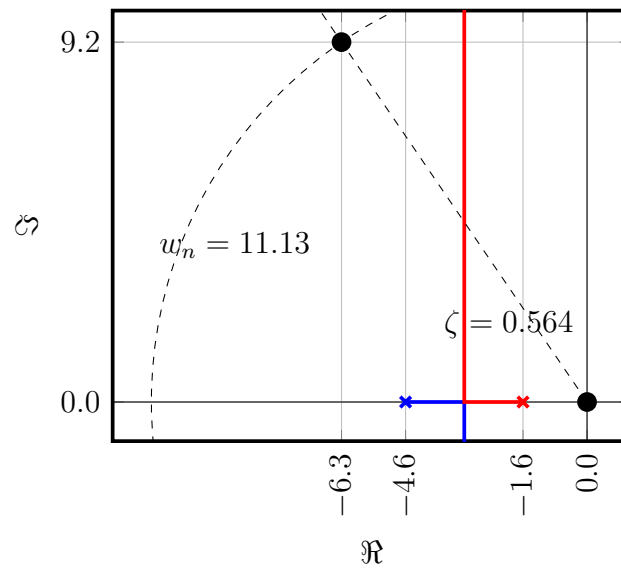
Which of the following PI controllers stabilizes the system in a unit-feedback closed-loop configuration?

A. $F(s) = 1.77272 + \frac{3.13635}{s}$

B. $F(s) = -8.09091 + \frac{3.13635}{s}$

C. $F(s) = -3.13635 + \frac{0.81818}{s}$

D. $F(s) = 2.40909 + \frac{1.63635}{s}$

E. $F(s) = -8.72728 + \frac{1.63635}{s}$

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?
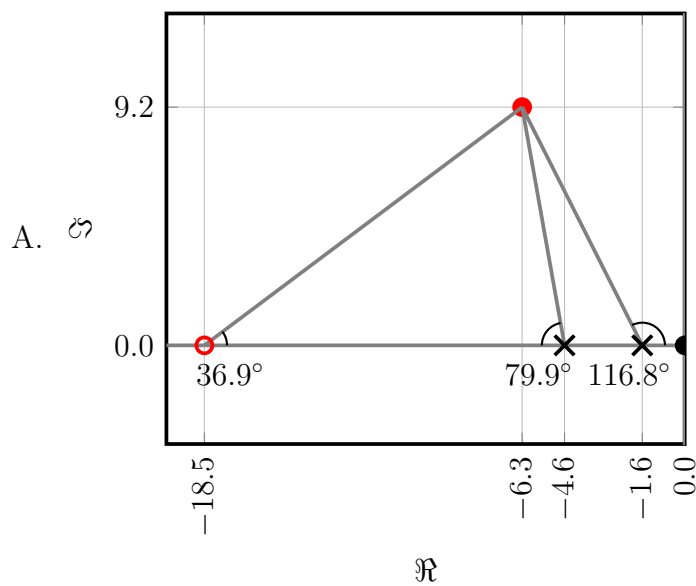
A.

B.

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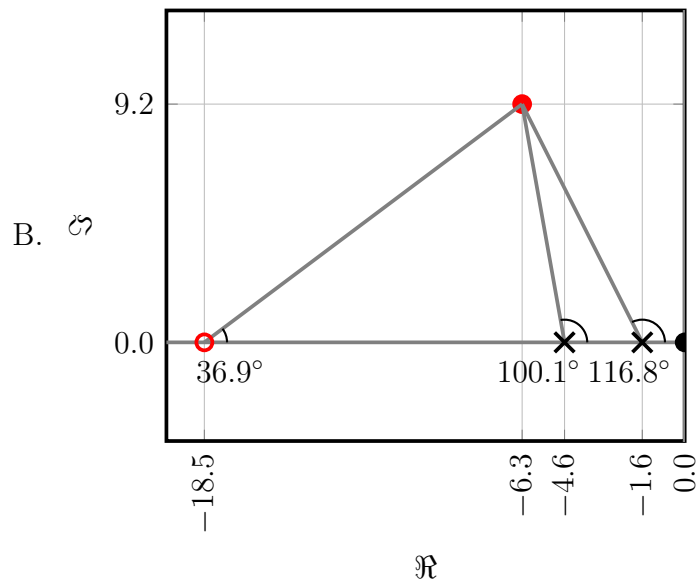   below.

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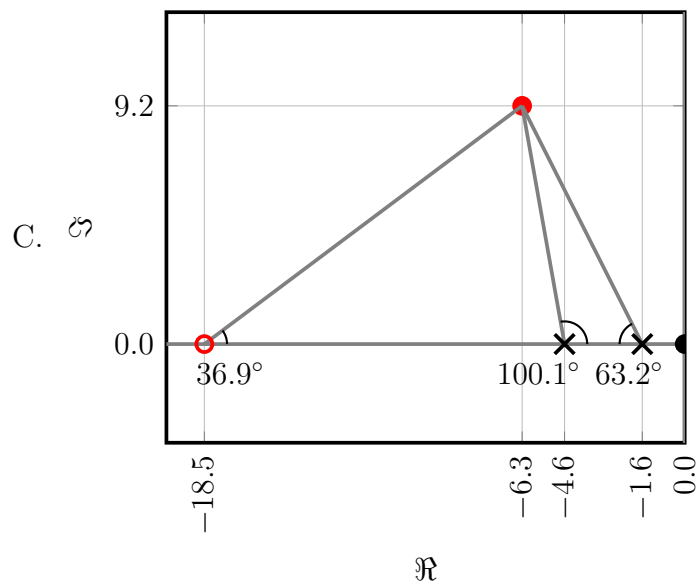the following represents the correct angle condition for this design?

$$\sum \theta = 116.8° + 79.9° + 36.9° =$$

A.

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

B.

$$\sum \theta = 63.2° + 100.1° + 36.9° =$$

C.

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

D.