1. (35 points) An open-loop transfer function is given by,
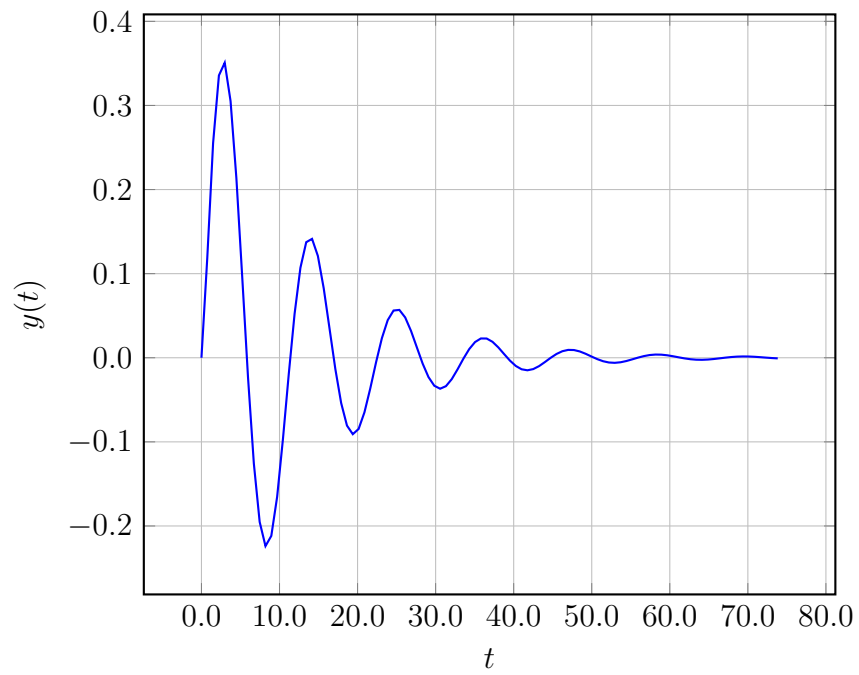
$$G(s) = \frac{1}{s^3 + 2.0s^2 + 3.0707s + 7.0707}$$

Which of the following PI controllers stabilizes the system in a unit-feedback closed-loop configuration?
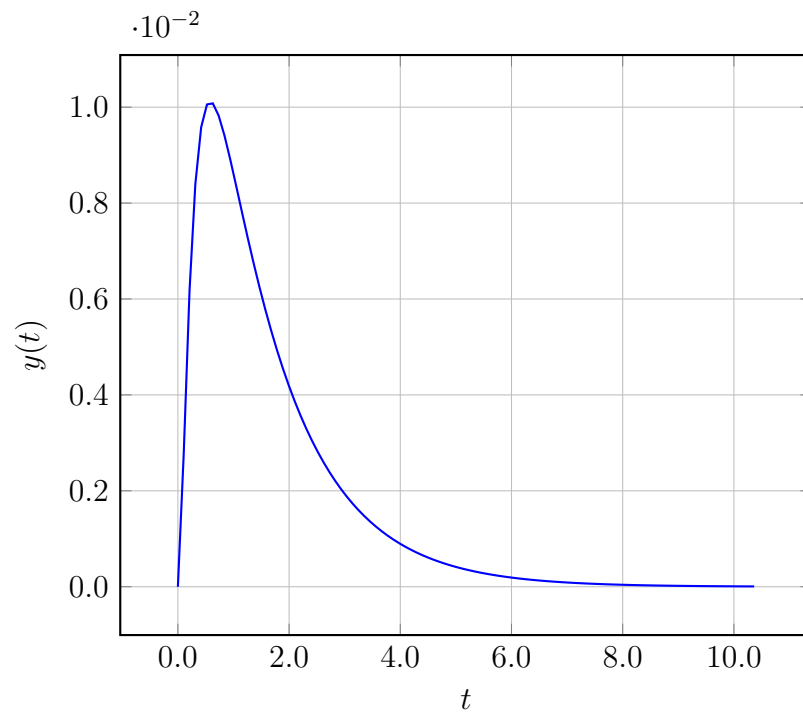
A. $F(s) = -2.6414 + \frac{0.5707}{s}$

B. $F(s) = -9.57576 + \frac{2.6414}{s}$

C. $F(s) = -9.71718 + \frac{1.1414}{s}$

D. $F(s) = 0.92424 + \frac{1.1414}{s}$

E. $F(s) = 0.78282 + \frac{2.6414}{s}$

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?
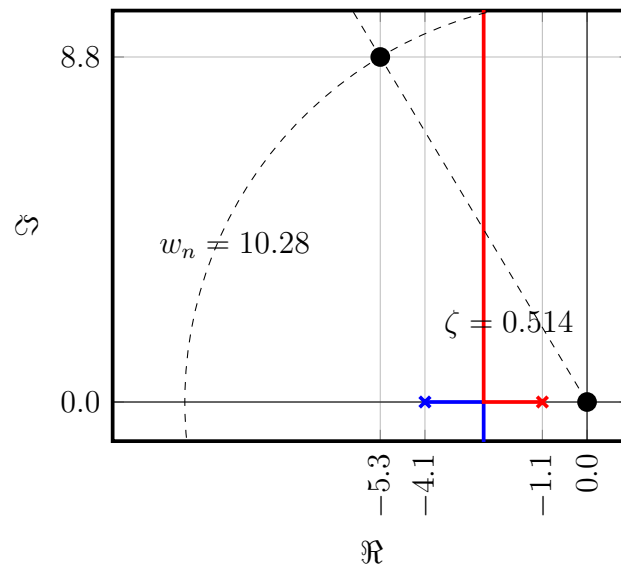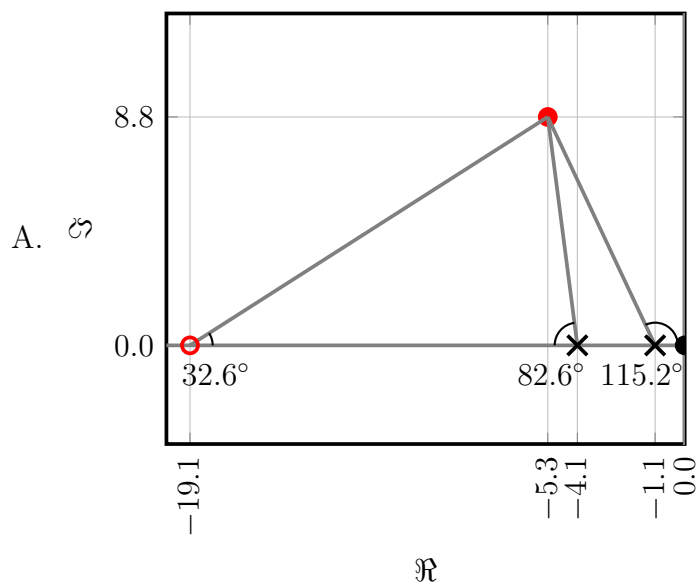
A.

B.

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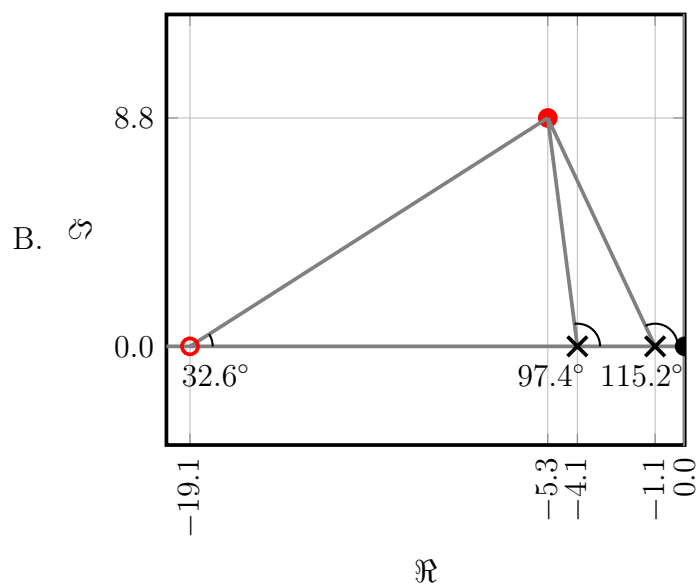

$w_n = 10.28$

$\zeta = 0.514$

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?
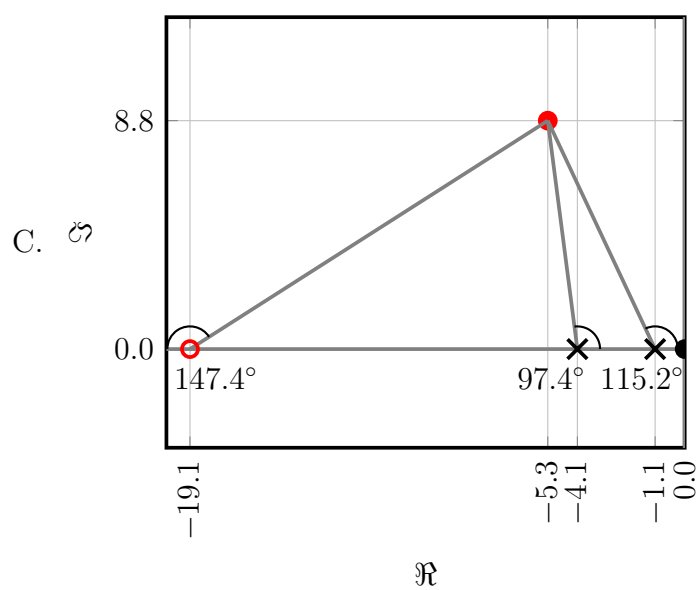
$$\sum \theta = 115.2° + 82.6° + 32.6° =$$

A.

$32.6°$ $82.6°$ $115.2°$

B.

$$\sum \theta = 115.2° + 97.4° + 32.6° =$$

C.

$$\sum \theta = 115.2° + 97.4° + 147.4° =$$

$$\sum \theta = 64.8° + 97.4° + 32.6° =$$

D.

$$\sum \theta = 115.2° + 97.4° - 32.6° =$$

E.