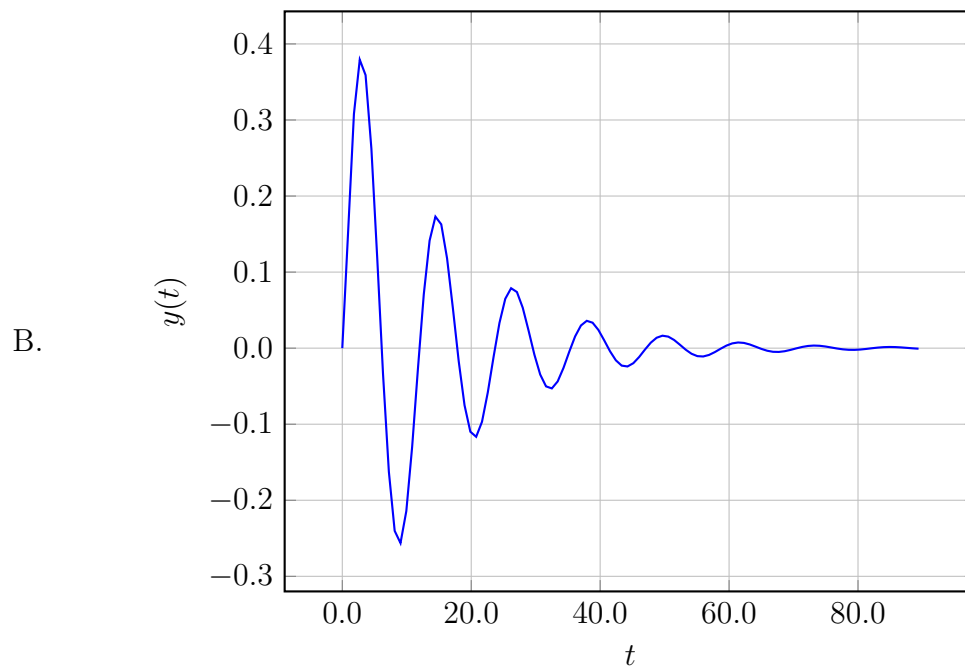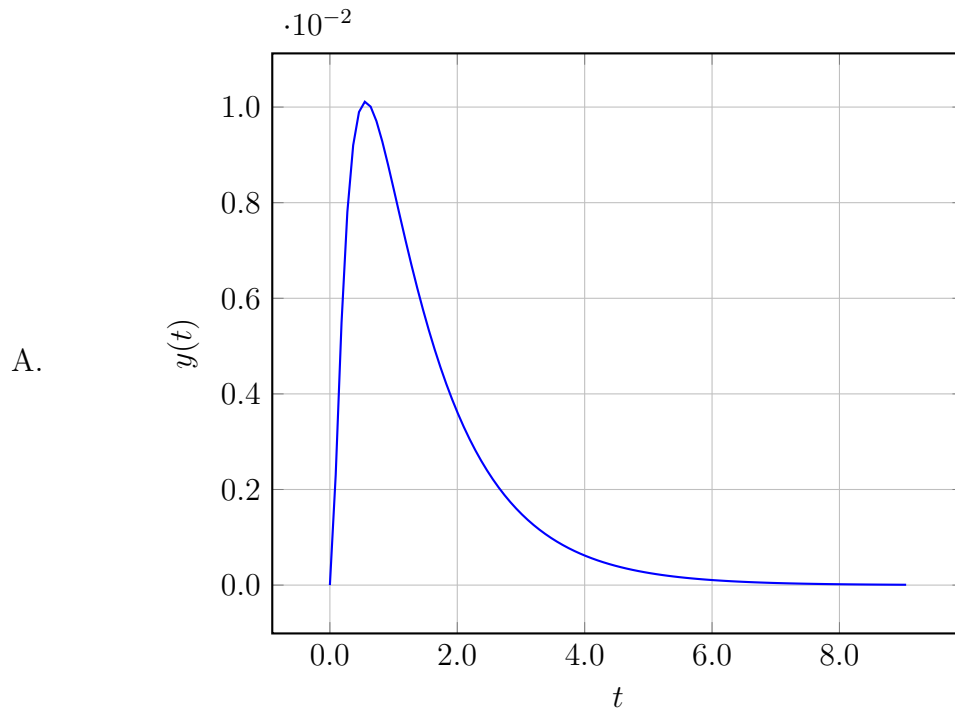1. (35 points) An open-loop transfer function is given by,

$$G(s) = \frac{1}{s^3 + 2.0s^2 + 3.04039s + 7.04039}$$
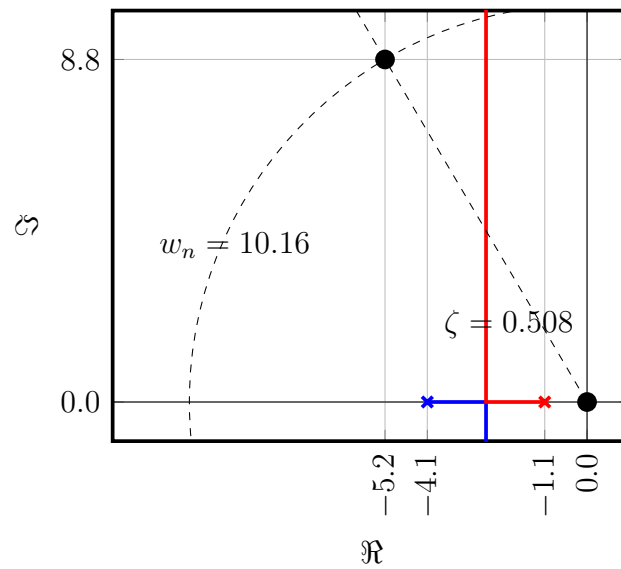
Which of the following PI controllers stabilizes the system in a unit-feedback closed-loop configuration?

A. $F(s) = 0.6616 + \frac{2.5808}{s}$

B. $F(s) = 0.74242 + \frac{1.0808}{s}$

C. $F(s) = -9.75758 + \frac{2.5808}{s}$

D. $F(s) = -9.8384 + \frac{1.0808}{s}$

E. $F(s) = -2.5808 + \frac{0.54039}{s}$

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?
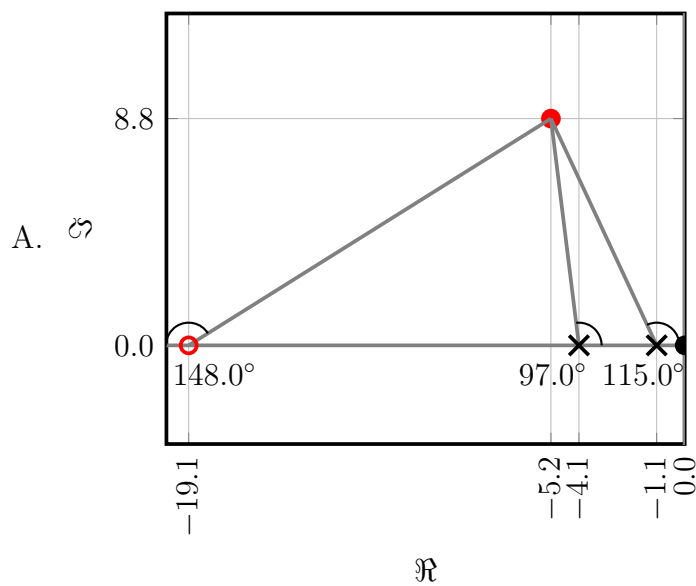
A.

B.

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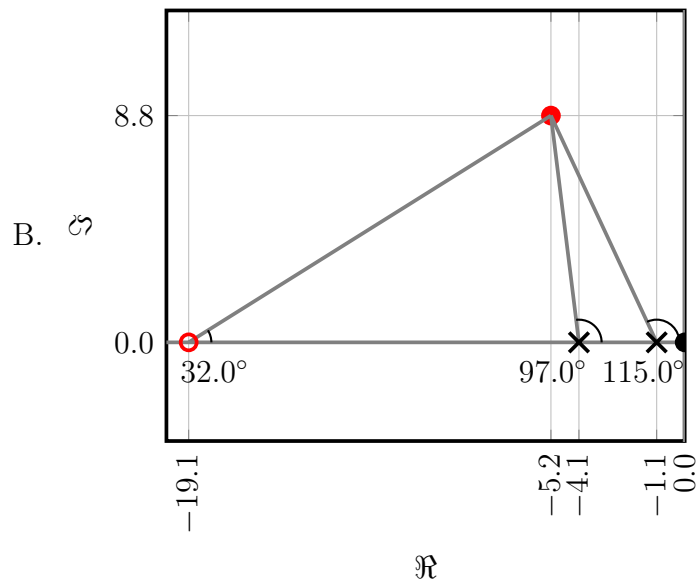

A zero is added so that the root-locus passes through this design point. Which of the following represents the correct angle condition for this design?
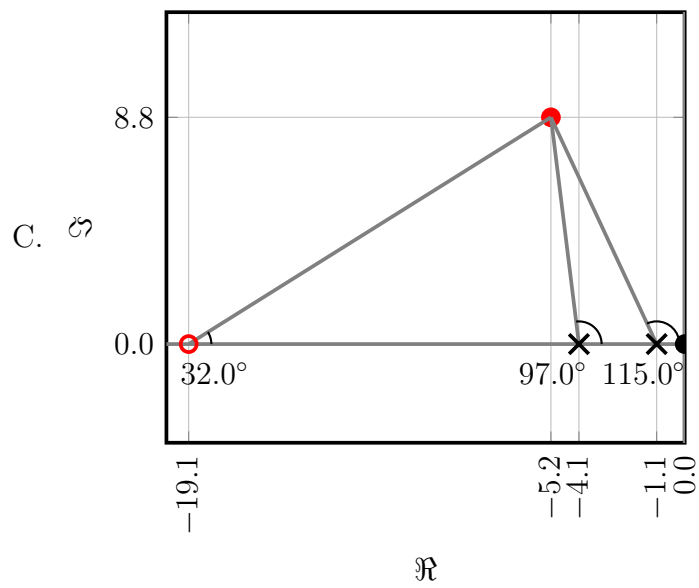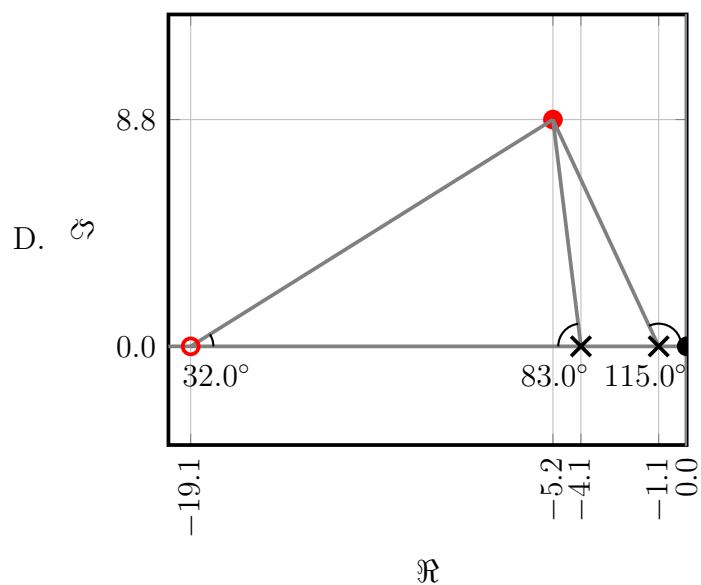
$$\sum \theta = 115.0° + 97.0° + 148.0° =$$

A.

B.

$$\sum \theta = 115.0° + 97.0° + 32.0° =$$

C.

$$\sum \theta = 115.0° + 97.0° - 32.0° =$$

D.

$$\sum \theta = 115.0° + 83.0° + 32.0° =$$

E.

$$\sum \theta = 65.0° + 97.0° + 32.0° =$$