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

$$G(s) = \frac{1}{s^3 + 2.0s^2 + 3.05554s + 7.05554}$$

which of the following PI-controllers stabilizes the system in a closed-loop unit feedback structure?

A. $F(s) = -9.77779 + \frac{1.1111}{s}$

**B.** $F(s) = -2.6111 + \frac{0.55554}{s}$

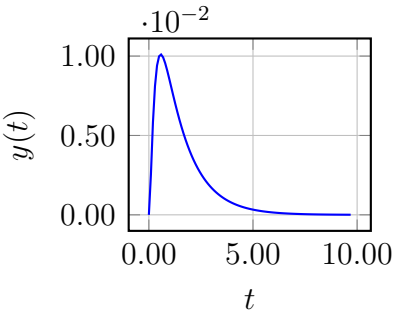
C. $F(s) = 0.83333 + \frac{1.1111}{s}$

D. $F(s) = 0.72221 + \frac{2.6111}{s}$

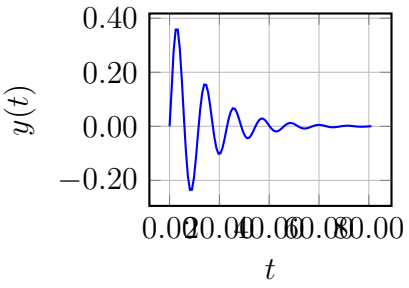
E. $F(s) = -9.66667 + \frac{2.6111}{s}$

2. (35 points) Which of the following does not overshoot?

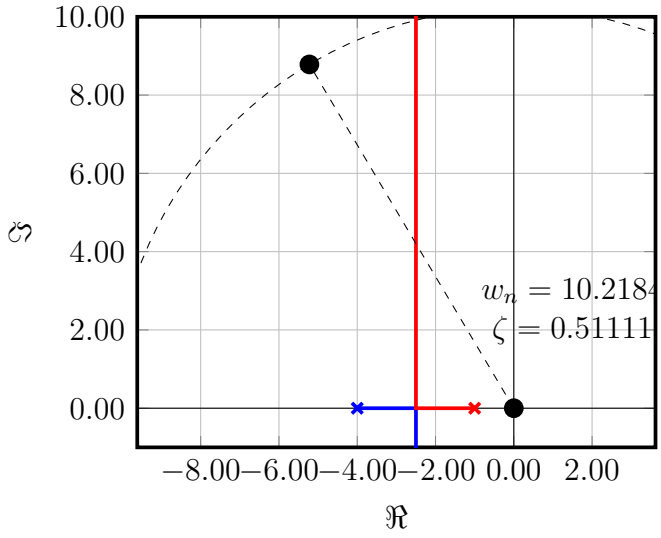
**A.**




B.

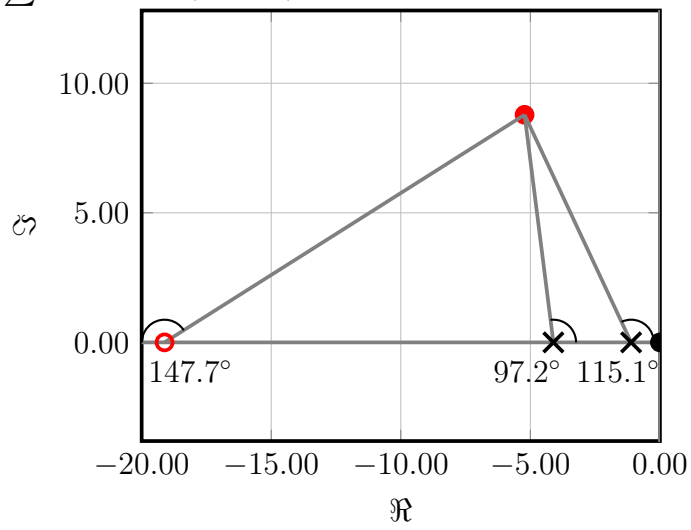



3. (30 points) Time-domain criteria is give as settling time $t_s = 1\,s$ and overshoot $os = 10\%$. The root-locus plot for the P-type controller design is depicted below.

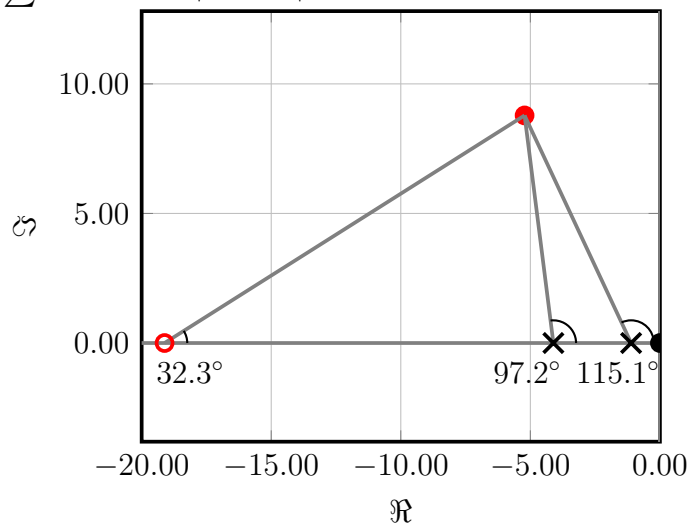



Upgrading the controller to a PD-type controller which of the following angle conditions need to be used?

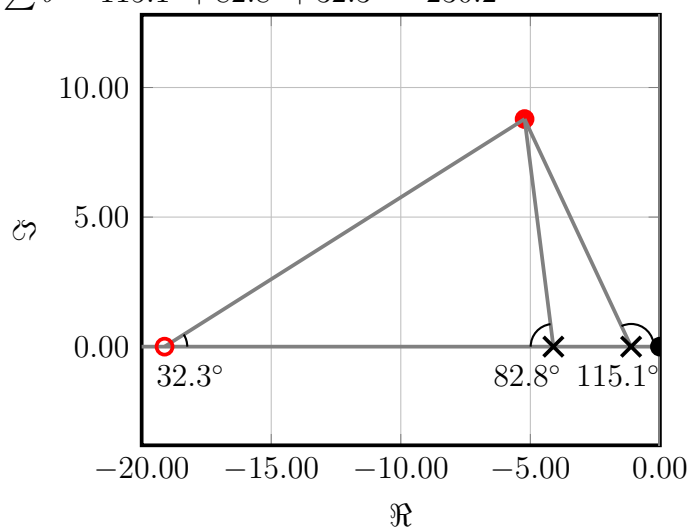
A. $\sum \theta = 115.1° + 97.2° + 147.7° = 360.0°$



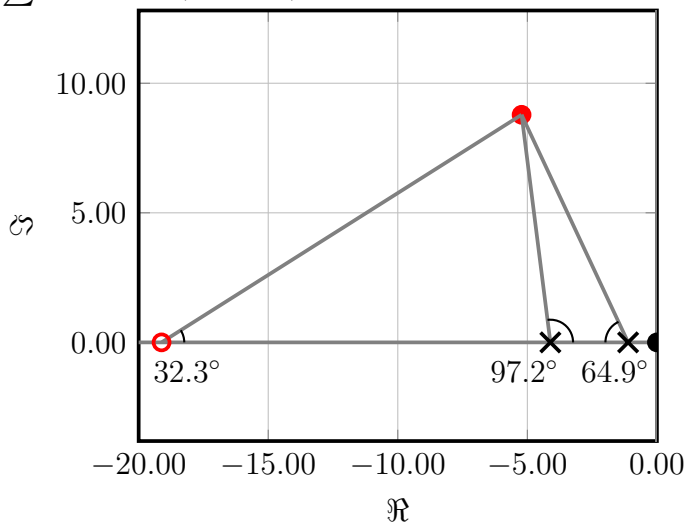

B. $\sum \theta = 115.1° + 97.2° + 32.3° = 244.6°$



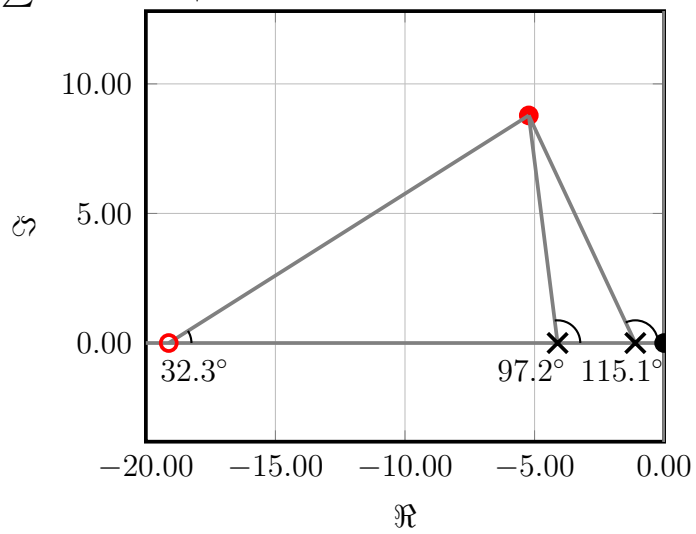

C. $\sum \theta = 115.1° + 82.8° + 32.3° = 230.2°$



D. $\sum \theta = 64.9° + 97.2° + 32.3° = 194.4°$




**E.** $\sum \theta = 115.1° + 97.2° - 32.3° = 180.0°$




| Q | A |
|---|---|
| 1 | B |
| 2 | A |
| 3 | E |