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

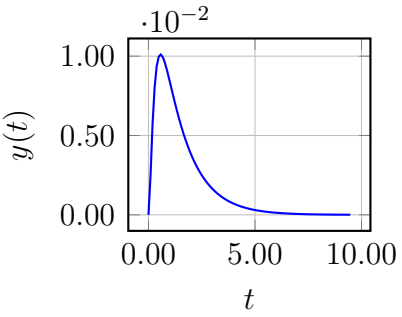
$$G(s) = \frac{1}{s^3 + 2.0s^2 + 3.05049s + 7.05049}$$

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

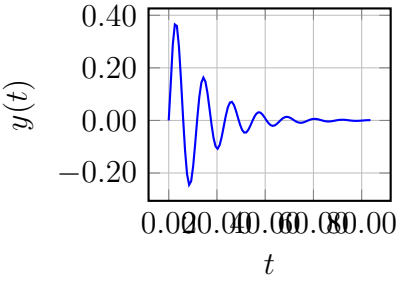
A. $F(s) = 0.80302 + \frac{1.101}{s}$
B. $F(s) = -9.79799 + \frac{1.101}{s}$
C. $F(s) = -9.69698 + \frac{2.601}{s}$
D. $F(s) = 0.70201 + \frac{2.601}{s}$
E. $F(s) = -2.601 + \frac{0.55049}{s}$

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

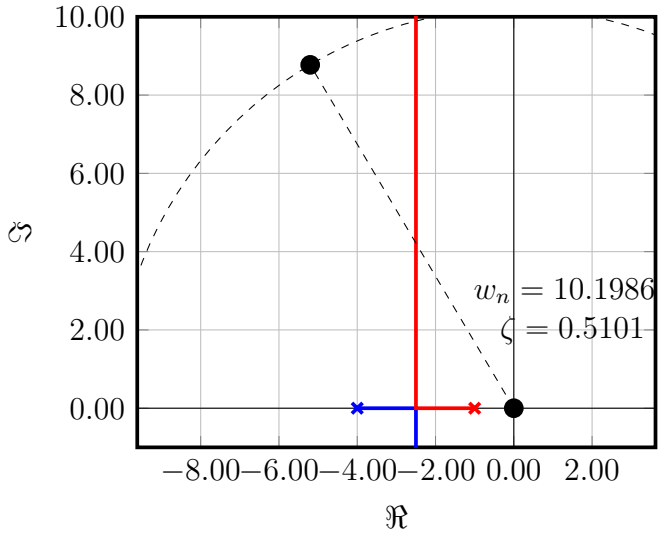
A.



B.



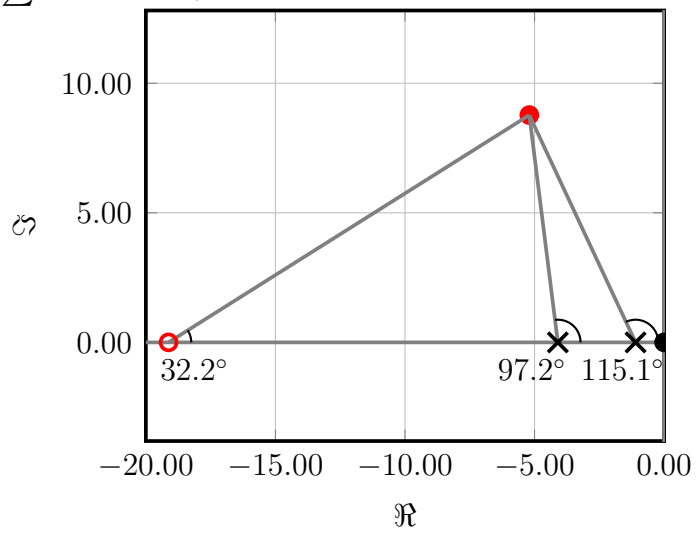
3. (30 points) Time-domain criteria is give as settling time $t_s = 1\,s$ and overshoot $os = 10\%$. The root-locus plot for the P-type controller design is depicted below.



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

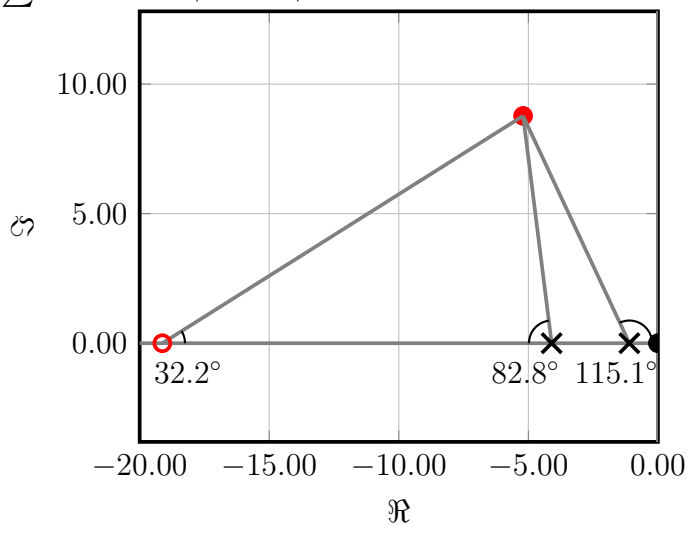
A.

$$\sum \theta = 115.1° + 97.2° - 32.2° = 180.0°$$



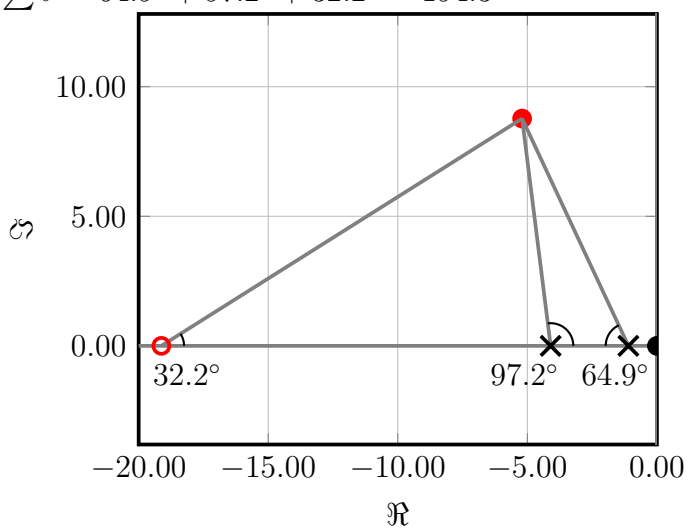
B.

$$\sum \theta = 115.1° + 82.8° + 32.2° = 230.1°$$

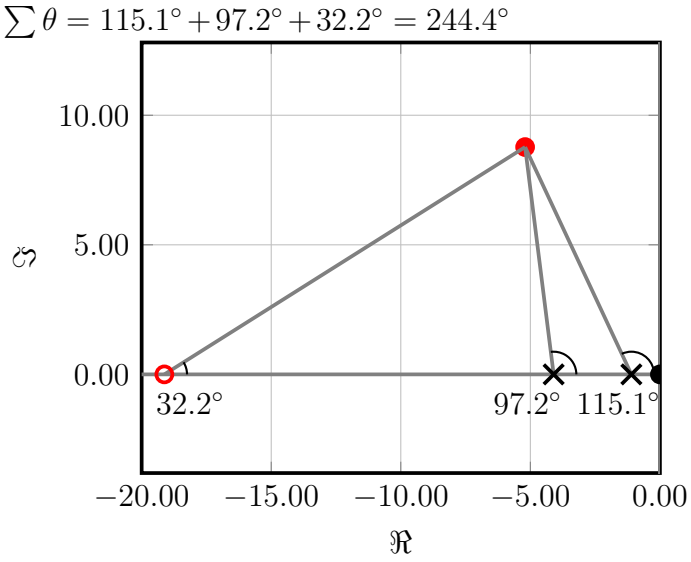


C.

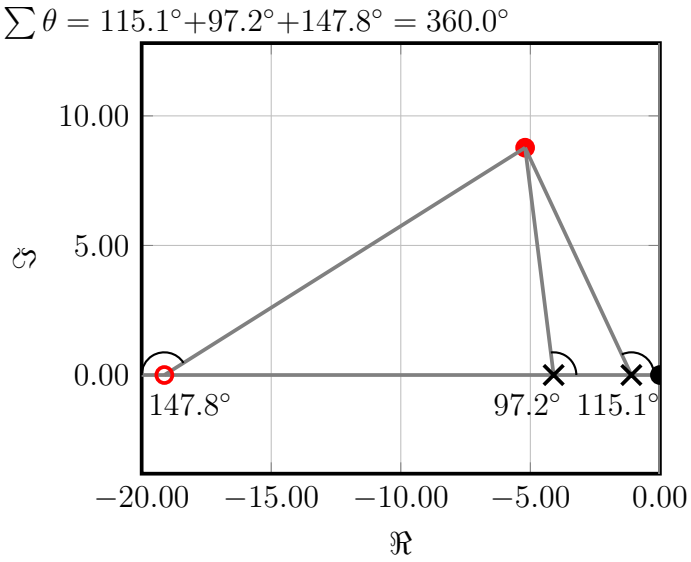
$$\sum \theta = 64.9° + 97.2° + 32.2° = 194.3°$$



D.


$\sum \theta = 115.1° + 97.2° + 32.2° = 244.4°$
10.00
5.00
0.00
$\Im$
32.2°
97.2°
115.1°
−20.00
−15.00
−10.00
−5.00
0.00
$\Re$

E.


$\sum \theta = 115.1° + 97.2° + 147.8° = 360.0°$
10.00
5.00
0.00
$\Im$
147.8°
97.2°
115.1°
−20.00
−15.00
−10.00
−5.00
0.00
$\Re$

Q	A
1	E
2	A
3	A