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

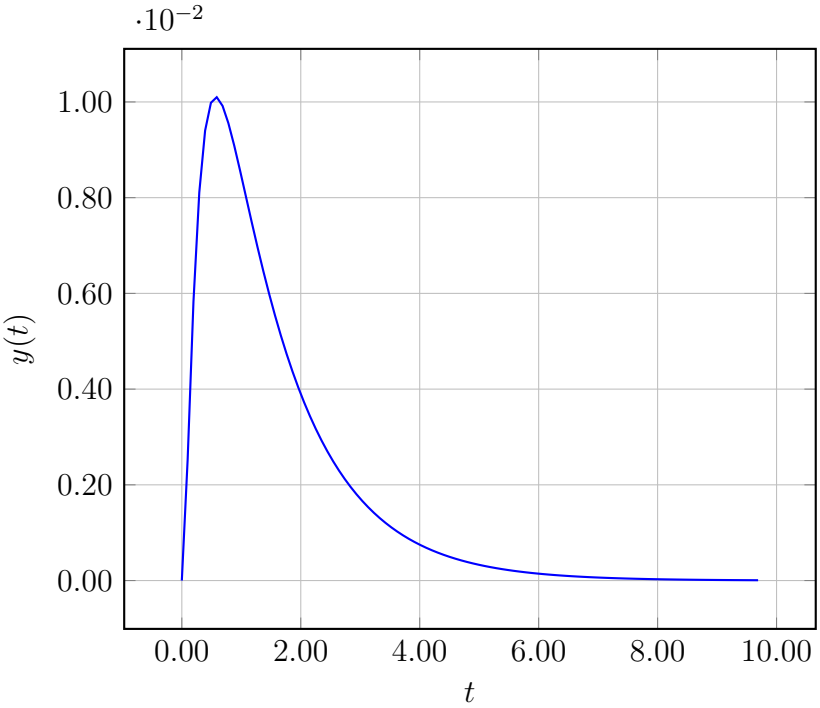
$$G(s) = \frac{1}{s^3 + 2.0s^2 + 3.05554s + 7.05554}$$

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

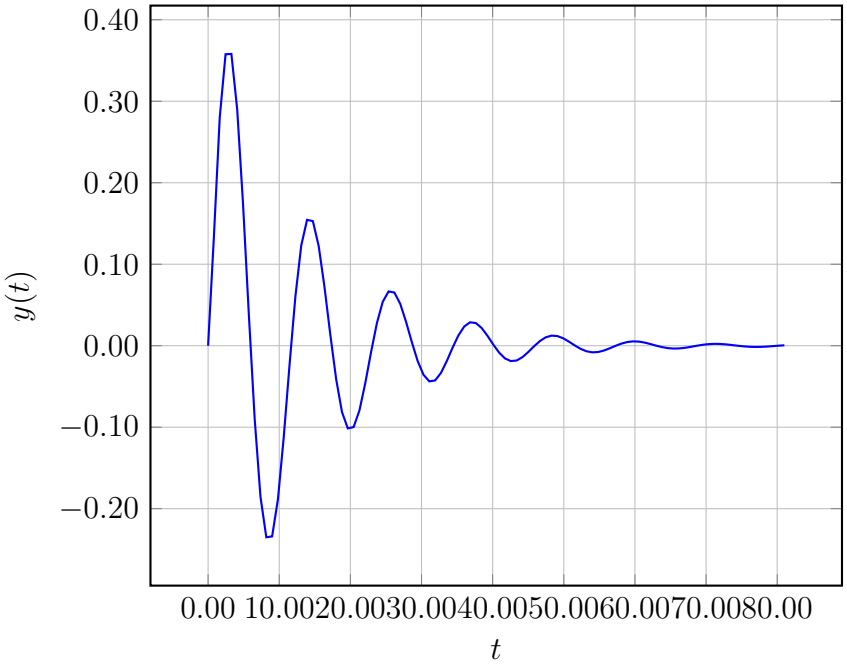
A. $F(s) = -9.77779 + \frac{1.1111}{s}$
B. $F(s) = -2.6111 + \frac{0.55554}{s}$
C. $F(s) = 0.83333 + \frac{1.1111}{s}$
D. $F(s) = 0.72221 + \frac{2.6111}{s}$
E. $F(s) = -9.66667 + \frac{2.6111}{s}$

2. (35 points) Which one of the following unit impulse responses corresponds to a system that does not overshoot when subjected to a unit step input?

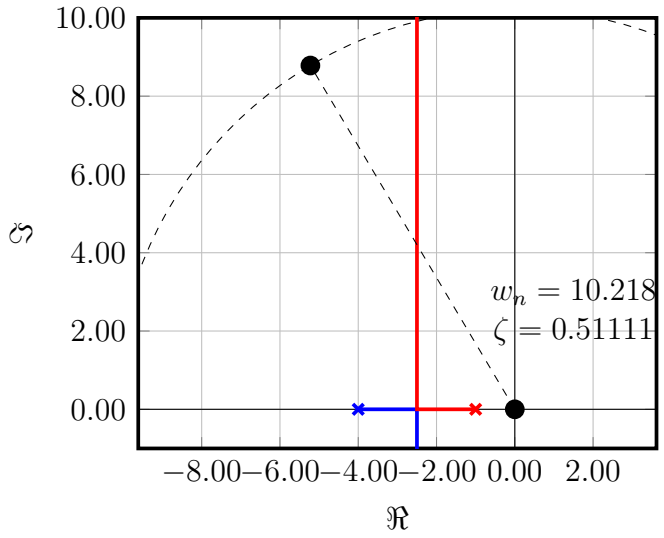
A.



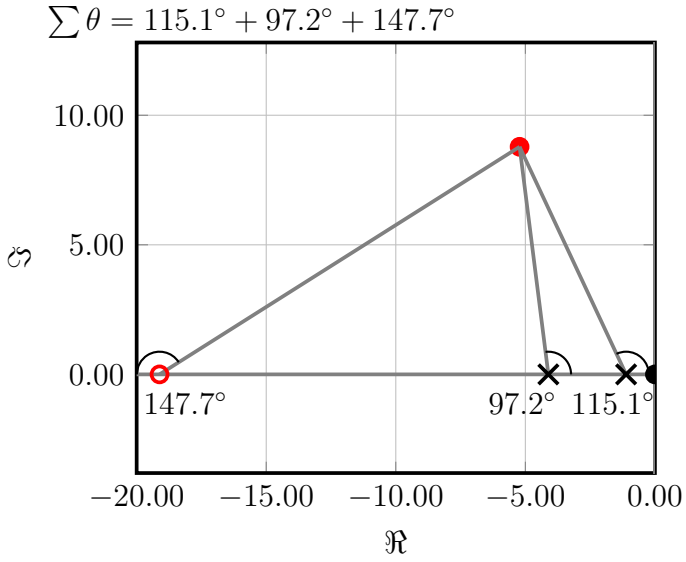
B.



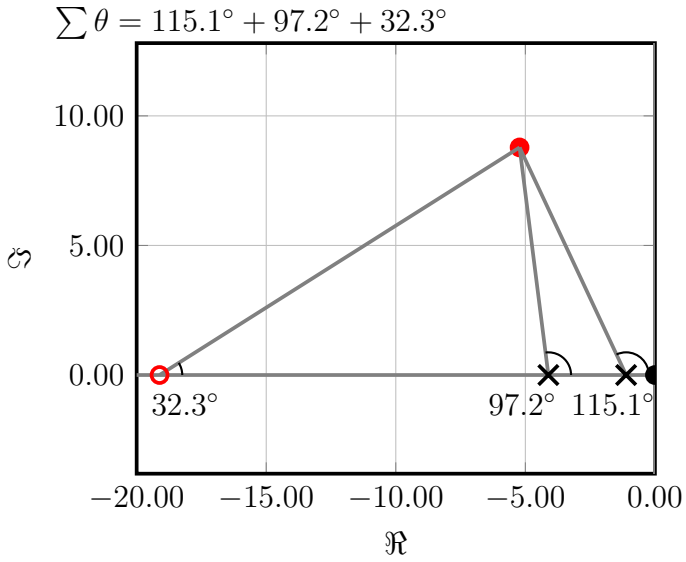
3. (30 points) A design point on the root-locus plot for a P-type controller is shown below. A zero is added so that the root-locus passes through this design point. Which of the following represents the correct angle condition for this design?



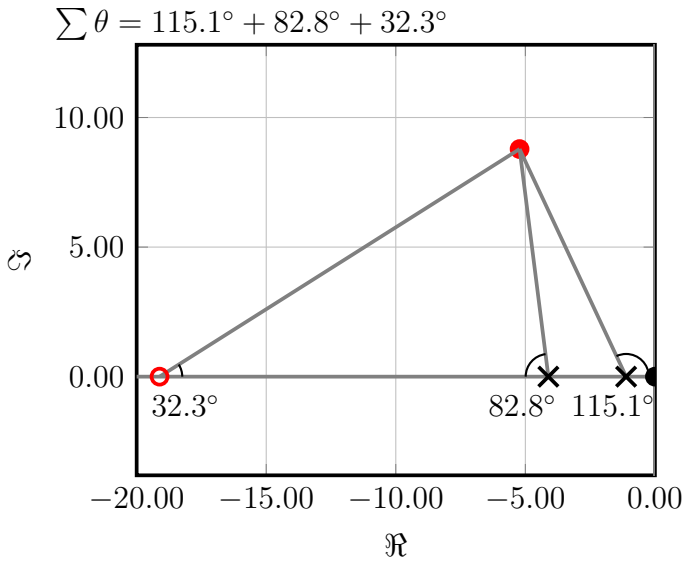
A.


$\sum \theta = 115.1° + 97.2° + 147.7°$
10.00
5.00
0.00
$\Im$
147.7°
97.2°
115.1°
−20.00
−15.00
−10.00
−5.00
0.00
$\Re$

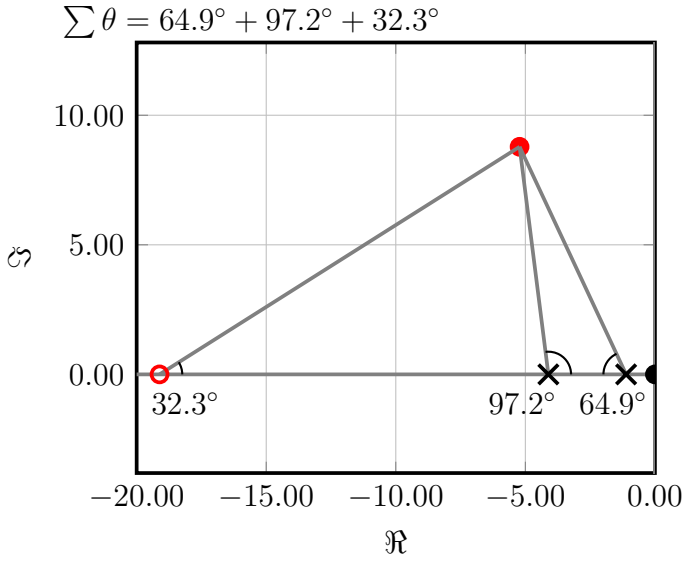
B.


$\sum \theta = 115.1° + 97.2° + 32.3°$
10.00
5.00
0.00
$\Im$
32.3°
97.2°
115.1°
−20.00
−15.00
−10.00
−5.00
0.00
$\Re$

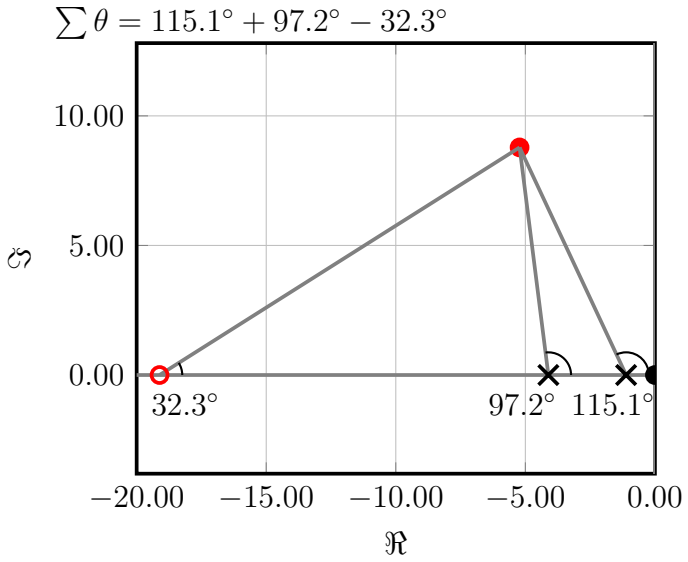
C.


$\sum \theta = 115.1° + 82.8° + 32.3°$
10.00
5.00
0.00
$\Im$
32.3°
82.8°
115.1°
−20.00
−15.00
−10.00
−5.00
0.00
$\Re$

D.


$\sum \theta = 64.9° + 97.2° + 32.3°$
10.00
5.00
0.00
$\Im$
32.3°
97.2°
64.9°
−20.00
−15.00
−10.00
−5.00
0.00
$\Re$

E.


$\sum \theta = 115.1° + 97.2° - 32.3°$
10.00
5.00
0.00
$\Im$
32.3°
97.2°
115.1°
−20.00
−15.00
−10.00
−5.00
0.00
$\Re$