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

$$G(s) = \frac{1}{s^3 + 2.0s^2 + 3.37373s + 7.37373}$$

Which of the following PI controllers stabilizes the system in a unit-feedback closed-loop configuration?

A. $F(s) = -3.24747 + \frac{0.87373}{s}$

B. $F(s) = -7.75758 + \frac{3.24747}{s}$

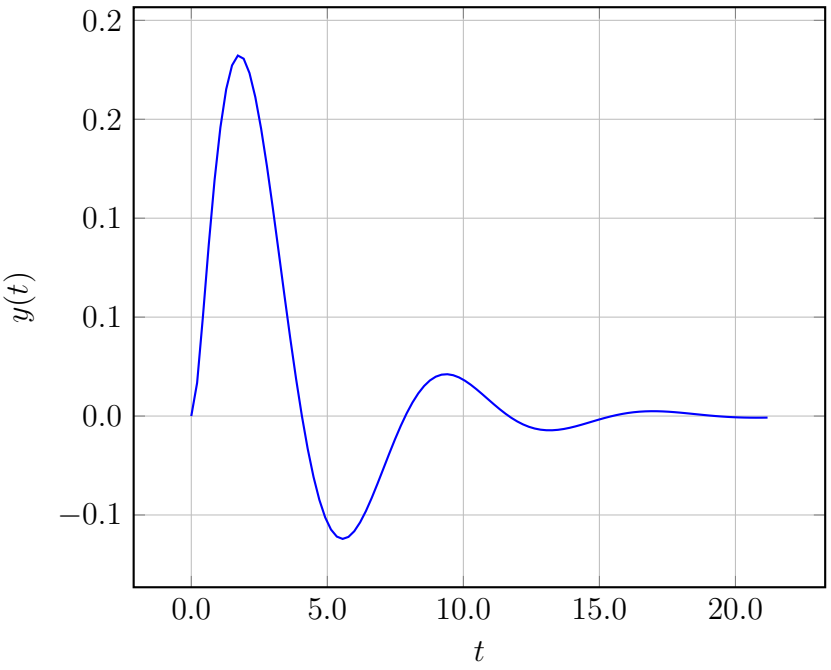
C. $F(s) = -8.50505 + \frac{1.74747}{s}$

D. $F(s) = 1.99495 + \frac{3.24747}{s}$

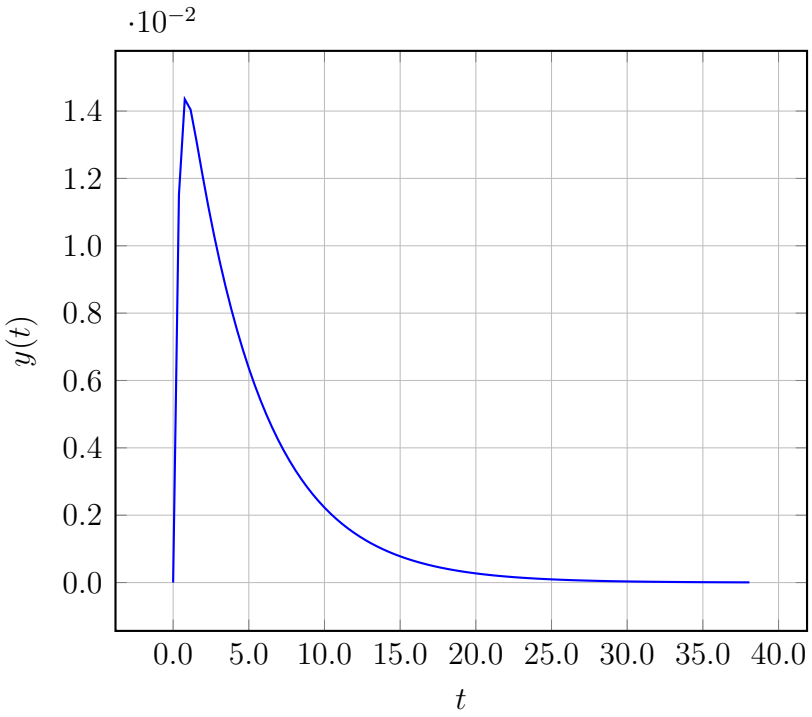
E. $F(s) = 2.74242 + \frac{1.74747}{s}$

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?

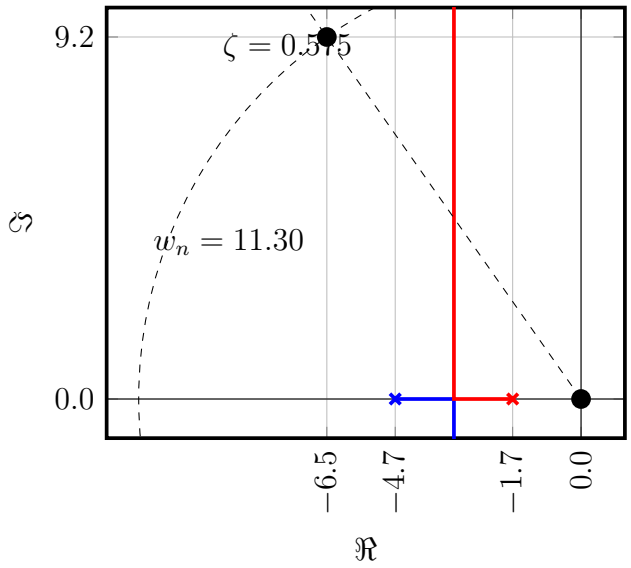
A.



B.

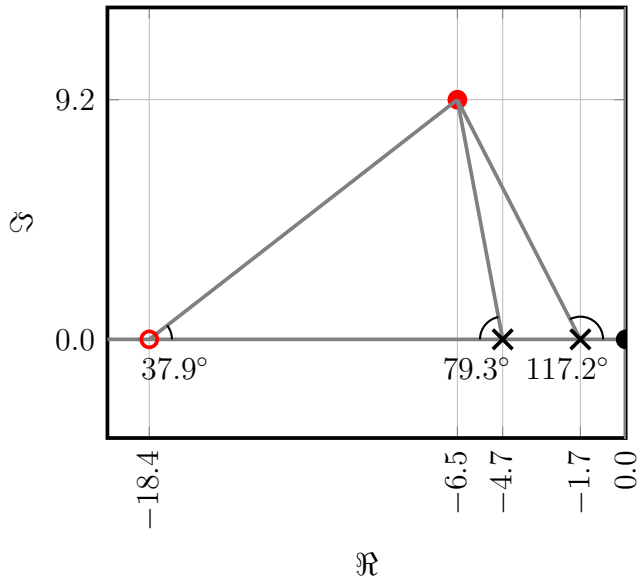


3. (30 points) A design point on the root-locus plot for a P-type controller is shown below.



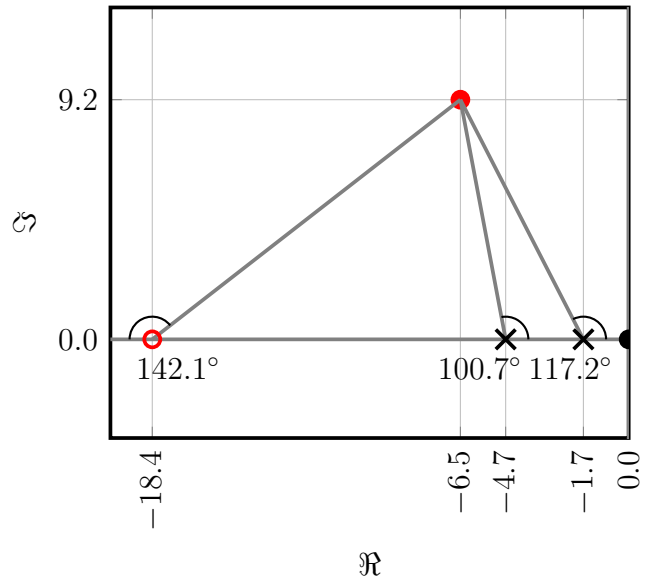
A zero is added so that the root-locus passes through this design point. Which of the following represents the correct angle condition for this design?

A. $\sum \theta = 117.2^\circ + 79.3^\circ + 37.9^\circ = 234.4^\circ$



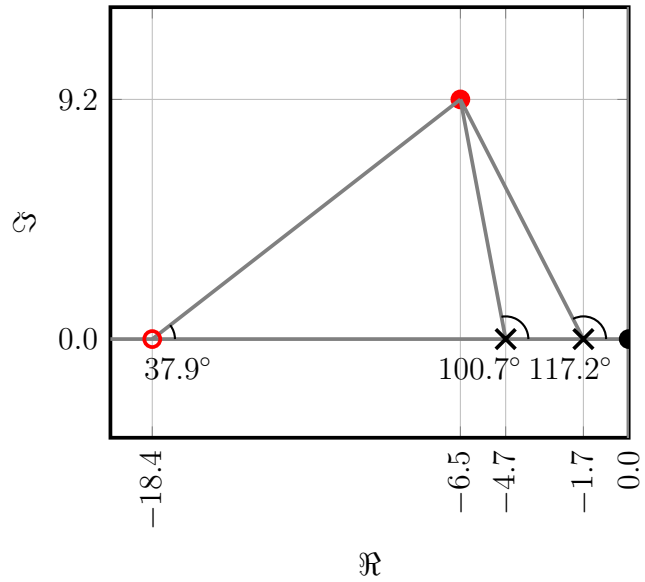
$$\sum \theta = 117.2^\circ + 100.7^\circ + 142.1^\circ = 360.0^\circ$$

B.



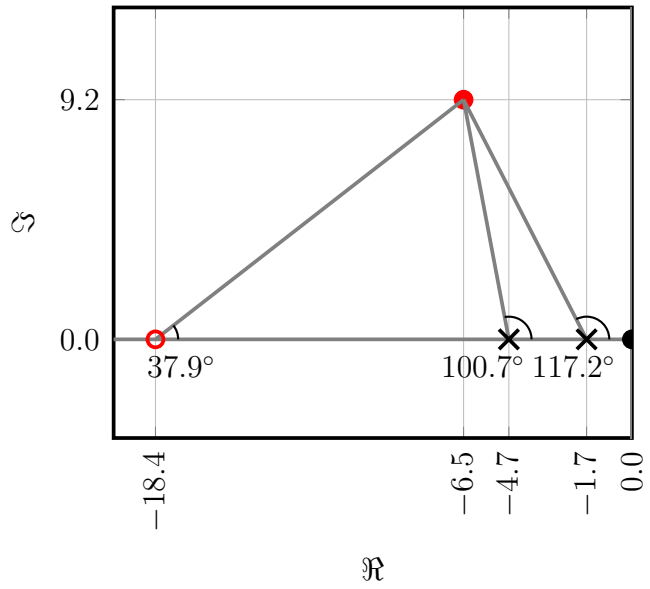
$$\sum \theta = 117.2^\circ + 100.7^\circ + 37.9^\circ = 255.7^\circ$$

C.



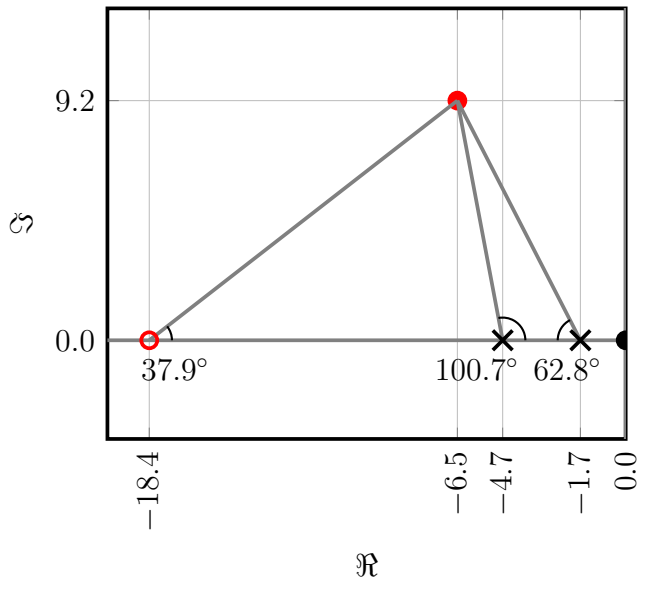
$$\sum \theta = 117.2^\circ + 100.7^\circ - 37.9^\circ = 180.0^\circ$$

D.



$$\sum \theta = 62.8^\circ + 100.7^\circ + 37.9^\circ = 201.4^\circ$$

E.



Q	A
1	A
2	B
3	D