1. (35 points) An open-loop transfer function is given by,
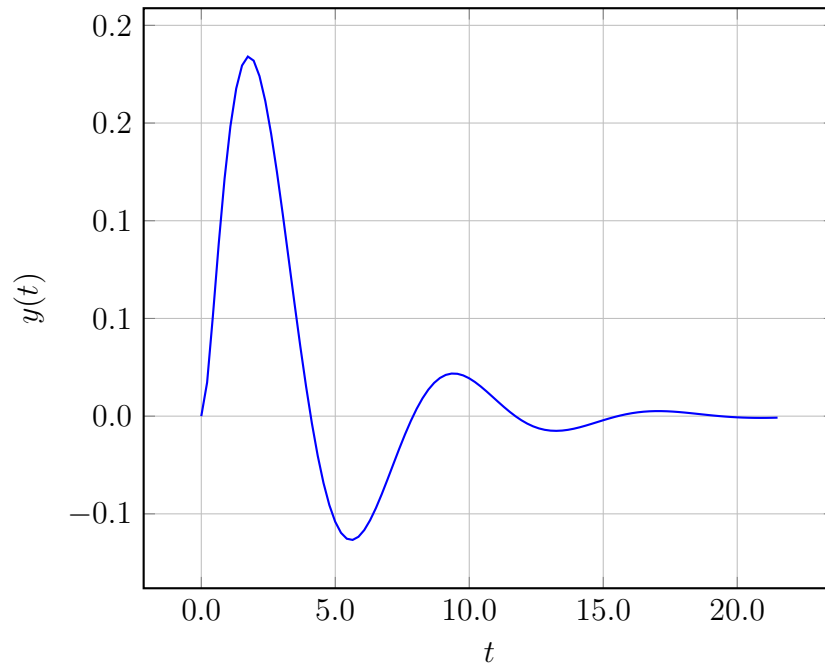
$$G(s) = \frac{1}{s^3 + 2.0s^2 + 3.36868s + 7.36868}$$

Which of the following PI controllers stabilizes the system in a unit-feedback closed-loop configuration?
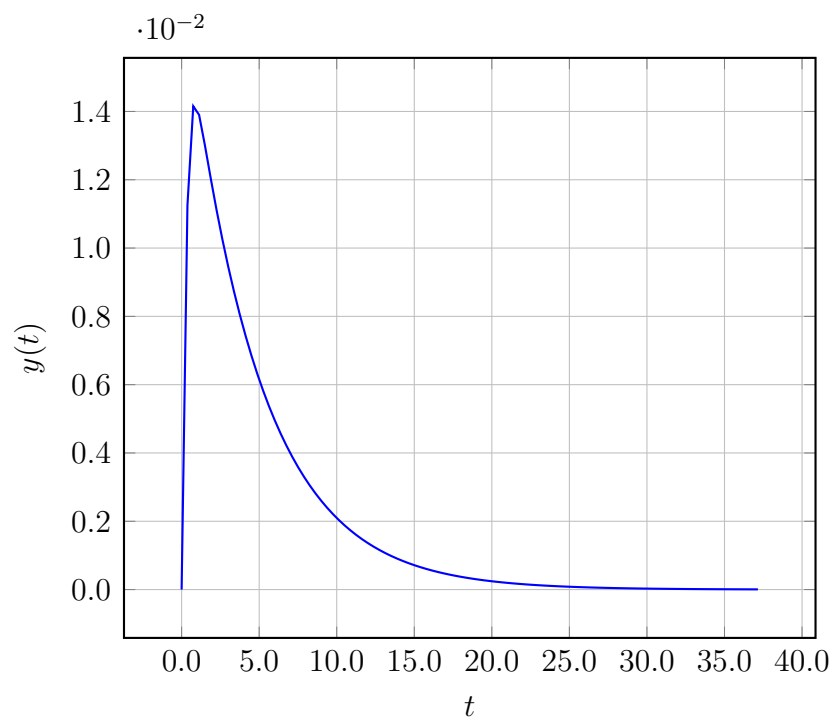
A. $F(s) = 1.97475 + \frac{3.23737}{s}$

B. $F(s) = -7.78789 + \frac{3.23737}{s}$

C. $F(s) = -3.23737 + \frac{0.86868}{s}$

D. $F(s) = -8.52525 + \frac{1.73737}{s}$

E. $F(s) = 2.71211 + \frac{1.73737}{s}$

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?
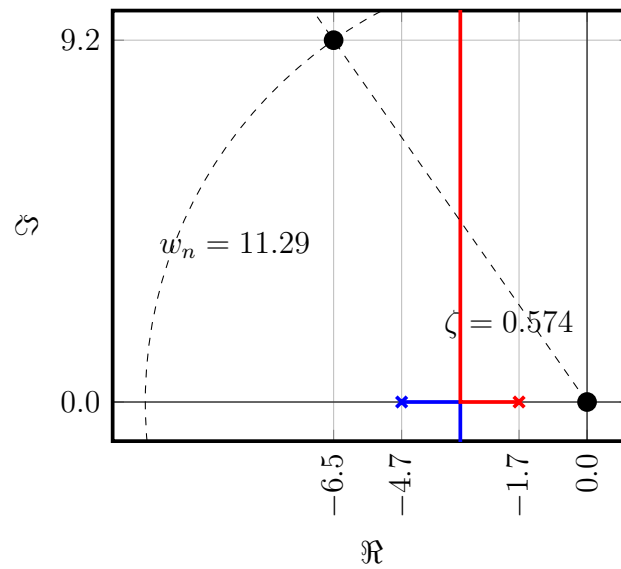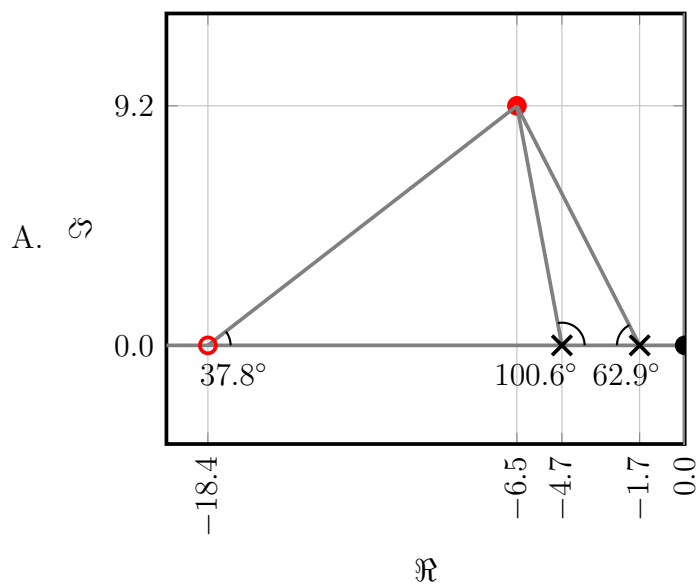
A.

B.

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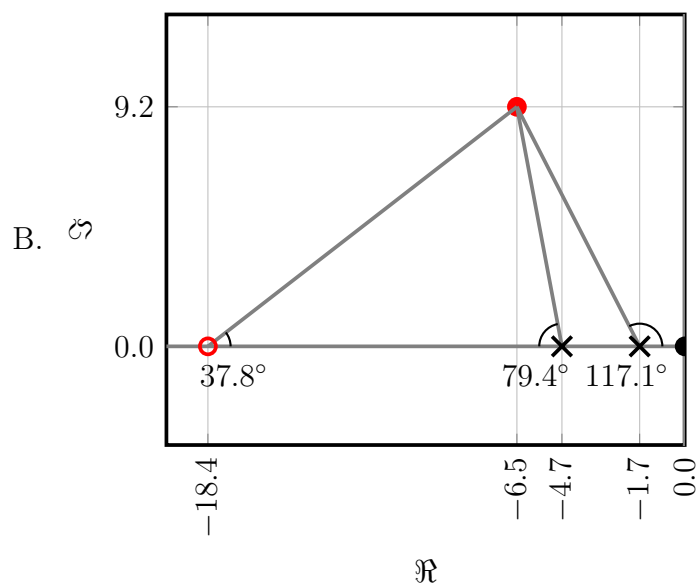

A zero is added so that the root-locus passes through this design point. Which of the following represents the correct angle condition for this design?
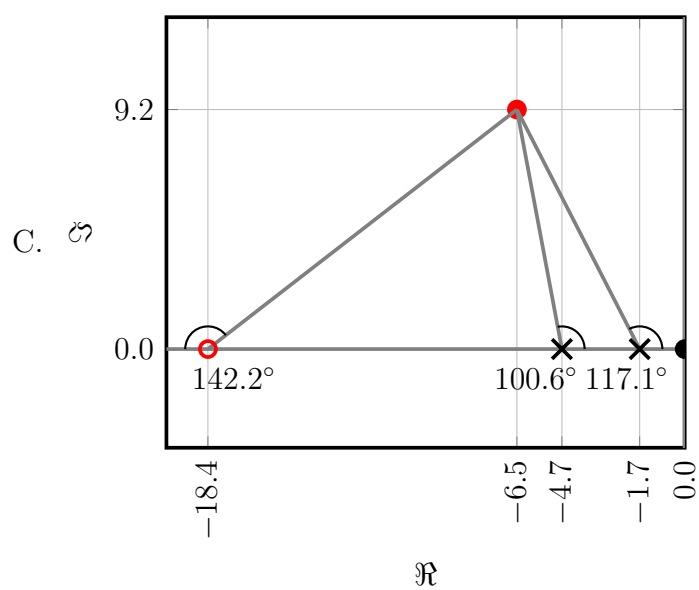
$$\sum \theta = 62.9° + 100.6° + 37.8° = 201.3°$$

A.

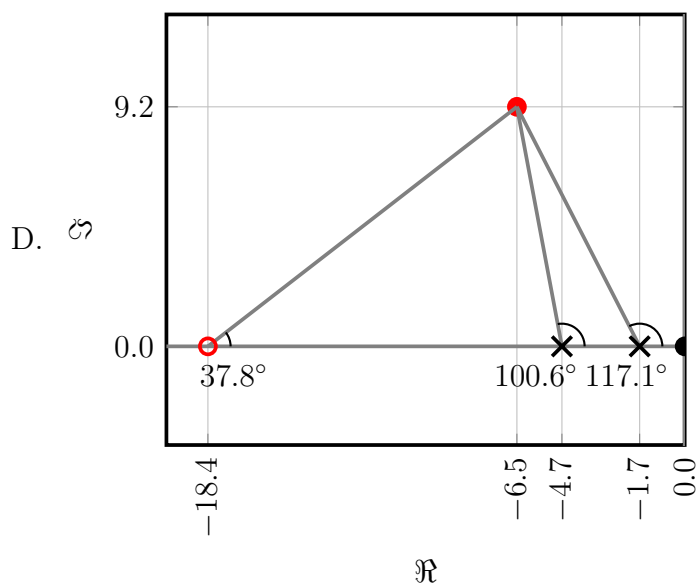$$\sum \theta = 117.1° + 79.4° + 37.8° = 234.3°$$

B.

$$\sum \theta = 117.1° + 100.6° + 142.2° = 360.0°$$

C.

$$\sum \theta = 117.1° + 100.6° + 37.8° = 255.6°$$

D.

$$\sum \theta = 117.1° + 100.6° - 37.8° = 180.0°$$

E.

Q	A
1	C
2	B
3	E