

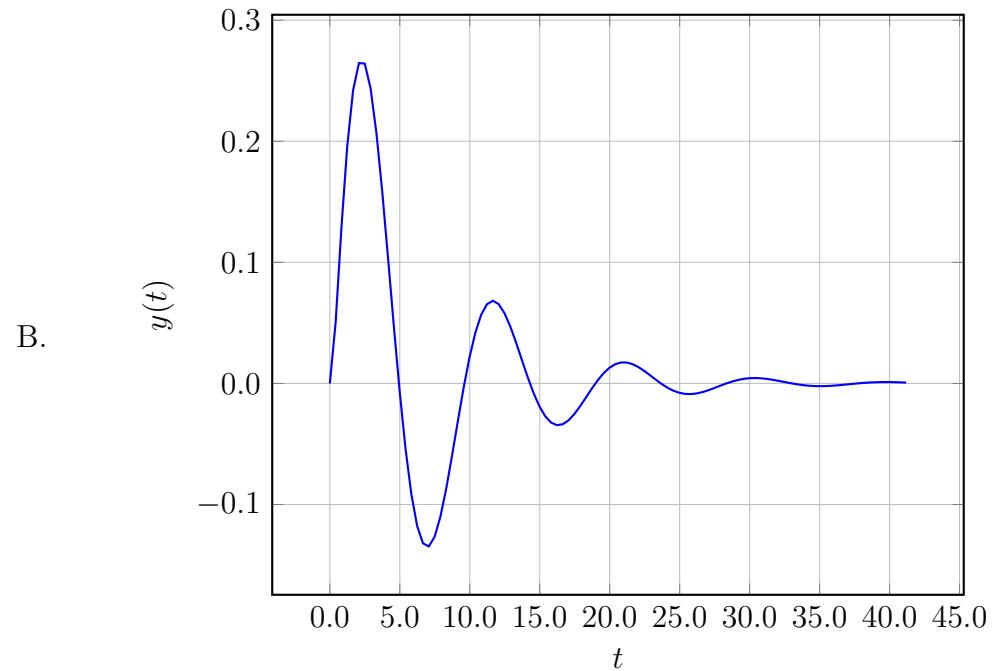
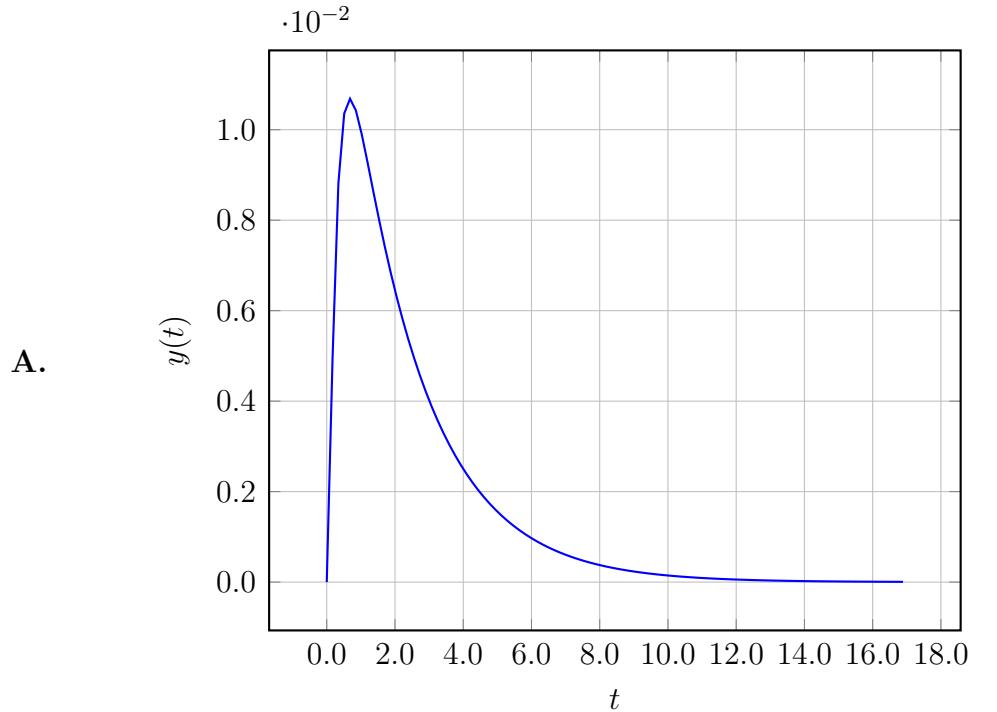
1. (35 points) An open-loop transfer function is given by,

$$G(s) = \frac{1}{s^3 + 2.0s^2 + 3.18686s + 7.18686}$$

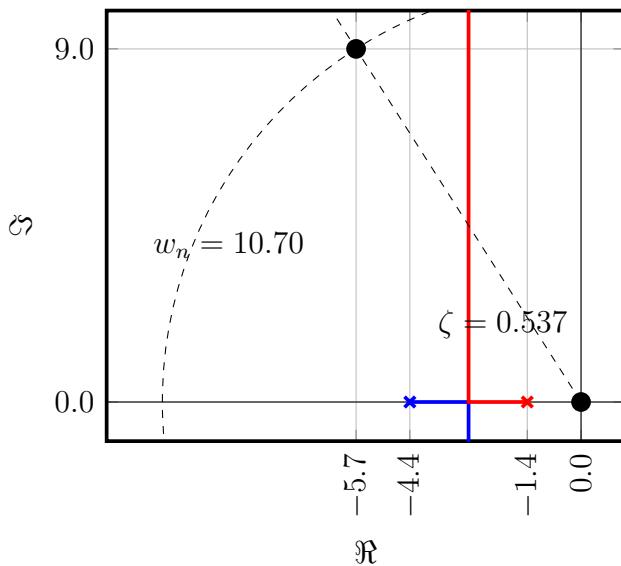
Which of the following PI controllers stabilizes the system in a unit-feedback closed-loop configuration?

- A.  $F(s) = -8.8788 + \frac{2.87373}{s}$
- B.  $F(s) = -9.25253 + \frac{1.37373}{s}$
- C.  $F(s) = -2.87373 + \frac{0.68686}{s}$
- D.  $F(s) = 1.24747 + \frac{2.87373}{s}$
- E.  $F(s) = 1.6212 + \frac{1.37373}{s}$

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?

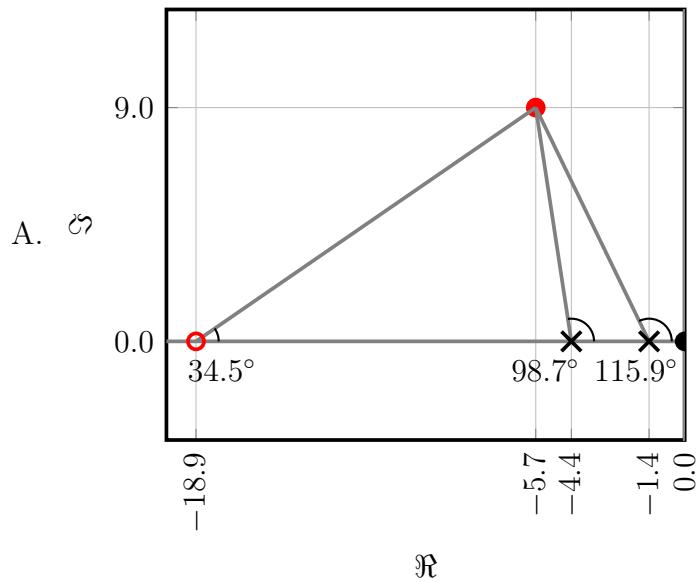


3. (30 points) A design point on the root-locus plot for a P-type controller is shown below.

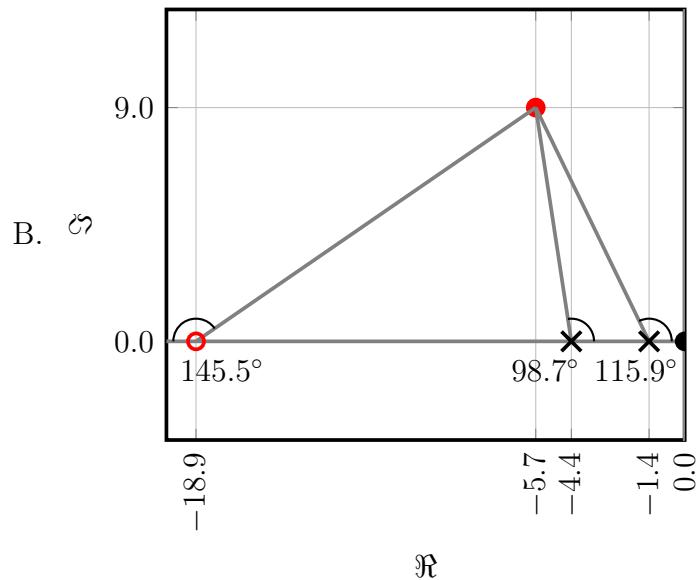


A zero is added so that the root-locus passes through this design point. Which of the following represents the correct angle condition for this design?

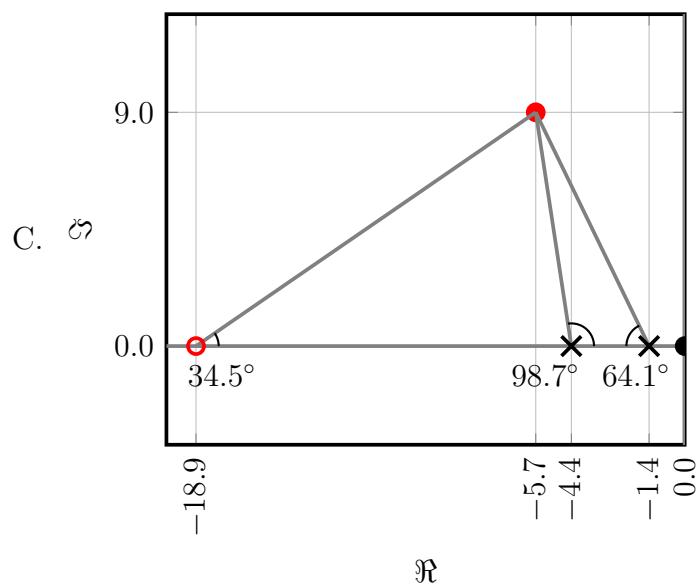
$$\sum \theta = 115.9^\circ + 98.7^\circ + 34.5^\circ = 249.1^\circ$$



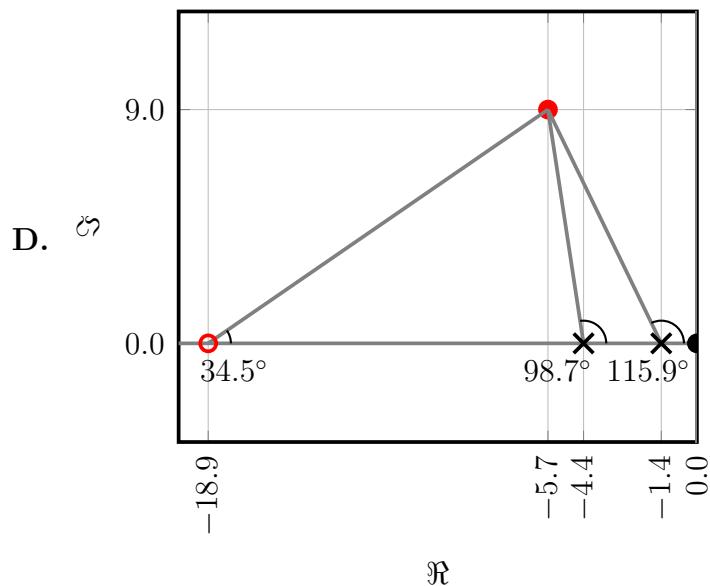
$$\sum \theta = 115.9^\circ + 98.7^\circ + 145.5^\circ = 360.0^\circ$$



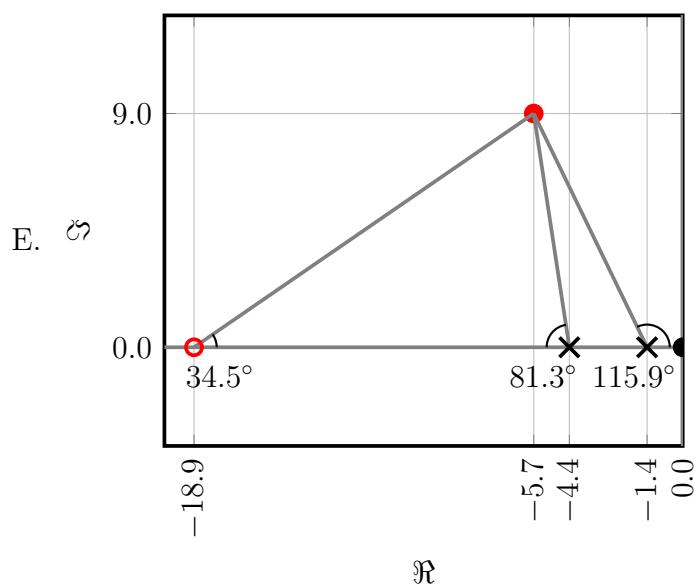
$$\sum \theta = 64.1^\circ + 98.7^\circ + 34.5^\circ = 197.3^\circ$$



$$\sum \theta = 115.9^\circ + 98.7^\circ - 34.5^\circ = 180.0^\circ$$



$$\sum \theta = 115.9^\circ + 81.3^\circ + 34.5^\circ = 231.7^\circ$$



Q	A
1	C
2	A
3	D