

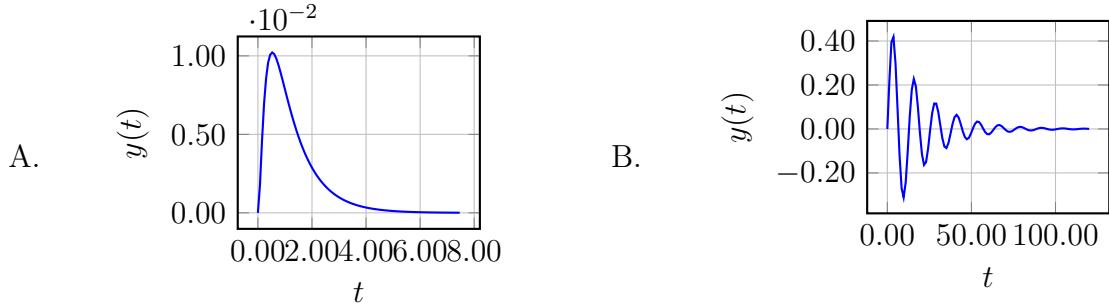
1. (35 points) An open-loop transfer function is given as,

$$G(s) = \frac{1}{s^3 + 2.0s^2 + 3.0s + 7.0}$$

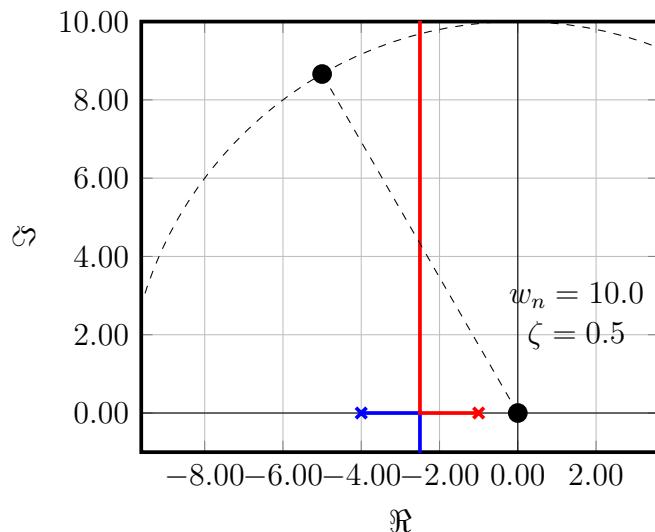
which of the following PI-controllers stabilizes the system in a closed-loop unit feedback structure?

- A.  $F(s) = 0.5 + \frac{1.0}{s}$
- B.  $F(s) = -10.0 + \frac{1.0}{s}$
- C.  $F(s) = -10.0 + \frac{2.5}{s}$
- D.  $F(s) = 0.5 + \frac{2.5}{s}$
- E.  $F(s) = -2.5 + \frac{0.5}{s}$

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

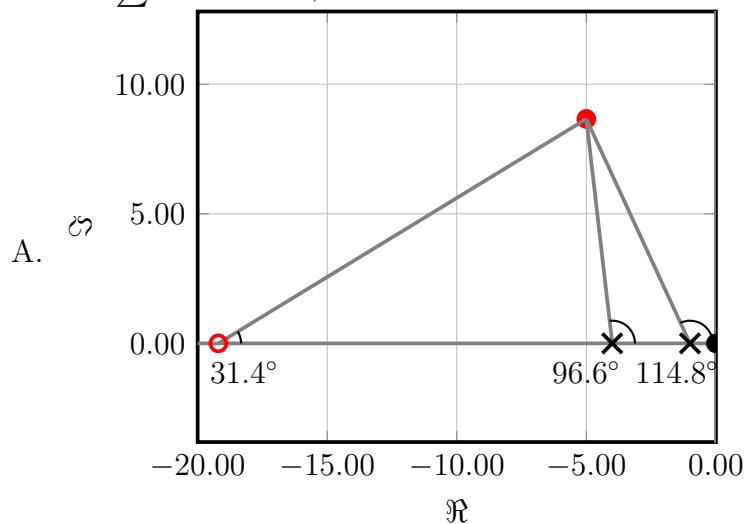


3. (30 points) Time-domain criteria is give as settling time  $t_s = 1\text{ s}$  and overshoot  $os = 10\%$ . The root-locus plot for the P-type controller design is depicted below.

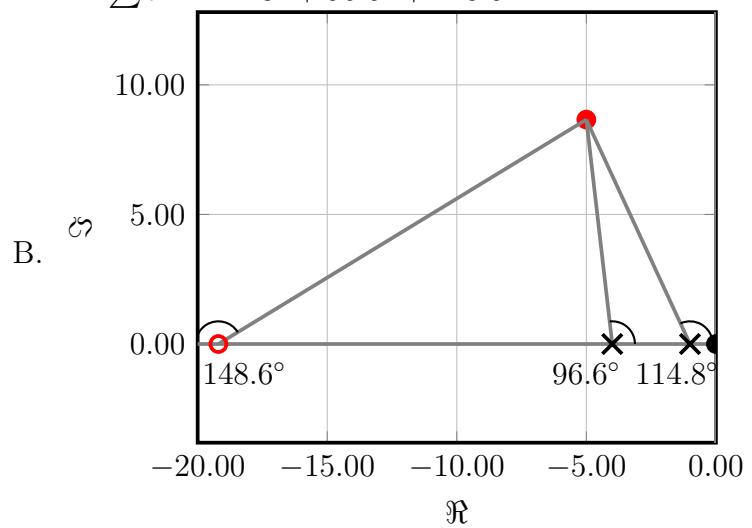


Upgrading the controller to a PD-type controller which of the following angle conditions need to be used?

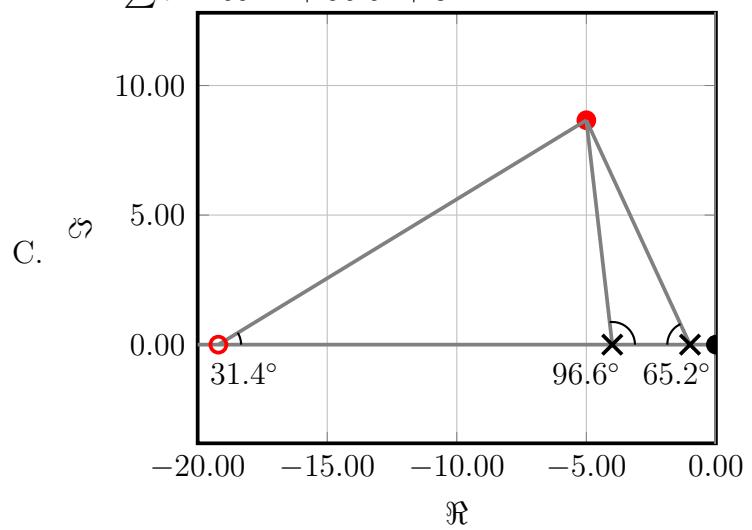
$$\sum \theta = 114.8^\circ + 96.6^\circ - 31.4^\circ$$



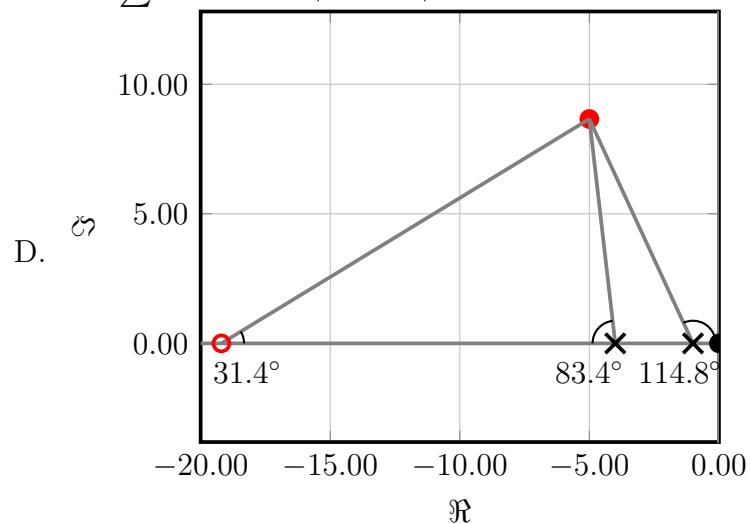
$$\sum \theta = 114.8^\circ + 96.6^\circ + 148.6^\circ$$



$$\sum \theta = 65.2^\circ + 96.6^\circ + 31.4^\circ$$



$$\sum \theta = 114.8^\circ + 83.4^\circ + 31.4^\circ$$



$$\sum \theta = 114.8^\circ + 96.6^\circ + 31.4^\circ$$

