

Systems are unstable if their characteristic equations have a positive root (solution). Determine whether each of the following characteristic equations represents a stable or unstable system.

(i)  $s^3 + 6s^2 + 11s + 6 = 0$

(ii)  $s^3 + s^2 - 8s - 12 = 0$

In a Hooke's law experiment, equal increments of force,  $w$ , are applied to a metal rod and the length of the rod is recorded. Within the elastic limit, the increases of length,  $x$ , are found to be equal.

After application of the 10<sup>th</sup> increment of force, the length of the rod is found to be 50.03 mm and after the 15<sup>th</sup> increment the rod's length is found to be 50.08 mm. Determine the original length of the rod,  $l$ , and evaluate

$$\sum_{n=1}^{10} (l + nx)$$