Classroom to Campus: Math and Stats Challenge

Grade 12 – MAP4C

Topic C: Geometry and Trigonometry
Exploring Geometry in Construction through Deck Design

A high school is planning to construct a new outdoor seating area for students, combining a rectangular patio with a semicircular extension to create a unique and functional space. The design aims to optimize the use of materials while providing ample space for seating and activities.

The design specifications are not provided except:

- Rectangular Patio: Length *(L)* and Width *(W)*: *(L > W)*.

- The semicircular extension is attached to one of the shorter sides of the rectangular patio.

- Semicircular Extension: Radius *(R)*: Equal to half of the width *(W)* of the rectangular patio ensuring a seamless connection between the two shapes.

- The combined area of the rectangular patio and the semicircular extension should be between 140 and 150 square metres.

- The perimeter of the entire seating area, including the curved edge of the semicircle, should not exceed 60 metres.

a) Create a scaled diagram of the seating area; determine possible dimensions and clearly label all dimensions and features.

b) Calculate the appropriate dimensions (L and W) of the rectangular patio that satisfy both the area and perimeter constraints. *(Round your final answer to two decimal places. Include units.)*

c) Design a ramp to provide wheelchair access to the deck, adhering to accessibility standards that require a maximum slope of 1:12 *(rise:run)*. If the deck is 42 decimetres above ground level, what is the minimum length of the ramp (in metres)? *(Round your final answer to two decimal places. Include units.)*

d) If the deck requires support posts every 2 metres along its perimeter, how many posts are needed? *(Provide your final answer as an integer.)*