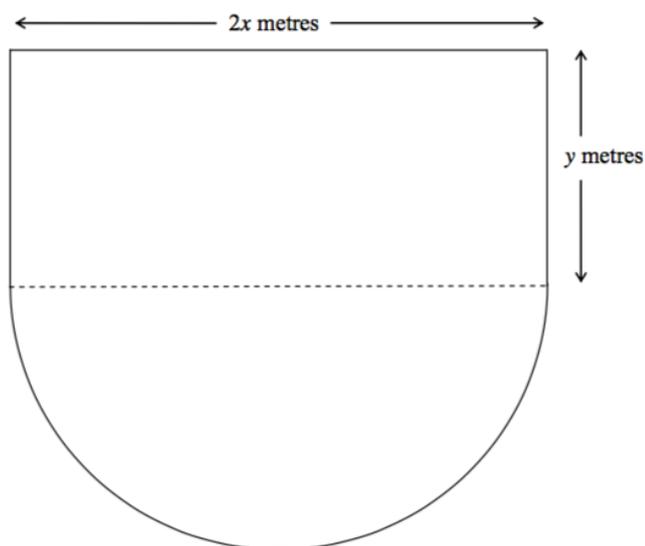


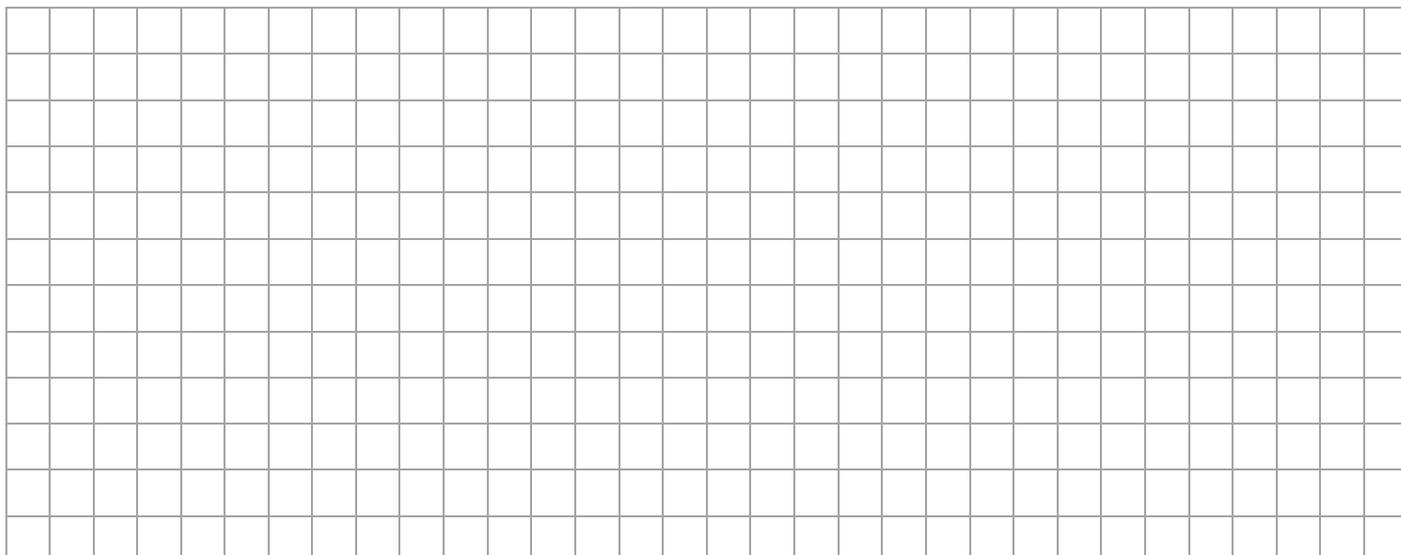
(60 Marks)

(a) Marcus is in charge of restoring an old theatre. He is replacing the stage and has been given a plan for the typical dimensions of a theatre stage.



The plan of the stage is in the shape of a rectangle joined to a semicircle. The length of the rectangular part is $2x$ metres and the width is y metres. The diameter of the semi-circular part is $2x$ metres. The perimeter of the stage is 80m.

(i) Using $P = 80$, show that $y = \frac{80 - 2x - \pi x}{2}$.



(ii) Hence, show that the area, $A \text{ m}^2$, of the stage is given by

$$A = 80x - \left(2 + \frac{\pi}{2}\right)x^2.$$

(iii) Use calculus to find the value of x at which A is a stationary point.

