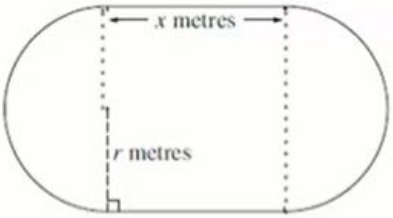
Air maths tuition

Interact, engage and perform

Optimisation | Past Paper Question | P1 CIE Nov 2013 Q8(i)



The inside lane of a school running track consists of two straight sections each of length x metres, and two semicircular sections each of radius r metres, as shown in the diagram. The straight sections are perpendicular to the diameters of the semicircular sections. The perimeter of the inside lane is 400 metres.

(i) Show that the area, A m^2, of the region enclosed by the inside lane is given by $A = 400r - \pi r^2$. [4]

(ii) Given that x and r can vary, show that, when A has a stationary value, there are no straight sections in the track. Determine whether the stationary value is a maximum or a minimum. [5]

$A = 2rx + \pi r^2$ (1)

Since perimeter $= 400$

$\therefore 2x + 2\pi r = 400$ (200)

$\therefore x = 200 - \pi r$ (2)

Sub (2) into (1)

$\therefore A = 2r(200 - \pi r) + \pi r^2$

$= 400r - 2\pi r^2 + \pi r^2$

$= 400r - \pi r^2$

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