9 A circle, centre O and radius r cm, has a sector OAB of fixed area $10\,\text{cm}^2$. Angle AOB is θ radians and the perimeter of the sector is P cm.

(a) Find an expression for P in terms of r. [3]

(b) Find the value of r for which P has a stationary value. [3]

(c) Determine the nature of this stationary value. [2]

(d) Find the value of θ at this stationary value. [1]

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10 The normal to the curve $y = \tan\left(3x + \frac{\pi}{2}\right)$ at the point P with coordinates $(p, -1)$, where $0 < p \leqslant \frac{\pi}{6}$, meets the x-axis at the point A and the y-axis at the point B. Find the exact coordinates of the mid-point of AB. [10]

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