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Nature of Stationary Points | Past Paper Question | P1 CIE June 2013 Q9(ii)

A curve has equation $y = f(x)$ and is such that $f'(x) = 3x^{\frac{1}{2}} + 3x^{-\frac{1}{2}} - 10$.

(i) By using the substitution $u = x^{\frac{1}{2}}$, or otherwise, find the values of x for which the curve $y = f(x)$ has stationary points. [4] $x = \frac{1}{9}$, $x = 9$

(ii) Find $f''(x)$ and hence, or otherwise, determine the nature of each stationary point. [3]

(ii) $f''(x) = \frac{3}{2}x^{-1/2} - \frac{3}{2}x^{-3/2}$

$= \frac{3}{2x^{1/2}} - \frac{3}{2x^{3/2}}$

when $x = 1/9$

$\therefore f''(\frac{1}{9}) = \frac{3}{2(\frac{1}{9})^{1/2}} - \frac{3}{2(\frac{1}{9})^{3/2}}$

$= \frac{9}{2} - \frac{81}{2} = -36 < 0$

$\therefore$ maximum at $x = 1/9$

when $x = 9$

$\therefore f''(9) = \frac{3}{2(9)^{1/2}} - \frac{3}{2(9)^{3/2}}$

$= \frac{1}{2} - \frac{1}{18}$

$= \frac{4}{9} > 0$

$\therefore$ minimum at $x = 9$

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