Numerical methods – A2 Further Mathematics P2

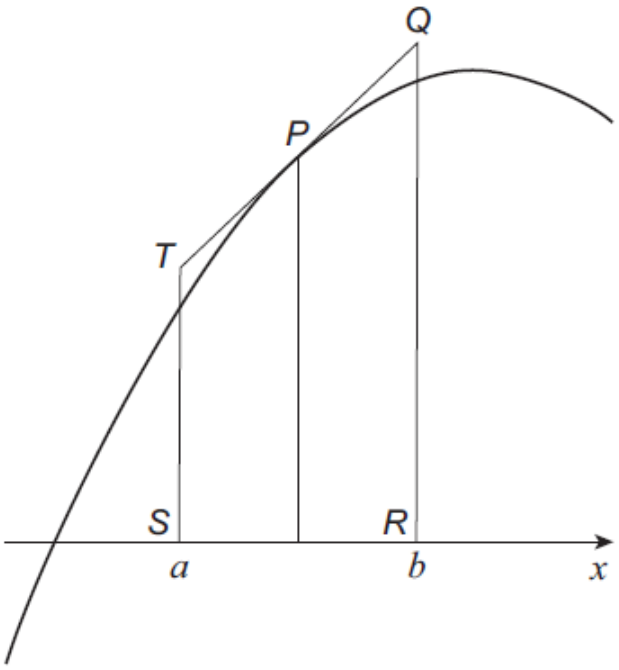
1. June/2022/Paper_7367/02/No.6

The diagram below shows part of the graph of $y = \mathrm{f}(x)$

The line TPQ is a tangent to the graph of $y = \mathrm{f}(x)$ at the point $P\left(\frac{a+b}{2}, \mathrm{f}\left(\frac{a+b}{2}\right)\right)$

The points $S(a, 0)$ and T lie on the line $x = a$

The points Q and $R(b, 0)$ lie on the line $x = b$



Sharon uses the mid-ordinate rule with one strip to estimate the value of the integral $\int_a^b \mathrm{f}(x)\,\mathrm{d}x$

By considering the area of the trapezium $QRST$, state, giving reasons, whether you would expect Sharon's estimate to be an under-estimate or an over-estimate.

[3 marks]

2. June/2022/Paper_7367/02/No.9(a)

(a) A curve passes through the point (5, 12.3) and satisfies the differential equation

$$\frac{dy}{dx} = (x^2 - 9)^{\frac{1}{2}} + \frac{2xy}{x^2 - 9} \qquad x > 3$$

Use Euler's step by step method once, and then the midpoint formula

$$y_{r+1} = y_{r-1} + 2hf(x_r, y_r), \quad x_{r+1} = x_r + h$$

once, each with a step length of 0.1, to estimate the value of y when $x = 5.2$

Give your answer to six significant figures.

[4 marks]