SATPREP
Assignment : Trapezium Rule

1 . Find an approximation for the area under the graph $y = \dfrac{4}{x^2}$ and the x-axis over

the interval $x = 0.5$ to $x = 3.5$ using the trapezoidal rule and:

(a) interval widths of 1 unit

(b) interval widths of 0.5 units

2. Find an approximation for the area between the curve $y = \dfrac{1}{4}x^2$ and the x-axis over

the

interval n=4

(a) the upper rectangles.

(b) the lower rectangles.

(c) the average of the upper and lower rectangles.

3. Find an approximation for the area between the curve $y = \dfrac{1}{3}x^3$ and the x-axis over

the interval n=3 using the area of the trapezium.

Answer

1.

(a)   Relevant points on graph are:

(0.5, 16), (1.5, $\frac{16}{9}$), (2.5, 0.64),

(3.5, $\frac{16}{49}$),

Area of trapezium is

$\frac{1}{2} \times (16 + \frac{16}{9}) \times 1 + \frac{1}{2} \times (\frac{16}{9} + 0.64) \times 1 +$

$\frac{1}{2} \times (0.64 + \frac{16}{49}) \times 1 = 10.6$ square units.

(b) Relevant points on graph are:

(0.5, 16), (1, 4), (1.5, $\frac{16}{9}$), (2, 1),

(2.5, 0.64), (3, $\frac{4}{9}$), (3.5, $\frac{16}{49}$),

Area of trapezium is

$\frac{1}{2} \times (16 + 4) \times \frac{1}{2} + \frac{1}{2} \times (4 + \frac{16}{9}) \times \frac{1}{2} +$

$\frac{1}{2} \times (\frac{16}{9} + 1) \times \frac{1}{2} + \frac{1}{2} \times (1 + 0.64) \times \frac{1}{2} +$

$\frac{1}{2} \times (0.64 + \frac{4}{9}) \times \frac{1}{2} + \frac{1}{2} \times (\frac{4}{9} + \frac{16}{49}) \times \frac{1}{2}$

= 8.0 square units.

2. $y = \frac{1}{4} x^2$ Relevant points on graph are:

(0, 0), (1, $\frac{1}{4}$), (2, 1), (3, $\frac{9}{4}$), (4, 4)

(a)   Total area of upper rectangles is

$\frac{1}{4} \times 1 + 1 \times 1 + \frac{9}{4} \times 1 + 4 \times 1$

$= 7\frac{1}{2}$ square units.

(b)   Total area of lower rectangles is $0 \times 1 + \frac{1}{4} \times 1 + 1 \times 1 + \frac{9}{4} \times 1$

$= 3\frac{1}{2}$ square units.

Average of the two areas is

$(7\frac{1}{2}+3\frac{1}{2}) \div 2 = 5\frac{1}{2}$ square units.

3. $y = \frac{1}{3}x^3$ Relevant points on graph are:

$(0, 0), (1, \frac{1}{3}), (2, \frac{8}{3}), (3, 9)$

Area of trapezium is $\frac{1}{2}\times(0+\frac{1}{3})\times1+\frac{1}{2}\times(\frac{1}{3}+\frac{8}{3})\times1+\frac{1}{2}\times(\frac{8}{3}+9)\times1$

$= 7\frac{1}{2}$ square units.