

1. Consider the definite integral given by

$$\int_0^2 (4 + 2x^2) dx.$$

- Divide the interval $x \in [0, 2]$ into $n = 2$ even subintervals, then apply both the midpoint rule and the trapezoid rule to estimate this integral.
- Divide the interval $x \in [0, 2]$ into $n = 4$ even subintervals, then again apply both the midpoint rule and the trapezoid rule to estimate this integral.
- It can be shown that the value of this integral is $\frac{40}{3}$. Give the percent error for each of the cases above, noting whether the estimate is high or low.

2. Consider the definite integral given by

$$\int_0^2 x^4 dx.$$

- Divide the interval $x \in [0, 2]$ into $n = 4$ even subintervals, then apply the midpoint rule, the trapezoid rule, and Simpson's rule to estimate this integral.
- It can be shown that the value of this integral is $\frac{32}{5}$. Give the percent error for each of the cases above, noting whether the estimate is high or low.

3. a. Consider the function

$$f(x) = 8 + 2x - x^2.$$

Find the x and y -intercepts and the vertex. You should sketch a graph of the function.

- Use the midpoint rule and the trapezoid rule with $n = 4$ to estimate the area in the first quadrant ($x \geq 0, y \geq 0$) under this curve.
- Since this is a quadratic function, Simpson's rule gives the exact value. Use Simpson's rule with $n = 4$ to find the area in the first quadrant under this curve. Compare your numbers from the midpoint rule and the trapezoid rule to this answer. (Give the percent errors of the approximations in Part b.)

4. Two researchers analyze seven years of population data for a particular animal that is given in the table below.

Year	0	1	2	3	4	5	6	7
Population	12	18	27	32	28	17	12	21

- Find the average population in the usual manner.

b. An alternate (often considered more accurate) method of computing the average population is given by the definite integral,

$$P_{ave} = \frac{1}{7} \int_0^7 P(t) dt.$$

Use the trapezoid rule ($n = 7$) to estimate the average population from this definite integral and compare this answer to your answer in Part a.

5. Toxicity of a drug is often determined by the amount of drug in the blood times the length of time it remains at that level. This cumulative effect is found by integrating the amount of drug over the time that the dose is effective. Suppose that the amount of a drug $A(t)$ is measured over a period of time after taking a pill and its quantity is found to be

Hour	0	1	2	3	4	5	6	7	8	9	10
A	0.05	0.46	0.87	0.54	0.43	0.36	0.28	0.21	0.16	0.12	0.09

The cumulative dose is given by integral

$$\int_0^{10} A(t) dt.$$

Use the trapezoid rule ($n = 10$) to estimate the cumulative drug effect from the data above.