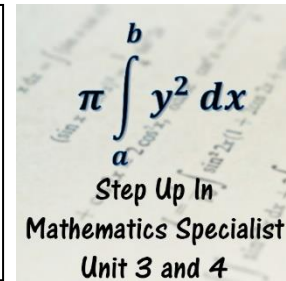


4.4 Numerical Integration

Problems Worksheet



1. Consider the definite integral $\int_0^1 e^x dx$ approximated with four slices.

a. Estimate this definite integral using the trapezoidal rule.

b. Estimate this definite integral using Simpson's rule.

c. Using integration techniques, evaluate $\int_0^1 e^x dx$ exactly.

2. Consider the definite integral $\int_0^\pi \sin x \, dx$ approximated with eight slices.
- Estimate this definite integral using the trapezoidal rule.
 - Estimate this definite integral using Simpson's rule.
 - Using integration techniques, evaluate $\int_0^\pi \sin x \, dx$ exactly.

3. Without calculation, comment on the accuracy or validity of the following approximations.

a. $\int_0^1 -x^2 dx$ using four slices with the trapezoidal rule.

b. $\int_{-7}^{-6} -x^2 dx$ using four slices with the trapezoidal rule.

c. $\int_3^4 (2x + 1) dx$ using four slices with the trapezoidal rule.

d. $\int_3^4 (2x + 1) dx$ using four slices with Simpson's rule.

e. $\int_3^4 (2x + 1) dx$ using five slices the trapezoidal rule.

f. $\int_3^4 (2x + 1) dx$ using five slices with Simpson's rule.

4. An impossible integration. Use the trapezium rule with 4 slices to estimate the value of $\int_0^1 e^{-x^2} dx$.