# Numerical Integration

Curriculum Module

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*Created with R2020b. Compatible with R2020b and later releases.*

## Description

This curriculum module contains interactive *live scripts* that teach two fundamental techniques for approximating definite integrals: the trapezoid and Simpson's rules. These rules are derived from Lagrange interpolating polynomials and explored through interactive visualizations. Each lesson concludes with a guided activity in which students implement the discussed integration rule. These live scripts can be used as part of a lecture, as activities in an instructional setting, or as an interactive assignment to be completed outside of class.

## Suggested Prework

MATLAB Onramp – a free two-hour introductory tutorial to learn the essentials of MATLAB.

## Details

### `TrapezoidRule.mlx`

**Products**: MATLAB
**Contents**: An interactive lesson that explores the trapezoid rule.
**Learning Goals:**

- Explain numerical quadrature and its relationship to the definite integral
- Describe how the trapezoid rule is derived
- Illustrate the trapezoid rule graphically
- Compare and contrast integration of a continuous function with integration of tabulated data
- Implement the trapezoid rule in MATLAB

### `SimpsonsRules.mlx`

**Products**: MATLAB
**Contents**: An interactive lesson that explores Simpson's rules.
**Learning Goals:**

- Describe how Lagrange interpolating polynomials can be used to derive integration rules
- Illustrate Simpson's 1/3 rule graphically
- Explain the steps required to implement Simpson's 1/3 rule
- Compare the accuracy and limitations of Simpson's 1/3 rule to those of Simpson's 3/8 rule
- Implement Simpson's 3/8 rule in MATLAB

### `TrapezoidRuleSoln.mlx`

**Products**: MATLAB
**Contents**: Completed solution for `TrapezoidRule.mlx`

### `SimpsonsRulesSoln.mlx`

**Products**: MATLAB
**Contents**: Completed solution for `SimpsonsRules.mlx`