Miniproject 2
Numerical Integration

Start by reading the following text on numerical integration:

- Section 5.9, page 259–267 (until the subsection on Parabolic Approximations).

Then solve these two exercises by hand, where you can use MATLAB as a simple calculator to compute the end results.

- Section 5.9, page 271: Problems no. 3, 13.

The following lines of MATLAB code illustrate a more general way to compute the trapezoidal approximation in problem 13. Type them into the command window and press *enter* after each line. Make sure, that you understand what happens. A dot in front of an operation, like in `c.*y`, means that the operation is performed elementwise.

```
n = 4
dx = (3-1)/n
x = 1:dx:3
y = x.^2
c = [1 2 2 2 1]
c.*y
sum(c.*y)
dx/2*sum(c.*y)
```

The command `trapz(x,y)` can be used to get the trapezoidal approximation directly from the lists of x and y values.

- Modify the code above, such that you compute Simpson's approximation in problem 13. Did you get the same result as before?

In multimedia applications, functions are often only available in tabular form. The numerical methods for approximating integrals still applies. As an example, solve the exercise

- Section 5.9, page 271: Problem no. 21.

Finally, use the MATLAB command `trapz` to compute the trapezoidal approximation to the integral below, using $n = 200$ subintervals:

$$\int_{-1}^{1} 2\sqrt{1-x^2}\,dx.$$

What is the exact value of this integral? Why?