

# Project

## Choosing an Integration Method

Solve the problems given below, then answer the questions. Calculators and computer algebra systems may be used for the computations and producing the graphs. The grading criteria are listed on the class web sites.

### Analysis of the Issue

$$\int \frac{2+x}{1-x^2} dx$$

1. Do **not** find the anti-derivative yet. What techniques look promising? Why?
2. Work the integral using partial fraction decomposition.
3. Work the integral using a trig substitution.
4. Which method was easier? Why?
5. Note that

$$\frac{2+x}{1-x^2} = \frac{2}{1-x^2} + \frac{x}{1-x^2}.$$

What methods look promising after separating the integral?

6. Note that the derivative of  $f(x) = \tanh^{-1} x$  is  $f'(x) = \frac{1}{1-x^2}$ . Using this and the separation above, work the integral again.
7. How does this answer compare to the previous two?

$$\int \sin^3 \theta \cos \theta d\theta$$

8. Do **not** find the anti-derivative yet. What techniques look promising? Why?
9. Work the integral.
10. Work the integral using a second method.
11. Which method was easier? Why?

### Description of the Issue

1. In general what is the role of algebra and trigonometry in solving complicated integrals?
2. In general how do you choose an initial integration technique? Your answer can be given as a list of tips or steps.