

MA 114 Worksheet # 19: Numerical Integration

1. Simpson's Rule turns out to exactly integrate polynomials of degree three or less. Show that Simpson's rule gives the *exact* value of $\int_0^h p(x) dx$ where $h > 0$ and $p(x) = ax^3 + bx^2 + cx + d$.

[Hint: First compute the exact value of the integral by direct integration. Then apply Simpson's rule with $n = 2$ and observe that the approximation and the exact value are the same.]

2. Use the Midpoint Rule and then Simpson's Rule to approximate the integral $\int_0^\pi x^2 \sin x dx$ with $n = 8$. Compare your results to the actual value to determine the error in each approximation.

3. Use the Trapezoid Rule, Midpoint Rule and Simpson's Rule to approximate the integral $\int_0^2 \sqrt[4]{1+x^2} dx$ with $n = 8$.