

Review of Selected Integration Techniques

Please work the following problems for homework. This will be due on Monday, June 11 during class. Please feel free to work together on this but be forewarned: some of the techniques that are being reviewed here are important for this course so I will expect you to know how to do integrals like these.

1. Evaluate the following definite and indefinite integrals. Here are some hints: (a) let $u = x^2$, (b/h) complete the square and substitute, (c/g) perform polynomial division, (d) do multiple substitutions starting with $u = x + 1$, (e) factor out a cosine, write $\cos^2 x$ in terms of $\sin^2 x$, and substitute, (f) split up the integral, (i) use a trig identity, make a substitution, and then divide.

$$\begin{array}{lll} \text{(a)} \int_1^{\sqrt{2}} \frac{x}{3+x^4} dx & \text{(b)} \int \frac{dx}{x^2-6x+14} & \text{(c)} \int_{\sqrt{2}}^3 \frac{2x^3}{x^2-1} dx \\ \text{(d)} \int \frac{\ln(x+1)}{x+1} dx & \text{(e)} \int \cos^3 x \sin^4 x dx & \text{(f)} \int \frac{1-x}{\sqrt{1-x^2}} dx \\ \text{(g)} \int \frac{x^2-2x+3}{x+5} dx & \text{(h)} \int \frac{dx}{\sqrt{1-4x-x^2}} & \text{(i)} \int_0^{\pi/4} \frac{\sin(2x)}{\cos x+1} dx \end{array}$$

2. Use partial fractions to evaluate

$$\int \frac{7x^3 - 11x^2 + 16x - 30}{x(x^2 + 3)(x - 2)} dx$$

Your partial fraction expansion should not contain any nasty-looking coefficients.

3. Evaluate the following improper integrals and say in words why each integral is improper. More hints: for (b) and (c) use integration by parts.

$$\begin{array}{ll} \text{(a)} \int_1^2 \frac{dx}{\sqrt{x-1}} & \text{(b)} \int_0^2 \ln x \, dx \\ \text{(c)} \int_0^\infty t^2 e^{-t} dt & \text{(d)} \int_2^\infty \frac{3}{x^2+4} dx \end{array}$$