

In order to more effectively pick an appropriate strategy, you should be familiar with the basic integration formulas (see p. 543).

1. Simplify

$$\underline{\text{EX}} \quad \int (x^2 + 2x + x^3)^2 dx$$

$$\underline{\text{EX}} \quad \int \sqrt{x} (x + 3x^{3/2}) dx$$

$$\underline{\text{EX}} \quad \int \frac{\tan \theta}{\sec^2 \theta} d\theta$$

2. Look for an obvious u -substitution

$$\underline{\text{EX}} \quad \int \frac{x-2}{x^2-4x} dx$$

$$\underline{\text{EX}} \quad \int \sin x \sqrt{\cos x} dx$$

3. Classify the integrand $f(x)$ according to form

(a). Trigonometric functions (Section 7.2)

- Products of powers $\sin x$ and $\cos x$ OR $\tan x$ and $\sec x$ OR $\cot x$ and $\csc x$.
 - Factor out the appropriate terms to be used as du and use identities to convert the rest to u for a u -substitution.

$$\underline{\text{EX}} \quad \int \sin^3 x \cos^2 x dx$$

$$\underline{\text{EX}} \quad \int \tan^2 \theta \sec^4 \theta d\theta$$

- Use 1/2-angle identities

$$\underline{\text{EX}} \quad \int \sin^4 x dx$$

- Products of the form $\sin mx \sin nx$ – use identities

$$\underline{\text{EX}} \quad \int \sin 2x \cos 5x dx$$

(b). Rational Functions $\frac{P(x)}{Q(x)}$ – Use partial fraction decomposition (Section 7.4)

$$\underline{\text{EX}} \quad \int \frac{x+1}{x^2+5x+6}$$

(c). Integration by Parts (Section 7.1)

- Products of polynomials (or x^n) and trigonometric, exponential, logarithmic, or inverse functions

$$\underline{\text{EX}} \quad \int x^3 \sin(5x) dx$$

- Products of exponential functions and trigonometric functions

$$\underline{\text{EX}} \quad \int e^x \cos 3x dx$$

- Inverse functions alone

$$\underline{\text{EX}} \quad \int \ln x dx$$

(d). Radicals

- For $\sqrt{\pm x^2 \pm a^2}$, use trigonometric substitution (Section 7.3)

$$\underline{\text{EX}} \quad \int \frac{1}{\sqrt{4x^2-25}} dx$$

- For $\sqrt[n]{ax+b}$, use a rationalizing substitution $u = \sqrt[n]{ax+b}$ (Section 7.4)

$$\underline{\text{EX}} \quad \int \frac{1}{1+\sqrt[3]{x}} dx$$

4. Try again – possible things you missed

- (a). Simplification or manipulation of the integrand (e.g. complete the square, split up fraction, trig identities, etc.)
- (b). Not so obvious u -substitution or trig substitution (or rationalizing substitution)
- (c). Integration by parts