In order to more effectively pick an appropriate strategy, you should be familiar with the basic integration formulas (see p. 519).

1. Simplify

Ex $\int \left(x^2 + 2x + x^3\right)^2 \, dx$

Ex $\int \sqrt{x}\left(x + 3x^{3/2}\right) \, dx$

Ex $\int \frac{\tan\theta}{\sec^2\theta} \, d\theta$

2. Look for an obvious u-substitution

Ex $\int \frac{x-2}{x^2-4x} \, dx$

Ex $\int \sin x\sqrt{\cos x} \, dx$

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.

    Ex $\int \sin^3 x \cos^2 x \, dx$

    Ex $\int \tan^2\theta \sec^4\theta \, d\theta$

  - Use 1/2-angle identities

    Ex $\int \sin^4 x \, dx$

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

  Ex $\int \sin 2x \cos 5x \, dx$

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

Ex $\displaystyle\int \frac{x+1}{x^2+5x+6}$

(c). Integration by Parts (Section 7.1)

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

  Ex $\displaystyle\int x^3 \sin(5x)\, dx$

- Products of exponential functions and trigonometric functions

  Ex $\displaystyle\int e^x \cos 3x\, dx$

- Inverse functions alone

  Ex $\displaystyle\int \ln x\, dx$

(d). Radicals

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

  Ex $\displaystyle\int \frac{1}{\sqrt{4x^2-25}}\, dx$

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

  Ex $\displaystyle\int \frac{1}{1+\sqrt[3]{x}}\, dx$

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