Table of integrals to remember.

Power functions:

$$\int x^\alpha\,dx = \frac{1}{\alpha+1}x^{\alpha+1} + C \quad \text{for all real numbers } \alpha \neq -1.$$

$$\int x^{-1}\,dx = \ln|x| + C.$$

Rational functions:

For expressions of the form $P(x)/Q(x)$, where both P and Q are polynomials, if the degree of P is less than the degree of Q, use partial fractions.

If the degree of P is bigger or equal to the degree of Q, then do long division to get it to the form $P(x) = Q(x)P_1(x)+R(x)$, where $R(x)$ has degree smaller than the degree of Q. Then you'll get: $P(x)/Q(x) = P_1(x) + R(x)/Q(x)$, and the first term $P_1(x)$ is very easy to integrate, and for the second term $R(x)/Q(x)$ you can use partial fractions.

Exponential and logarithmic functions:

$$\int e^x\,dx = e^x + C.$$

$$\int a^x\,dx = \frac{1}{\ln a}a^x + C.$$

$$\int \ln(x)\,dx = x\ln x - x + C.$$

For expressions such as $x^n \ln x$ or $x^n e^x$, use integration by parts.

Trigonometric functions:

$$\int \sin(x)\,dx = -\cos(x) + C; \qquad \int \cos(x)\,dx = \sin(x) + C.$$

$$\int \tan(x)\,dx = \ln|\sec(x)| + C = -\ln|\cos(x)| + C; \qquad \int \cot(x) = \ln|\sin(x)| + C.$$

$$\int \sec(x) = \ln|\sec(x) + \tan(x)| + C; \qquad \int \csc(x) = \ln|\csc(x) - \cot(x)| + C.$$

$$\int \sec^2(x) = \tan(x) + C \qquad \int \csc(x)^2 = -\cot(x) + C.$$

$$\int \sec x \tan x\,dx = \sec(x) + C.$$

Note: the startegy for integrating $\sin^n(x)\cos^m(x)\,dx$ is to make a substitution $u = \cos(x)$ or $u = \sin(x)$ (use the function whose power is odd); if both powers are even, use double-angle formulas to reduce to smaller powers of the functions of $2x$.

The strategy for integrating $\tan^n(x)\sec^m(x)$ is: if $m \geq 2$ is even, use the substitution $u = \tan x$. If n is odd, use $u = \sec(x)$ (remember that $\sec'(x) = \sec(x)\tan(x)$. In other cases, sometimes can use integration by parts to reduce to the integral of $\sec(x)$ or $\tan(x)$, which you should remember (see the table above).

Derivatives of the inverse trigonometric functions:

$$\int \frac{1}{\sqrt{1-x^2}} = \sin^{-1}(x)$$

$$\int \frac{1}{1+x^2} = \tan^{-1}(x)$$

$$\int \frac{1}{x\sqrt{a^2-x^2}} = \frac{1}{a}\sec^{-1}(x/a) + C.$$

Note: if in these integrals, instead of $1 - x^2$ or $1 + x^2$ you have $a^2 - x^2$ or $a^2 + x^2$, then use the substitution $u = x/a$; if you have some other quadratic polynomial, then *complete the square*, and reduce it to $a^2 - x^2$, $a^2 + x^2$, or $x^2 - a^2$.

Strategy for the other functions involving $\sqrt{a^2 - x^2}$ or $a^2 + x^2$: for $\sqrt{a^2 - x^2}$, use the substitution $x = a\sin(u)$, for $a^2 + x^2$, use the substitution $x = a\tan(u)$. If you have a quadratic polynomial inside a square root, then *complete the square* to reduce it to $a^2 - x^2$, $x^2 - a^2$, or $x^2 + a^2$.

Always look for an easy way out first: when computing definite integrals, do not forget to look for symmetry; always look for easy substitutions that could make the integral simpler. See if there is a clever integration by parts that could make it simpler, too.