1. Trig Addition, Half Angle.

$\cos(A \pm B) = \cos(A)\cos(B) \mp \sin(A)\sin(B)$ $\qquad$ $\cos(2A) = \cos^2(A) - \sin^2(A)$

$\cos(2A) = 2\cos^2(A) - 1$ $\qquad$ $\cos(2A) = 1 - 2\sin^2(A)$ $\qquad$ $\sin^2(x) = (1 - \cos(2x))/2$

$\cos^2(x) = (1 + \cos(2x))/2$ $\qquad$ $\sin(2x) = 2\sin(x)\cos(x)$

$\sin(A \pm B) = \sin(A)\cos(B) \pm \cos(A)\sin(B)$

2. Hyperbolic.

$\sinh(x) = \frac{1}{2}(e^x - e^{-x})$ $\qquad$ $\cosh(x) = \frac{1}{2}(e^x + e^{-x})$

3. Integration by Parts.

$\int u\,dv \;=\; uv \;-\; \int v\,du$

4. Integration by substitution.

$$\int f(u(x))\frac{du}{dx}\,dx \;=\; \int f(u)\,du$$

5. Inverse Trig.

$\frac{d}{dx}\sin^{-1}(x) = \frac{1}{\sqrt{1-x^2}}$ $\qquad$ $\frac{d}{dx}\tan^{-1}(x) = \frac{1}{1+x^2}$ $\qquad$ $\int \frac{dx}{x^2+a^2} = \frac{1}{a}\tan^{-1}(\frac{x}{a})$

6. Trig Substitutions.

For $\sqrt{a^2 - x^2}$ use $x = a\sin(\theta)$
For $\sqrt{a^2 + x^2}$ use $x = a\tan(\theta)$
For $\sqrt{x^2 - a^2}$ use $x = a\sec(\theta)$

7. Some integrals.

$$\int \frac{dx}{x} \;=\; \ln|x| + C$$

$$\int \tan(x)\,dx \;=\; \ln|\sec(x)| + C$$

$$\int \sec(x)\,dx \;=\; \ln|\sec(x) + \tan(x)| + C$$

8. First order linear ODE $y' + p(x)y = q(x)$ can be solved by first multiplying across by an integrating factor

$$I \;=\; e^{\int p\,dx}$$

9. The equation $M(x,y)dx + N(x,y)dy = 0$ is said to be exact if $M_y = N_x$. If it is exact, it can be solved by antidifferentiating M with respect to x and N with respect to y to obtain $F(x,y)$ and then setting $F(x,y) = C$.

10. An ODE of the form $y' = f(ax + by + c)$ can be solved by first making a substitution $v = ax + by + c$.

11. An ODE of the form $y' = f(y/x)$ can be solved by first making a substitution $v = y/x$.

12. The Bernoulli equation $y' + p(x)y = q(x)y^n$ can be solved by first making a substitution $v = \frac{1}{y^{n-1}}$.