Integrals

Group 1:

$$\int x \cos(4x) \; dx$$

Answer: Let $u = x$, $dv = \cos(4x) \; dx$

$$\frac{x}{4} \sin(4x) + \frac{1}{16} \cos(4x) + C$$

Group 2:

$$\int x(\ln x)^2 \; dx$$

Answer: Let $u = (\ln x)^2$, $dv = x \; dx$ to start. After two applications of parts you should get:

$$\frac{x^2}{2} (\ln x)^2 - \frac{x^2}{2} \ln x + \frac{x^2}{4} + C$$

Group 3:

$$\int x\sqrt{5x + 3} \; dy$$

Answer: Let $u = x$, $dv = \sqrt{5x + 3} \; dx$

$$\frac{2x}{15} (5x + 3)^{3/2} - \frac{4}{375} (5x + 3)^{5/2} + C$$

Group 4:

$$\int \theta^2 \sin(2\theta) \; d\theta$$

Answer: Let $u = \theta^2$, $dv = \sin(2\theta) \; d\theta$ to start. After two applications of parts, you should get:

$$\frac{-\theta^2}{2} \cos(2\theta) + \frac{\theta}{2} \sin(2\theta) + \frac{1}{4} \cos(2\theta) + C$$

Group 5:

$$\int t^2 e^{-3t} \; dt$$

Answer: Let $u = t^2$, $dv = e^{-3t}$ to start. After two applications of parts, you should get:

$$\frac{-t^2}{3}e^{-3t} - \frac{2t}{9}e^{-3t} - \frac{2}{27}e^{-3t} + C$$

Group 6:

$$\int \frac{\ln(x)}{x^2}\, dx$$

Answer: Let $u = \ln x$, $dv = x^{-2}\, dx$

$$\frac{-1}{x}\ln x - \frac{1}{x} + C$$

Group 7:

$$\int x^5 \cos(x^3)\, dx$$

Hint: The $\cos(x^3)$ should go in dv, but what "else" do you need to be able to find v?
Answer: Let $u = x^3$ and $dv = x^2 \cos(x^3)\, dx$. The idea is to include the derivative of the x^3 inside the cosine (up to a constant), so that you can find $v = \int dv$ by substitution.

$$\frac{x^3}{3}\sin(x^3) + \frac{1}{3}\cos(x^3) + C$$

Group 8:

$$\int \arcsin(x) dx$$

Answer: Let $u = \arcsin(x)$ and $dv = dx$. The idea is to include the derivative of the x^3 inside the cosine (up to a constant), so that you can find $v = \int dv$ by substitution.

$$x \arcsin(x) + \sqrt{1 - x^2} + C$$