Practice Integrals

If you would like answers, use Wolfram alpha (just type in, e.g., "Integrate x^2+1" and it should give you $\frac{x^3}{3}+x+C$). If you get stuck on how an integral works, there are some hints on the back.

1.
$$\int xe^x dx \quad \int \ln(t)dt \quad \int (r+2)^{5/2}dr \quad \int e^x\cos(x)dx \quad \int \cos(x)\sin(2x)dx$$

2.
$$\int (p+1)^3(p+2)^2dp \quad \int (\sin(y)+1)^2dy \quad \int t^2e^{-t}dt \quad \int \frac{1}{x^3}dx$$

3.
$$\int \frac{1}{x\ln(x)} \quad \int \frac{x}{(x^2-1)^{3/2}} \quad \int e^{\cos(5y)}\sin(5y)dy \quad \int \theta\sin(\pi+\theta^2)d\theta$$

4.
$$\int (1+s)\cos(s)ds \quad \int \cos(s^2)sds \quad \int x\ln(x)dx \quad \int x^3e^{x^2}dx$$

5.
$$\int 7xe^{-2x^2}dx \quad \int x^2\sin\left(\frac{x}{2}\right)dx \quad \int \frac{5y}{\left(\frac{y}{4}\right)^2-1}dy$$

6.
$$\int e^{-x}\cos(5x)dx \quad \int \left(x^3+5x^2-x-\frac{1}{2}\right)dx \quad \int \frac{x^6-x^4-x^2}{x^2}dx \quad \int \frac{\ln(y)}{y}dy \quad \int \frac{\ln(x)(x-1)}{x}dx$$

7.
$$\int (5x)^3e^{5x}dx \quad \int (u^2+1)du \quad \int \frac{1}{u^2+1}du \quad \int \frac{1}{\sqrt{1-x^2}}dx \quad \int \frac{\frac{1}{2}x}{(x^2+1)^{3/2}}$$

8.
$$\int (1+t^2)^{-3/2}dt \quad \int \frac{x+1}{x}dx \quad \int \frac{\sin(\theta)}{\cos^2(\theta)+1}d\theta \quad \int \tan(x)dx$$

9.
$$\int_0^1 x^m dx \quad \int_0^\infty e^{-x}dx \quad \int_{-\infty}^\infty re^{-r^2}dr \quad \int_{-\pi/4}^{\pi/4}\tan(x)dx$$

10.
$$\int_0^1 \sqrt{1-x^2}dx \quad \int_{-\infty}^\infty \frac{1}{\sigma\sqrt{2\pi}}e^{-\left(\frac{x-\mu}{\sigma}\right)^2}dx \quad \int_0^1 \sqrt{x}dx \quad \int_0^5 3e^{-\frac{x^2}{2}}xdx \quad \int_0^x \cos(t)dt \quad \int_0^1 dx$$

11.
$$\int_1^x \ln(t)dt \quad \int_2^x e^t dt \quad \int_0^x \frac{1}{1+s^2}ds \quad \int_0^x e^{-y}dy.$$

Selected Hints/Answers

1. $\int xe^x$ is integration by parts. $\int \ln(t)dt$ is also integration by parts:

$$\int \ln(t) = \int \ln(t)\left(\frac{d}{dt}t\right)dt = t\ln(t) - \int\left(\frac{d}{dt}\ln(t)\right)tdt.$$

$\int e^x\cos(x)dx$ is integration by parts, twice:

$$\int e^x\cos(x)dx = \int\left(\frac{d}{dx}e^x\right)\cos(x)dx = e^x\cos(x) - \int e^x\left(\frac{d}{dx}\cos(x)\right)dx = e^x\cos(x) + \int e^x\sin(x)$$

$$= e^x\cos(x) + \int\left(\frac{d}{dx}e^x\right)\sin(x)dx$$

$$= e^x\cos(x) + \left[e^x\sin(x) - \int e^x\left(\frac{d}{dx}\sin(x)\right)\right] = e^x\cos(x) + \left[e^x\sin(x) - \int e^x\cos(x)\right]$$

so

$$\int e^x\cos(x)dx = e^x\cos(x) + e^x\sin(x) - \int e^x\cos(x)dx$$

so

$$2\int e^x\cos(x)dx = e^x\cos(x) + e^x\sin(x)$$

so

$$\int e^x\cos(x)dx = \frac{1}{2}(e^x\cos(x) + e^x\sin(x)) + C.$$

For $\int\cos(x)\sin(2x)dx$, note that $\sin(2x) = 2\sin(x)\cos(x)$ (double angle formula for sine).

2. To integrate $\sin^2(y)$, use the half angle formula for sine. $\int t^2e^{-t}dt$ is integration by parts.
3. The first is by parts, the next are all u-substitutions.
4. For the last one, do it by parts but split it like $x^3e^{x^2} = x^2(xe^{x^2})$.
5. Second one is integration by parts. The others can be done with u-substitutions.

8. I think the first one is hard. I did it by parts after adding and subtracting something to the numerator. For $\int\frac{\sin(\theta)}{\cos^2(\theta)+1}d\theta$, use $u = \cos(\theta)$. For the last one, note that $\tan(\theta) = \frac{\sin(\theta)}{\cos(\theta)}$ and do a u-substitution.