Homework 4: Integration by Parts

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7.

$$\int \cos x \left(x^2+2x\right) dx = \cos x \left(\frac{x^3}{3}+x^2\right) - \int \cos x dx = \boxed{\cos x \left(\frac{x^3}{3}+x^2\right) - \sin x + C}$$

10.

$$\int \sin^{-1} x dx = \boxed{\sqrt{1-x^2} + x \sin^{-1} x + C}$$

11.

$$\int \tan^{-1} 4t dt = t\left(\tan^{-1} 4t\right) - \int \frac{4t}{16t^2+1} = \boxed{t\left(\tan^{-1} 4t\right) - \frac{\ln\left(16t^2+1\right)}{8} + C}$$

15.

$$\int (\ln x)^2 dx = x(\ln x)^2 - \int 2\ln x = \boxed{x\Big((\ln x)^2 - 2(\ln x - 1)\Big) + C}$$

18.

$$\int e^{-\theta} \cos 2\theta d\theta = \boxed{-\frac{e^{-x}(\cos 2x - 2\sin 2x) + C}{5}}$$

23.

$$\int_0^{\frac{1}{2}} x \cos \pi x dx = x^2 \cos \pi x - \int x(\cos \pi x - \pi x \sin \pi x) dx = \left.\frac{x \sin \pi x +}{\pi} \frac{\cos \pi x}{\pi^2}\right|_0^{\frac{1}{2}} = \boxed{\frac{\pi - 2}{2\pi^2}}$$

27.

$$\int_1^3 r^3 \ln r dr = \frac{x^4 \ln x}{4} - \int \frac{x^3}{4} dx = \frac{x^4 \ln x}{4} - \frac{1}{4}\int x^3 dx = \left.\frac{x^4 \ln x}{4} - \frac{x^4}{16}\right|_1^3 \approx \boxed{17.247}$$

30.

$$\int_1^{\sqrt{3}} \tan^{-1}\frac{1}{x}dx = x\left(\tan^{-1}\frac{1}{x}\right) - \int -\frac{x}{x^2+1}dx = \left(x\left(\tan^{-1}\frac{1}{x}\right) - \frac{\ln\left(x^2+1\right)}{2}\right)\Bigg|_1^{\sqrt{3}} = \boxed{\frac{\pi}{2\sqrt{3}} + \ln 2}$$

32* $\int_1^2 \frac{(\ln x)^2}{x^3}dx =$
37*. Use substitution first
$\int \cos\sqrt{x}dx =$