Evaluate the integral using integration by parts with the indicated choices of u and dv.

1) $\int x \ln x \, dx \quad u = \ln x \quad dv = x \, dx$ $\boxed{\frac{1}{2}x^2 \ln x - \frac{1}{4}x^2 + C}$

2) $\int \theta \sec^2 \theta \, d\theta \quad u = \theta \quad dv = \sec^2 \theta \, d\theta$ $\boxed{\theta \tan \theta - \ln|\sec \theta| + C}$

Evaluate the definite or indefinite integral.

3) $\int xe^{-x} \, dx$ $\boxed{-xe^{-x} - e^{-x} + C}$

4) $\int x^2 \sin \pi x \, dx$ $\boxed{-\frac{1}{\pi} x^2 \cos \pi x + \frac{2}{\pi^2} x \sin \pi x + \frac{2}{\pi^3} \cos \pi x + C}$

5) $\int t^3 e^t \, dt$ $\boxed{(t^3 - 3t^2 + 6t - 6)e^t + C}$

6) $\int e^{2\theta}\sin 3\theta\, d\theta$ $\boxed{\frac{1}{13}e^{2\theta}(2\sin 3\theta - 3\cos 3\theta) + C}$

7) $\int \ln(2x+1)\, dx$ $\boxed{\frac{1}{2}(2x+1)\ln(2x+1) - x + C}$

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

9) $\int_0^{\pi} t \sin 3t \, dt$ $\boxed{\frac{\pi}{3}}$

10) $\int_1^2 \frac{\ln x}{x^2} dx$ $\boxed{\frac{1}{2} - \frac{1}{2}\ln 2}$

11) $\int_0^{1/2} \cos^{-1} x \, dx$ $\boxed{\frac{1}{6}\left(\pi + 6 - 3\sqrt{3}\right)}$

12) $\int_0^1 x5^x\,dx$ $\boxed{\dfrac{5}{\ln 5}-\dfrac{4}{(\ln 5)^2}}$

13) First make a substitution and then use integration by parts to evaluate the integral: $\int_1^4 e^{\sqrt{x}}\,dx$

$\boxed{2e^2}$

14) Suppose that $f(1)=2$, $f(4)=7$, $f'(1)=5$, $f'(4)=3$, and f'' is continuous. Find the value of $\int_1^4 x\,f''(x)\,dx$.

$\boxed{2}$