1. *Evaluate the following integrals using integration by parts:*

   a. $\int \cos^{-1}\left(\frac{x}{2}\right) dx$

   b. $\int e^{-2x} \sin 3x dx$

2. *Evaluate the integrals. It may be necessary to use a substitution first.*

   a. $\int \frac{dx}{x(1+\sqrt[3]{x})}$

   $$\begin{bmatrix} u & = & \sqrt[3]{x} \\ du & = & \frac{dx}{3x^{2/3}} \\ dx & = & 3u^2 du \end{bmatrix} \rightarrow \int \frac{3u^2 du}{u^3(1+u)} = 3\int \frac{du}{u(1+u)} = 3\ln\left|\frac{u}{u+1}\right| + C = 3\ln\left|\frac{\sqrt[3]{x}}{1+\sqrt[3]{x}}\right| + C$$

   b. $\int \frac{ds}{\sqrt{e^s+1}}$

   $$\begin{bmatrix} u & = & \sqrt{e^s+1} \\ du & = & \frac{e^s ds}{2\sqrt{e^s+1}} \\ ds & = & \frac{2udu}{u^2-1} \end{bmatrix} \rightarrow \int \frac{2udu}{u(u^2-1)} = 2\int \frac{du}{(u+1)(u-1)} = \int \frac{du}{u-1} - \int \frac{du}{u+1} = \ln\left|\frac{u-1}{u+1}\right| + C = \ln\left|\frac{\sqrt{e^s+1}-1}{\sqrt{e^s+1}+1}\right| + C$$

3. *Evaluate the integrals (1) without using a trigonometric substitution, (2) using a trigonometric substitution.*

   a. $\int \frac{xdx}{\sqrt{4+x^2}}$

   (1) $\frac{1}{2}\int \frac{d(4+x^2)}{\sqrt{4+x^2}} = \sqrt{4+x^2} + C$

   (2) $[x = 2\tan y] \rightarrow \int \frac{2\tan y \cdot 2\sec^2 y dy}{2\sec y} = 2\int \sec y \tan y dy = 2\sec y + C = \sqrt{4+x^2} + C$

   b. $\int \frac{tdt}{\sqrt{4t^2-1}}$

   (1) $\frac{1}{8}\int \frac{d(4t^2-1)}{4t^2-1} = \frac{1}{4}\sqrt{4t^2-1} + C$

   (2) $[t = \frac{1}{2}\sec\theta] \rightarrow \int \frac{\frac{1}{2}\sec\theta\tan\theta \cdot \frac{1}{2}\sec\theta d\theta}{\tan\theta} = \frac{1}{4}\int \sec^2\theta d\theta = \frac{\tan\theta}{4} + C = \frac{\sqrt{4t^2-1}}{4} + C$

4. $\int e^t \sqrt{\tan^2 e^t + 1} dt$