1. Use Ex. 50 in Exercises 7.1 to show that

$$\int \sec^3 u \, du = \frac{1}{2} \sec u \tan u + \frac{1}{2} \ln |\sec u + \tan u| + C.$$

2. Use the formula in problem 1 to show

$$\int \tan^2 u \sec u \, du = \frac{1}{2} \sec u \tan u - \frac{1}{2} \ln |\sec u + \tan u| + C.$$

In # 3–#8, derive each formula.

3. $\displaystyle\int \frac{du}{\sqrt{a^2 + u^2}} = \ln\left(u + \sqrt{a^2 + u^2}\right) + C$

4. $\displaystyle\int \frac{du}{\sqrt{u^2 - a^2}} = \ln\left|u + \sqrt{u^2 - a^2}\right| + C$

5. $\displaystyle\int \frac{du}{(a^2 + u^2)^2} = \frac{1}{2a^3}\left(\operatorname{Arctan}\frac{u}{a} + \frac{au}{a^2 + u^2}\right) + C$

6. $\displaystyle\int \sqrt{a^2 - u^2}\, du = \frac{a^2}{2} \operatorname{Arcsin}\frac{u}{a} + \frac{u}{2}\sqrt{a^2 - u^2} + C$

7. $\displaystyle\int \sqrt{a^2 + u^2}\, du = \frac{u}{2}\sqrt{a^2 + u^2} + \frac{a^2}{2} \ln\left(u + \sqrt{a^2 + u^2}\right) + C$

8. $\displaystyle\int \sqrt{u^2 - a^2}\, du = \frac{u}{2}\sqrt{u^2 - a^2} - \frac{a^2}{2} \ln\left|u + \sqrt{u^2 - a^2}\right| + C$

9. Use trigonometric substitutions to derive Basic Integral Formulas [14]–[16].