EXERCISE SET 8.3

1. $u = \cos x, -\int u^3 du = -\frac{1}{4}\cos^4 x + C$

2. $u = \sin 3x, \frac{1}{3}\int u^5\, du = \frac{1}{18}\sin^6 3x + C$

3. $\int \sin^2 5\theta = \frac{1}{2}\int (1 - \cos 10\theta)\, d\theta = \frac{1}{2}\theta - \frac{1}{20}\sin 10\theta + C$

4. $\int \cos^2 3x\, dx = \frac{1}{2}\int (1 + \cos 6x) dx = \frac{1}{2}x + \frac{1}{12}\sin 6x + C$

5. $\int \sin^3 a\theta\, d\theta = \int \sin a\theta (1 - \cos^2 a\theta)\, d\theta = -\frac{1}{a}\cos a\theta - \frac{1}{3a}\cos^3 a\theta + C \quad (a \neq 0)$

6. $\int \cos^3 at\, dt = \int (1 - \sin^2 at)\cos at\, dt$

$$= \int \cos at\, dt - \int \sin^2 at \cos at\, dt = \frac{1}{a}\sin at - \frac{1}{3a}\sin^3 at + C \quad (a \neq 0)$$

7. $u = \sin ax, \quad \frac{1}{a}\int u\, du = \frac{1}{2a}\sin^2 ax + C, a \neq 0$

8. $\int \sin^3 x \cos^3 x\, dx = \int \sin^3 x (1 - \sin^2 x)\cos x\, dx$

$$= \int (\sin^3 x - \sin^5 x)\cos x\, dx = \frac{1}{4}\sin^4 x - \frac{1}{6}\sin^6 x + C$$

9. $\int \sin^2 t \cos^3 t\, dt = \int \sin^2 t (1 - \sin^2 t)\cos t\, dt = \int (\sin^2 t - \sin^4 t)\cos t\, dt$

$$= \frac{1}{3}\sin^3 t - \frac{1}{5}\sin^5 t + C$$

10. $\int \sin^3 x \cos^2 x\, dx = \int (1 - \cos^2 x)\cos^2 x \sin x\, dx$

$$= \int (\cos^2 x - \cos^4 x)\sin x\, dx = -\frac{1}{3}\cos^3 x + \frac{1}{5}\cos^5 x + C$$

11. $\int \sin^2 x \cos^2 x\, dx = \frac{1}{4}\int \sin^2 2x\, dx = \frac{1}{8}\int (1 - \cos 4x) dx = \frac{1}{8}x - \frac{1}{32}\sin 4x + C$