Calculus I
Section 5.3A – Integration by Substitution

Evaluate the following given the appropriate value of *u*.

1. $\int \sin 3x\,dx \quad u = 3x$

2. $\int x \sin 2x^2\,dx \quad u = 2x^2$

3. $\int \sec 2t \tan 2t\,dt \quad u = 2t$

4. $\int 28(7x-2)^{-5}\,dx \quad u = 7x-2$

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5. $\int x^3(x^4-1)^2\,dx \quad u=x^4-1$

6. $\int \frac{9r^2}{\sqrt{1-r^3}}dr \quad u=1-r^3$

7. $\int \frac{dx}{\sqrt{5x+8}} \quad u=5x+8$

8. $\int\left(1-\cos\frac{t}{2}\right)^2 \sin\frac{t}{2}dt \quad u=1-\cos\frac{t}{2}$

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Evaluate the following given the appropriate value of *u*.

1. $\int \sin 3x\,dx \quad u = 3x$

$du = 3dx$

$\frac{1}{3}\int \sin u\,du$

$-\frac{1}{3}\cos u + C$

$\boxed{-\frac{1}{3}\cos 3x + C}$

2. $\int x \sin 2x^2\,dx \quad u = 2x^2$

$du = 4x$

$\frac{1}{4}\int \sin u\,du$

$-\frac{1}{4}\cos u + C$

$\boxed{-\frac{1}{4}\cos 2x^2 + C}$

3. $\int \sec 2t \tan 2t\,dt \quad u = 2t$

$du = 2dt$

$\frac{1}{2}\int \sec u \tan u\,du$

$\frac{1}{2}\sec u + C$

$\boxed{\frac{1}{2}\sec 2t + C}$

4. $\int 28(7x-2)^{-5}\,dx \quad u = 7x - 2$

$du = 7dx$

$4\int u^{-5}\,du$

$-u^{-4} + C$

$\boxed{\frac{-1}{(7x-2)^4} + C}$

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5. $\int x^3(x^4-1)^2\,dx \quad u = x^4-1$

$du = 4x^3\,dx$

$\frac{1}{4}\int u^2\,du$

$\frac{1}{12}u^3 + C$

$\boxed{\frac{1}{12}(x^4-1)^3 + C}$

6. $\int \frac{9r^2}{\sqrt{1-r^3}}\,dr \quad u = 1-r^3$

$du = -3r^2$

$-3\int u^{-1/2}\,du$

$-6u^{1/2} + C$

$\boxed{-6\sqrt{1-r^3} + C}$

7. $\int \frac{dx}{\sqrt{5x+8}} \quad u = 5x+8$

$du = 5\,dx$

$\frac{1}{5}\int u^{-1/2}\,du$

$\frac{2}{5}u^{1/2} + C$

$\boxed{\frac{2}{5}\sqrt{5x+8} + C}$

8. $\int\left(1-\cos\frac{t}{2}\right)^2 \sin\frac{t}{2}\,dt \quad u = 1-\cos\frac{t}{2}$

$du = \frac{1}{2}\sin\frac{t}{2}\,dt$

$2\int u^2\,du$

$\frac{2}{3}u^3 + C$

$\boxed{\frac{2}{3}\left(1-\cos\frac{t}{2}\right)^3 + C}$