

Questions: Integration by substitution

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Summary

A selection of questions for the study guide on integration by substitution.

Before attempting these questions, it is highly recommended that you read [Guide: Integration by substitution].

Q1

Using an appropriate substitution or the chain rule for integration, integrate the following expressions with respect to x .

1.1. $\int (2x + 5)^3 \, dx$

1.2. $\int (3 - 4x)^5 \, dx$

1.3. $\int \left(\frac{x}{2} - 1\right)^4 \, dx$

1.4. $\int (5x - 2)^{-3} \, dx$

1.5. $\int (4 - 3x)^{-2} \, dx$

1.6. $\int (2x + 7)^{-3} \, dx$

1.7. $\int \left(\frac{x}{5} + 3\right)^{-4} \, dx$

1.8. $\int (1 - 2x)^{-1/2} \, dx$

1.9. $\int (3x + 4)^{-3/2} \, dx$

1.10. $\int (5 - 6x)^{-2/3} \, dx$

Q2

Using an appropriate substitution or the chain rule for integration, integrate the following trigonometric functions with respect to x .

- 2.1. $\int \cos(x) \, dx$
- 2.2. $\int \sin(2x) \, dx$
- 2.3. $\int \frac{5}{6} \cos(x) \, dx$
- 2.4. $\int \cos(3x) \, dx$
- 2.5. $\int \sin\left(\frac{x}{3}\right) \, dx$
- 2.6. $\int \frac{4}{5} \cos\left(3x - \frac{\pi}{4}\right) \, dx$
- 2.7. $\int \sin\left(\frac{\pi}{3} - \frac{4x}{9}\right) \, dx$
- 2.8. $\int -\frac{1}{2} \cos\left(3x + \frac{\pi}{2}\right) \, dx$
- 2.9. $\int 4 \sin\left(\frac{x}{4} - \frac{\pi}{2}\right) \, dx$
- 2.10. $\int \frac{3}{5} \cos\left(\frac{\pi}{6} - 5x\right) \, dx$

Q3

Using an appropriate substitution or the chain rule for integration, integrate the following exponential and reciprocal linear functions with respect to x .

- 3.1. $\int 5e^{2x+1} \, dx$
- 3.2. $\int 7e^{-3x+4} \, dx$
- 3.3. $\int -e^{-3(x-2)} \, dx$
- 3.4. $\int 2 \exp\left(\frac{x}{3} - 5\right) \, dx$
- 3.5. $\int \frac{6}{3x-7} \, dx$
- 3.6. $\int \frac{4}{5-2x} \, dx$
- 3.7. $\int \frac{3}{2x+5} \, dx$
- 3.8. $\int -\frac{3}{5(x-2)+1} \, dx$

Q4

Using an appropriate substitution, integrate the following functions with respect to x . Express your answers in terms of x only.

4.1. $\int 6x(3x^2 + 2)^4 \, dx$

4.2. $\int 5(5x - 7)^3 \, dx$

4.3. $\int 8x \exp(4x^2 - 1) \, dx$

4.4. $\int \frac{2x + 1}{(x^2 + x + 5)^2} \, dx$

4.5. $\int 6x \cos(3x^2 + 2) \, dx$

4.6. $\int (2x + 3) \exp(x^2 + 3x) \, dx$

4.7. $\int \frac{x}{(x^2 + 1)^{3/2}} \, dx$

4.8. $\int \frac{e^{5x}}{2e^{5x} + 3} \, dx$

4.9. $\int -4x \sin(4 - 2x^2) \, dx$

4.10. $\int \frac{3x^2}{(x^3 + 1)^2} \, dx$

[After attempting the questions above, please click this link to find the answers.](#)

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v1.0: initial version created 05/25 by Donald Campbell as part of a University of St Andrews VIP project.

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