

Integration Exercises

1. Find each of the following differentials.

(a) For $y = f(x) = x^{100}$, find dy .

(c) For $u = g(x) = 5e^x + x$, find du .

(b) For $u = g(x) = e^x$, find du .

(d) For $u = h(x) = \ln(x^2 - 1)$, find du .

2. Find each indefinite integral using the substitution indicated. *Check your answer by differentiating.*

(a) Evaluate $\int \frac{3x^2}{x^3 - 4} dx$ using the substitution $u = x^3 - 4$.

(b) Evaluate $\int \frac{3x^2}{(x^3 - 4)^5} dx$ using the substitution $u = x^3 - 4$.

(c) Evaluate $\int \frac{\ln(x - 2)}{x - 2} dx$ using the substitution $u = \ln(x - 2)$.

(d) Evaluate $\int x^4 e^{x^5} dx$ using the substitution $u = x^5$.

(e) Evaluate $\int \frac{1}{1 - 5x} dx$ using the substitution $u = 1 - 5x$.

(f) Evaluate $\int x^4(x^5 + 7)^{-3} dx$ using the substitution $u = x^5 + 7$.

3. Evaluate each indefinite integral. Try simplifying the integrand algebraically instead of or in addition to using a substitution. *Check your answer by differentiating.*

(a) $\int e^{3x} (2 - e^{3x})^5 dx$

(i) $\int \frac{1}{x \ln x} dx$

(b) $\int \frac{\sqrt{\ln x}}{x} dx$

(j) $\int \frac{(x + 2)^3}{x^2} dx$

(c) $\int \frac{1}{x\sqrt{\ln x}} dx$

(k) $\int e^x \sqrt{e^x - 17} dx$

(d) $\int \frac{x^2 - 36}{x + 6} dx$

(l) $\int \frac{x}{x^2 - 5} dx$

(e) $\int \frac{e^{-1/x}}{x^2} dx$

(m) $\int \frac{x^2 - 5}{x} dx$

(f) $\int x^3(x + 3)^2 dx$

(n) $\int x e^{x^2-1} dx$

(g) $\int \frac{e^x + 1}{e^x + x} dx$

(o) $\int x e^{x^2-2x} - e^{x^2-2x} dx$

(h) $\int \frac{e^{2x} + x}{e^{2x} + x^2} dx$