

STEWART

5.6

ANTON

8.2

1-2 ■ Evaluate the integral using integration by parts with the indicated choices of u and dv .

1. $\int x \ln x \, dx$; $u = \ln x$, $dv = x \, dx$

2. $\int \theta \cos \theta \, d\theta$; $u = \theta$, $dv = \cos \theta \, d\theta$

3-24 ■ Evaluate the integral.

3. $\int x e^{2x} \, dx$

4. $\int x^4 \ln x \, dx$

5. $\int x \sin 4x \, dx$

6. $\int \sin^{-1} x \, dx$

7. $\int x^2 \cos 3x \, dx$

8. $\int x^2 \sin ax \, dx$

9. $\int (\ln x)^2 \, dx$

10. $\int t^3 e^t \, dt$

11. $\int r^3 \ln r \, dr$

12. $\int \sin(\ln t) \, dt$

13. $\int e^{2\theta} \sin 3\theta \, d\theta$

14. $\int e^{-\theta} \cos 2\theta \, d\theta$

15. $\int_0^1 t e^{-t} \, dt$

16. $\int_1^4 \sqrt{t} \ln t \, dt$

17. $\int_0^{\pi/2} x \cos 2x \, dx$

18. $\int_0^1 (x^2 + 1)e^{-x} \, dx$

19. $\int_0^{1/2} \sin^{-1} x \, dx$

20. $\int_{\pi/4}^{\pi/2} x \csc^2 x \, dx$

21. $\int_1^4 \ln \sqrt{x} \, dx$

22. $\int x \tan^{-1} x \, dx$

37-38 ■ Use integration by parts to prove the reduction formula.

37. $\int (\ln x)^n \, dx = x(\ln x)^n - n \int (\ln x)^{n-1} \, dx$

38. $\int x^n e^x \, dx = x^n e^x - n \int x^{n-1} e^x \, dx$

39. Use Exercise 37 to find $\int (\ln x)^3 \, dx$.

40. Use Exercise 38 to find $\int x^4 e^x \, dx$.

41. A particle that moves along a straight line has velocity $v(t) = t^2 e^{-t}$ meters per second after t seconds. How far will it travel during the first t seconds?

42. A rocket accelerates by burning its onboard fuel, so its mass decreases with time. Suppose the initial mass of the rocket at liftoff (including its fuel) is m , the fuel is consumed at rate r , and the exhaust gases are ejected with constant velocity v_e (relative to the rocket). A model for the velocity of the rocket at time t is given by the equation

$$v(t) = -gt - v_e \ln \frac{m - rt}{m}$$

where g is the acceleration due to gravity and t is not too large. If $g = 9.8 \text{ m/s}^2$, $m = 30,000 \text{ kg}$, $r = 160 \text{ kg/s}$, and $v_e = 3000 \text{ m/s}$, find the height of the rocket one minute after liftoff.

1-40 Evaluate the integral.

1. $\int x e^{-2x} \, dx$

2. $\int x e^{3x} \, dx$

3. $\int x^2 e^x \, dx$

4. $\int x^2 e^{-2x} \, dx$

5. $\int x \sin 3x \, dx$

6. $\int x \cos 2x \, dx$

7. $\int x^2 \cos x \, dx$

8. $\int x^2 \sin x \, dx$

9. $\int x \ln x \, dx$

10. $\int \sqrt{x} \ln x \, dx$

11. $\int (\ln x)^2 \, dx$

12. $\int \frac{\ln x}{\sqrt{x}} \, dx$

13. $\int \ln(3x - 2) \, dx$

14. $\int \ln(x^2 + 4) \, dx$

15. $\int \sin^{-1} x \, dx$

16. $\int \cos^{-1}(2x) \, dx$

17. $\int \tan^{-1}(3x) \, dx$

18. $\int x \tan^{-1} x \, dx$

19. $\int e^x \sin x \, dx$

20. $\int e^{3x} \cos 2x \, dx$

21. $\int e^{ax} \sin bx \, dx$

22. $\int e^{-3\theta} \sin 5\theta \, d\theta$

23. $\int \sin(\ln x) \, dx$

24. $\int \cos(\ln x) \, dx$

25. $\int x \sec^2 x \, dx$

26. $\int x \tan^2 x \, dx$

27. $\int x^3 e^{x^2} \, dx$

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