These are review exercises from the textbook from chapters 12 and 13. The answers to each exercise may be found at the back of the book (both odd and even solutions).

Review Exercises

CH 12

Evaluate the integrals in Problems 1–26.

1. $\int x^6\,dx$
2. $\int x^{1/2}\,dx$
3. $\int (12x^3 - 3x^2 + 4x + 5)\,dx$
4. $\int 7(x^2 - 1)^2\,dx$
5. $\int 7x(x^2 - 1)^2\,dx$
6. $\int (x^3 - 3x^2)^5(x^2 - 2x)\,dx$
7. $\int (x^3 + 4)^2 3x\,dx$
8. $\int 5x^2(3x^3 + 7)^6\,dx$
9. $\int \frac{x^2}{x^3 + 1}\,dx$
10. $\int \frac{x^2}{(x^3 + 1)^2}\,dx$
11. $\int \frac{x^2\,dx}{\sqrt[3]{x^3 - 4}}$
12. $\int \frac{x^2\,dx}{x^3 - 4}$
13. $\int \frac{x^3 + 1}{x^2}\,dx$

XXXXXXXXXXXXXXXXXXXXXXXXX
14. $\int \frac{x^3 - 3x + 1}{x - 1}\,dx$
XXXXXXXXXXXXXXXXXXXXXXXXX

15. $\int y^2 e^{y^3}\,dy$
16. $\int (3x - 1)^{12}\,dx$
17. $\int \frac{3x^2}{2x^3 - 7}\,dx$
18. $\int \frac{5\,dx}{e^{4x}}$
19. $\int (x^3 - e^{3x})\,dx$
20. $\int xe^{1+x^2}\,dx$
21. $\int \frac{6x^7}{(5x^8 + 7)^3}\,dx$
22. $\int \frac{7x^3}{\sqrt{1 - x^4}}\,dx$
23. $\int \left(\frac{e^{2x}}{2} + \frac{2}{e^{2x}}\right)dx$
24. $\int \left[x - \frac{1}{(x + 1)^2}\right]dx$
25. (a) $\int (x^2 - 1)^4 x\,dx$ (b) $\int (x^2 - 1)^{10} x\,dx$ (c) $\int (x^2 - 1)^7 3x\,dx$ (d) $\int (x^2 - 1)^{-2/3} x\,dx$
26. (a) $\int \frac{2x\,dx}{x^2 - 1}$ (b) $\int \frac{2x\,dx}{(x^2 - 1)^2}$ (c) $\int \frac{3x\,dx}{\sqrt{x^2 - 1}}$ (d) $\int \frac{3x\,dx}{x^2 - 1}$

35. *Revenue* If the marginal revenue for a month for a product is $\overline{MR} = 0.06x + 12$ dollars per unit, find the total revenue from the sale of $x = 800$ units of the product.

40. *Revenue* If the marginal revenue for a product is $\overline{MR} = \frac{800}{x + 2}$, find the total revenue function.

41. *Cost* The marginal cost for a product is $\overline{MC} = 6x + 4$ dollars per unit, and the cost of producing 100 items is \$31,400.
(a) Find the fixed costs.
(b) Find the total cost function.

42. *Profit* Suppose a product has a daily marginal revenue $\overline{MR} = 46$ and a daily marginal cost $\overline{MC} = 30 + \frac{1}{5}x$, both in dollars per unit. If the daily fixed cost is \$200, how many units will give maximum profit and what is the maximum profit?

43. *National consumption* If consumption is \$8.5 billion when disposable income is 0, and if the marginal propensity to consume is

$$\frac{dC}{dy} = \frac{1}{\sqrt{2y + 16}} + 0.6 \quad \text{(in billions of dollars)}$$

find the national consumption function.

44. *National consumption* Suppose that the marginal propensity to save is

$$\frac{dS}{dy} = 0.2 - 0.1e^{-2y} \quad \text{(in billions of dollars)}$$

and consumption is \$7.8 billion when disposable income is 0. Find the national consumption function.

CH 13

Evaluate the integrals in Problems 7–18.

7. $\int_1^4 4\sqrt{x^3}\,dx$
8. $\int_{-3}^{2} (x^3 - 3x^2 + 4x + 2)\,dx$
9. $\int_0^5 (x^3 + 4x)\,dx$
10. $\int_{-1}^{3} (3x + 4)^{-2}\,dx$
11. $\int_{-3}^{-1} (x + 1)\,dx$
12. $\int_2^3 \frac{x^2}{2x^3 - 7}\,dx$
13. $\int_{-1}^{2} (x^2 + x)\,dx$
14. $\int_1^4 \left(\frac{1}{x} + \sqrt{x}\right)dx$
15. $\int_0^2 5x^2(6x^3 + 1)^{1/2}\,dx$
16. $\int_0^1 \frac{x}{x^2 + 1}\,dx$
17. $\int_0^1 e^{-2x}\,dx$
18. $\int_0^1 xe^{x^2}\,dx$

Find the area between the curves in Problems 19–22.

19. $y = x^2 - 3x + 2$ and $y = x^2 + 4$ from $x = 0$ to $x = 5$
20. $y = x^2$ and $y = 4x + 5$
21. $y = x^3$ and $y = x$ from $x = -1$ to $x = 0$
22. $y = x^3 - 1$ and $y = x - 1$

39. *Maintenance* Maintenance costs for buildings increase as the buildings age. If the rate of increase in maintenance costs for a building is

$$M'(t) = \frac{14{,}000}{\sqrt{t + 16}}$$

where M is in dollars and t is time in years, $0 \le t \le 15$, find the total maintenance cost for the first 9 years ($t = 0$ to $t = 9$).

46. *Income streams* Find the total income over the next 10 years from a continuous income stream that has an annual flow rate at time t given by $f(t) = 125e^{0.05t}$ in thousands of dollars per year.

47. *Income streams* Suppose that a machine's production is considered a continuous income stream with an annual rate of flow at time t given by $f(t) = 150e^{-0.2t}$ in thousands of dollars per year. Money is worth 8%, compounded continuously.
    (a) Find the present value of the machine's production over the next 5 years.
    (b) Find the future value of the production 5 years from now.

48. *Average cost* Suppose the cost function for x units of a product is given by $C(x) = \sqrt{40{,}000 + x^2}$ dollars. Find the average cost over the first 150 units.

49. *Producer's surplus* Suppose the supply function for x units of a certain lamp is given by

$$p = 0.02x + 50.01 - \frac{10}{\sqrt{x^2 + 1}}$$

where p is in dollars. Find the producer's surplus if the equilibrium price is \$70 and the equilibrium quantity is 1000.

50. *Income streams* Suppose the present value of a continuous income stream over the next 5 years is given by

$$P = 9000\int_0^5 te^{-0.08t}\,dt, \quad P \text{ in dollars, } t \text{ in years}$$

Find the present value.

51. *Cost* If the marginal cost for x units of a product is $\overline{MC} = 3 + 60(x + 1)\ln(x + 1)$ dollars per unit and if the fixed cost is \$2000, find the total cost function.

53. *Capital value* Find the capital value of a business if its income is considered a continuous income stream with annual rate of flow given by

$$f(t) = 120e^{0.03t}$$

in thousands of dollars per year, and the current interest rate is 6% compounded continuously.

54. *Total income* Suppose that a continuous income stream has an annual rate of flow $f(t) = 100e^{-0.01t^2}$ (in thousands of dollars per year). Use Simpson's Rule with $n = 4$ to approximate the total income from this stream over the next 2 years.

41. *Savings* The future value of \$1000 invested in a savings account at 10%, compounded continuously, is $S = 1000e^{0.1t}$, where t is in years. Find the average amount in the savings account during the first 5 years.

42. *Income streams* Suppose the total income in dollars from a video machine is given by

$$I = 50e^{0.2t}, \quad 0 \le t \le 4, \ t \text{ in hours}$$

Find the average income over this 4-hour period.

43. *Income distribution* In 1969, after the "Great Society" initiatives of the Johnson administration, the Lorenz curve for the U.S. income distribution was $L(x) = x^{2.1936}$. In 2000, after the stock market's historic 10-year growth, the Lorenz curve for the U.S. income distribution was $L(x) = x^{2.4870}$. Find the Gini coefficient of income for both years, and determine in which year income was more equally distributed.

44. *Consumer's surplus* The demand function for a product under pure competition is $p = \sqrt{64 - 4x}$, and the supply function is $p = x - 1$, where x is the number of units and p is in dollars.
    (a) Find the market equilibrium.
    (b) Find the consumer's surplus at market equilibrium.

45. *Producer's surplus* Find the producer's surplus at market equilibrium for Problem 44.

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