APPLICATIONS OF INTEGRATION

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1 Examples

- 1. Find the area of the region bounded by the x-axis and the graph of $f(x) = x^2 1$ for $1 \le x \le 2$.
- 2. Evaluate the definite integral $\int_0^1 (4t+1)^2 dt$.

2 ClassWork Problems

2.1 Finding Areas

Find the area of the shaded region described by the function and bounds (implicitly or explicitly shown/stated):

1

3.
$$y = x - x^2$$
 (Implied bounds from x-intercepts, likely 0 to 1)

4.
$$y = 1 - x^4$$
 (Implied bounds from x-intercepts, likely -1 to 1)

5.
$$y = \frac{1}{x^2}$$
 bounded by $x = 1, x = 2$, and the x-axis.

6.
$$y = \frac{2}{\sqrt{x}}$$
 bounded by $x = 1, x = 4$, and the x-axis.

7.
$$y = 3e^{-x/2}$$
 bounded by $x = 1, x = 4$, and the x-axis.

8.
$$y = 2e^{x/2}$$
 bounded by $x = 1, x = 3$, and the x-axis.

9.
$$y = \frac{x^2 + 4}{x}$$
 bounded by $x = 1, x = 4$, and the x-axis.

10.
$$y = \frac{x-2}{x}$$
 bounded by $x = 2, x = 4$, and the x-axis.

2.2 Evaluating Definite Integrals

Evaluate the following definite integrals:

$$11. \int_0^1 2x \, \mathrm{d}x$$

12.
$$\int_{2}^{7} 3 \, dv$$

- 13. $\int_{-1}^{1} (x-2) dx$
- 14. $\int_{2}^{5} (-3x+4) \, \mathrm{d}x$
- 15. $\int_{-1}^{1} (2t 1)^2 \, \mathrm{d}t$
- 16. $\int_0^1 (1-2x^2) dx$
- 17. $\int_{1}^{3} (x-2)^3 dx$
- 18. $\int_0^2 (x-3)^4 dx$
- 19. $\int_{-1}^{1} (\sqrt[3]{t} 2) dt$
- 20. $\int_{1}^{4} \frac{2}{\sqrt{x}} dx$
- 21. $\int_{1}^{4} \frac{u-2}{\sqrt{u}} du$
- 22. $\int_0^1 \frac{x \sqrt{x}}{3} \, \mathrm{d}x$
- 23. $\int_{-1}^{0} (t^{1/3} t^{2/3}) dt$
- 24. $\int_0^4 (x^{1/2} + x^{1/4}) \, \mathrm{d}x$
- 25. $\int_0^1 e^{-2x} dx$
- 26. $\int_{1}^{2} e^{1-x} dx$
- 27. $\int_{1}^{3} \frac{e^{3/x}}{x^2} dx$
- 28. $\int_{-1}^{1} (e^x e^{-x}) \, \mathrm{d}x$
- 29. $\int_0^2 e^{2x} \sqrt{e^{2x} + 1} \, dx$
- 30. $\int_0^1 \frac{e^{-x}}{\sqrt{e^{-x}+1}} \, \mathrm{d}x$

31.
$$\int_0^2 \frac{x}{1 + 4x^2} \, \mathrm{d}x$$

$$32. \int_0^1 \frac{e^{2x}}{e^{2x} + 1} \, \mathrm{d}x$$