

Topics you should understand (the ones in bold are extra important):

- **Antiderivatives**
- **Areas with limits**
- **Definite Integrals**
- **Evaluating Definite Integrals with Geometry**
- **Fundamental Theorem of Calculus Part 1**
- **Fundamental Theorem of Calculus Part 2**
- **Indefinite Integrals**
- **U-substitution**

Practice Problems:

1. Find f if $f'(x) = \sqrt{x}(6 + 5x)$, $f(1) = 10$.
2. Find f if $f''(x) = 10 \sin(x) + 3 \cos(x)$, $f(0) = 0$, and $f(2\pi) = 12$.
3. Find f if $f''(x) = 24x^2 + 6x + 4$, $f(1) = 10$, $f(-1) = 4$.
4. A car braked with a constant deceleration of $16ft/s^2$, producing skid marks of 200 feet before coming to a stop. How fast was the car traveling when the brakes were first applied?

Sol: Click here to watch the solution!

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5. Find an expression for the area under the graph of f as a limit. Do not evaluate the limit.

$$f(x) = \frac{2x}{x^2 + 1}, \quad 1 \leq x \leq 3.$$

6. Find an expression for the area under the curve $y = x^3$ from 0 to 1 as a limit, then evaluate the limit. The following identity may be helpful:

$$\sum_{i=1}^n i^3 = \frac{n^2(n+1)^2}{4}.$$

Sol: Click here to watch the solution!

7. Estimate the area under the graph of $f(x) = 1 + x^2$ from $x = -1$ to $x = 2$ using three rectangles and left endpoints. Then repeat the problem with right endpoints. Repeat the problem again using midpoints.

8. Use the Midpoint Rule with the given value of n to approximate the integral.

$$\int_0^2 \frac{x}{x+1} dx \quad n = 5.$$

Sol: Click here to watch the solution!

9. Evaluate the Riemann Sum for $f(x) = 6x^5$, take sample points to be the midpoints and $a = 1$, $b = 9$, and $n = 4$. Then express the following integral as a limit of sums.

$$\int_1^9 6x^5 dx$$

Sol: Click here to watch the solution!

10. Express the following limit as a definite integral.

$$\lim_{n \rightarrow \infty} \sum_{i=1}^n \frac{1}{1 + \left(\frac{i}{n}\right)^2} \cdot \frac{1}{n}$$

Sol: Click here to watch the solution!

11. Evaluate the integral by interpreting it in terms of areas.

$$\int_{-3}^0 (1 + \sqrt{9 - x^2}) dx$$

12. Evaluate the integral by interpreting it in terms of areas.

$$\int_{-5}^5 (x - \sqrt{25 - x^2}) dx$$

13. Evaluate the integral by interpreting it in terms of areas.

$$\int_0^4 3x - \sqrt{16 - x^2} dx$$

Sol: Click here to watch the solution!

14. Let $y = \int_1^{3x+2} \frac{t}{1+t^3} dt$. Find y' .

15. Find the derivative of the following function:

$$h(x) = \int_{\sqrt{x}}^{x^3} \cos(t^2) dt$$

Sol: Click here to watch the solution!

16. Evaluate the integral $\int_1^4 \frac{2+x^2}{\sqrt{x}} dx$.

17. Evaluate the integral $\int_{\pi/6}^{\pi} \sin(x) \, dx$.

18. Evaluate the integral $\int_{-1}^2 (3x - 2)(x + 1) \, dx$.

19. Sketch the region enclosed by the given curves and calculate its area: $y = 2x - x^2$, $y = 0$.

Sol: Click here to watch the solution!

20. Evaluate the following integral.

$$\int_2^5 |x - 3| dx$$

Sol: Click here to watch the solution!

21. Find the general indefinite integral $\int \sqrt{x}(x^2 + 3x + 2) \, dx$.

22. Find the general indefinite integral $\int \sec(x)(\sec(x) + \tan(x)) \, dx$.

23. Evaluate the following integral.

$$\int \tan(x) \cos(x) dx$$

Sol: Click here to watch the solution!

24. Evaluate the integral $\int_0^1 \sqrt[4]{x^5} + \sqrt[5]{x^4} \, dx$

25. Find the general indefinite integral $\int \cos(1 + 5x) \, dx$.

26. Evaluate the integral.

$$\int \frac{x^3}{(x^4 - 5)^2} dx$$

Sol: Click here to watch the solution!

27. Find the general indefinite integral $\int x^2 \sec^2(x^3) \, dx$.

28. Evaluate the integral.

$$\int_0^{\pi/2} \cos(x) \sin(\sin(x)) dx$$

Sol: Click here to watch the solution!

29. Evaluate the integral $\int_0^1 \sqrt[3]{1 + 7x} \, dx$

30. Evaluate the integral $\int_0^4 \frac{x}{\sqrt{1 + 2x}} \, dx$

31. Evaluate the integral.

$$\int x^2 \sqrt{2+x} \, dx$$

Sol: [Click here to watch the solution!](#)