Math 140: Calculus I (Spring 2026)
Homework Week 12

Relevant Topics: antiderivatives, indefinite integrals, definite integrals, area, sequences of partial sums

Instructions. Show enough work to justify your answers. For Problems 5–8, use geometric formulas rather than antiderivatives. For Problems 9–12, write your answers using summation notation before simplifying.

1. Evaluate the indefinite integral:

$$\int \left(6x^5 - 4x^2 + 3\right)\, dx$$

2. Evaluate the indefinite integral:

$$\int \left(\frac{1}{x} + \sec^2 x - e^x\right) dx$$

3. Evaluate the indefinite integral:

$$\int \left(3x^{1/2} + 2x^{-2} - 5\cos x\right) dx$$

4. Evaluate the indefinite integral:

$$\int \left(4x^3 - \frac{2}{x} + 3e^x + \frac{1}{1+x^2}\right) dx$$

5. Evaluate the definite integral using geometry:

$$\int_0^6 5dx$$

6. Evaluate the definite integral using geometry:

$$\int_0^4 xdx$$

7. Evaluate the definite integral using geometry:

$$\int_{-1}^1 \sqrt{1-x^2}dx$$

8. Evaluate the definite integral using geometry:

$$\int_0^3 (x+1)dx$$

9. Let

$$A_n^{\text{right}}$$

denote the right-endpoint rectangle approximation to

$$\int_{-1}^2 x^2 dx$$

using n subintervals of equal width.

(a) Compute A_4^{right}.

(b) Write A_n^{right} as a summation.

(c) Use summation formulas to write A_n^{right} without sigma notation.

(d) Evaluate $\lim_{n\to\infty} A_n^{\text{right}}$.

10. Let

$$A_n^{\text{left}}$$

denote the left-endpoint rectangle approximation to

$$\int_{-1}^2 x^2 dx$$

using n subintervals of equal width.

(a) Compute A_4^{left}.

(b) Write A_n^{left} as a summation.

(c) Use summation formulas to write A_n^{left} without sigma notation.

(d) Evaluate $\lim_{n\to\infty} A_n^{\text{left}}$.

11. Let

$$A_n^{\text{mid}}$$

denote the midpoint rectangle approximation to

$$\int_{-1}^{2} x^2 dx$$

using n subintervals of equal width.

(a) Compute A_4^{mid}.

(b) Write A_n^{mid} as a summation.

(c) Use summation formulas to write A_n^{mid} without sigma notation.

(d) Evaluate $\lim_{n\to\infty} A_n^{\text{mid}}$.

12. **Challenge.** Derive a sequence of partial sums that converges to π.