

Chapter 6 Free-Response Review Exercises

Directions: These review exercises are free-response questions based on the content in Chapter 6: Integration Techniques.

- 6.1:** Integration by Parts
- 6.2:** Trigonometric Integrals
- 6.3:** Trigonometric Substitution
- 6.4:** Integration by Partial Fractions
- 6.5:** Improper Integrals

For each question, show all your work. To make the best use of these review exercises, follow these guidelines:

- Print out this document and work through the questions as if this paper were an exam.
- Do not use a calculator of any kind. All of these problems are designed to contain simple numbers.
- Adhere to the time limit.
- After you complete all the questions, score yourself according to the Solutions document. Note any topics that require revision.

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Integration Techniques**Number of Questions—12****Time—1 hour 30 minutes****NO CALCULATOR****Scoring Chart**

Section	Points Earned	Points Available
Short Integrals		40
Question 9		15
Question 10		15
Question 11		15
Question 12		15
TOTAL		100

Short Integrals

1. $\int (3t + 2) \cos 5t \, dt$

(5 pts.)

2. $\int_0^{\pi/6} \sin^2 \theta \cos^3 \theta \, d\theta$

(5 pts.)

3. $\int \sin 5\theta \cos 9\theta \, d\theta$

(5 pts.)

4. $\int_{-\infty}^{\infty} \frac{2}{x^2 + 16} dx$

(5 pts.)

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

(5 pts.)

6. $\int_5^{10} \frac{x^2}{\sqrt{x^2 - 25}} dx$

(5 pts.)

7. $\int \frac{1}{\sqrt{30 - 6x - 2x^2}} dx$

(5 pts.)

8. $\int_1^4 e^{\sqrt{x}} dx$

(5 pts.)

Long Questions

9. Evaluate $\int \sec^m x \tan^n x \, dx$ for each case.

(a) $m = 3, n = 5$

(5 pts.)

(b) $m = 4, n = 2$

(5 pts.)

(c) $m = 4, n = 9$

(5 pts.)

10. Evaluate $\int_0^1 \frac{3x^2 - 8}{x^4 - 81} dx$.

(15 pts.)

11. Calculate $\int_{-1}^0 \frac{1-x}{2x^2+kx+6} dx$ for each value of k .

(a) $k = 7$

(5 pts.)

(b) $k = -13$

(5 pts.)

(c) $k = 8$

(5 pts.)

12. Consider the family of improper integrals $I = \int_1^{\infty} \frac{1}{x^{3c+6}} dx$, where c is a constant.

(a) Find all values of c for which the integral converges.

(2 pts.)

(b) For $c = -\frac{1}{3}$, show that $I = \frac{1}{4}$.

(4 pts.)

(c) Does $\int_1^{\infty} \frac{|\cos x|}{x^5} dx$ converge or diverge?

(3 pts.)

(d) For $c = -\frac{17}{9}$, evaluate $\int_0^1 \frac{1}{x^{3c+6}} dx$ or show that it diverges.

(6 pts.)

This marks the end of the review exercises.