

University of South Carolina
Midterm Examination 1 September 21, 2017
Math 142–005/006

Closed book examination

Time: 75 minutes

Name _____

Instructions:

No notes, books, or calculators are allowed. If you need more space than is provided use the back of the previous page and clearly indicate you have done so. Simplify your final answers. Full credit may not be awarded for insufficient accompanying work.

| | | |
|-------|--|----|
| 1 | | 16 |
| 2 | | 9 |
| 3 | | 9 |
| 4 | | 8 |
| 5 | | 8 |
| 6 | | 10 |
| Total | | 60 |

1. (16 points) Find the following integrals.

(a) $\int 3x^3 + 2x^2 - 3x + 4 \, dx$

(b) $\int \frac{1}{r^3} + e^r + 4^r + \sqrt{r} \, dr$

(c) $\int \sin(\theta) + \cos(\theta) + \tan(\theta) + \sec(\theta) \, d\theta$

(d) $\int \sec^2(x) + \sec(x) \tan(x) + \frac{1}{1+x^2} + \frac{1}{\sqrt{1-x^2}} \, dx$

2. (9 points) Find the following integrals.

(a) $\int 3r \sin(r^2 - 1) dr$

(b) $\int 4x \cos(x) dx$

(c) $\int \tan^3(\theta) \sec^2(\theta) d\theta$

3. (9 points) Find the following integrals.

(a) $\int_0^2 \frac{2x \, dx}{x^2 + 1}$

(b) $\int \frac{dx}{x^2 + 6x + 10}$

(c) $\int x^2 e^{2x} \, dx$

4. (8 points) Find $\int \sqrt{1-x^2} dx$ for $|x| < 1$. (Hint: use a trigonometric substitution)

5. (8 points) Find the following integrals.

(a) $\int \frac{4r - 7}{r^2 - 3r + 2} dr$

(b) $\int_0^2 \frac{1}{x - 1} dx$ (Hint: be careful)

6. (10 points)

(a) Estimate the integral $\int_1^3 \frac{dx}{x}$ using Simpson's rule with 4 equal subintervals.

(b) Let E_S be the error of Simpson's rule applied to the integral $\int_a^b f(x) dx$ with n equal subintervals. Recall that $|E_S| \leq \frac{M(b-a)^5}{180n^4}$ where M is an upper bound for the values of $|f^{(4)}(x)|$ on $[a, b]$. What is a bound on the error in the estimate from part (a)?

(c) Why does part (a) give an approximation of $\ln(3)$?

The End