MA 16200
Alternate Exam 2

NAME ______________________ YOUR TA'S NAME ______________________

STUDENT ID # ____________________ RECITATION TIME ____________________

1. You must use a #2 pencil on the mark–sense sheet (answer sheet).

2. On the scantron, fill in your TA's name and the course number.

3. Fill in your NAME and STUDENT IDENTIFICATION NUMBER and blacken in the appropriate spaces. BE SURE TO INCLUDE THE TWO LEADING ZEROS.

4. Fill in your four-digit SECTION NUMBER.

5. Sign the scantron.

6. Fill in your name and your instructor's name on the question sheets above.

7. There are 12 questions, each worth 8 points (you will automatically earn 4 points for taking the exam). Blacken in your choice of the correct answer in the spaces provided for questions 1–12. Do all your work on the question sheets.

8. Turn in both the scantron and the exam booklet when you are finished.

9. You cannot turn in your exam during the first 20 min or the last 10 min of the exam period.

10. NO CALCULATORS, PHONES, BOOKS, OR PAPERS ARE ALLOWED. Use the back of the test pages for scrap paper.

EXAM POLICIES

1. Students may not open the exam until instructed to do so.
2. Students must obey the orders and requests by all proctors, TAs, and lecturers.
3. No student may leave in the first 20 min or in the last 10 min of the exam.
4. Books, notes, calculators, or any electronic devices are not allowed on the exam, and they should be put away and should not be visible at all. Students may not look at anybody else's test, and may not communicate with anybody else except, if they have a question, with their TA or lecturer.
5. After time is called, the students have to put down all writing instruments and remain in their seats, while the TAs will collect the scantrons and the exams.
6. Any violation of these rules and any act of academic dishonesty may result in severe penalties. Additionally, all violators will be reported to the Office of the Dean of Students.

I have read and understand the exam rules stated above:

STUDENT NAME: ______________________________

STUDENT SIGNATURE: ______________________________

1. A rectangular box with length 2 m, width 1 m, and height $\frac{1}{2}$ m is full of water. On a small asteroid with low gravity such that $g = 0.02$ m/s^2, what is the work done (in J) in pumping all of the water out over the top of the box? The density of water is 1000 kg/m^3.

A. $\frac{5}{2}$

B. $\frac{1}{2}$

C. 1

D. 2

E. 5

2. On a different small asteroid, the gravity is such that $g = \dfrac{1}{\pi}$ m/s^2. A mysterious fluid is discovered and is used to completely fill a tank in the shape of a cone (vertex pointing down) with heigh 2 m and top radius 1 m. The work required to pump all the fluid out of the tank over the top is determined to be 2 J. What is the density (in kg/m^3) of this mysterious fluid?

A. 1

B. 3

C. 6

D. 9

E. 12

3. Find the integral: $\int_1^e x^{1/2} \ln x \, dx$

A. $\frac{1}{9}e^{3/2} + \frac{4}{9}$
B. $\frac{2}{9}e^{3/2} + \frac{4}{9}$
C. $\frac{4}{9}e^{3/2} + \frac{4}{9}$
D. $\frac{5}{9}e^{3/2} + \frac{4}{9}$
E. $\frac{7}{9}e^{3/2} + \frac{4}{9}$

4. What is the most appropriate substitution or procedure to compute

$$\int \sin^5 x \cos^4 x \; dx$$

A. substitution with $u = \cos x$
B. substitution with $u = \sin x$
C. substitution with $u = \sin^4 x$
D. substitution with $u = \cos^5 x$
E. use the identities $\sin^2 x = \frac{1-\cos 2x}{2}$ and $\cos^2 x = \frac{1+\cos 2x}{2}$

5. Evaluate

$$\int_0^{\frac{\pi}{4}} \sqrt{\sec^2\theta - 1}\, d\theta$$

You may find the fact that $\displaystyle\int \tan x\, dx = -\ln\cos x + C$ useful in your calculation.

A. $-\ln 2$

B. $-\ln\sqrt{2}$

C. 0

D. $\ln\sqrt{2}$

E. $\ln 2$

6. Evaluate

$$\int_0^{\frac{\pi}{4}} \sec^4 x\, dx$$

A. π

B. $\frac{1}{3}$

C. $\frac{2}{3}$

D. $\frac{\pi}{2}$

E. $\frac{4}{3}$

7. Evaluate the integral.

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

A. $\frac{x}{\sqrt{4-x^2}} - \sin^{-1}\left(\frac{x}{2}\right) + C$

B. $\frac{x^3}{\sqrt{4-x^2}} + C$

C. $\frac{1}{2}\tan^3\left(\frac{x}{2}\right) + C$

D. $-x + \tan x + C$

E. $2x + \cos^{-1}(2x) + C$

8. Which trigonometric substitution should be used to compute

$$\int \frac{dt}{\sqrt{20-4t+t^2}} \quad ?$$

A. $t = 2\tan\theta - 20$

B. $t = 2\tan\theta - 2$

C. $t = 4\tan\theta + 2$

D. $t = 4\tan\theta + 4$

E. $t = 20\tan\theta - 2$

9. If
$$\frac{1}{x^2(x-1)^2} = \frac{A}{x} + \frac{B}{x^2} + \frac{C}{x-1} + \frac{D}{(x-1)^2},$$
what is the value of $A - B + C - D$?

A. -2

B. -1

C. 0

D. 1

E. 2

10. Compute $\displaystyle\int_0^1 \frac{x+2}{(x+3)(x+1)}\,dx$

A. $\ln\left(2\sqrt{3}\right)$

B. $\ln\left(\dfrac{2}{\sqrt{3}}\right)$

C. $\dfrac{1}{2}\ln\left(8\sqrt{3}\right)$

D. $\ln\left(\dfrac{4}{\sqrt{3}}\right)$

E. $\dfrac{1}{2}\ln\left(\dfrac{8}{3}\right)$

11. Find all values of p for which the integral $\displaystyle\int_1^\infty \frac{dx}{x^{p+1}}$ converges.

A. $p < -1$

B. $p < 0$

C. $p > 0$

D. $p > 1$

E. Diverges for all p

12. Evaluate

$$\int_1^2 \frac{dx}{\sqrt{2-x}}$$

A. 4

B. 2

C. $2-\sqrt{2}$

D. $\sqrt{2}-1$

E. $2\sqrt{2}-2$