MA114:012–014 Russell Brown
Exam 2 9 March 1999

Answer all of the following questions. Use the answer sheets provided. Additional sheets are available if necessary. No books or notes may be used. You may use a calculator. When answering these questions, please be sure to 1) check answers when possible, 2) clearly indicate your answer and the reasoning used to arrive at that answer **(unsupported answers may receive NO credit)**, and 3) label all variables and equations.

Name ______________________

Section ____________

Question	Score	Total
1		10
2		10
3		10
4		30
5		10
6		15
7		15
Total		100

1. Find a number c so that

$$\int_0^2 (x^2 + x + c)\, dx = 0.$$

2. Write out the form of the partial fractions decomposition for the function

$$\frac{x^2 - 2}{x(x^2 + 3)}.$$

Do not solve for the numerical values of the coefficients.

3. Find the indefinite integral

$$\int \sqrt{1 - x^2}\, dx.$$

4. Find the following integrals. You must use calculus to evaluate the definite integrals, but you should feel free to check your answers with your calculator.

(a) $\displaystyle\int_0^{\pi/4} \sin^2 x\, dx$

(b) $\displaystyle\int_0^1 \frac{1}{x^2 - 4}\, dx$

(c) $\displaystyle\int \frac{x}{x^2 + 4}\, dx$

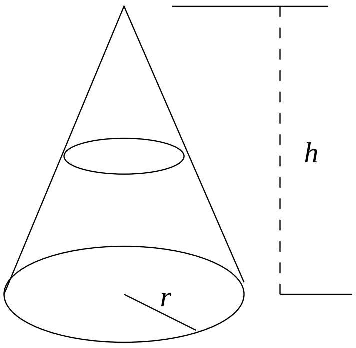
(d) $\displaystyle\int \sin^3 x\, dx$

(e) $\int \tan x\, dx$

5. Find the arc-length of the curve

$$x(t) = 3t^2, \qquad y(t) = 2t^3, \qquad 0 \leq t \leq 2.$$

6. Consider a right-circular cone of height h and with base a circle of radius r and express its volume as an integral. Evaluate the integral.



7. Suppose that we have a spherical tank whose radius is 10 meters and a soccer ball is sitting nearby. The tank is full of oil which has a density of 900 kilograms/meter^3. Carry out the following steps to find the work needed to pump the oil out through an outlet on the top of the tank.

   (a) If we slice the tank parallel to the ground at a height of y meters above the ground, what is the radius of the cross-section?

   (b) Approximate the slice between height y meters and $y + \Delta y$ by a cylinder and give the mass of the oil contained in this slice.

   (c) Give an approximate value for the work needed to lift the oil in part b) to the top of the tank.

   (d) Express the work required to empty the tank as an integral and evaluate this integral.