

These problems are a selection of problems from old midterm exams that you can work in review for the first midterm (in class on Tuesday, February 5th). Solutions will be posted on the class web page: <http://filer.case.edu/pmg5/126/>. The blue-colored problems in the textbook's chapter review pages are also good review problems, and they cover some topics omitted here.

1 Find the following indefinite integrals. Show your method for each part.

$$\begin{array}{lll} \text{(a)} \int (2x^{-2} - e^{3x}) dx & \text{(b)} \int \frac{(\ln x)^5}{2x} dx & \text{(c)} \int 2\sqrt{x} \ln(x) dx \\ \text{(d)} \int \frac{x}{\sqrt{1-x}} dx & \text{(e)} \int \left(3x^4 - \frac{\sqrt{x}}{3} + e^{-3x}\right) dx & \text{(f)} \int 3xe^{2x} dx \\ \text{(g)} \int (e^{-2x} - x^{-1} + x^{-2}) dx & \text{(h)} \int \frac{x}{1+3x^2} dx & \text{(i)} \int xe^{4x} dx \end{array}$$

2 Compute the following definite integrals. Show your solution method.

$$\begin{array}{lll} \text{(a)} \int_1^2 \left(-\frac{4}{3x} - 2x^{-3}\right) dx & \text{(b)} \int_0^{\pi/2} \sin^2(2x) \cos(2x) dx & \text{(c)} \int_0^{2\pi} x \cos(x^2 - \pi) dx \\ \text{(d)} \int_1^2 \frac{9x^2 + 12x}{x^3 + 2x^2 - 2} dx & \text{(e)} \int_0^{\pi/2} x \sin(8x) dx & \text{(f)} \int_1^e \left(\frac{2}{x} - x^2\right) dx \\ \text{(g)} \int_0^{\pi/2} x \cos(x) dx & \text{(h)} \int_e^{e^2} \frac{1}{x \ln(x)} dx & \text{(i)} \int_0^{\ln(2)} xe^{2x} dx \end{array}$$

3 Find the area bounded between the following functions:

$$f(x) = \sqrt{x-1} \qquad g(x) = -\sqrt{x-1} \qquad h(x) = 7-x.$$

4 Scientists predict that if current global warming trends continue the North polar region's icebergs will melt, increasing the volume of water in the the oceans. Measurements indicate that  $f(t)$  billions of liters per year will flow into the oceans, where  $f(t)$  is given by

$$f(t) = e^{t/2} + 10t.$$

If they are correct, how many billion liters of water will be added to the oceans in the next five years ?

5 Calculate the average value of the function  $f(x) = x \cos(ax)$  on the interval  $0 \leq x \leq \frac{2\pi}{a}$  for constant  $a > 0$ .

6 Find the area bounded by the following functions:

$$f(x) = x^3 + x^2 - x + 10 \qquad g(x) = x^2 + 10$$

7 Approximate the integral  $\int_1^3 e^{x^2} dx$  by partitioning the interval  $[1, 3]$  into 4 subintervals and choosing  $u$  as the left endpoint of each subinterval. Round your answer to 4 digits after the decimal.

8 Find the function  $f(x)$  for which  $f'(x) = 2e^{-x} - \frac{3}{x+1}$  and  $f(0) = 2$ .

9 Find the area bounded by the following functions:

$$f(x) = -x^2 + 2x + 8 \qquad g(x) = x^2 - 6x - 2.$$

10 Suppose  $f'(x) = \frac{1}{\sqrt{x+4}} + 6e^{2x}$ . If  $f(0) = 3$ , find  $f(x)$ .

11 Calculate the average value of the function  $f(x) = x\sqrt{x+1}$  on the interval  $0 \leq x \leq 9$ .