Homework 9

Calculus I, section 10

Due December 6, 2022 by 4:10 PM

As usual, you may use any resources to solve these problems except where stated otherwise, with the exception of computational software and posting these problems anywhere to be answered by others. Collaboration is encouraged, but everyone should write their own solutions. Write the names of any collaborators or sources used at the top of your homework. If you did not use any sources, write "sources used: none."

If you find any errors in either the homework or the lecture notes, please let me know, even if you are unsure whether it is an error or not.

As on most math problems, the mathematics is the issue, not the answer: whether you have a correct method is more important then whether you get to the correct number at the end, so include your method!

You do not have to simplify your answers completely (so for example $\frac{2}{2}$ is fine), but you do need to do all the computations (so for example if the problem is "find the largest value of $f(x)$," the answer "$f(3)$" is incomplete; you would also need to evaluate f at 3).

Problem 1. Compute the following definite integrals.

(a) $\displaystyle\int_0^1 (x + e^x)\,dx$

(b) $\displaystyle\int_2^4 \frac{x^2 - 4x + 2}{x}\,dx$

The above problem is primarily directed towards Objective 14 (the fundamental theorem of calculus).

Problem 2. Using u-substitution, compute the following indefinite integrals.

(a) $\displaystyle\int xe^{-x^2}\,dx$

(b) $\displaystyle\int \frac{1}{x\ln(x)}\,dx$

The above problem is primarily directed towards Objective 15 (u-substitution).

Problem 3.

(a) Using u-substitution, find an antiderivative for $5x\sqrt{9-x}$.

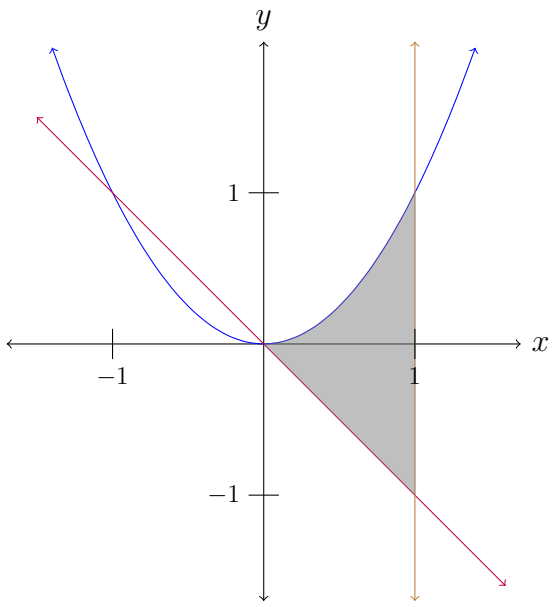
(b) Using the fundamental theorem of calculus together with your answer from part (a), compute $\displaystyle\int_0^9 5x\sqrt{9-x}\,dx$.

The above problem is directed towards Objectives 14 and 15 (the fundamental theorem of calculus and u-substitution).

Problem 4. A car is approaching an intersection at 60 feet per second. When it is 200 feet away from the intersection, the light turns red and the driver applies their brakes and begins to decelerate at 10 feet per second squared, i.e. if the position of the car is $x(t)$, with $x(0) = 0$ and the intersection at $x = 200$, then $x''(t) = -10$. Will the car be able to come to a stop before reaching the intersection?

The above problem is directed towards Objectives 14 and 16 (the fundamental theorem of calculus and applications of integrals).

Problem 5. Find the area of the shape bounded by $y = x^2$, $y = -x$, and $x = 1$, graphed below.



The above problem is primarily directed towards Objective 16 (applications of integrals).

Survey. Complete the following survey by rating each problem you attempted on a scale of 1 to 10 according to how interesting you found it (1 = "mind-numbing," 10 = "mind-blowing"), and how difficult you found it (1 = "trivial," 10 = "brutal"). Also estimate the amount of time you spent on each problem to the nearest half hour.

	Interest	Difficulty	Time Spent
Problem 1			
Problem 2			
Problem 3			
Problem 4			
Problem 5			