

# MATH 152 Assignment 4, Fall 2019.

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## Webassign exercises.

8.1 Exercises 1, 11, 19

For exercises 11 and 19, you should find that the  $\sqrt{1 + f'(x)^2}$  simplifies to a rational function.

8.2 Exercises 7, 8, 15

10.2 Exercises 3, 31, 41, 61

9.1 Exercise 5, 9, 14

9.2 Exercise 3

9.3 Exercises 1, 11, 38, 45

## Written exercises.

- 1 Let  $y = 1/x$  so that  $dy/dx = -1/x^2$ . The length  $L$  of  $1/x$  on  $[1, 2]$  is given by  $\int_1^2 \sqrt{1 + \frac{1}{x^4}} dx$ . There is no elementary antiderivative for this integral. Use Simpson's rule with  $n = 6$  to approximate  $L$ . You should get close to 1.13209.
- 2 A hawk flying at 15 m/s at a height of 180 m accidentally drops its prey. The parabolic trajectory of the falling prey is given by the equation  $y = 180 - x^2/45$  where  $y$  is the height above the ground and  $x$  is the horizontal distance travelled in  $m$ . Calculate the distance travelled by the prey until it hits the ground. Show your working. You should get 209.1 m. Formula 21 in the Table of Integrals at the back of the text should be helpful.
- 3 If the curve  $y = e^{-x}$  for  $x \geq 0$  is rotated about the  $x$ -axis, find the area of the resulting surface. You should get  $\pi(\sqrt{2} + \ln(1 + \sqrt{2})) = 7.21$ .
- 4 Find the surface area of a sphere of radius  $r$  by rotating  $y = \sqrt{r^2 - x^2}$  about the  $x$ -axis.
- 5 Consider the parametric curve  $x = t^3 + 1, y = 2t - t^2$ . Sketch the curve for  $0 \leq t \leq 2$ . For what value of  $t$  is  $\frac{dy}{dx} = 0$ . Identify the point in your sketch. Calculate the area between  $y(x)$  and the  $x$  axis.
- 6 For what values of  $k$  does  $y = e^{kt}$  satisfy the differential equation  $2y'' + y' - 6y = 0$ ?
- 7 Try to guess a solution, other than  $y = 0$ , to the differential equation  $y''(x) = -4y(x)$ .
- 8 Use separation of variables to find the function  $y(t)$  such that  $y' = 2ty - 2t$  and  $y(0) = 3$ .
- 9 An equation with an integral in it is called an integral equation. Integral equations arise in many applications. Here is one from statistics.

$$\int_0^m e^{-x} dx = \frac{1}{2}.$$

Solve it for  $m$ .

**Midterm 2 is on Wednesday November 6th at 8:30am.**

It covers the material covered on Assignments 3 and 4.