COURSE OUTLINE

ABOUT THE COURSE: *In this course, we will be looking at integrals. Integrals are important topic that will be covered in calculus. As with derivatives, this subject will be devoted almost exclusively to finding and computing integrals. Applications will be given in the following chapter. There are really two types of integrals that we will be looking at in this course: Indefinite Integrals and Definite Integrals. The first half of this course is devoted to indefinite integrals and the last half is devoted to definite integrals. As we will see in the last half of the course, if we do not know indefinite integrals, we will not be able to do definite integrals.*

Here is a quick *listing of the lessons that we are going to discuss in this course.

- **Indefinite Integrals** – In this section, we will start off the course with the definition and properties of indefinite integrals. We will not be computing many indefinite integrals in this section. This section is devoted to simply defining what an indefinite integral is and to give many of the properties of the indefinite integral. Actually, computing indefinite integrals will start in the next section.
- **Computing Indefinite Integrals** – In this section, we will compute some indefinite integrals. The integrals in this section will tend to be those that do not require a lot of manipulation of the function we are integrating in order to actually compute the integral. As we will see starting in the next section many integrals do require some manipulation of the function before we can actually do the integral. We will also take a quick look at an application of indefinite integrals.
- **Substitution Rule for Indefinite Integrals** – In this section, we will start using one of the more common and useful integration techniques – The Substitution Rule. With the substitution rule we will be able integrate a wider variety of functions. The integrals in this section will all require some manipulation of the function prior to integrating unlike most of the integrals from the previous section where all we really needed were the basic integration formulas.
- **More Substitution Rule** – In this section we will continue to look at the substitution rule. The problems in this section will tend to be a little more involved than those in the previous section.
- **Area Problem** – In this section we start off with the motivation for definite integrals and give one of the interpretations of definite integrals. We will be approximating the amount of area that lies between a function and the xx-axis. As we will see in the next section this problem will lead us to the definition of the definite integral and will be one of the main interpretations of the definite integral that we will be looking at in this material.
- **Definition of the Definite Integral** – In this section we will formally define the definite integral, give many of its properties and discuss a couple of interpretations of the definite integral. We will also look at the first part of the Fundamental Theorem of Calculus which shows the very close relationship between derivatives and integrals.
- **Computing Definite Integrals** – In this section we will take a look at the second part of the Fundamental Theorem of Calculus. This will show us how we compute definite integrals without using (the often very unpleasant) definition. The examples in this section can all be done with a basic knowledge of indefinite integrals and will not require the use of the substitution rule. Included in the examples in this section are computing definite integrals of piecewise and absolute value functions.
- **Substitution Rule for Definite Integrals** – In this section we will revisit the substitution rule as it applies to definite integrals. The only real requirements to being able to do the examples in this section are being able to do the substitution rule for indefinite integrals and understanding how to compute definite integrals in general.

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- **Applications of Integrals** - In this chapter we will take a look at some applications of integrals. We will look at Average Function Value, Area Between Curves, Volume (both solids of revolution and other solids) and Work.
- **Average Function Value** – In this section we will look at using definite integrals to determine the average value of a function on an interval. We will also give the Mean Value Theorem for Integrals.
- **Area Between Curves** – In this section we'll take a look at one of the main applications of definite integrals in this chapter. We will determine the area of the region bounded by two curves.
- **Volumes of Solids of Revolution / Method of Rings** – In this section, the first of two sections devoted to finding the volume of a solid of revolution, we will look at the method of rings/disks to find the volume of the object we get by rotating a region bounded by two curves (one of which may be the x or y-axis) around a vertical or horizontal axis of rotation.
- **Volumes of Solids of Revolution / Method of Cylinders** – In this section, the second of two sections devoted to finding the volume of a solid of revolution, we will look at the method of cylinders/shells to find the volume of the object we get by rotating a region bounded by two curves (one of which may be the x or y-axis) around a vertical or horizontal axis of rotation.
- **More Volume Problems** – In the previous two sections we looked at solids that could be found by treating them as a solid of revolution. Not all solids can be thought of as solids of revolution and, in fact, not all solids of revolution can be easily dealt with using the methods from the previous two sections. So, in this section we'll take a look at finding the volume of some solids that are either not solids of revolutions or are not easy to do as a solid of revolution.
- **Work** – In this section we will look at is determining the amount of work required to move an object subject to a force over a given distance.

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**Any unlisted yet relevant topics/lessons may be inserted along the way as these topics are deemed to be significant in the development of the listed lessons.*

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