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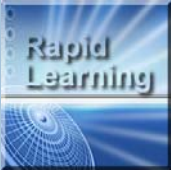



Rapid Learning Center Presenting ...

Teach Yourself
Calculus II Visually in 24 Hours



1/39 <http://www.RapidLearningCenter.com>




**Introduction to
Calculus II**

Rapid Learning Tutorial Series

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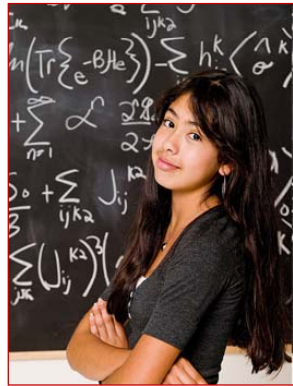
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Learning Objectives

By completing this tutorial, you will:



- Learn the scope of Calculus II
- Learn typical topics covered in Calculus II
- Review some calculator techniques that will help you in Calculus II
- Learn study tips for understanding Calculus II

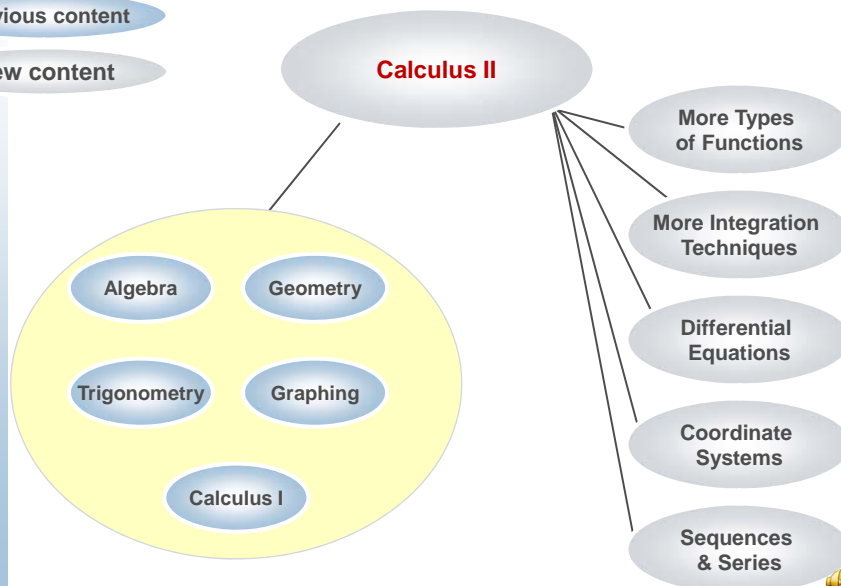
3/39



Concept Map


Previous content

New content

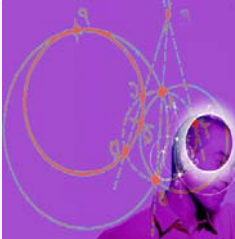



4/39






What is Calculus?




5/39 




Definition: Calculus

Calculus is the study of how things **change**.

Whereas **Algebra**, **Arithmetic**, and **Geometry** are sufficient to study many types of problems, they are not suitable to study problems where there is some type of continual change. These types of problems require **Calculus**.



6/39 



Definition: Calculus (Cont 1)

Consider the problem of finding the **surface area** of the roof of a building.

In some cases, it would be easy to do using only **Geometry** or **Algebra** because there are non-complicated flat-like surfaces.



7/39



Definition: Calculus (Cont 2)

But in other cases, it would be a much harder problem because of **irregular shapes** and **constantly changing** quantities.



8/39





Where Did Calculus Come From?

In the 1680's two men, **Gottfried Leibniz** and **Isaac Newton**, independently developed the foundations that led to Calculus.



Leibniz



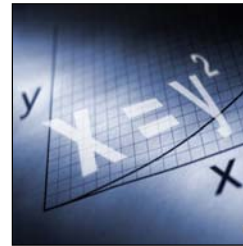
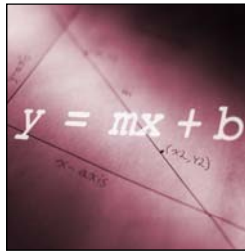
Newton

9/39



Prerequisites

Being successful in Calculus II requires a good knowledge of **precalculus topics** such as algebra, geometry, trigonometry, and graphing.



10/39





Prerequisites (Cont.)

It also requires a good knowledge of **Calculus I topics** such as limits, differentiation, and integration.



11/39



Calculus I Versus Calculus II

Much of Calculus II is a **generalization** of what you learned in Calculus I.

In Calculus I you learned:	In Calculus II you will learn:
About derivatives and integrals of basic functions	How to extend differentiation and integration to more types of functions
What a derivative is and how to interpret it	How to solve equations that involve derivatives
What an integral is and how to use it	More advanced integration techniques
How to interpret derivative and integrals in the rectangular coordinate system	How to apply Calculus techniques to other coordinate systems



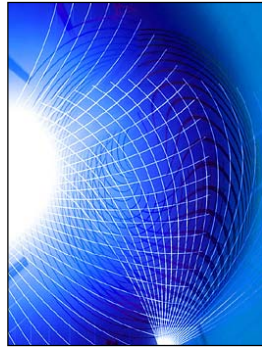
12/39





Topics In Calculus II

The **general topics** covered in Calculus II are:



- Differentiation and Integration of Transcendental Functions
- Advanced Integration Techniques
- Differential Equations
- Different Coordinate Systems
- Infinite Sequences and Series

13/39



Differentiation and Integration of Transcendental Functions

Transcendental functions include exponential, logarithmic, inverse trigonometric, hyperbolic, and inverse hyperbolic functions.

Being able to differentiate and integrate these types of functions **expands** your ability to use them in various applications.



14/39

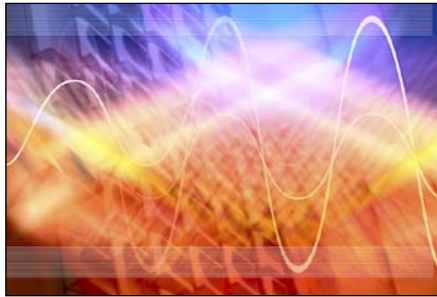




Advanced Integration Techniques

Advanced integration techniques generalizes the types of integrals that you will be able to handle.

Particular techniques include Integration by Parts, Partial Fractions, Trigonometric Integrals, Trigonometric Substitution, and Improper Integrals.



15/39



Differential Equations

Differential Equations are equations that involve one or more derivatives of an unknown function.

Differential equations arise in many areas of science and technology.



16/39





Different Coordinate Systems

You will learn how to do Calculus in **different coordinate systems**. Calculus for parametric coordinates and polar coordinates will be explored as well as the relationships between the different coordinate systems.



17/39




Infinite Sequences and Series

Other topics in Calculus II include **infinite sequences and series**. These topics address issues such as approximating functions, their derivatives, and integrals.

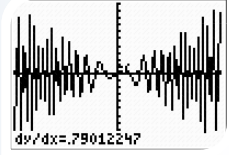


18/39








Calculator Techniques



19/39




Calculator Techniques



Remembering a couple of **calculator techniques** from Calculus I will be helpful to you in Calculus II.

20/39





Approximating Derivatives - 1

Suppose that we start with a differentiable function f . Recall that the definition of the **derivative** is:

$$f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$$

So for small values of h we may say that

$$f'(x) \approx \frac{f(x+h) - f(x)}{h}$$



21/39



Approximating Derivatives - 2

If we replace h by $-h$, then we have

$$f'(x) \approx \frac{f(x) - f(x-h)}{h}$$

And by averaging the previous two expressions, it follows that

$$f'(x) \approx \frac{f(x+h) - f(x-h)}{2h}$$

This is the routine that is built into most **graphing utilities** for finding the derivative.



22/39





Example – Finding Derivative 1

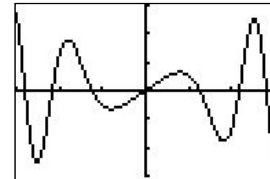
This example illustrates how to approximate derivatives.

Example: Approximate $f'(0.54)$ where $f(x) = x\cos(x^2)$.

Solution: We start by graphing $f(x)$.

```
Plot1 Plot2 Plot3
Y1=Xcos(X^2)
Y2=
Y3=
Y4=
Y5=
Y6=
Y7=
```

```
WINDOW
Xmin=-3
Xmax=3
Xscl=1
Ymin=-3
Ymax=3
Yscl=1
Xres=1
```



23/39



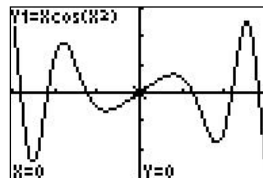
Example – Finding Derivative 2

Next, we go to the Calculate menu by pressing

2nd TRACE

```
CALCULATE
1:value
2:zero
3:minimum
4:maximum
5:intersect
6:dy/dx
7:∫f(x)dx
```

Select 6: dy/dx



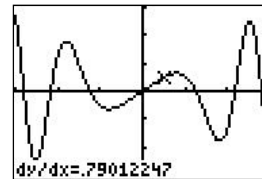
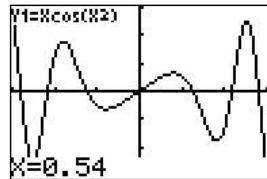
24/39





Example – Finding Derivative 3

Type 0.54 and press ENTER



The approximation for the derivative appears at the bottom of the screen.

25/39



Approximating Definite Integrals - 1

Most graphing utilities use either the Midpoint Rule, the Trapezoid Rule, or Simpson's Rule to approximate definite integrals.

$$\int_a^b f(x) dx$$



26/39





Example – Finding Definite Integrals 1

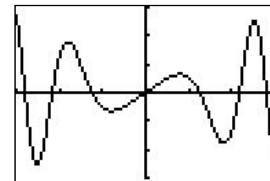
This example illustrates how to approximate a definite integral using a typical graphing calculator.

Example: Approximate $\int_0^1 x \cos(x^2) dx$

Solution: We start by graphing $x \cos(x^2)$.

```
Plot1 Plot2 Plot3
Y1=Xcos(X^2)
Y2=
Y3=
Y4=
Y5=
Y6=
Y7=
```

```
WINDOW
Xmin=-3
Xmax=3
Xscl=1
Ymin=-3
Ymax=3
Yscl=1
Xres=1
```



27/39



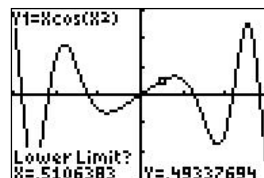
Example – Finding Definite Integrals 2

Next, we go to the Calculate menu by pressing

2nd TRACE

```
CALCULATE
1:value
2:zero
3:minimum
4:maximum
5:intersect
6:dy/dx
7:∫f(x)dx
```

Select 7: $\int f(x)dx$

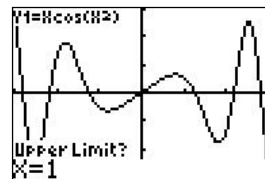
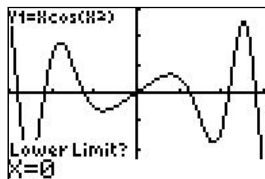


28/39



Example – Finding Definite Integrals 3

Type 0 as the lower limit, press ENTER, and type 1 as the upper limit.



The approximation for the integral appears at the bottom of the screen.

29/39



How to Study Calculus



30/39





Know Prerequisite Material

Mathematics in general is a **cumulative subject**. Calculus is no exception. Knowing the **prerequisite material** will make Calculus II much easier.



Prerequisite Material Includes:

- Algebra
- Geometry
- Trigonometry
- Graphing
- Calculus I topics like limits, differentiation, and integration

31/39



Read Your Math Book

Remember that your **math book** is there to help you understand the content.



- Read your book carefully.
- Write down questions as you have them.
- Work through any steps that your book may skip over.

32/39





Ask Questions

If you have trouble understanding the material, **ask questions**.



33/39



Study With a Group

Your **classmates** are trying to learn the same material that you are. Take advantage of it.



- Organize a study group.
- Compare lecture notes.
- Work homework together.

34/39





Get Something Out of the Study Group

Remember that you will be tested **individually**. When studying with a group, be sure to get something out of it.



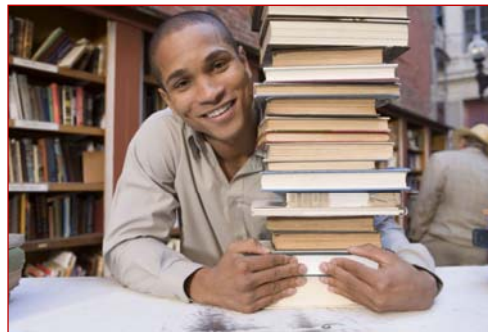
- Be an active member of the study group.
- Work some exercises alone.

35/39



Focus on the Concepts


Everything may not make sense all at once. Focusing on the **concepts** and how the **procedures** fit into the **big picture** will help you succeed in Calculus II.



36/39



Learning Summary




Calculus problems involve finding **slopes** of curves, **areas** of irregular shapes, and **optimization** of functions.

Calculus is the study of how things **change**.

Focus on the **big picture** when studying Calculus II.

Prerequisites for Calculus II include algebra, trigonometry, geometry, graphing, and Calculus I

Calculus II **topics** involve Transcendental Functions, Advanced Integration, Differential Equations, Coordinate Systems, and Infinite Series




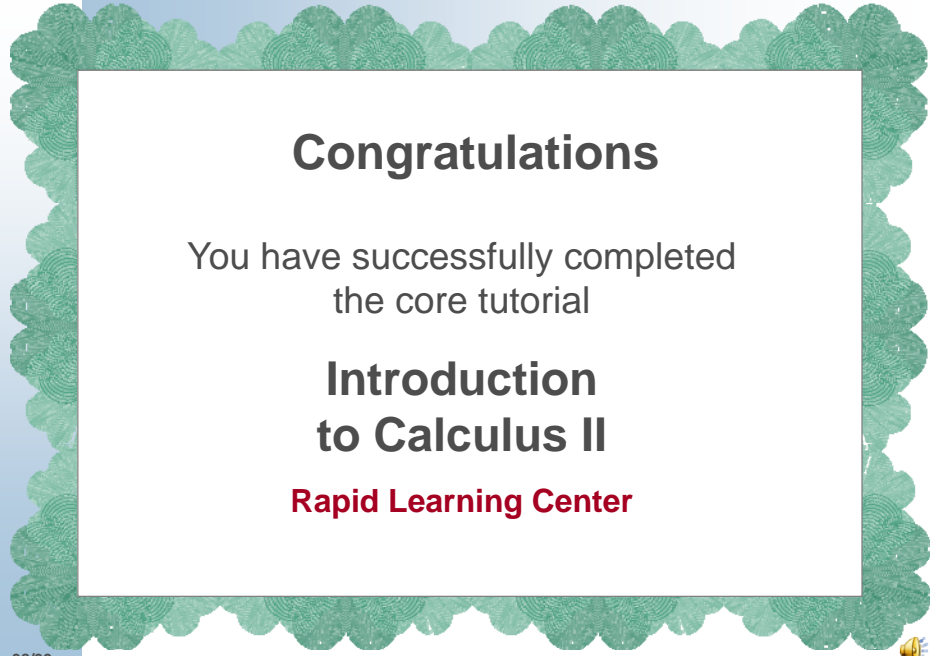
37/39

Congratulations


You have successfully completed the core tutorial

Introduction to Calculus II

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38/39



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What's Next ...

Step 1: Concepts – Core Tutorial (Just Completed)

→ Step 2: Practice – Interactive Problem Drill

Step 3: Recap – Super Review Cheat Sheet

Go for it!



39/39

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