

Lecture for Week 0

A Sales Pitch and a Sermon

WHAT WILL CALCULUS DO FOR YOU?

Source: S. L. Salas and E. Hille, *Calculus* (Wiley)

Time, skill, and copyright law will not let me copy their drawings illustrating these concepts.

High school math

slope of a line

tangent line to a circle

average velocity

distance moved under
constant velocity

area of a polygon

finite sum

average of some numbers

length of a line segment

Calculus

slope of a curve

tangent line to any curve

instantaneous velocity

distance moved under
varying velocity

area of a region with
curved boundary

sum of infinite series

average of a function

length of a curve

center of a circle

volume of a
rectangular solid

surface area of cylinder

tangent plane to sphere

motion on a straight line
with constant velocity

work done by a
constant force

mass of a body of
constant density

center of a sphere

centroid of any region

volume of a solid
with curved boundary

surface area of any solid

tangent plane to any surface

motion along a curved path
with varying velocity

work done by a
varying force

mass of a body of
varying density

center of gravity
of any solid

HOW TO LEARN CALCULUS

Rule 1: Accept the fact that YOU must do 90% of the work.

Learning requires time, effort, and patience.

Rule 2: Don't expect to understand everything the first time you hear or read it.

Don't confuse temporary frustration (which is normal) with failure.

Rule 3: Read the book BEFORE the lecture.

Do the homework BEFORE it's discussed in class.

(At least try; then go back if necessary.)

Rule 4: Don't hesitate to ask questions

(but choose the time sensibly).

The next rule is most important of all:

Rule 5: Aim for understanding. Don't just memorize.

Whenever possible, memorize METHODS instead of formulas.

Whenever possible, learn HOW a method works, WHY a formula is true, what each symbol MEANS.

Always make sure you understand WHEN the formula or method should be applied.

Penalties for memorizing formulas and imitating examples instead of thinking

- You waste time and enthusiasm memorizing unnecessary and boring things.
- You forget everything a week after the test.
- You forget or misremember the formula during the test.
- You use the formula in a context where it doesn't apply, and get a wrong answer.
- You are not able to solve problems that are different from the examples you've seen.

Rule 6: The night before a test is for sleeping.