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.