

## Final Exam Information

The final exam is cumulative, covering everything we have done this semester, and that was a lot of stuff. It would be easy to lose the main ideas from the class among the details of certain calculations.

The two most important topics were the definition of the derivative and the definition of the definite integral, or at least the facts that the derivative measures the slope of the function while the definite integral gives the area under the curve.

Hence, the two essay questions below will be present on the final exam. I wanted you to think deeply about these ideas as a way of reinforcing the main concepts from the class, and so wanted to share these in advance.

1. In complete sentences and using proper grammar explain why the limit

$$\lim_{h \rightarrow 0} \frac{f(a+h) - f(a)}{h}$$

**gives the slope of the tangent line to  $f(x)$  at  $a$ .** You should draw a picture and refer to the picture in your essay. Do not simply say that this is the derivative, you need to explain **why** the derivative gives the slope of the curve.

2. Suppose  $f(x) > 0$  and  $a < b$ . In complete sentences and using proper grammar explain why the limit

$$\lim_{n \rightarrow \infty} \sum_{k=1}^n f(x_k) \Delta x$$

**gives the area under  $f(x)$  between  $a$  and  $b$ .** Here  $\Delta x = \frac{b-a}{n}$  and  $x_k = a + k\Delta x$ . You should draw a picture and refer to the picture in your essay. Do not simply say that this is the definite integral, you need to explain **why** the definite integral gives the area under the curve.

To prepare for the final exam, I suggest reviewing old exams, worksheets and homework. For the final you should be able to:

- Explain why the definition of the derivative gives the slope of the curve.
- Explain why the definite integral gives the area under the curve.
- Use a graph to calculate limits, derivatives, and integrals.
- Use the differentiation rules accurately.
- Find antiderivatives accurately.
- Evaluate definite integrals using the Fundamental Theorem of Calculus.
- Translate calculus concepts into English and vice-versa.
- Solve related rates problems.
- Solve optimization problems.