

This is an overview of the most important skills and understanding I expect you to have developed. I don't promise that every exam problem will match with something on this sheet. **Closed book, closed notes, no calculators.** There will be challenge questions, as explained on the first review sheet.

- Know and correctly use **all of the differentiation rules shown on the first review sheet** (Derivative of a Constant, Constant Multiple Rule, Sum Rule, Derivative of a Constant, Product Rule, Quotient Rule, Chain Rule).

- Know and correctly use **the derivatives of all of functions listed/described on the first review sheet** (Power Rule and all trigonometric functions).

- **Also**, know and correctly use the the derivatives of functions given below.

$$\frac{d}{dx} \arcsin x = \frac{1}{\sqrt{1-x^2}}$$

$$\frac{d}{dx} \arctan x = \frac{1}{1+x^2}$$

$$\frac{d}{dx} e^x = e^x$$

$$\frac{d}{dx} \ln x = \frac{1}{x}$$

$$\frac{d}{dx} a^x = (\ln a)a^x \quad \text{for } a > 0$$

$$\frac{d}{dx} \log_a x = \frac{1}{(\ln a)x} \quad \text{for } a > 0$$

- Exam questions might test your understanding of some of the following important terms and concepts:

Absolute (AKA global) min/max	increasing function	linear approximation
Relative (AKA local) min/max	decreasing function	critical points

The exam might reasonably test your ability to carry out some of the following procedures.

- Use differentiation rules to find the derivative of any function that we could write down using addition, subtraction, multiplication, division, composition, and the functions whose derivatives we know. This is a major part of the test.
- Compute higher derivatives (e.g. second derivatives, third derivatives, etc.)
- Show/explain why the functions listed above have the derivatives given above. Some are easier than others, and I don't want to ask ridiculously difficult questions on the test.
- Given a relationship between x and y , use Implicit Differentiation to find an expression for $\frac{dy}{dx}$ in terms of x and y .
- Use Logarithmic Differentiation to find the derivative of a given function. You might not be told that Logarithmic Differentiation is the right approach.
- Solve a Related Rates problem.
- Given a function $f(x)$ and a value c , find the linearization of f at $x = c$. Then, given another value c' , find an approximate value for $f(c')$ using the linear approximation at $x = c$.
- Determine absolute maxima/minima of a given function on a closed interval by testing function values at critical points and endpoints. (Or slightly harder: Determine absolute maxima/minima on an open interval, if they exist, by testing values at critical points and taking limits at endpoints.)
- Analyze a given function f , in particular finding some or all of the following:
 - Critical points
 - Intervals where f is increasing or decreasing
 - Local maxima/minima (perhaps using the First or Second Derivative Tests)
 - Absolute (AKA global) maxima/minima if either or both exists
 - Intervals where f is concave up or concave down
 - points of inflection.
- Use your analysis of a given function to make a reasonable sketch of the function.
- Solve an Optimization problem by determining the function whose absolute minimum or maximum should be found and then finding it.