**MAT143 Final Exam Review Topics**

1. **Limits and Derivatives of Functions**

* Limits of a function
* Continuity of a function
* Rate of change of a function and the slope of the secant line.
* Instantaneous rate of change and the slope of the tangent line.
* Derivative of a function
* Rules of derivatives

1. Constant rule
2. Power rule
3. Additive and difference rule
4. Multiplicative rule
5. Quotient rule
6. Chain rule (for composite functions)

* High-order derivatives

1. **Exponential and Logarithmic Functions**

* The natural base exponential function
* Properties of natural base exponential functions

1. e0 = 1
2. ex + y = ex×ey
3. ex - y = ex/ey
4. ekx = [ex]k

* Natural-base logarithmic function
* Properties of natural log

1. ln(1) = 0
2. ln(xy) = ln(x) + ln(y)
3. ln(x/y) = ln(x) – ln(y)
4. ln(xk) = k ln(x)

* derivative of natural log and exponential functions

1. [ex]’ = ex
2. [ln x]’ = 1/x

* Exponential and logarithmic functions with arbitrary bases
* Derivatives of general exponential and logarithmic functions

1. [ax]’ = ax lna
2. [loga x]’ = 1/(x lna)
3. **Applications Derivatives - Optimization**

* Optimizations problems and concepts

1. Finding critical values
2. Concave-up and concave-down
3. Relative maxima and minima
4. Absolute maximum and minimum

* Business Applications – exponential models

1. Compound interests
2. Depreciation model.

* Cost, Revenue, and Profit

1. Relationship between the three functions
2. Maximization/minimization of these functions
3. Marginal analysis of these functions
4. Average cost, revenue, and profit functions
5. **Integration and Applications**

* Antiderivative /Indefinite integral
* Four basic rules of integral

1. Constant rule:
2. Power rule: , for
3. Natural log:
4. Natural exponential:

* Two basic properties
* Integration by substitution: the reverse of the chain rule

1. Identify the candidate u-function (substitution)
2. Convert the problem to one of the four rules
3. Substitute back to the original variable.

* Applications

1. For a given marginal cost (revenue, profit) function to find the actual cost function.
2. Initial value problem to find the integral constant C.
3. **Multi-variable Functions and Partial Derivatives**

* Concepts of a function with more than variable
* Partial derivatives

1. Definition and geometry
2. Calculation

* Applications – production function as an example

1. Finding marginal productivity of a specific variable
2. Evaluating marginal productivity