Math 229: Final Exam Review Sheet

Final Exam: Tuesday, July 1st 12:00-2:00pm, Bridges Room 269

Part 1: Sections 1.1, 1.2, 1.3, 1.4, 9.4, 10.1, 10.2

- Plotting points, lines, slope, x and y-intercepts, parallel and perpendicular lines
- Functions, the Vertical Line Test, Cost, Revenue, and Profit functions, demand equations
- Intersection of lines using Substitution and Elimination, Applications
- Solving Inequalities, Factor Analysis, Interval Notation
- The Domain and Range of a Function, Evaluating Functions, The sum, difference, product, quotient, and composition of functions.

Key Formulas:
$m = \frac{y_2 - y_1}{x_2 - x_1}$, $y - y_1 = m(x - x_1)$, $y = mx + b$
$R(x) = x \cdot p(x)$, $P(x) = R(x) - C(x)$

Not Tested: absolute value equations and inequalities, Section 10.3

Review Problems: Chapter 1 #5-10, 17, 24, 25, 29; Chapter 9 #29, 37, 38; Chapter 10 #1, 2, 4, 5

Part 2: Sections 10.4, 10.5, 10.6, 11.1, 11.2, 11.3, 11.4, 11.5

- Definition of a limit, evaluating limits, showing a limit does not exist, limits at infinity
- One sided limits (definition and evaluating them), continuity, finding points of discontinuity, piecewise defined functions
- The limit definition of the derivative, finding derivatives using limits (the 4 step process), finding the equation of a tangent line
- Differentiation rules [sums, products, quotients, and the chain rule], higher order derivatives
- Marginal functions [$C'(x), R'(x), P'(x)$, average cost $\overline{C}(x)$].

Key Formulas:

$$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$
$$\frac{d}{dx} x^r = r x^{r-1}$$
$$\frac{d}{dx} \left(f(x) + g(x)\right) = f'(x) + g'(x)$$
$$\frac{d}{dx} \left(f(x) g(x)\right) = f'(x) g(x) + f(x) g'(x)$$
$$\frac{d}{dx} \left(\frac{f(x)}{g(x)}\right) = \frac{f'(x) g(x) - f(x) g'(x)}{(g(x))^2}$$
$$\frac{d}{dx} \left(g(f(x))\right) = g'(f(x)) f'(x)$$

Not Tested: Elasticity of Demand, the Intermediate Value Theorem

Review Problems: Chapter 10 # 10, 15, 16, 20, 24, 27, 28 ; Chapter 11 # 2, 6, 7, 10, 19, 26, 30, 35, 47, 61

Part 3: Sections 12.1, 12.2, 12.3, 12.4, 12.5

- Applications of the first derivative (increasing/decreasing, critical points, relative extrema)
- Applications of the second derivative (concavity, inflection points, the second derivative test)
- Using factor analysis on the first and second derivative of a function, curve sketching
- Absolute extrema and Optimization problems

Key Formulas:
A function is increasing when $f'(x) > 0$, decreasing when $f'(x) < 0$, critical numbers are where $f'(x) = 0$ or is undefined.
A function is concave up when $f''(x) > 0$, concave down when $f''(x) < 0$. Inflection points are when the function changes concavity.
Relative Extrema occur at critical points, absolute extrema occur either at critical points or at the end points of the interval under consideration.

Not Tested: Vertical and Horizontal Asymptotes

Review Problems: Chapter 12 # 5, 13, 24, 36, 38

Part 4: Sections 13.1, 13.2, 13.3, 13.4, 14.1, 14.2, 14.3, 14.4, 14.5, 14.6

- Exponential Functions (definition, properties, graphs)
- Logarithmic Functions (definition, properties, graphs)
- Compound interest, continuous interest and the base e, simplifying log expressions
- Differentiating exponential and logarithmic functions
- Antiderivatives, initial value problems, indefinite integrals
- Definite integrals, the Fundamental Theorem of Calculus, the area under a curve, the average value of a function, the area between two curves

Key Formulas:
$\log_b(x) = y$ if and only if $b^y = x$
$\log(xy) = \log(x) + \log(y)$, $\log(\frac{x}{y}) = \log(x) - \log(y)$, and $\log(x^a) = a\log(x)$
$A = P(1 + \frac{r}{n})^{nt}$ and $A = Pe^{rt}$
$\dfrac{d}{dx}(\ln(f(x))) = \dfrac{f'(x)}{f(x)}$, and $\dfrac{d}{dx}\left(e^{f(x)}\right) = f'(x)e^{f(x)}$
$\int a\ dx = ax + C$ for any constant a
$\int x^r\ dx = \dfrac{1}{r+1}x^{r+1} + C$
$\int af(x)\ dx = a\int f(x)\ dx$ for any constant a
$\int f(x) \pm g(x)\ dx = \int f(x)\ dx \pm \int g(x)\ dx$
$\int e^x\ dx = e^x + C$
$\int \dfrac{1}{x}\ dx = \ln|x| + C.$
The Fundamental Theorem of Calculus:
Let f be a continuous function on the interval $[a, b]$, and let F be an antiderivative of f.
Then $\int_a^b f(x)\ dx = F(b) - F(a)$

Key Formulas:
$\int_a^b f(x)\ dx = -\int_b^a f(x)\ dx$
$\int_a^b cf(x)\ dx = c\int_a^b f(x)\ dx$ for any constant c
$\int_a^b f(x) \pm g(x)\ dx = \int_a^b f(x)\ dx \pm \int_a^b g(x)\ dx$
$\int_a^b f(x)\ dx = \int_a^c f(x)\ dx + \int_c^b f(x)\ dx$ for any $a < c < b$
Let f be a function that is integrable on an interval $[a, b]$. Then the **average value** of f over $[a, b]$ is $\dfrac{1}{b-a}\int_a^b f(x)\ dx$.
Given two functions f and g, with $g(x) \geq f(x)$ on an interval $[a, b]$, the area between f and g between a and b is given by $\int_a^b g(x) - f(x)\ dx$.

Review Problems: Chapter 13 # 3, 6, 13, 19, 20, 27, 36, 40, 45; Chapter 14 # 3, 7, 22, 35, 40, 46, 51

Part 5: Sections 2.1, 2.2, 2.3, 2.4, 2.5, 2.6

- Systems of linear equations, representing a system as a matrix
- Solving systems using matrix techniques
- Unique solutions versus infinitely many solutions and no solutions
- Operations on Matrices: equality, addition/subtraction, scalar multiplication, multiplying matrices
- Finding the inverse of a matrix, solving systems of equations using the inverse of a matrix

Review Problems: Chapter 2 # 1, 3, 4, 5, 6, 9, 13, 17, 19, 21, 23, 25, 29, 37