Final Exam Topics List

Chapter 1: Functions and Derivatives: The Graphical View
1. Calculus functions & elementary functions
2. Graphs
3. Amount functions v rate functions
4. Tangent lines
5. Estimating derivatives: graphs & tables
6. Geometry of derivatives

Chapter 2: Functions and Derivatives: The Symbolic View
1. Definition of the derivative
2. Polynomial derivatives
3. Limits and left- & right-hand limits
4. Derivative and antiderivative formulas
5. Modeling with differential equations: motion, growth, and periodic phenomena

Chapter 3: New Derivatives from Old
1. Derivative rules: product, quotient, and chain rules
2. Implicit differentiation
3. Inverse trigonometric functions’ derivatives

Chapter 4: Using the Derivative
1. Slope fields
2. Infinity, limits, and the Marquis de l’Hôpital
3. Applications: optimization, related rates, Newton’s Method, Taylor polynomials
4. Parametric functions: graphs, derivatives, tangents
5. Continuity: Intermediate Value Theorem, Extreme Value Theorem
6. Differentiability: Mean Value Theorem, Racetrack Principle

Chapter 5: The Integral
1. Area and the definite integral
2. The Fundamental Theorem of Calculus
3. Indefinite integrals
4. Using substitution to evaluate integrals

Rules of Differentiation

Results:
1. \((u^r)' = ru^{r-1} \cdot u'\)
2. \((e^u)' = e^u \cdot u'\)
3. \(\ln(u)' = \frac{1}{u} \cdot u'\)
4. \(\sin(u)' = \cos(u) \cdot u'\)
5. \(\cos(u)' = -\sin(u) \cdot u'\)
6. \(\tan(u)' = \sec^2(u) \cdot u'\)
7. \(\cot(u)' = -\csc^2(u) \cdot u'\)
8. \(\sec(u)' = \sec(u) \tan(u) \cdot u'\)
9. \(\csc(u)' = -\csc(u) \cot(u) \cdot u'\)
10. \(\sin^{-1}(u)' = \frac{1}{\sqrt{1 - u^2}} \cdot u'\)
11. \(\cos^{-1}(u)' = \frac{-1}{\sqrt{1 - u^2}} \cdot u'\)
12. \(\tan^{-1}(u)' = \frac{1}{1 + u^2} \cdot u'\)
13. \(\cot^{-1}(u)' = -\frac{1}{1 + u^2} \cdot u'\)
14. \(\sec^{-1}(u)' = \frac{1}{|u|\sqrt{u^2 - 1}} \cdot u'\)
15. \(\csc^{-1}(u)' = -\frac{1}{|u|\sqrt{u^2 - 1}} \cdot u'\)

Reductions:
1. \((k \cdot u)' = k \cdot (u')\)
2. \((u \pm v)' = (u') \pm (v')\)
3. \((u \cdot v)' = (u') \cdot v + u \cdot (v')\)
4. \((u \cdot v)' = u' \cdot v + u \cdot v'\)
5. \((u \cdot v)' = \frac{(u') \cdot v - u \cdot (v')}{v^2}\)
6. \((u \cdot v)' = u' \cdot v' \quad \text{or} \quad (u(v))' = u'(v) \cdot v'\)