

REVIEW SHEET FOR FINAL EXAM: MATH 161

Study: Chapters 1 – 5 and section 6.1 (excluding section 2.4) of Stewart.

1. Understanding graphs

- A. precalculus strategy (domain, zeroes, singularities, sign analysis, limiting behavior, symmetry)
- B. regions of increase and decrease (first derivative test for local extrema)
- C. concavity and points of inflection
- D. second derivative test for local extrema
- E. Graphing functions of the form $g(x) = \int_a^x f(t)dt$
- F. geometric differentiation
- G. geometric anti-differentiating

2. Differential Calculus

- A. limit definition of the derivative
- B. finding tangent and normal lines
- C. continuity
- D. differentiation rules including sum, product, and quotient
- E. chain Rule
- F. meaning of the derivative as rate of change
- G. higher-order derivatives
- H. l'Hôpital's rule
- I. linearization: estimating numerical values using a tangent line
- J. related rate problems
- K. optimization problems
- L. Newton's method

3. Definition and meaning of the definite (Riemann) integral.

- A. area between curves
- B. distance, velocity, acceleration problems
- C. limit of a Riemann sum equals a definite integral
- D. average value of a function

- E. properties of the indefinite and the definite integral
- F. Fundamental Theorem of Calculus! (*both versions*)
- G. Net Change Theorem
- H. Leibniz's extension of FTC for differentiation of an integral
- I. implicit and logarithmic differentiation
- J. differential equations; initial value problems

4. Techniques of integration

- A. judicious guessing
- B. substitution (for both indefinite and definite integrals)
- C. use of symmetry in evaluating definite integrals (odd functions, even functions)
- D. verifying an integration formula by means of differentiation

5. Logs and exponential functions

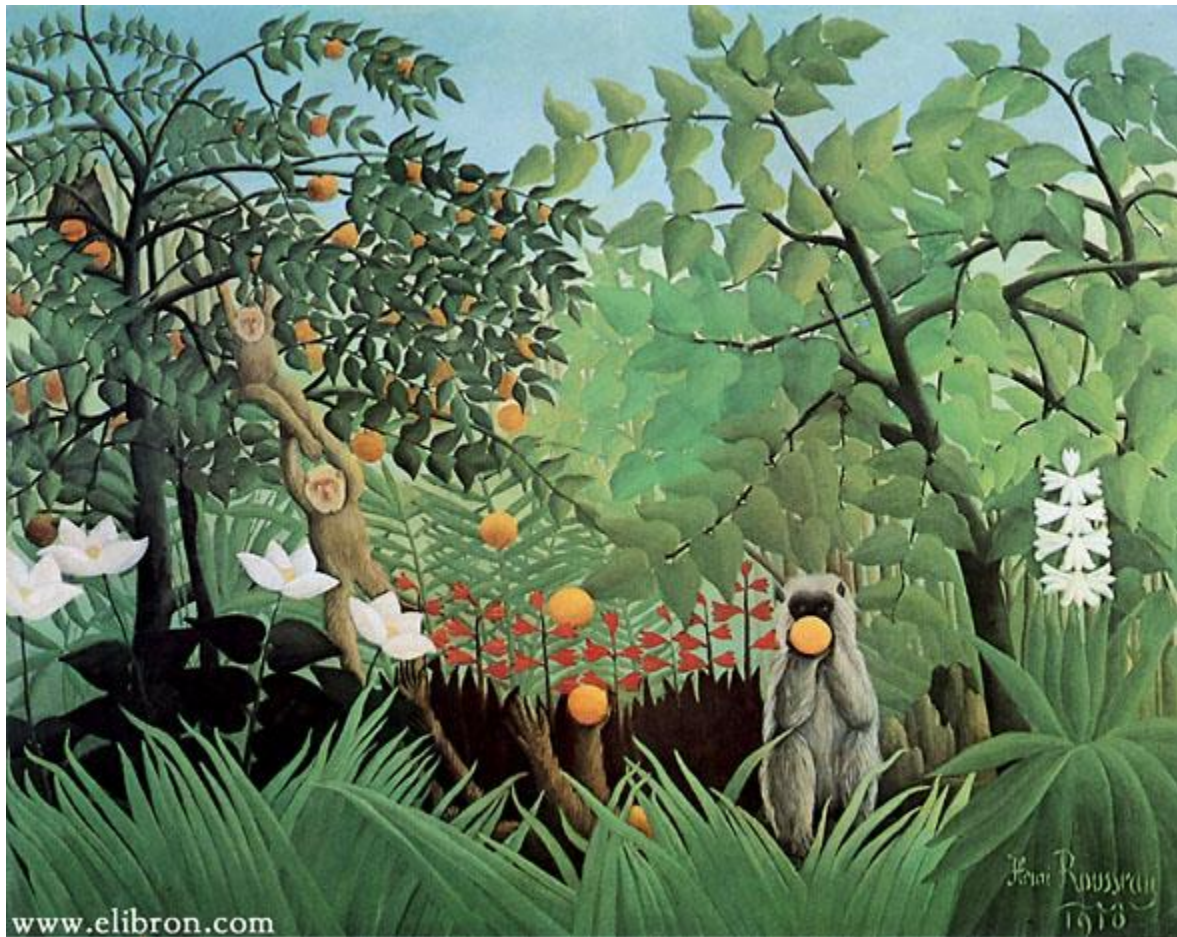
- A. log and exp as inverse functions of one another
- B. properties of logs and exponentials: $\log(ab)$, $\log(a/b)$, $\log(a^p)$, $\exp(a + b)$, etc.;
change of base formula for logs
- C. differentiating and integrating function of the form b^x
- D. differentiating functions of the form $f(x)^{g(x)}$

6. Statements of Theorems

- A. Sandwich (aka Squeeze) Theorem
- B. limit as $\theta \rightarrow 0$ of $(\sin \theta) / \theta$
- C. Intermediate Value Theorem
- D. Extreme Value Theorem
- E. Rolle's Theorem
- F. Mean Value Theorem and its Corollaries
- G. Fundamental Theorem of Calculus (*both versions*)
- H. Net Change Theorem

Examinations are formidable even to the best prepared, for the greatest fool may ask more than the wisest man can answer.

- C. C. Colton, **Lacon**



Henri Rousseau. **Exotic Landscape.** (1910)