I. Pre Calculus

 A. Parent Functions

 B. Log Rules

 C. Trigonometry

 1. Unit Circle

 2. Graphs

 3. Trig Identities

II. Limits

 A. When do limits not exist?

 1. left and right hand limits do not agree

 2. oscillates between two fixed values

 B. Evaluate Limits

 1. Graphically

 2. Algebraically

 a. direct substitution

 b. may require factoring when graph has a hole

 c. if limit equals , limit is approaching , has a vertical asymptote

 d. If limit equals or , use L’Hopital’s Rule:

 e. gives horizontal asymptote “BOSTON”

 i. degree of numerator = degree of denominator HA : y = coefficients

 ii. degree of numerator > degree of denominator No HA, limit

 iii. degree of numerator < degree of denominator HA : y = 0, limit

 iv. may require dividing numerator and denominator by highest power of

 x in the denominator

III. Continuity

 A. Types of Discontinuity

 1. removable (hole)

 2. infinite (asymptote)

 3. jump (step)

 B. Definition

 To be continuous at x = a,

 1. and *f(a)* must exist

 2.

 C. Piecewise Functions

 is continuous if and only if the left-hand and right-hand limits of the function agree

 at the connecting points.

 Example:

at 3, both left and right pieces equal 9, therefore f(x) is continuous

D. Intermediate Value Theorem (IVT)

If is continuous in an interval [a,b], then somewhere on the interval it will achieve every value between and

IV. Derivatives

 A. Definition

 1.

 2.

 B. When Derivatives Do Not Exist

 1. cusp or corner (left hand limit right hand limit)

 2. discontinuity (If f(x) does not exist, then f’(x) cannot exist)

 3. vertical tangent (f’(x) = #/0)

 C. Piecewise Functions

 A piecewise function is differentiable if and only if the derivatives of both halves of the

 function are equal at the breaking point.

Example:

at 3, derivatives of both pieces equal 6, therefore f(x) is differentiable

 D. Average Rate of Change vs. Instantaneous Rate of Change

 Slope of Secant vs. Slope of Tangent

 vs.

 E. Mean Value Theorem

If is continuous on the interval [a, b] and differentiable on the interval (a, b), then at some point (c, the slope of the secant equals the slope of the tangent; or

 there exists a point c on the interval (a,b) such that

 F. Rolle’s Theorem

If is continuous on the interval [a, b], differentiable on the interval (a, b), and then for some c in the interval (a, b), .

 G. Derivative Rules (blue page 5 #1-24)

 1. to give a general formula

 2. to evaluate at a specific point

1. Derivative of an Inverse

If is a one-to-one differentiable function with inverse function and, then the inverse function is differentiable at the point (a,b) and

 I.. Implicit Differentiation

 Examples:

1. 2. 3.

V. Curve Sketching

 A. Min and Max values

 1. absolute or local

 2. or DNE, x = critical number

 3. sign chart to verify min/max

 4. , critical number is max; critical number is a min

 B. Intervals of increasing and decreasing

 1. , decreasing; , increasing

 C. Inflection points

 1. or DNE, x = possible point of inflection

 2. sign chart to verify points of inflection

 D. intervals of concavity

 , concave down; , concave up

 E. Reading graphs

 1. given graph of , describe graph of *f*

 2. given graph of *f*, describe graph of

VI. Applications of Derivatives

 A. Related Rates

 B. Optimization

 C. Linearization

 D. Motion

 1. position

2. = velocity

3. acceleration

4. jerk

5. particle is at rest

6. movement along a numberline

 i. (or up)

 ii. . ( or down)

 7. = speed

 8. displacement vs. total distance

 E. Write Equation

 1. Of tangent lines

 2. of normal lines (perpendicular to tangent)

VII. Integrals

 A. Approximate

 1. LRAM

 2. RRAM

 3. MRAM

 4. Trapezoidal

 B. Fundamental Theorem of Calculus

 1.

 2. is the anti-derivative of ,

 3. Definite integrals = Area under a curve

 4. Integrals are the inverse of derivatives

 C. Integral Rules (p351 in textbook)

 1. to find indefinite integrals (plus C!!!!!)

 2. to find definite integrals without a calculator

 D. Improper Integrals

 Have a discontinuity on the interval of integration

 E. U-substitution

 F. Integration by Parts

 G. Integration by Partial Fractions

VIII. Application of Integrals

 A. Area between curves

 1.

 2.

 B. Volume

 1. by cross sections – know area formulas

 2. disk –

 3. washer -

 C. Average Value :

 D. Motion

 1. Average distance :

 2. Displacement :

 3. Total distance:

IX. Differential Equations

1. Slope Fields

 B. Solve Separable Equations

 1. general

 2. specific to an initial value

 C. Exponential Growth and Decay

 1.

 2.