MIDTERM 1 – STUDY GUIDE

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<u>Know how to:</u>

1. Chapter 1: Functions and Models

- Determine whether a given graph is the graph of a function (1.1.7, 1.1.8)
- Given the graph of a function, determine its domain and range (1.1.7, 1.1.8)
- Given a formula, find the domain of a function (1.1.31, 1.1.38)
- Given a formula, find the range of a function (1.1.38)
- Find an expresion of a function whose graph is a given curve (1.1.54)
- Solve word problems (1.1.63, 1.2.16)
- Determine whether a function is even, odd, or neither, given a graph (1.1.69)
- Determine whether a function is even, odd, or neither, given a formula (1.1.73, 1.1.77)
- Classify functions as power functions, etc. (1.2.2)
- Match a given equation with a given graph (1.2.4)
- Find expressions of quadratic functions whose graphs are shown (1.2.8)
- Explain how to obtain a new function from a given function (1.3.1, 1.3.2, 1.3.7)
- Graph functions that are obtained from shifting/stretching/flipping a given function (1.3.13, 1.3.14, 1.3.17, 1.3.18)
- Find $f + g$, $f - g$, fg, $\frac{f}{g}$ (1.3.29, 1.3.30)
- Find composition of functions (1.3.31, 1.3.35, 1.3.36)
- Find domains of functions that involve e^x or $\ln(x)$ (1.5.20)
- Find an exponential functions whose graphs are given (1.5.21, 1.5.22)
- Given a graph, determine whether a function is one-to-one (1.6.5, 1.6.7)
- Given a formula, determine whether a function is one-to-one (1.6.9, 1.6.10, 1.6.11)
- Given a formula for f find things like $f^{-1}(3)$ (1.6.15, 1.6.16, 1.6.17)
- Given the graph of f, find the domain and range of f^{-1} as well as $f^{-1}(0)$ (1.6.18)
- Find the formula for the inverse of a function (1.6.25, 1.6.26)
- Solve equations using e^x or $\ln(x)$ (1.6.51, 1.6.52)
- Find exact values of expressions involving inverse trig functions (1.6.63, 1.6.64)
- Simplify expressions involving inverse trig functions, using the triangle method (1.6.70, 1.6.71, 1.6.72)

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2. Chapter 2: Limits and Derivatives

- Given a graph, find a given limit if it exists or explain why it does not exist (2.2.5, 2.2.6, 2.2.7, 2.2.8)
- Sketch the graph of a function which satisfies certain limit conditions (2.2.16)
- **Find limits of a function:**
  - Step 1: Just by plugging in (2.3.3, 2.3.6, 2.3.9)
  - Step 2: By noticing that it's of the form $\frac{1}{0^+} = \infty$ or $\frac{1}{0^-} = -\infty$ (2.2.29, 2.2.30, 2.2.33, 2.2.37, 2.2.46)
  - Step 3: By factoring out the numerator and the denominator and simplifying (2.3.13, 2.3.17, 2.3.18, 2.3.26)
  - Step 4: Whenever there is a square root, by multiplying numerator and denominator by the conjugate form (2.3.21, 2.3.23, 2.3.29, 2.3.30)
  - Step 5: By using the squeeze theorem (2.3.37, 2.3.40)
  - Step 6: By calculating $\lim_{x\to a^-}$ and $\lim_{x\to a^+}$ and by noticing that they're equal or not (2.3.47, 2.3.49)
- **Find limits using the $\epsilon - \delta$ notion of a limit** (2.4.19, 2.4.20, 2.4.25, 2.4.26, 2.4.29, 2.4.30, 2.4.31, 2.4.32, 2.4.36)
- Solve the limit word-problem in 2.3.64
- Given a graph, say where a function is continuous, and state the types of discontinuities (2.5.3, 2.5.4)
- Given a formula, say where a function is continuous and state the types of discontinuities (2.5.27, 2.5.37, 2.5.39, 2.5.40)
- Explain why a function is continuous (2.5.27, 2.5.28)
- Sketch the graph of a function which satisfies certain continuity conditions (2.5.5, 2.5.6)
- Evaluate limits using continuity (2.5.38., 2.6.38)
- Use the intermediate value theorem to show that a given equation has at least one solution in a given interval (2.5.51, 2.5.53, 2.5.54)
- Use the intermediate value theorem to solve a cute word problem (2.5.69)
- Given a graph, find limits at ∞ as well as equations of asymptotes (2.6.3, 2.6.4)
- Sketch a graph of a function which satisfies certain limit at ∞ conditions (2.6.7, 2.6.8, 2.6.9)
- **Find limits at infinity of a function:**
  - Step 1: Just by plugging in (2.6.33, 2.6.38)
  - Step 2: By factoring out the highest power out of an expression
  - Step 3: By factoring out the highest power of the numerator and the denominator (2.6.16, 2.6.17, 2.6.19, 2.6.21, 2.6.34)
  - Step 4: By factoring out the highest power of x out of a square root (2.6.22, 2.6.23, 2.6.24)
  - Step 5: By using the conjugate form, making sure to do Step 4 first (2.6.25, 2.6.26, 2.6.27)
  - Step 6: By using the squeeze theorem (2.6.57)
- Find an equation of the tangent line of a function at a given point (2.7.6, 2.7.7, 2.7.8)
- Sketch the graph of a function which satisfies certain derivative conditions (2.7.21)
- Express a given limit as a derivative of some function f at a given point a (2.7.33, 2.7.34, 2.7.35, 2.7.36, 2.7.37)
- Given a graph of f, sketch the graph of its derivative (2.8.4, 2.8.7)

- **Find the derivative of a function using the definition of the derivative** (2.7.27, 2.7.28, 2.7.29, 2.7.30, 2.8.21, 2.8.24, 2.8.25, 2.8.28, 2.8.29, 2.8.31)
- Also look at 2.7.53, 2.7.54)
- Given a graph of f, say where it is not differentiable (2.8.37, 2.8.39)
- Identify given curves with f, f', and f'' (2.8.41, 2.8.43)

3. Chapter 3: Differentiation rules

- Differentiate polynomials, as well as exponential and root functions (3.1.5, 3.1.7, 3.1.11, 3.1.13, 3.1.17, 3.1.20, 3.1.31, 3.1.32)
- Differentiate functions using the product and quotient rules (3.2.3, 3.2.5, 3.2.6, 3.2.7, 3.2.13, 3.2.15, 3.2.17, 3.2.19, 3.2.25)
- Differentiate functions involving trigonometric functions (3.3.5, 3.3.7, 3.3.8, 3.3.9, 3.3.13)
- Find the equation to the tangent line / normal line to a given curve at a given point (3.1.33, 3.1.34, 3.1.35, 3.1.36, 3.2.31, 3.2.33, 3.3.21, 3.3.24)
- Find an equation of the tangent line to a function that is parallel to a given line (3.1.54, 3.1.56)
- Find $f''(x)$ (3.2.27, 3.2.41)
- Given a graph of f and g, find $(fg)'(1)$, $\left(\frac{f}{g}\right)'(1)$ etc. (3.2.49, 3.2.50)
- Find limits involving $\lim_{x\to 0}\frac{\sin(x)}{x}=1$ and $\lim_{x\to 0}\frac{\cos(x)-1}{x}=0$ (3.3.39, 3.3.40, 3.3.42)