

Test 1 topics

Things to know for **Test 1, Thursday September 10th**

0.1 & 0.2: Precalc review

- Determine the elements of a set when given a statement that describes the set
- Switch between set notation and interval notation
- Determine when a set is a subset of another set
- Find and describe the union and intersection of two sets
- Know the definition of Real numbers (be able to write it as a set)
- Plot points in two-dimensions ($\mathbb{R}^2$) on labeled coordinate axes
- Given the equation of a conic section, be able to sketch its graph
- Complete the square to determine the standard form of a conic section
- Determine if a conic section is an ellipse, circle, parabola, or hyperbola

NOT testing: distance between two points in $\mathbb{R}^2$, supremum/infimum

ex. p. 10 # 1, 2, 3, 5, 6-11, 14

ex. p. 29 # 2-5, 13, 19-22, 24-30 (Just graph and find center, radius, and endpoints)

0.3: Functions

- Know the definition of function
- Be able to find the domain and range of functions
- Evaluate functions at given values in the function's domain
- Know the definition of one-to-one
- Be able to perform the Horizontal and Vertical Line Tests
- Know when you can find the inverse of a function
- Find and graph the inverse of a function
- Calculate the composite function of two given functions
- Simplify a difference quotient
- Determine asymptotes of rational functions
- Determine the slope of a line
- Calculate equations of lines in point-slope form and slope-intercept form
- Use the laws of exponents and logarithms
- Switch between exponentials and logarithms
- Sketch and label the graphs of:
 $x, x^2, x^3, \sqrt{x}, \sqrt[3]{x}, |x|, \frac{1}{x}, e^x, a^x$ (where $a > 0$), $\ln(x)$, $\log_a(x)$ (where $a > 0$), $\sin(x)$, $\cos(x)$, $\tan(x)$, piece-wise defined functions
- Know the Trig. identities: $\sin^2(x) + \cos^2(x) = 1$ and $\tan(x) = \frac{\sin(x)}{\cos(x)}$
- Compute $\sin(\theta)$, $\cos(\theta)$, $\tan(\theta)$ for $\theta = 0, \frac{\pi}{4}, \frac{\pi}{3}, \frac{\pi}{2}, \pi, \frac{3\pi}{2}, 2\pi$

NOT testing: Sum and Difference of Angles, Double/Half-Angle Formulas, The Law of Cosines/Sines, The Binomial Expansion Theorem/Pascal's Triangle, Greatest Integer Functions.

ex. p. 65 # 1-3, 7-22, 25-31, 33, 39-42, 52-58

0.4: Parametric Functions

- Eliminate the parameter to obtain a Cartesian xy Equation of a curve given parametrically
- Describe/sketch what curve/conic section is traced out by the parametric equations
- Determine the initial point, terminal point, and direction of the curve traced out by the parametric equations

ex. p. 79 #1-17

1.1: Intro to Limits

- Identify different types of discontinuities
- Determine when a function is continuous at a point, continuous for all real numbers, and/or continuous in its domain
- Plug values in the domain of a function into the function near a point to determine the limit trend as we approach the given point
- Use a graph to determine a limit
- Determine left-hand limit and right-hand limit
- Find the slope of a secant line through two points on a curve
- Find the slope of the tangent line to the curve using the difference quotient
Note: you will NOT be allowed to use derivatives here
- Find the equation of the tangent line to the curve at a point.
- Calculate average speed/velocity over the duration of a trip and instantaneous speed/velocity at a particular moment during the trip

[Khan Academy: Estimating Limits from Graphs](#)

ex. p. 17 # 1-6, 8-12, 14-21

1.2: Formal Limits

- State the formal definition of a limit (in terms of epsilon and deltas)
- Use the formal definition to prove the limit of a function
- Write a formal proof of a limit
- Describe/sketch the distances involved in a formal $\varepsilon - \delta$ proof of a limit of a function at a point
- Know the formal definition of right and left-hand limits
- Use right-hand and left-hand limits of a function at a point to determine *the* limit of a function at a point
- Know and understand how to use theorems and laws about limits
- Evaluate limits at infinity ($\lim_{x \rightarrow x_0} f(x) = \pm\infty$)
- Evaluate infinite limits ($\lim_{x \rightarrow \infty} f(x) = L \neq \pm\infty$)
- Understand and know how to implement Theorem 5 (page 41) regarding limits with infinity
- Know when a limit represents a horizontal or vertical asymptote

[Khan Academy: Epsilon-Delta Definition of Limits](#)

[Khan Academy: Limit Laws](#)

[Khan Academy: Infinite Limits](#)

[Khan Academy: Limits at Infinity](#)

ex. p. 41 # 1, 3, 5, 6, 8-15, 17-20

1.3: Continuity

- Know the formal definition of continuity
(What 3 requirements must be satisfied to be continuous?)
- Classify discontinuities in a function: removable/'hole', jump, or infinite
- Be able to know and use the fact that polynomials, rationals, roots, exponentials, logarithms, and trigonometric functions are continuous on their domains.
- Determine when the Intermediate Value Theorem is applicable and use it appropriately
- Determine limits using the squeeze theorem
Note: I'll give you a hint when you should apply it

[Khan Academy: Types of Discontinuities](#)

ex. p. 60 # 1-8, 10, 13, 14

1.4: Instantaneous velocity

- Know and use the limit relationship between a position function and the instantaneous velocity at a specific time
- Understand what is meant by positive/negative velocities

ex. p. 66 # 1-6

2.1: Intro to Derivatives

- Know and use the limit definition of the derivative of a function
- Know and use the definition of right-hand and left-hand derivative of a function
- Know when a function is differentiable
(What are the three cases when a function is NOT differentiable?)
- Be able to transition between derivative, instantaneous rate of change, and slope of tangent line
- Find the equation of the tangent line to the graph at a given point
- Know the relationship between continuity and differentiable
- Understand and transition between prime notation, Leibniz notation, and evaluation notation

[Khan Academy: Formal Definition of Derivative](#)

[Khan Academy: Derivative as Slope of Tangent](#)

[Khan Academy: Differentiability and Continuity](#)

ex. p. 13 # 1-10

2.2: Basic Differentiation Rules

- Know and use the derivative of a constant
- Know and use the Constant Multiple Rule
- Know and use the Sum Rule
- Know and use the Difference Rule
- Know and use the Product Rule
- Know and use the Quotient Rule
- Understand how the limit definition of the derivative was used to create all the Rules listed above

[Khan Academy: Basic Derivative Rules](#)

ex. p. 23 # 1-18

2.3: Power Rule

- Know and use the Power Rule
- Find the first and second derivatives using the Power Rule

[Khan Academy: Applying the Power Rule](#)

ex. p. 32 # 1-16

2.4: Derivative of Trigonometric Functions

- Know and use the derivatives of $\sin(x)$, $\cos(x)$, $\tan(x)$, $\csc(x)$, $\sec(x)$, $\cot(x)$.

ex. p. 40 # 1-20

Other Helpful Resources:

1. [Paul's Online Math Notes](#)
2. [Khan Academy- Calc 1](#)
3. [3Blue1Brown: The Essence of Calculus](#) (This is a wonderful Math YouTube channel)
4. For a wonderful drag queen that gives quick TikTok explanations about math, check out [@onlinekyne](#)
 - [Explaining "The Limit Doesn't Exist" from Mean Girls](#)
 - [Explaining functions](#)
 - [Rationals vs. Irrationals](#)
 - [Why \$\(anything\)^0 = 1\$](#)
 - [Why \$0! = 1\$](#)