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Math 120 Review Sheet Exponential And Logarithmic Functions

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Mastering Your Math 120 Review Sheet: Exponential and Logarithmic Functions Explained

Preparing for a Math 120 exam often means facing the challenging yet fascinating world of exponential and logarithmic functions. These concepts are not only central to college algebra and precalculus courses but also underpin real-world phenomena from population growth to sound intensity. Your **Math 120 review sheet exponential and logarithmic functions** is the perfect tool to organize key ideas and practice problem-solving techniques. In this guide, we'll break down everything you need to know—from definitions and properties to solving equations and avoiding common pitfalls. Whether you are flipping through your review sheet for a quick refresher or diving deep for the first time, this article will help you build confidence and mastery.

We'll explore the fundamental relationship between exponentials and logarithms, examine their graphs, and walk through strategies for solving equations. By the end, you will have a clearer understanding of how to approach your Math 120 review material effectively. Let's begin by establishing a strong foundation in exponential functions.

Understanding Exponential Functions

An **exponential function** is any function of the form *f(x) = a "Å b^x*, where *a* is a constant, *b* is a positive real number not equal to 1, and *x* is the exponent. The base *b* determines whether the function models growth or decay. When *b > 1*, the function represents exponential growth; when *0 < b < 1*, it represents exponential decay. Your **Math 120 review sheet exponential and logarithmic functions** often highlights these two behaviors as essential for applications.

Key Properties of Exponential Functions

To work efficiently with exponentials, memorize these core properties:

- The domain is all real numbers.
- The range is (0, ") if a > 0.
- The graph has a horizontal asymptote at y = 0 (the x-axis).
- The y-intercept is at (0, a) because b0 = 1.
- The function is one-to-one, meaning it passes the horizontal line test.

On your review sheet, you might also see transformations: shifting the graph horizontally or vertically, reflecting across the *x*- or *y*-axis, and stretching or compressing. For example, *f(x) = 2^x + 3* shifts the basic exponential curve upward by 3 units.

Logarithmic Functions: The Inverse of Exponentials

A **logarithmic function** is the inverse of an exponential function. If *y = b^x*, then *x = log_b(y)*. In words, the logarithm of a number *y* to the base *b* is the exponent *x* to which *b* must be raised to obtain *y*. For example, *log₂(8) = 3* because *2³ = 8*.

Two special bases appear so frequently that they have their own notation: **common logarithm** (base 10) written as *log(x)*, and **natural logarithm** (base *e*) written as *ln(x)*. The constant *e* "H 2.71828 is the base of natural exponentials and appears in many contexts, from compound interest to calculus. Your **Math 120 review sheet exponential and logarithmic functions** undoubtedly dedicates space to these two logarithms.

Properties of Logarithmic Functions

Similar to exponentials, logarithms have distinctive properties:

- Domain: (0, ") – you cannot take the logarithm of zero or a negative number.
- Range: all real numbers.
- Vertical asymptote at x = 0 (the y-axis).
- x-intercept at (1, 0) because logb(1) = 0.
- Also one-to-one, so the inverse relationship with exponentials holds.

Graphing logarithmic functions: the curve increases slowly for large *x* and falls steeply as *x*approaches zero from the right. You can create a table of values to sketch accurate curves.

Essential Rules for Exponentials and Logarithms

Your review sheet will list rules that allow you to simplify expressions and solve equations. Mastering these is crucial for success in Math 120.

Exponential Rules

1. Product of powers: bm · bn = bm+n
2. Quotient of powers: bm / bn = bm" n
3. Power of a power: (bm)n = bm·n
4. Negative exponent: b" m = 1 / bm
5. Zero exponent: b0 = 1 (provided b "` 0)

Logarithm Rules

1. Product rule: logb(M·N) = logb(M) + logb(N)
2. Quotient rule: logb(M/N) = logb(M) " logb(N)
3. Power rule: logb(Mp) = p · logb(M)
4. Change of base formula: logb(M) = ln(M) / ln(b) or log(M) / log(b)

These rules let you rewrite complicated expressions. For instance, using the change of base formula, you can compute any logarithm using a calculator that only has *ln* or *log* base 10. Your **Math 120 review sheet exponential and logarithmic functions** should include examples of each rule.

Solving Exponential and Logarithmic Equations

Equations involving exponentials or logarithms often require specific strategies. Here are step-by-step approaches common in Math 120.

Solving Exponential Equations

When the bases are the same, set exponents equal. For example: *2^x = 2⁵* !*x = 5*.

When bases differ, use logarithms to bring the variable down. For example: *3^x = 11*.

1. Take the natural log (or log base 10) of both sides: ln(3x) = ln(11).
2. Apply the power rule: x · ln(3) = ln(11).

3. Solve: x = ln(11) / ln(3).

If an equation involves multiple exponential terms, factor where possible. For instance, *e^{2x} " 3e^x + 2 = 0* can be treated as a quadratic in *e^x*: let *u = e^x*, then *u² " 3u + 2 = 0*. *u = 1* or *u = 2*. Back-substitute to find *x*.

Solving Logarithmic Equations

First, isolate the logarithmic term. Then rewrite in exponential form. For example: *log₂(x + 1) = 3* !*x + 1 = 2³ = 8* !*x = 7*.

When multiple logarithms appear, combine them using the product or quotient rules. Then solve the resulting equation. Always check for extraneous solutions because the domain of a logarithm is positive numbers. For instance, *log(x) + log(x " 3) = 1* becomes *log(x(x " 3)) = 1*. Rewrite: *x(x " 3) = 10*. *x² " 3x " 10 = 0*. *x = 5* or *x = " 2*. Only *x = 5* is valid because *x = " 2* is outside the domain.

Real-World Applications on Your Math 120 Review Sheet

One reason exponential and logarithmic functions are so important is their prevalence in science, finance, and everyday life. Your **Math 120 review sheet exponential and logarithmic functions** likely includes application problems. Here are common ones.

Exponential Growth and Decay

The formula *A(t) = A₀ e^{kt}* models populations, radioactive decay, and more. *A₀* is the initial amount, *k* is the growth (positive) or decay (negative) constant, and *t* is time. A typical problem: "A population of bacteria doubles every 3 hours. If the initial count is 500, how many after 12 hours?" Find *k* using the doubling condition, then plug *t = 12*.

Compound Interest

The formula *A = P(1 + r/n)^{nt}* is exponential. For continuous compounding: *A = Pe^{rt}*. Your review sheet might ask you to compare different compounding frequencies or to find the time needed to reach a certain amount.

Logarithmic Scales

The pH scale uses *pH = " log[H⁺]*; the Richter scale for earthquake magnitude uses

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