



Name

Score

Solve and show all steps.

<p>Consider the function <math>y=3^x</math>.</p> <ul style="list-style-type: none"> <li>• Is this function an example of exponential growth or decay?</li> <li>• What is its y-intercept?</li> <li>• What is the equation of its horizontal asymptote?</li> <li>• What is the domain and range of the function?</li> </ul>	<p>Show all steps here</p>
<p>A population of bacteria is modeled by the function <math>P(t)=500(0.8)^t</math>, where <math>P(t)</math> is the population after <math>t</math> hours.</p> <ul style="list-style-type: none"> <li>• What does the number 500 represent in this context?</li> <li>• Is this population growing or decaying? By what percentage per hour?</li> <li>• What is the y-intercept of this function?</li> </ul>	<p>Show all steps here</p>
<p>Describe the effect of the base 'b' on the graph of <math>y = b^x</math> when:</p> <ul style="list-style-type: none"> <li>• <math>b &gt; 1</math></li> <li>• <math>0 &lt; b &lt; 1</math></li> </ul>	<p>Show all steps here</p>
<p>Consider the function <math>f(x)=2^{x+1}-4</math>.</p> <ul style="list-style-type: none"> <li>• What is the y-intercept?</li> <li>• What is the equation of the horizontal asymptote?</li> <li>• Describe the transformation from the parent function <math>y=2^x</math>.</li> </ul>	<p>Show all steps here</p>
<p>Explain why the base of an exponential function (<math>b</math> in <math>y=b^x</math>) cannot be negative, zero, or one.</p>	<p>Show all steps here</p>



Solve and show all steps.

**Growth or Decay?** This function is an example of **exponential growth** because the base (3) is greater than 1.

**Y-intercept:** To find the y-intercept, set  $x=0$ :  $y=3^0=1$ . The y-intercept is **(0, 1)**.

**Horizontal Asymptote:** The equation of its horizontal asymptote is  **$y=0$**  (the x-axis).

**Domain and Range:**

- Domain: **All real numbers** or  $(-\infty, \infty)$ .
- Range: **All positive real numbers** or  $(0, \infty)$ .

**What does 500 represent?** The number 500 represents the **initial population of bacteria** (when  $t=0$ ).

**Growing or Decaying? Percentage?** This population is **decaying** because the base (0.8) is between 0 and 1. It is decaying by  $1-0.8=0.2$ , or **20% per hour**.

**Y-intercept:** The y-intercept is **(0, 500)**, which is the initial population.

**$b>1$ :** When  $b>1$ , the function represents **exponential growth**. As  $x$  increases,  $y$  increases rapidly. The graph rises from left to right.

**$0<b<1$ :** When  $0<b<1$ , the function represents **exponential decay**. As  $x$  increases,  $y$  decreases rapidly, approaching the x-axis. The graph falls from left to right.

The y-intercept is **(0, -2)**.

The equation of the horizontal asymptote is  **$y=-4$** .

The "+1" in the exponent ( $x+1$ ) shifts the graph **1 unit to the left**.

The "-4" outside the exponent shifts the graph **4 units down**.

**Cannot be negative:** If the base were negative (e.g.,  $y=(-2)^x$ ), the function would oscillate between positive and negative values, and would be undefined for many rational exponents (like  $x=1/2$ ). This would not create a smooth, continuous exponential curve.

**Cannot be zero:** If the base were zero ( $y=0^x$ ), the function would be 0 for  $x>0$  and undefined for  $x\leq 0$ . It would not represent exponential behavior.

**Cannot be one:** If the base were one ( $y=1^x$ ), the function would always equal 1 for all values of  $x$  (since 1 raised to any power is 1). This would result in a horizontal line,  $y=1$ , which is a constant function, not an exponential function.