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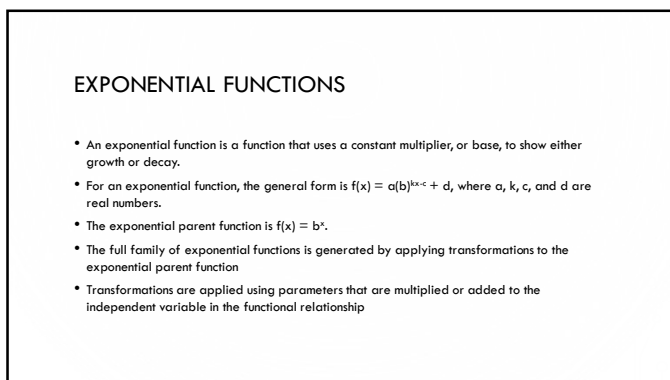
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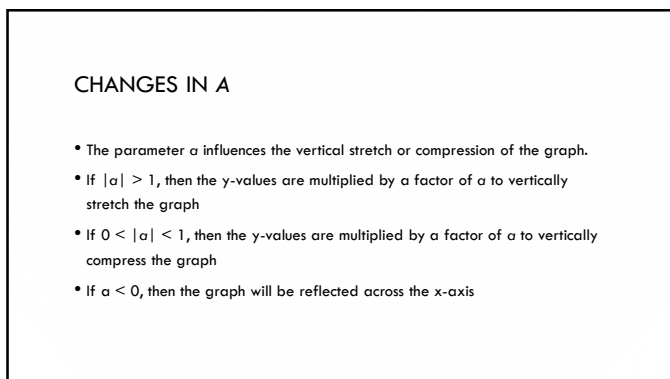
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### CHANGES IN K

- The parameter  $k$  influences the horizontal stretch or compression of the graph.
- If  $|k| > 1$ , then the  $x$ -values are multiplied by a factor of  $\frac{1}{|k|}$  to horizontally compress the graph
- If  $0 < |k| < 1$ , then the  $x$ -values are multiplied by a factor of  $\frac{1}{|k|}$  to horizontally stretch the graph
- If  $k < 0$ , then the graph will be reflected across the  $y$ -axis

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### CHANGES IN C

- The parameter  $c$ , like  $k$ , influences the horizontal translation of the graph.
- Note that in the general form, the sign in front of the  $c$  is negative. This means that when reading the value of  $c$  from the equation, you should read the opposite sign from what is given in the equation.
- If  $c > 0$ , then the graph will translate  $(\frac{c}{k})$  to the right.
- If  $c < 0$ , then the graph will translate  $(\frac{c}{k})$  to the left.

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### CHANGES IN D

- The parameter  $d$  influences the vertical translation of the graph.
- If  $d > 0$ , then the graph will translate  $|d|$  units up.
- If  $d < 0$ , then the graph will translate  $|d|$  units down.

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## ASYMPTOTES

- Each exponential function has one horizontal asymptote
- The horizontal asymptote is governed by vertical parameters changes. A vertical translation moves the asymptote  $d$  units and a vertical dilation does not move the asymptote.
  - horizontal asymptote:  $y = d$

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## DOMAIN AND RANGE

- An exponential function does not have any domain restrictions. Therefore, the domain will always be *all real numbers*, or  $\{x \mid x \in \mathbb{R}\}$
- The range is restricted by the horizontal asymptote,  $y = d$ . If  $a > 0$ , then the range is  $y > d$ . If  $a < 0$ , then the range is  $y < d$ .
  - $a > 0, \{y \mid y > d\}$
  - $a < 0, \{y \mid y < d\}$

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## X- AND Y-INTERCEPTS

- An exponential function has at most one  $x$ -intercepts. Use the graph and the calculator to determine the value of the  $x$ -intercept
- An exponential function has at most one  $y$ -intercepts. If it exists, the  $y$ -intercept is located at:
  - $(0, \frac{a}{b^0} + d)$

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### EXAMPLES

- What transformations of the exponential parent function,  $f(x) = 10^x$ , will result in the graph of the exponential function  $g(x) = -3(10)^{2x-1} + 5$ ?

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### EXAMPLES

- Step 1: Determine the values of the parameters  $a$ ,  $k$ ,  $c$ , and  $d$  of  $g(x)$  and the value of  $b$ , the base of  $g(x)$ .

- $a = -3$ ,  $k = 2$ ,  $c = 1$ , and  $d = 5$

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### EXAMPLES

- Use the values of the parameters to describe the transformations of the exponential parent function  $f(x)$  that are necessary to produce  $g(x)$ .
- $a = -3$ ; vertical stretch by a factor of 3, reflected over the  $x$ -axis
- $k = 2$ ; horizontal compression by a factor of  $\frac{1}{2}$
- $c = 1$ ; horizontal shift  $\frac{1}{2}$  unit to the right
- $d = 5$ ; vertical shift 5 units up

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### EXAMPLES

- Identify the key attributes of  $y = -2^{1.5x-3} + 1$ , including domain and range, asymptote, x-intercept, and y-intercept. Write the domain and range in set builder notation.

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### EXAMPLES

- Step 1: Determine the domain, range and asymptote of  $y = -2^{1.5x-3} + 1$ .
  - The domain is all real numbers;  $\{x \mid x \in \mathbb{R}\}$
  - The range is affected by a and d; a is negative, d = 1
    - The range is numbers  $< 1$ ;  $\{y \mid y < 1\}$
    - Asymptote:  $y = 1$

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### EXAMPLES

- Step 2: Determine if the function has an x-intercept
  - The function has an x-intercept at  $(2, 0)$
- Step 3: Determine if the function has a y-intercept
  - The function has a y-intercept at  $(0, \frac{7}{8})$

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