Math 48B, Lesson 12: Exponential Functions

In Math 48B Lessons 11, 12, and 13, we study exponential functions:

To begin our exploration, let’s recall the rules of powers/exponents.

1. WHAT ARE RULES OF POWERS/EXPONENTS?

Powers vs exponents:

Product Rule:

Quotient Rule:

Zero Power:

Negative Powers:

Power to a Power:

2. WHAT IS EXPONENTIAL GROWTH?

2A. Fill in the table below. To the best of your ability, fill this table out by hand.

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2B. Graph the functions , , and from problem 2A above.

Table

Description automatically generated

2C. Identify patterns in the graphs of the functions , , and from problems 2AB above. Make a conjecture about the general behavior of the graph of the function

for

In your conjecture, identify the domain, range, y-intercept, and the end behavior as as well as .

3. WHAT IS EXPONENTIAL DECAY?

3A. Fill in the table below. To the best of your ability, fill this table out by hand.

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3B. Graph the functions , , and from problem 3A above.

Table

Description automatically generated

3C. Identify patterns in the graphs of the functions , , and from problems 3AB above. Make a conjecture about the general behavior of the graph of the function

for

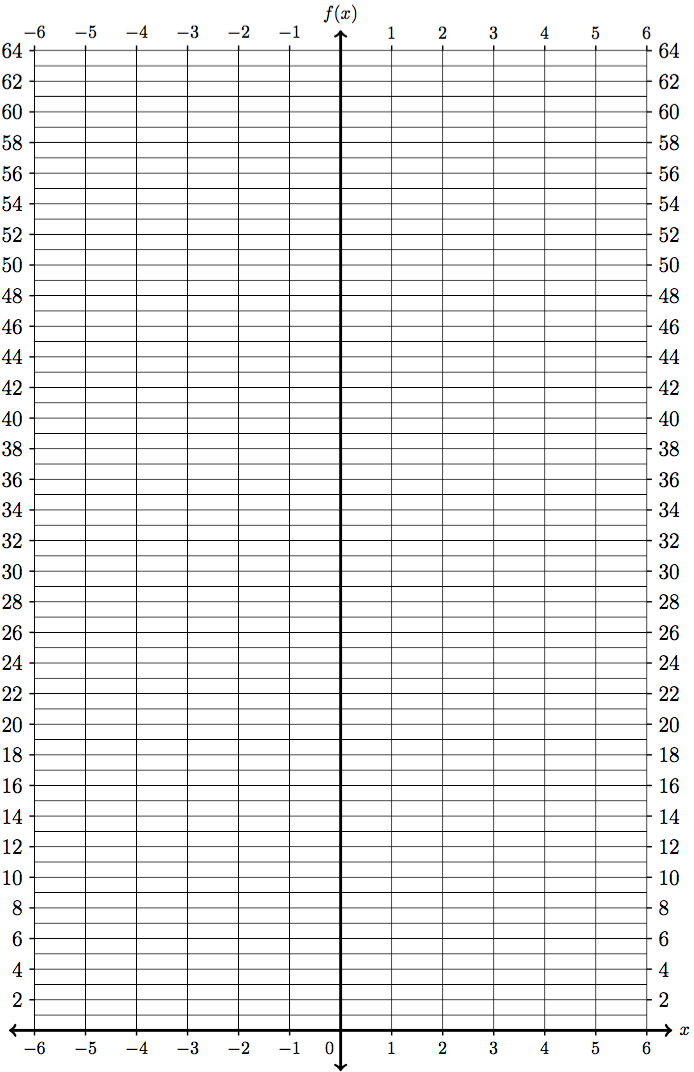
In your conjecture, identify the domain, range, y-intercept, and the end behavior as as well as .

4. TRANSFORMATIONS OF EXPONENTIAL FUNCTIONS?

4A. For exponential function , what do parameters  *,,* and do to the graph of ?

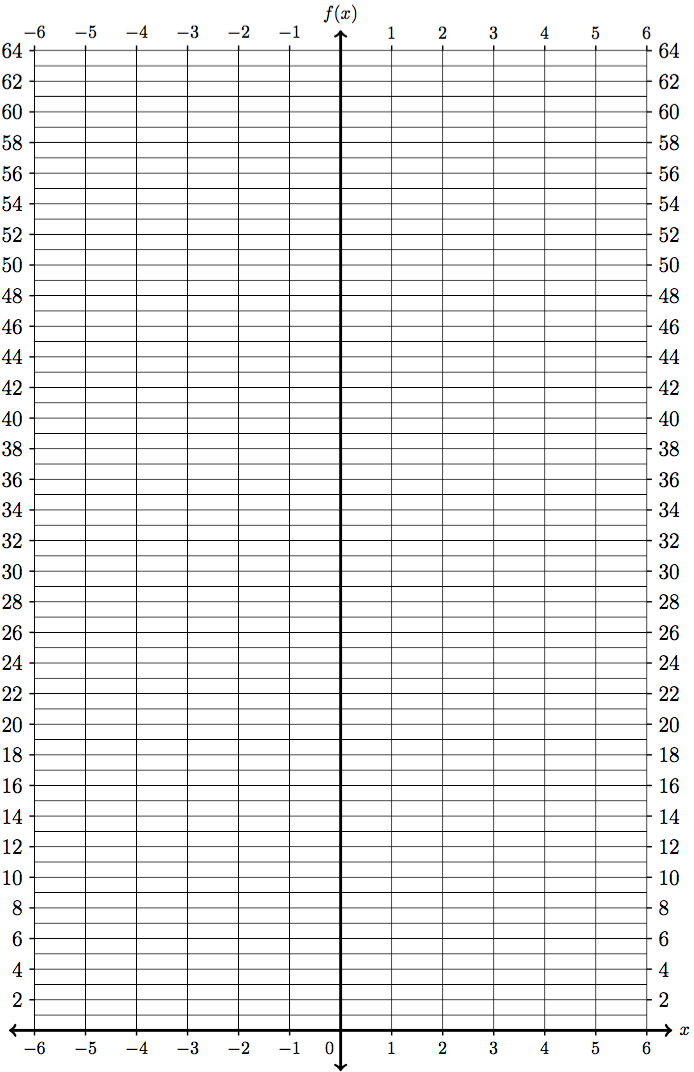
4B. Test your hypothesis from Problem 4A above by graphing the function below.

|  |  |  |
| --- | --- | --- |
| *x* |  |  |
| -4 |  |  |
| -3 |  |  |
| -2 |  |  |
| -1 |  |  |
| 0 |  |  |
| 1 |  |  |
| 2 |  |  |
| 3 |  |  |
| 4 |  |  |
| 5 |  |  |
| 6 |  |  |
| 7 |  |  |



4C. Test your hypothesis from Problem 4A above by graphing the function below.

|  |  |  |
| --- | --- | --- |
| *x* |  |  |
| -4 |  |  |
| -3 |  |  |
| -2 |  |  |
| -1 |  |  |
| 0 |  |  |
| 1 |  |  |
| 2 |  |  |
| 3 |  |  |
| 4 |  |  |
| 5 |  |  |
| 6 |  |  |
| 7 |  |  |



Table

Description automatically generated4D. Test your hypothesis from Problem 4A above by graphing the function below.

|  |  |  |
| --- | --- | --- |
| *x* |  |  |
| -4 |  |  |
| -3 |  |  |
| -2 |  |  |
| -1 |  |  |
| 0 |  |  |
| 1 |  |  |
| 2 |  |  |
| 3 |  |  |
| 4 |  |  |
| 5 |  |  |
| 6 |  |  |
| 7 |  |  |

4E. How is your work on problems 4ABC related to the general transformations:

5. QUADRATIC VERSUS EXPONENTIAL GROWTH?

5A. Fill out the table below

|  |  |  |
| --- | --- | --- |
| *x* |  |  |
| 0 |  |  |
| 1 |  |  |
| 2 |  |  |
| 3 |  |  |
| 4 |  |  |
| 5 |  |  |
| 6 |  |  |

5B. Fill out the table below

|  |  |  |
| --- | --- | --- |
| *x* |  |  |
| 0 |  |  |
| 1 |  |  |
| 2 |  |  |
| 3 |  |  |
| 4 |  |  |
| 5 |  |  |
| 6 |  |  |

5C. Graph and below. What behavior do you notice? Which one is growing more quickly well as .

