**Algebra 1 Functions and Graphing Summary**

There are six types of functions we have studied this year, each with it’s own unique characteristics.

* What the equation “looks” like.
* How the range values in the table change as the domain values increase.
* What the graph looks like and the behavior of the graph.
* Over what intervals is the function increasing, decreasing or staying constant?
* Where the value of the function is positive or negative vs. . (above vs. below )
* Domain and range of the function (Non- restricted vs. restricted domains.)

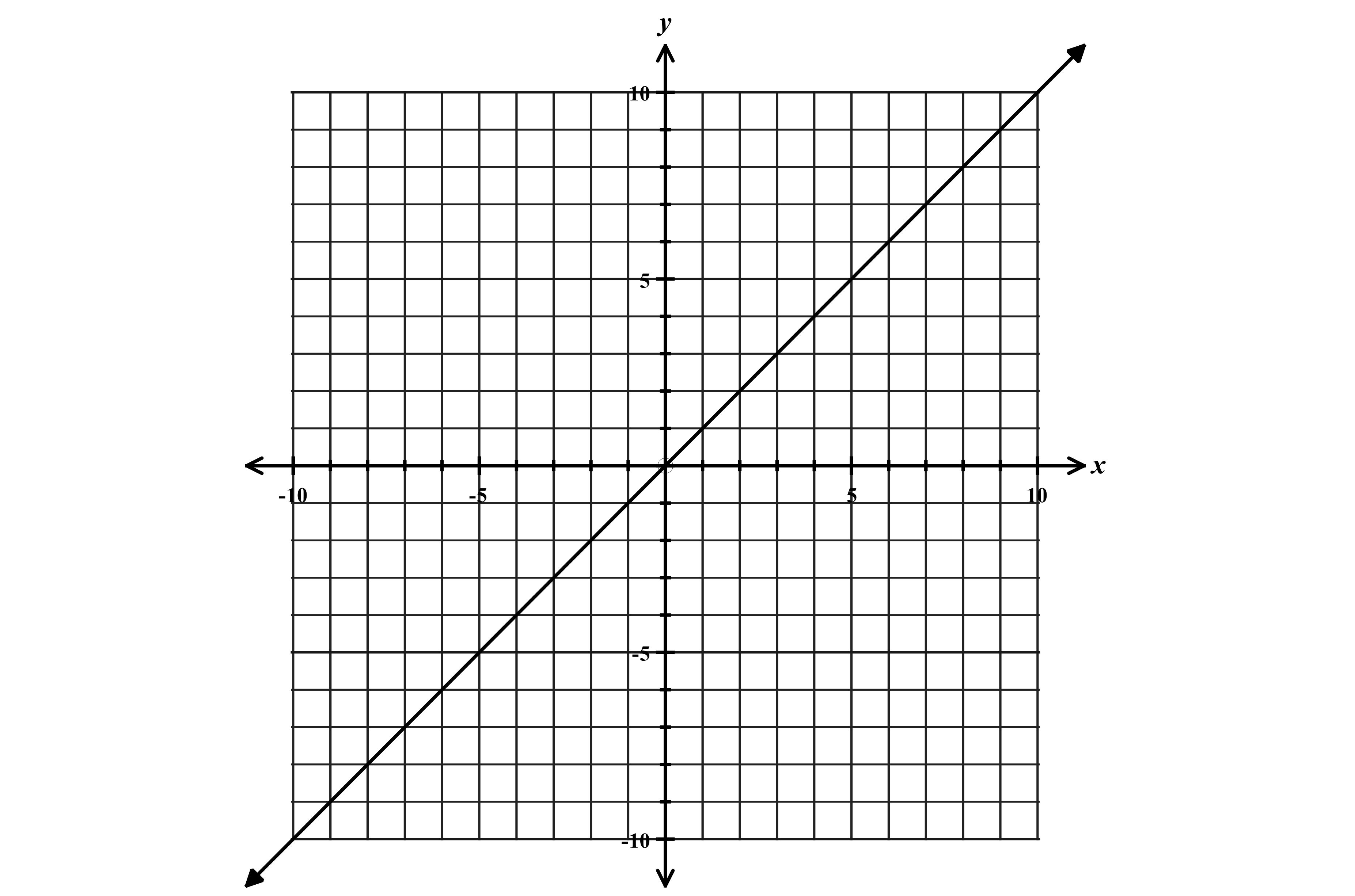
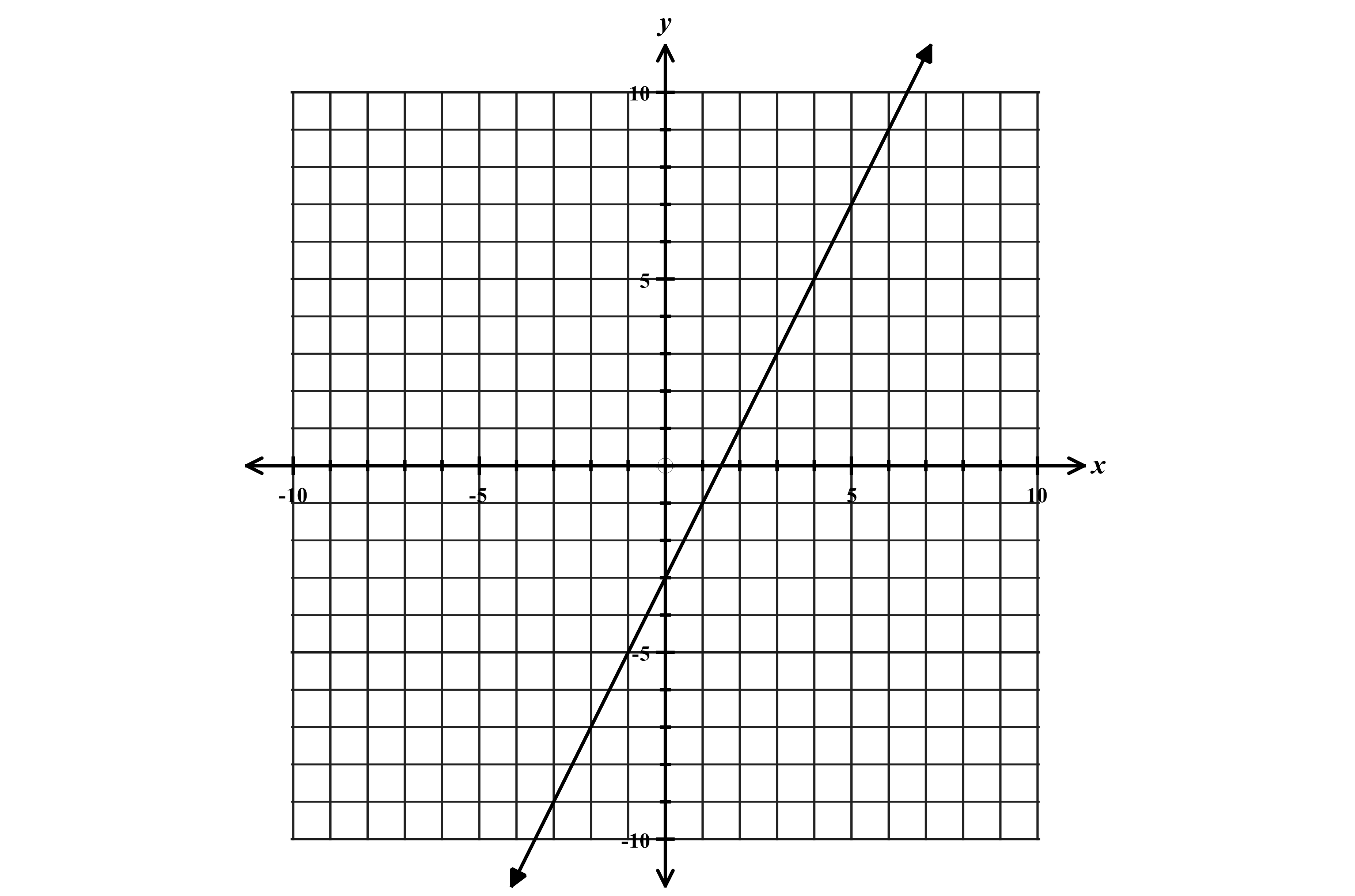
***Function 1: Linear Function***

Parent Function

General equation where is the slope or the average rate of change

The average rate of change is constant (Can be positive, negative, or zero)

Graph of Graphs in the form where is the slope and is the y-intercept.



Table

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | -2 | -1 | 0 | 1 | 2 | 3 |
|  | -7 | -5 | -3 | -1 | 1 | 3 |

+2 constant change

Table shows a constant rate of change.

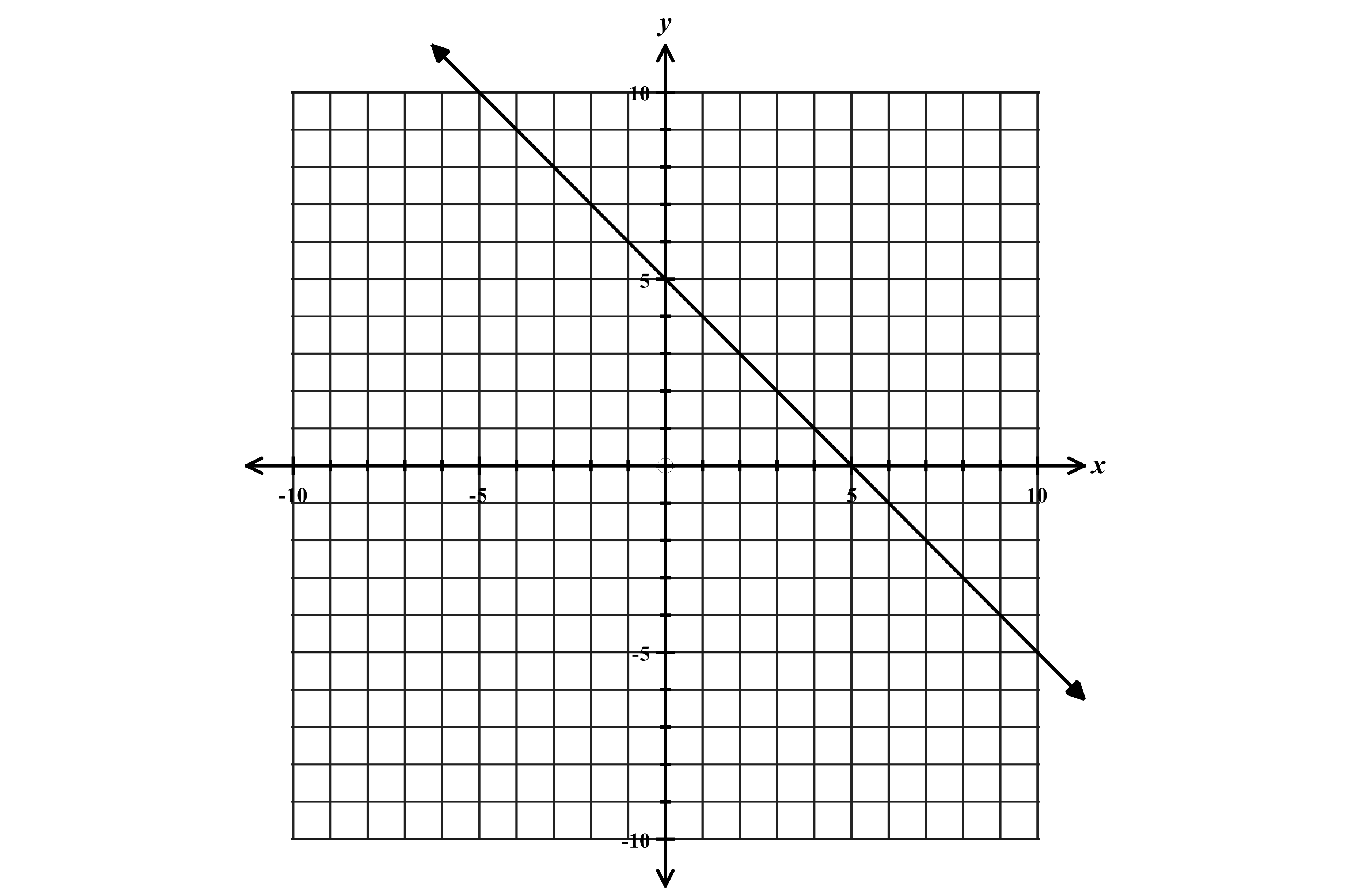
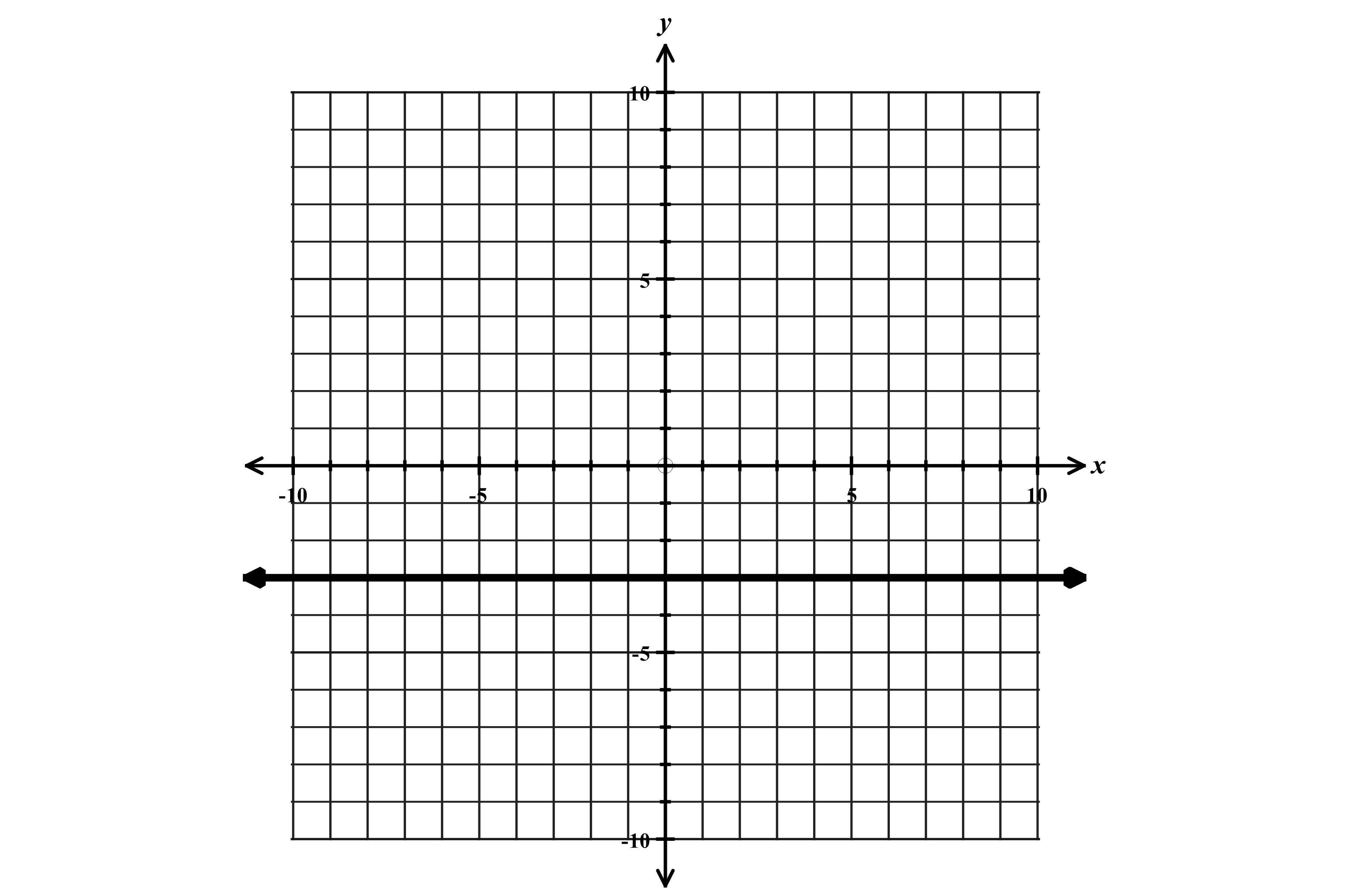
For each change in , the value changes

by equal amounts.

***Variations of linear functions***

Horizontal Line

Negative slope Slope of zero

Example: Example

|  |  |
| --- | --- |
|  |  |
| -2 | -3 |
| -1 | -3 |
| 0 | -3 |
| 1 | -3 |
| 2 | -3 |

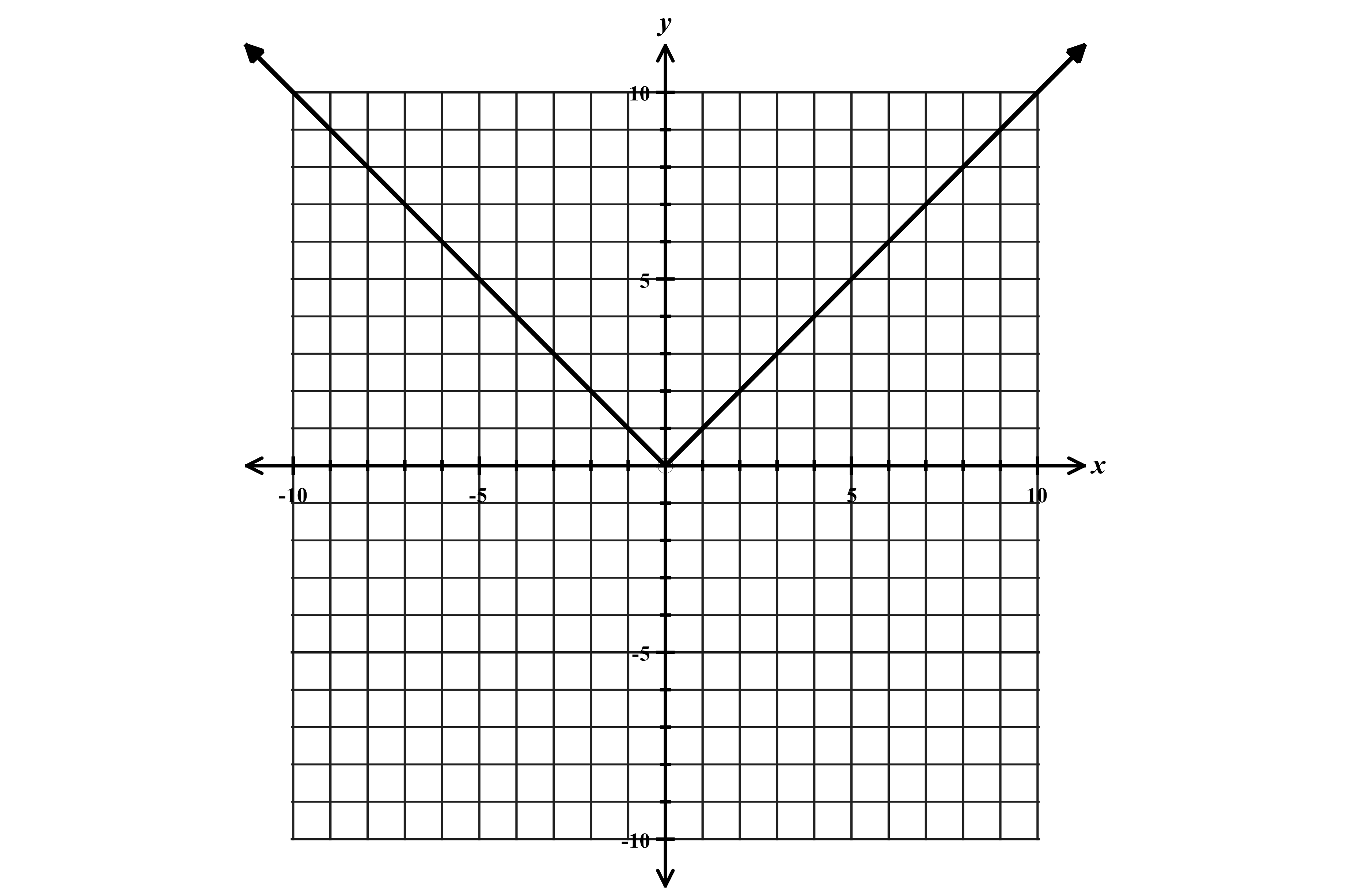
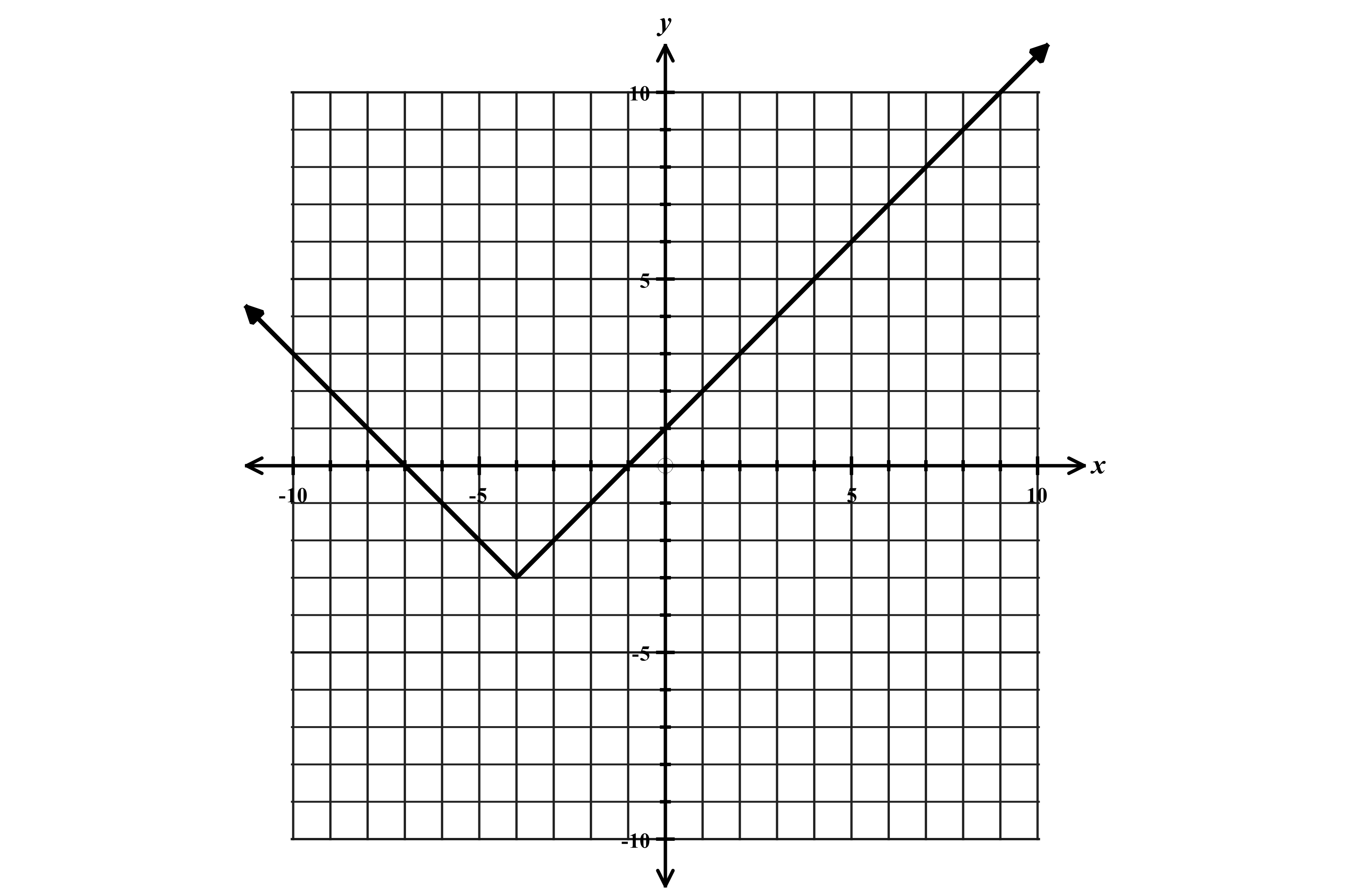
|  |  |
| --- | --- |
|  |  |
| -2 | 7 |
| -1 | 6 |
| 0 | 5 |
| 1 | 4 |
| 2 | 3 |

***Function 2: Absolute Value Function***

Parent function General Equation

|  |  |
| --- | --- |
|  |  |
| -3 | 3 |
| -2 | 2 |
| -1 | 1 |
| 0 | 0 |
| -1 | 1 |
| -2 | 2 |
| -3 | 3 |

|  |  |
| --- | --- |
|  |  |
| -8 | 1 |
| -7 | 0 |
| -6 | -1 |
| -5 | -2 |
| -4 | -3 |
| -3 | -2 |
| -2 | -1 |

Graph of Graphs in the form Example:

Vertex Vertex

Increasing over interval or Increasing over the interval or

Decreasing over interval or Decreasing over the interval or

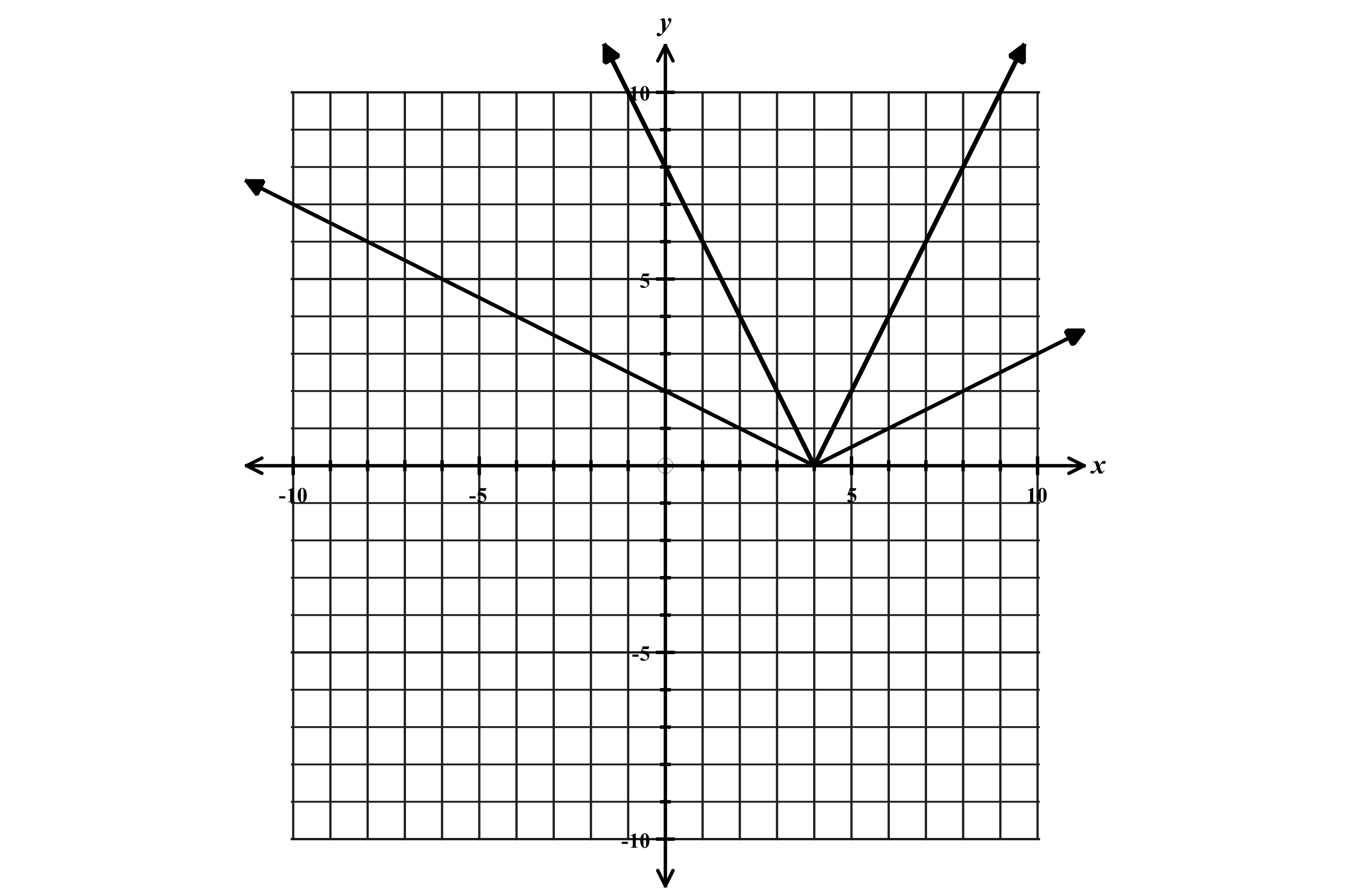
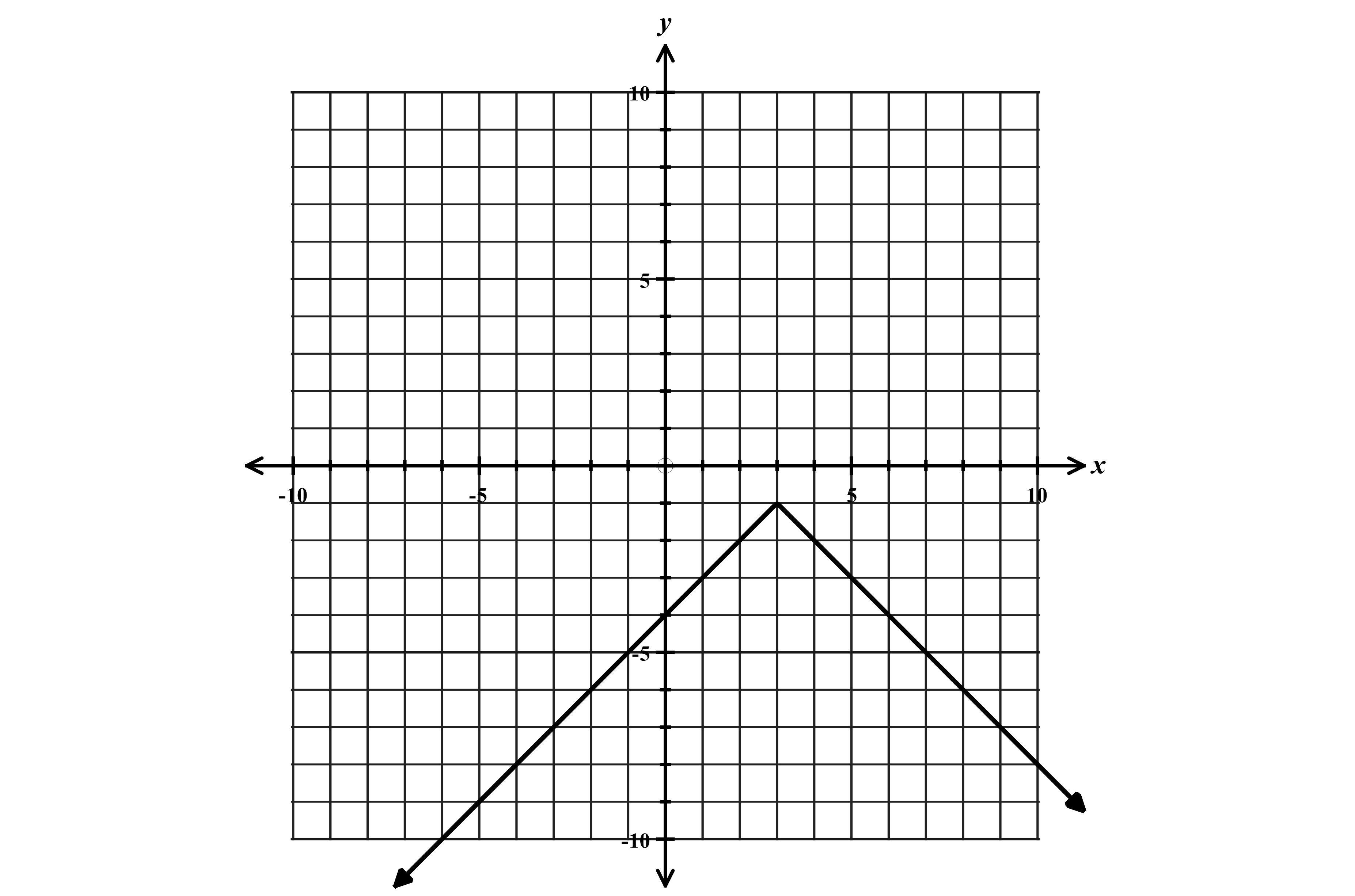
Think of this graph as a piecewise linear function

so slope is 1 when and -1 when Shifted left 4 down 3. Zeros at

Value of function is positive: when Value of function is negative when

Domain or Range or Domain Range or

***When leading coefficient is less than 0. When leading coefficient is greater or less than 1.***

 and

Increasing over the interval or is narrower or “compressed”

Decreasing over the interval or is wider or “stretched”

Value of function is always negative for all values of . Both graphs are shifted right 4 units

Domain or Range or vertex is

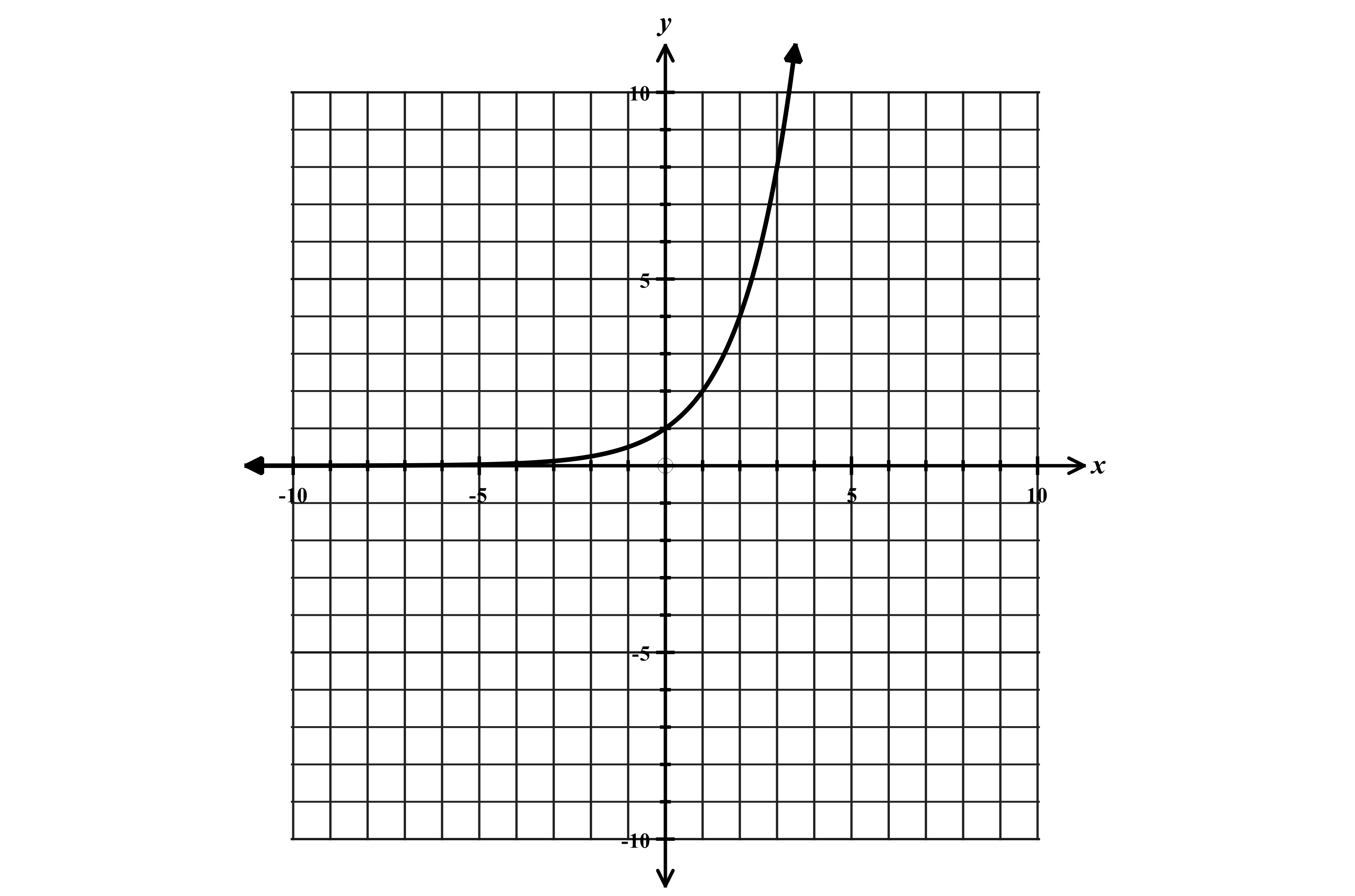
Graph is shifted right 3 units and down 1 unit so vertex is

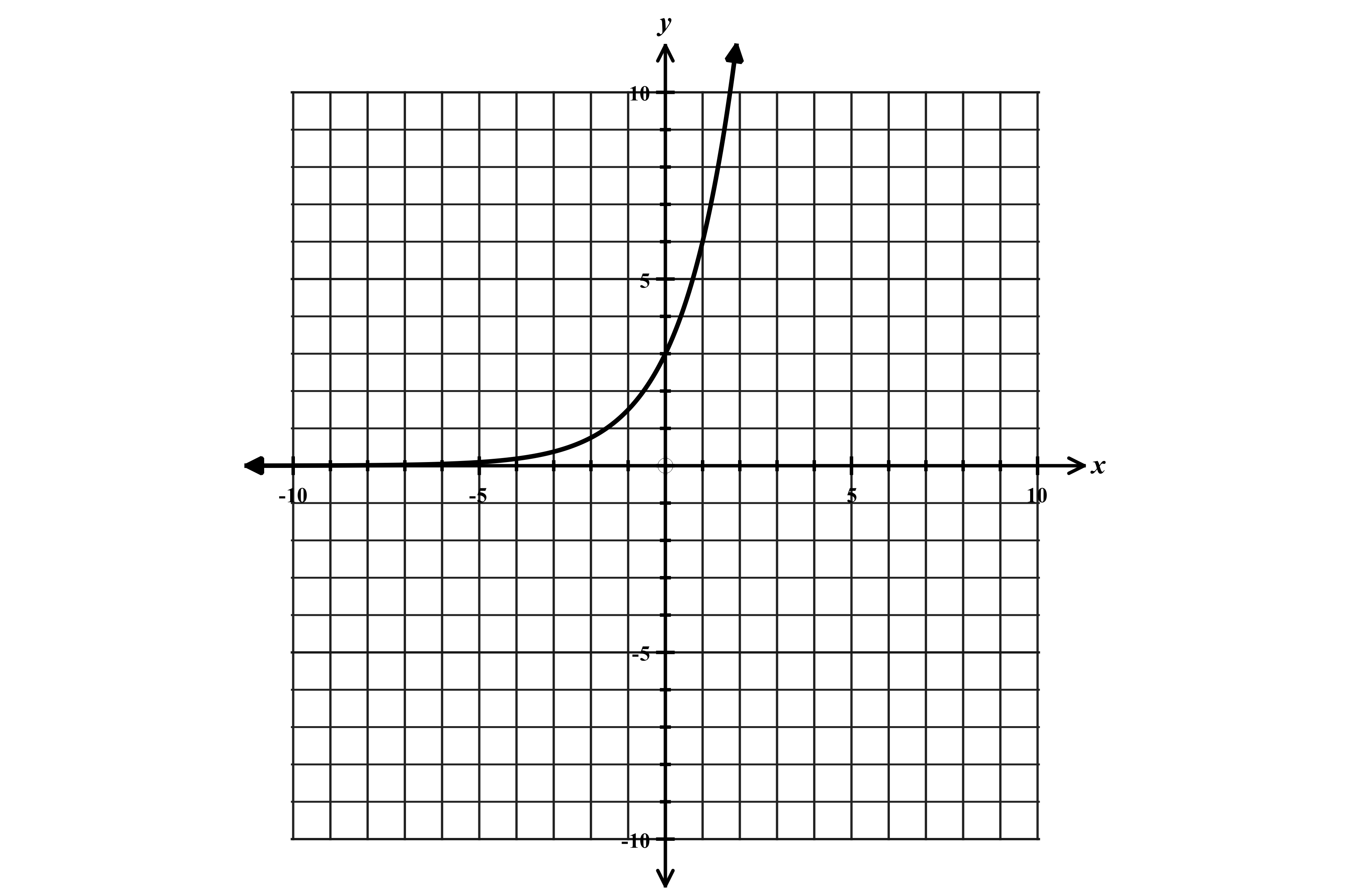
***Function 3: Exponential Function***

Parent function General Equation where is the y-intercept and is the growth or decay factor.

Rate of change ***is not*** constant!

|  |  |
| --- | --- |
|  |  |
| -3 |  |
| -2 |  |
| -1 |  |
| 0 | 1 |
| 1 | 2 |
| 2 | 4 |
| 3 | 8 |
| 4 | 16 |

Graph of Graphs in the form Example:



Increasing over all values of or Graph is the same as with the exception of value

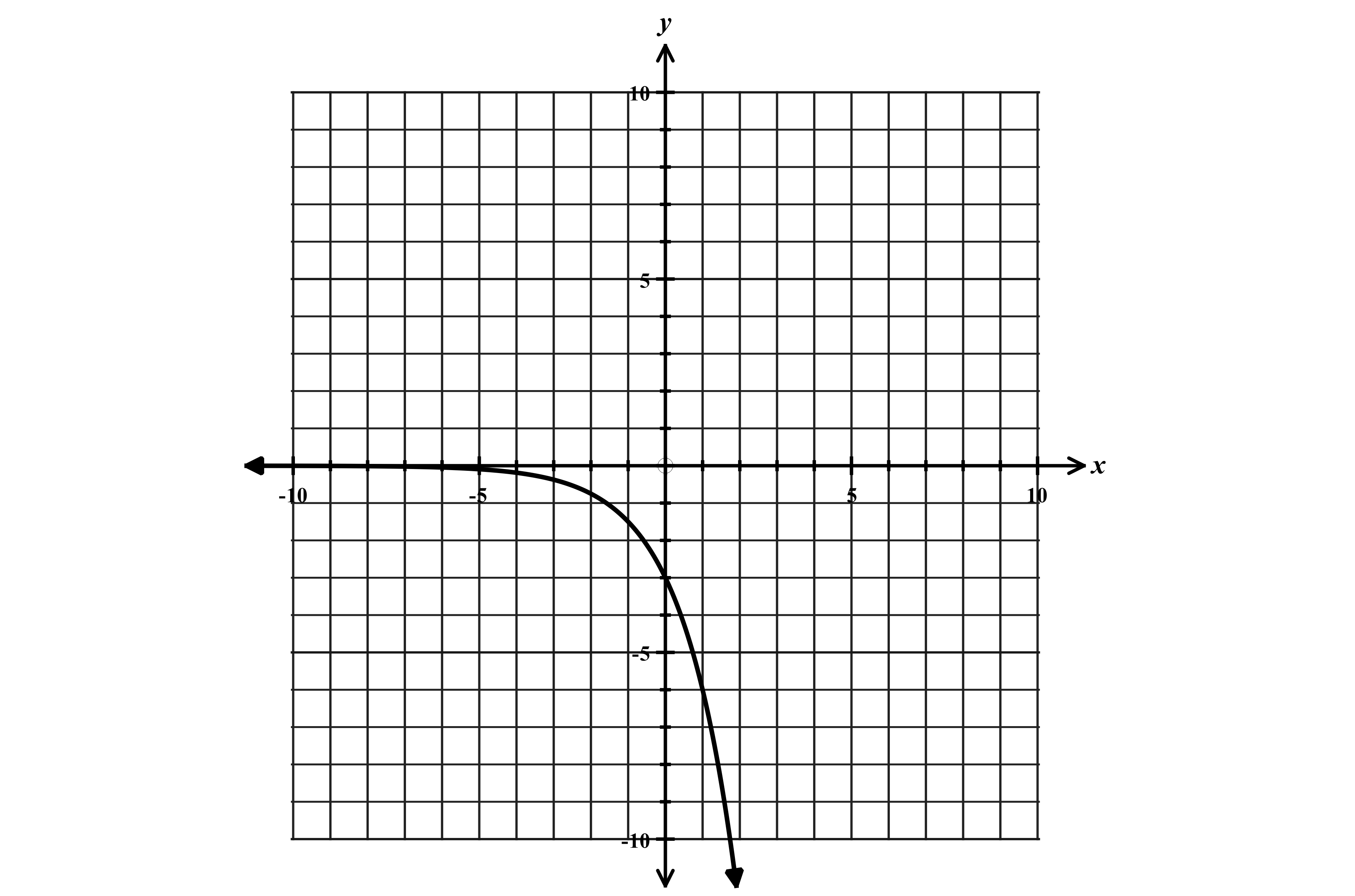
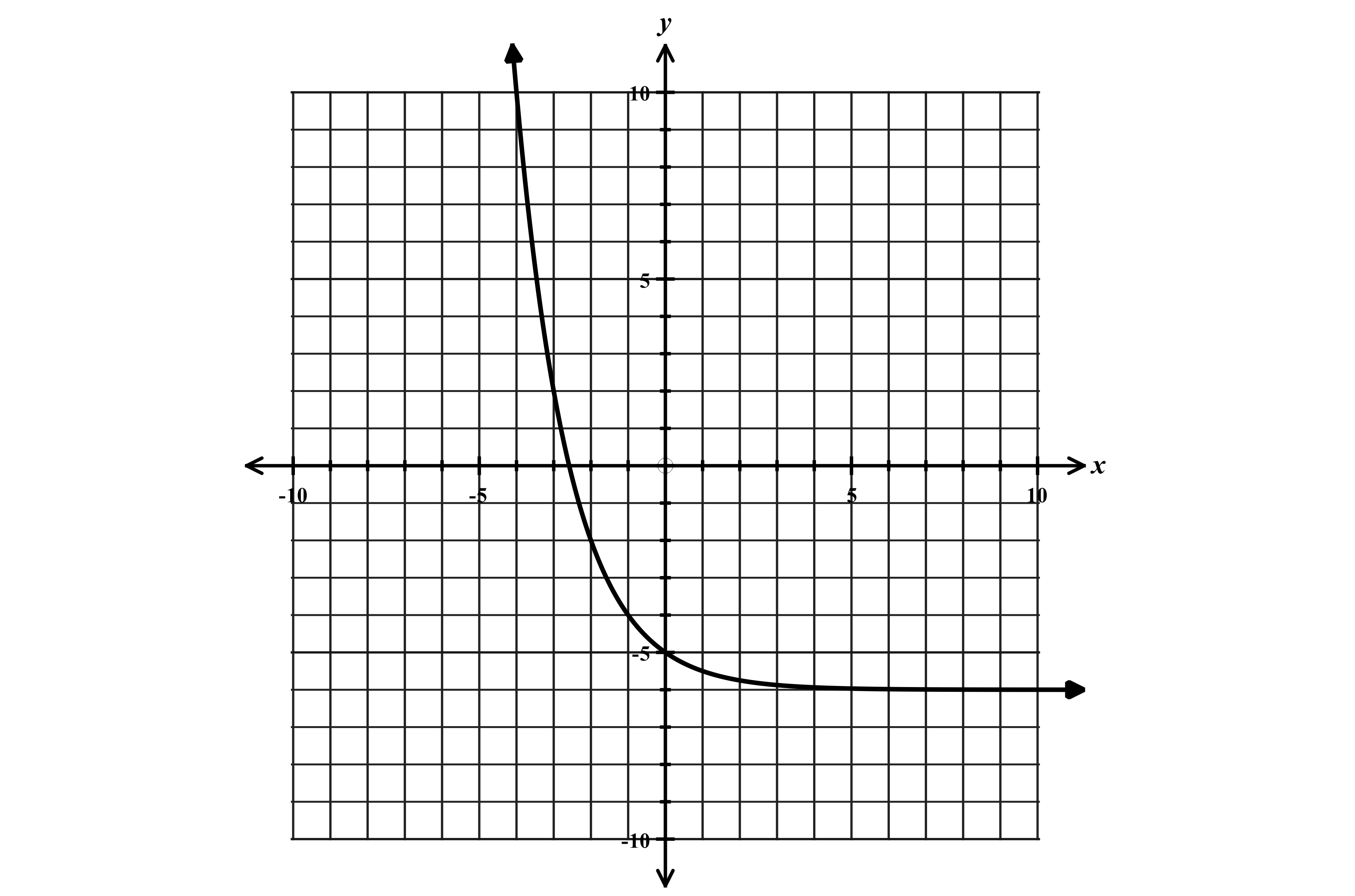
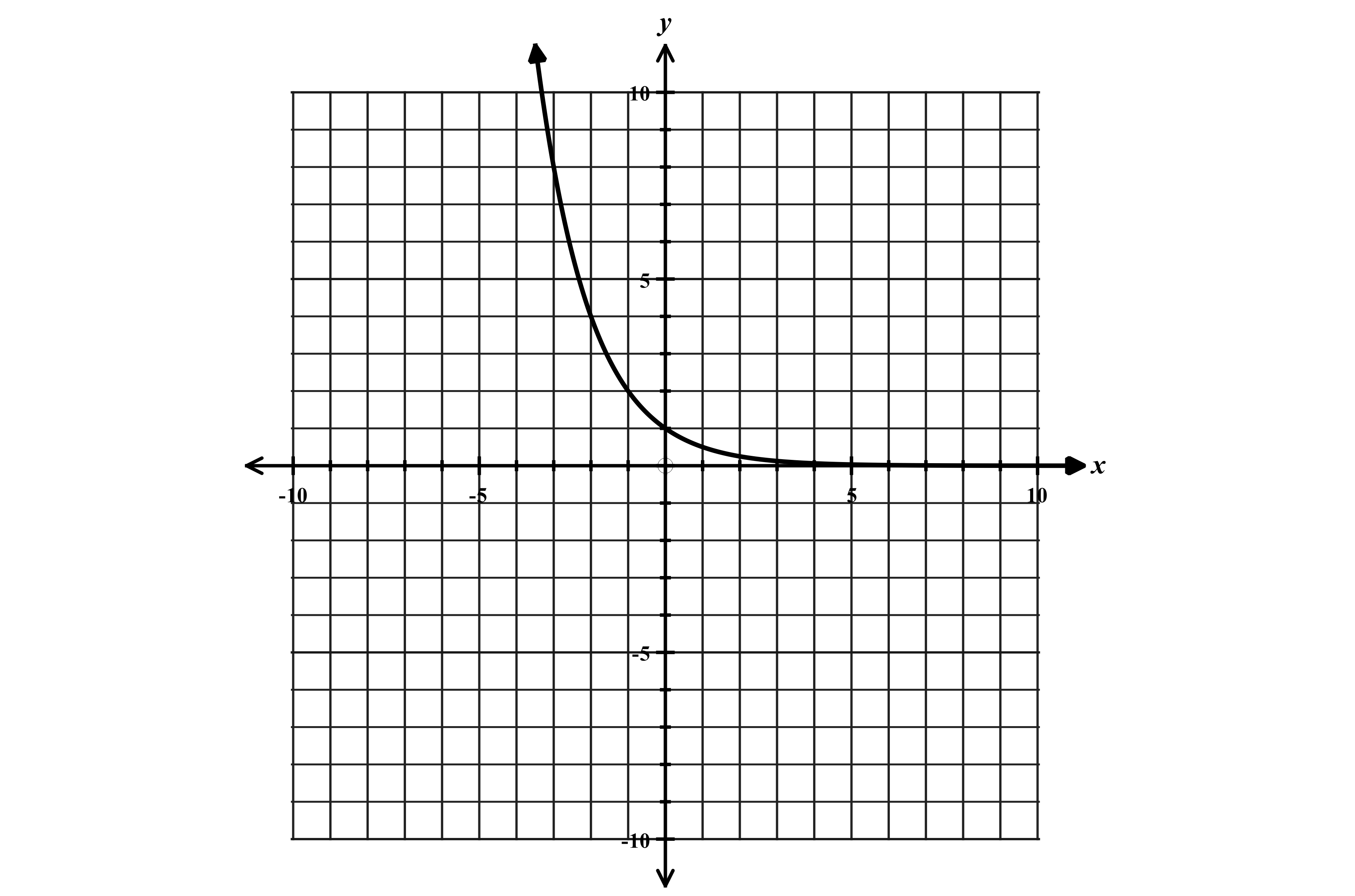
Value of the function is always positive for all values of . y-intercept is 3 because of leading coefficient of 3.

y-intercept of function is 1 (because when , ) Exponential growth with a growth factor of 2.

This graph displays exponential growth with a growth factor of 2. Domain and range is same as .

Domain or Range or

***Examples when a and b values change.***



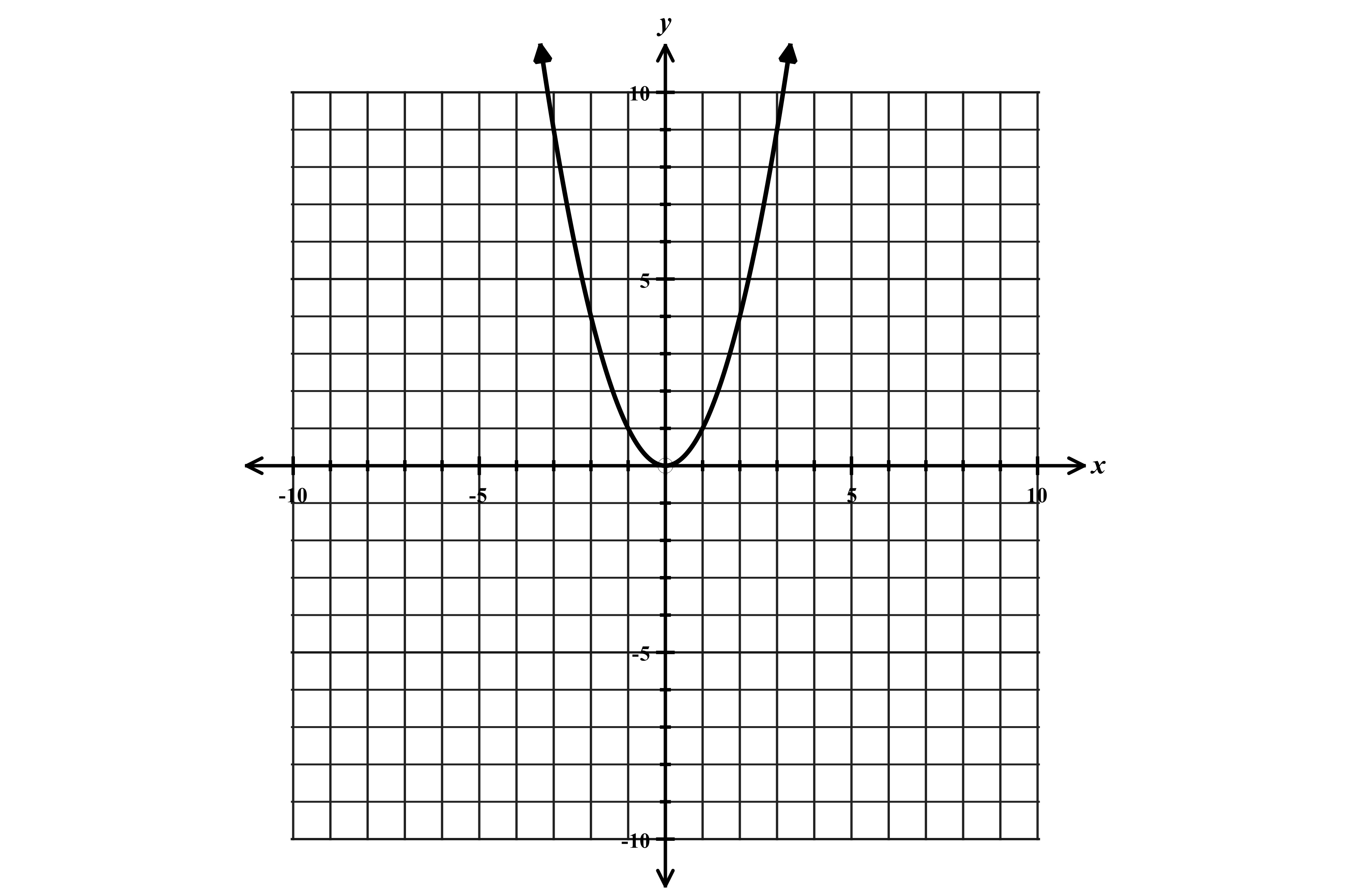
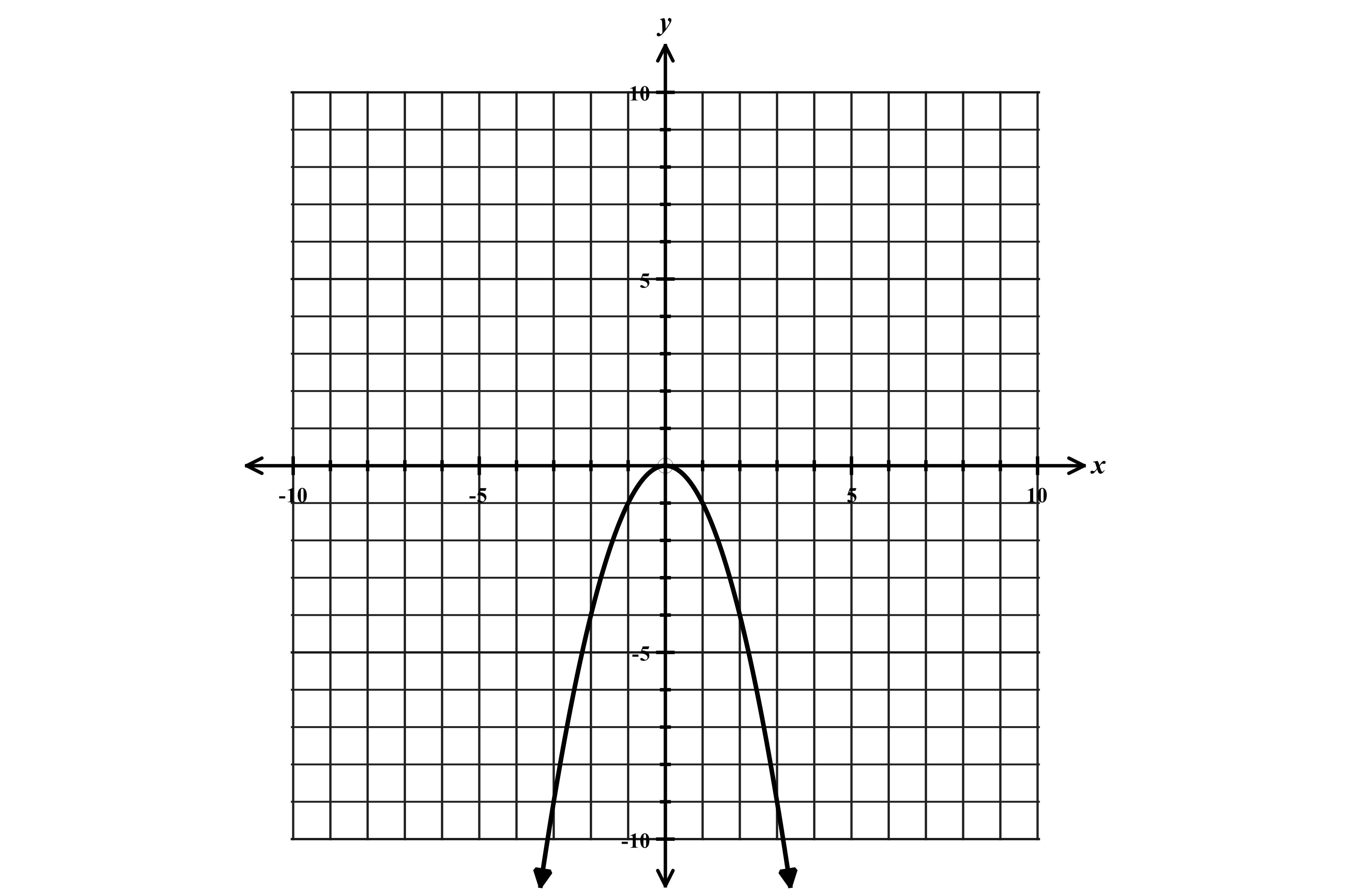
Graph is “flipped” Exponential decay Same as but shifted down 6

y-intercept is -3 Decay factor is

***Function 4: Quadratic Function***

Parent Function: Standard form Equation:

|  |  |
| --- | --- |
|  |  |
| -3 | -9 |
| -2 | -4 |
| -1 | -1 |
| 0 | 0 |
| 1 | -1 |
| 2 | -4 |
| 3 | -9 |

 Graph of Graph of

|  |  |
| --- | --- |
|  |  |
| -3 | 9 |
| -2 | 4 |
| -1 | 1 |
| 0 | 0 |
| 1 | 1 |
| 2 | 4 |
| 3 | 9 |

Vertex : Minimum point (opens up) Vertex maximum point (opens down)

Increasing over the interval or Increasing over the interval or

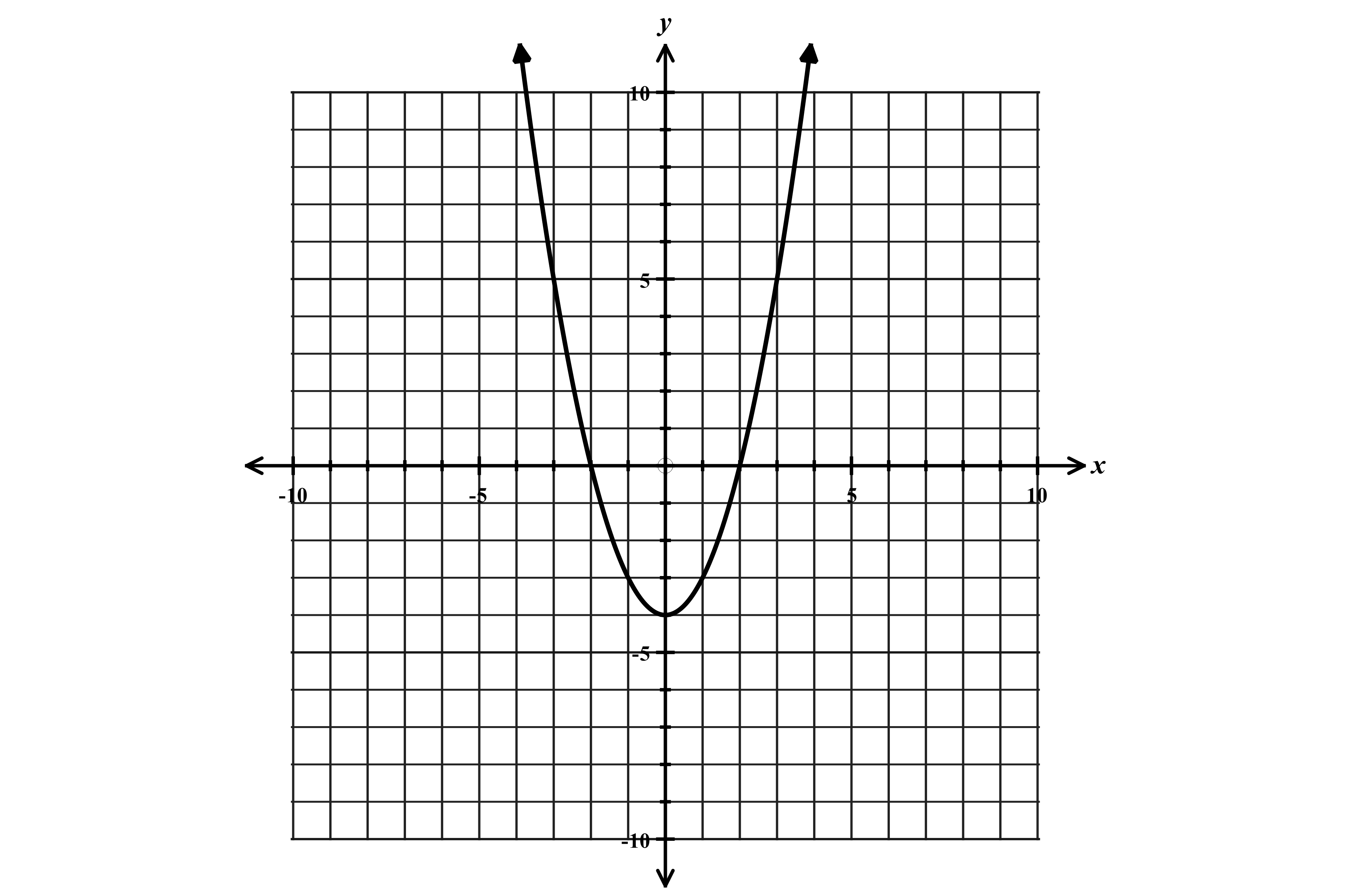
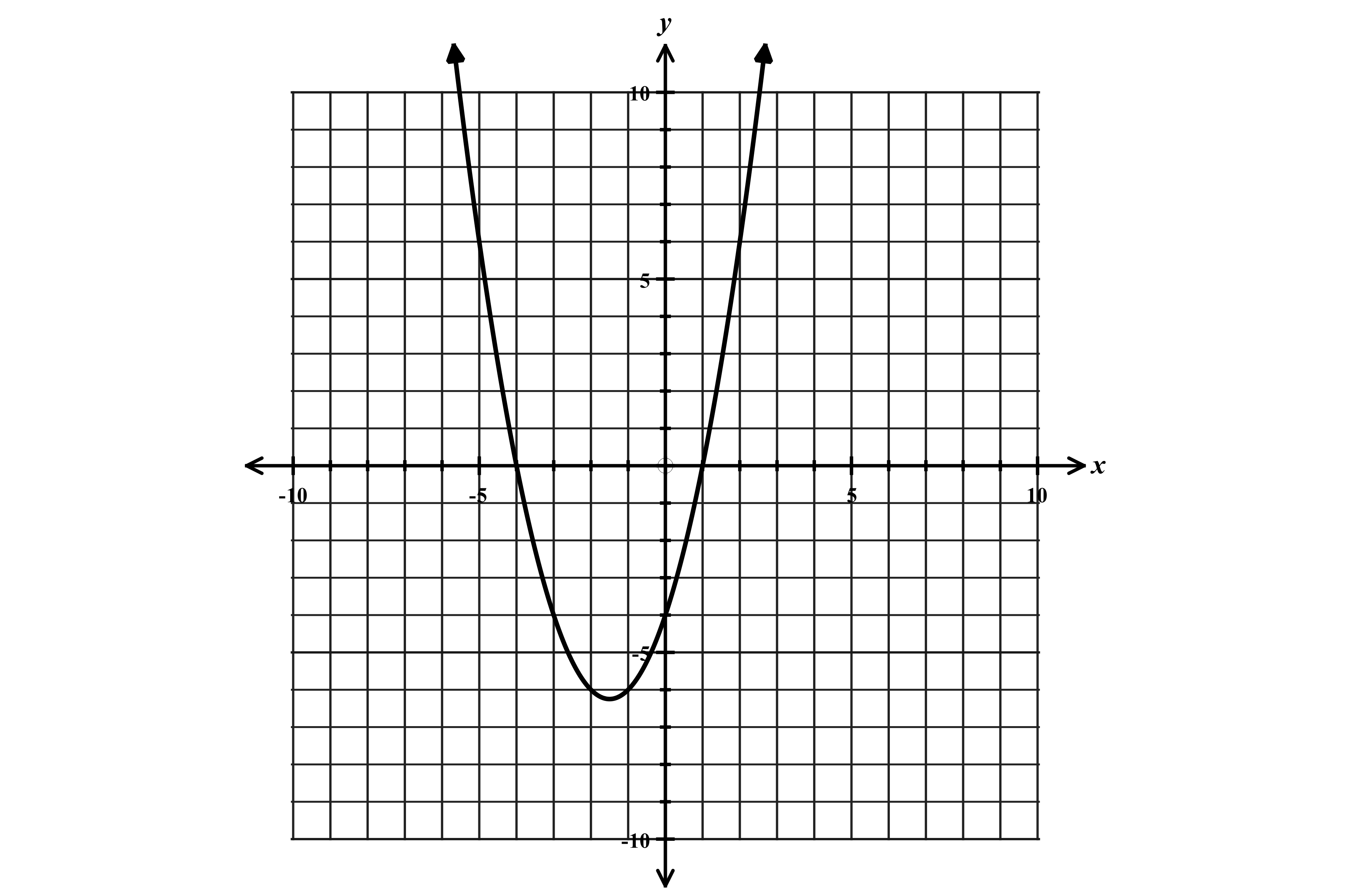
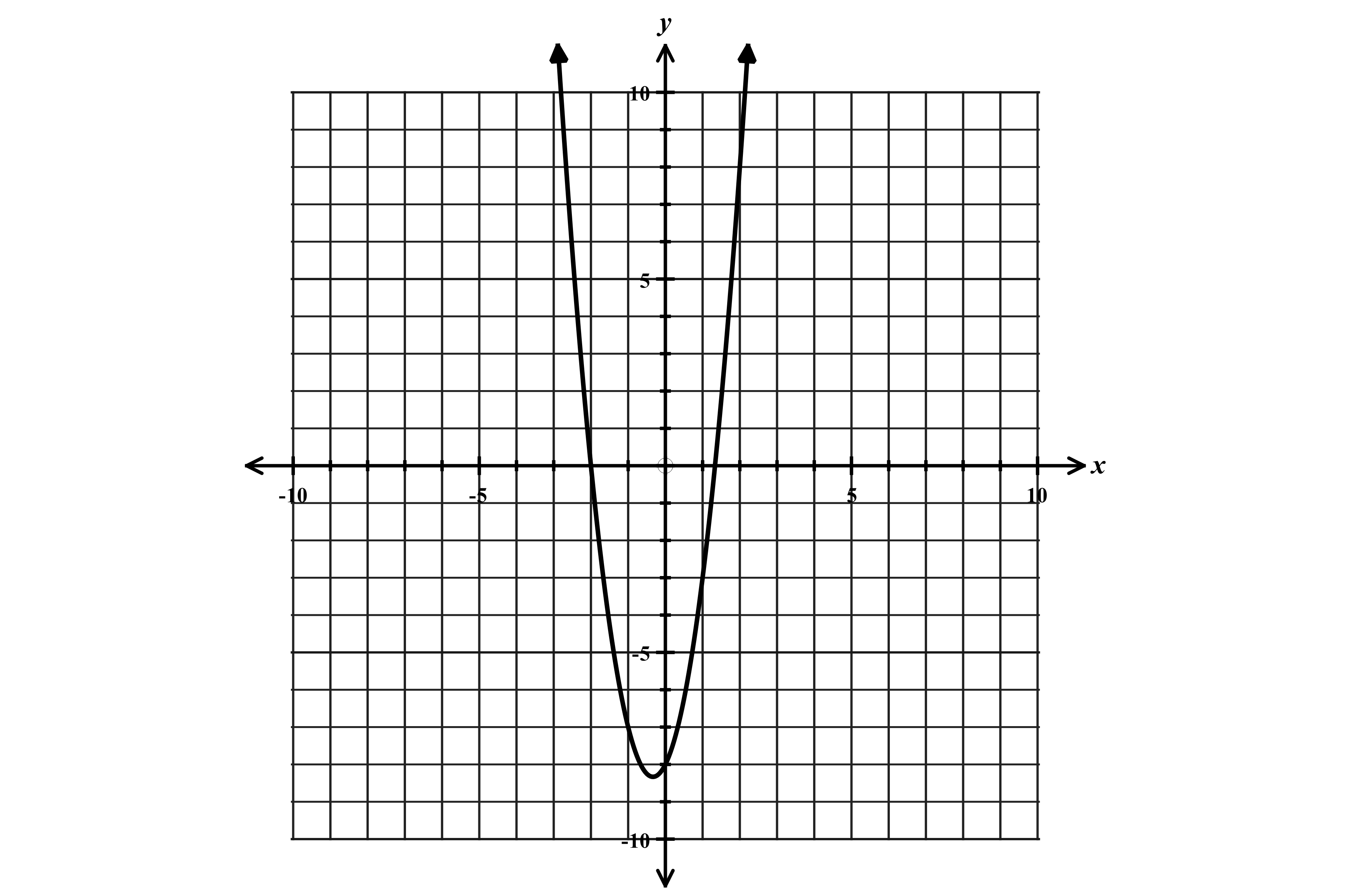
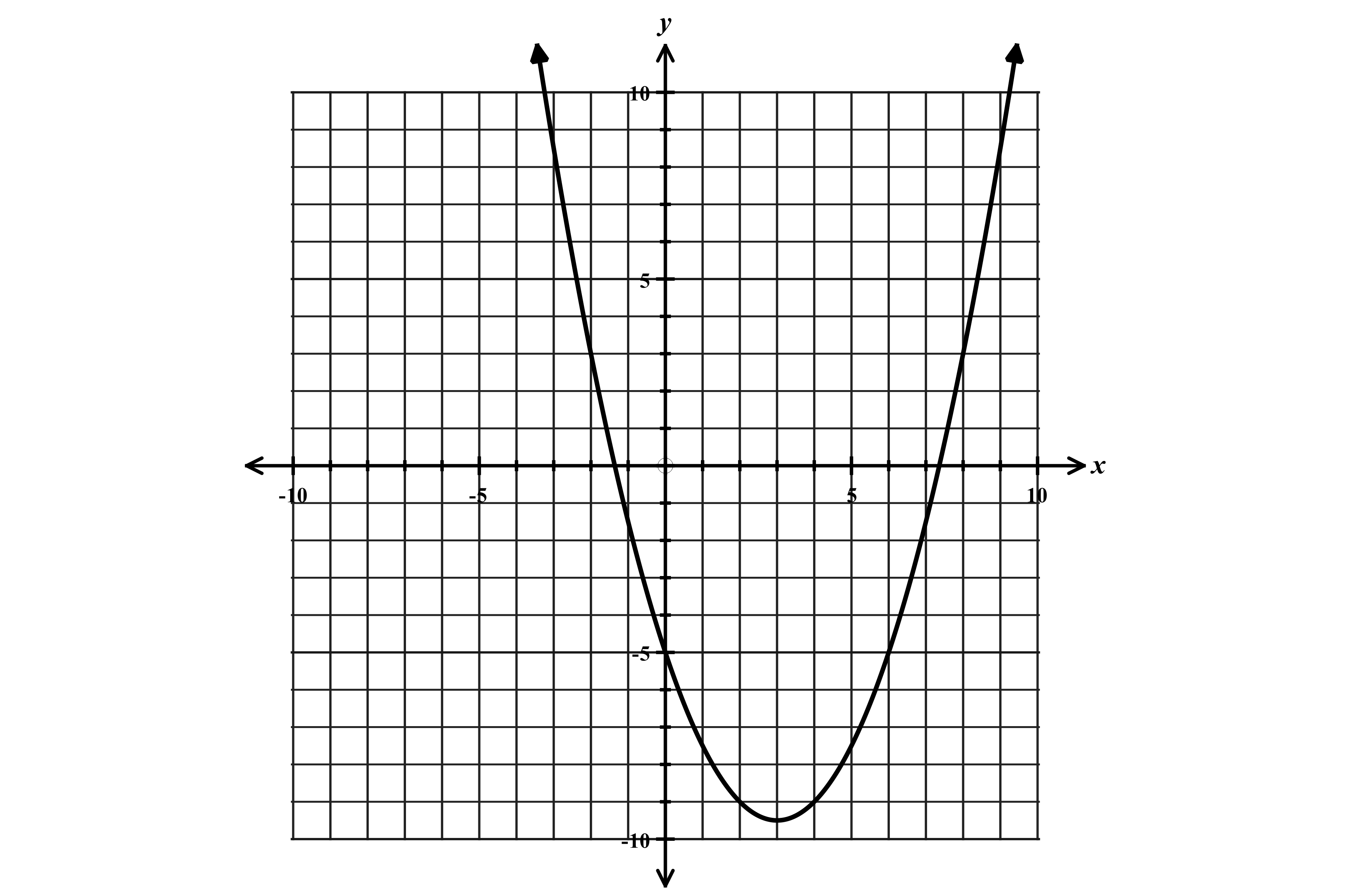
Decreasing over the interval or Decreasing over the interval or

Domain or Domain or

Range or Range or

Axis of symmetry: ( Axis of symmetry: (

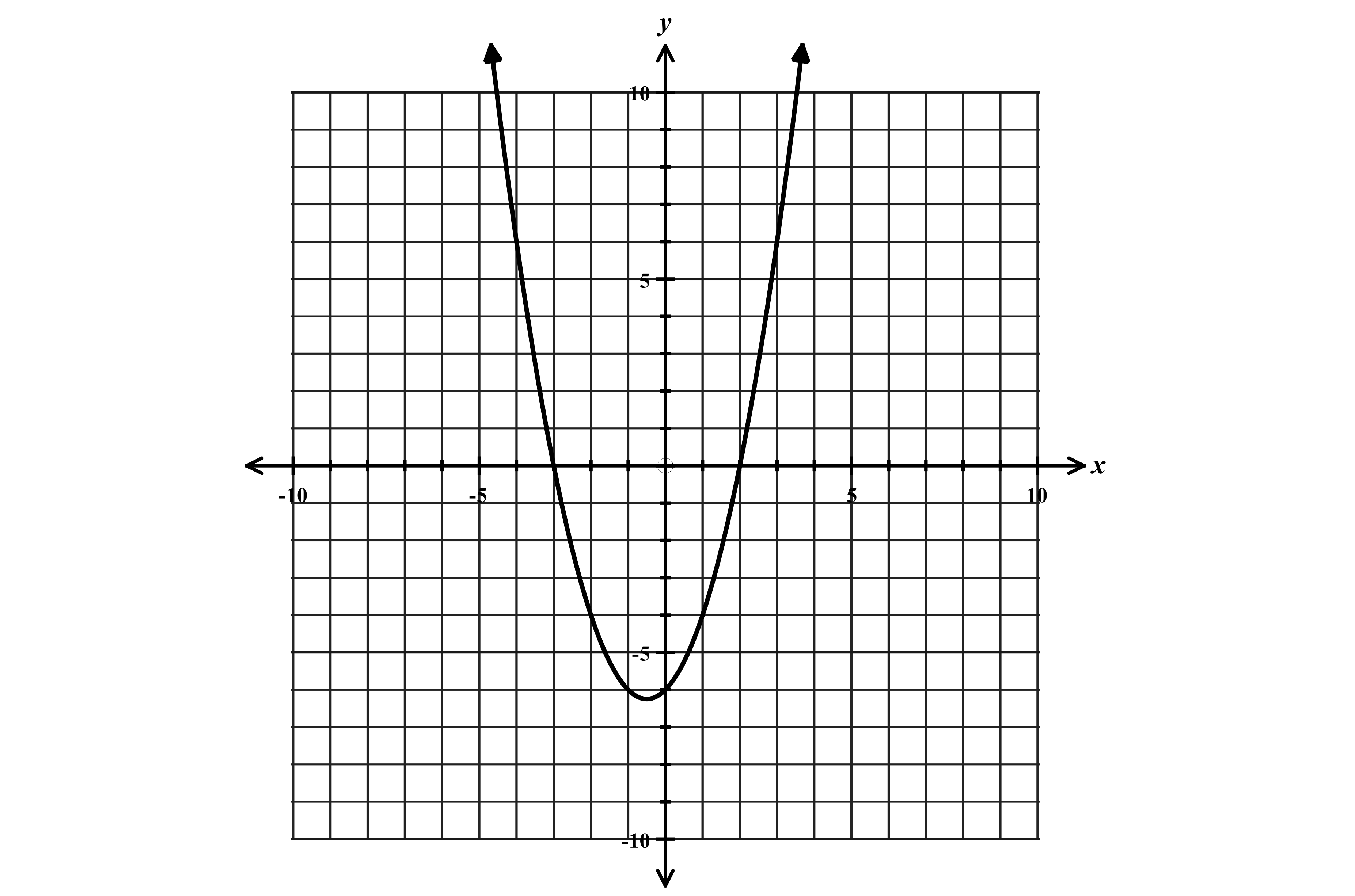
**Shifting, compressing, and stretching quadratics**

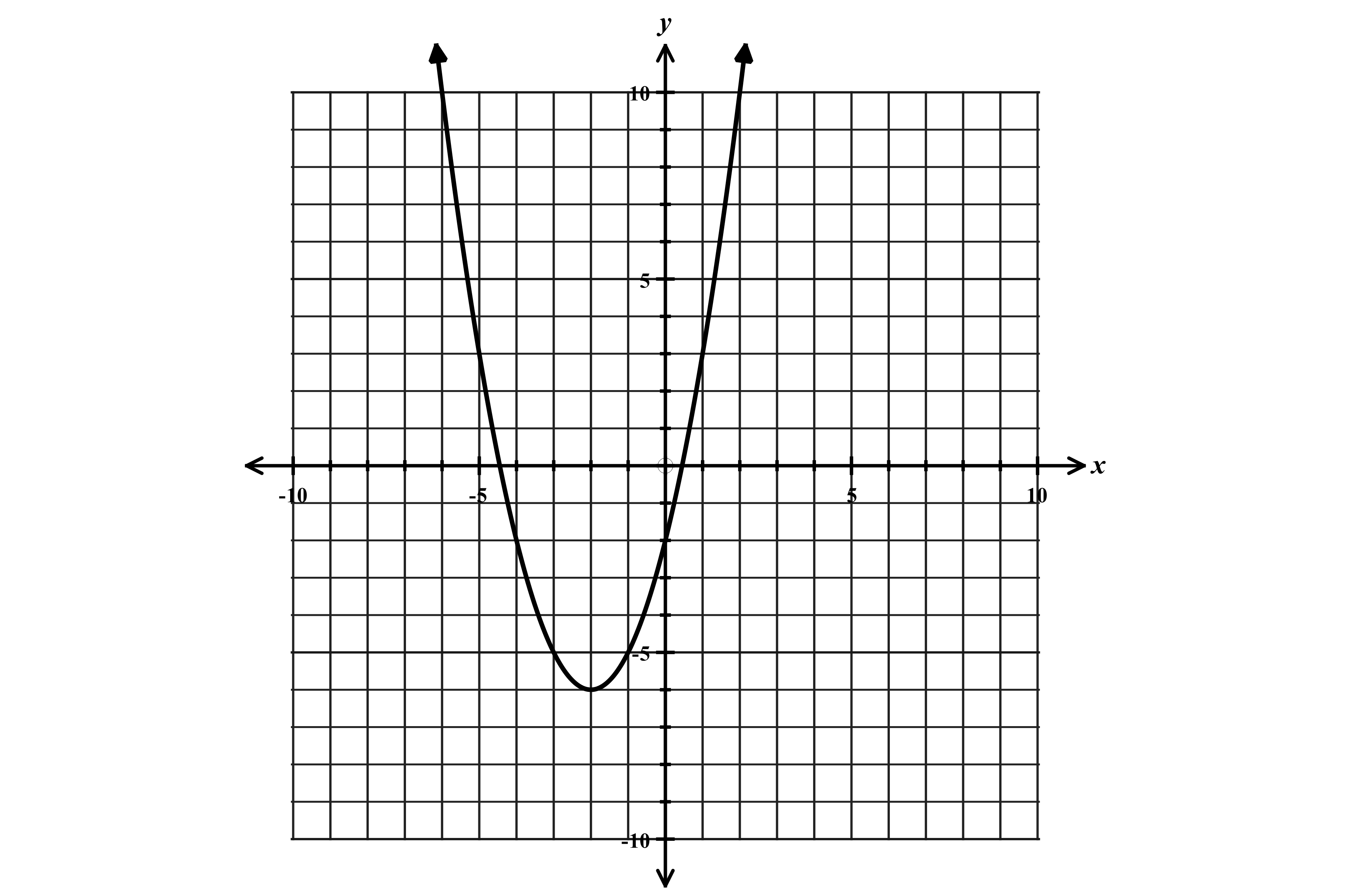
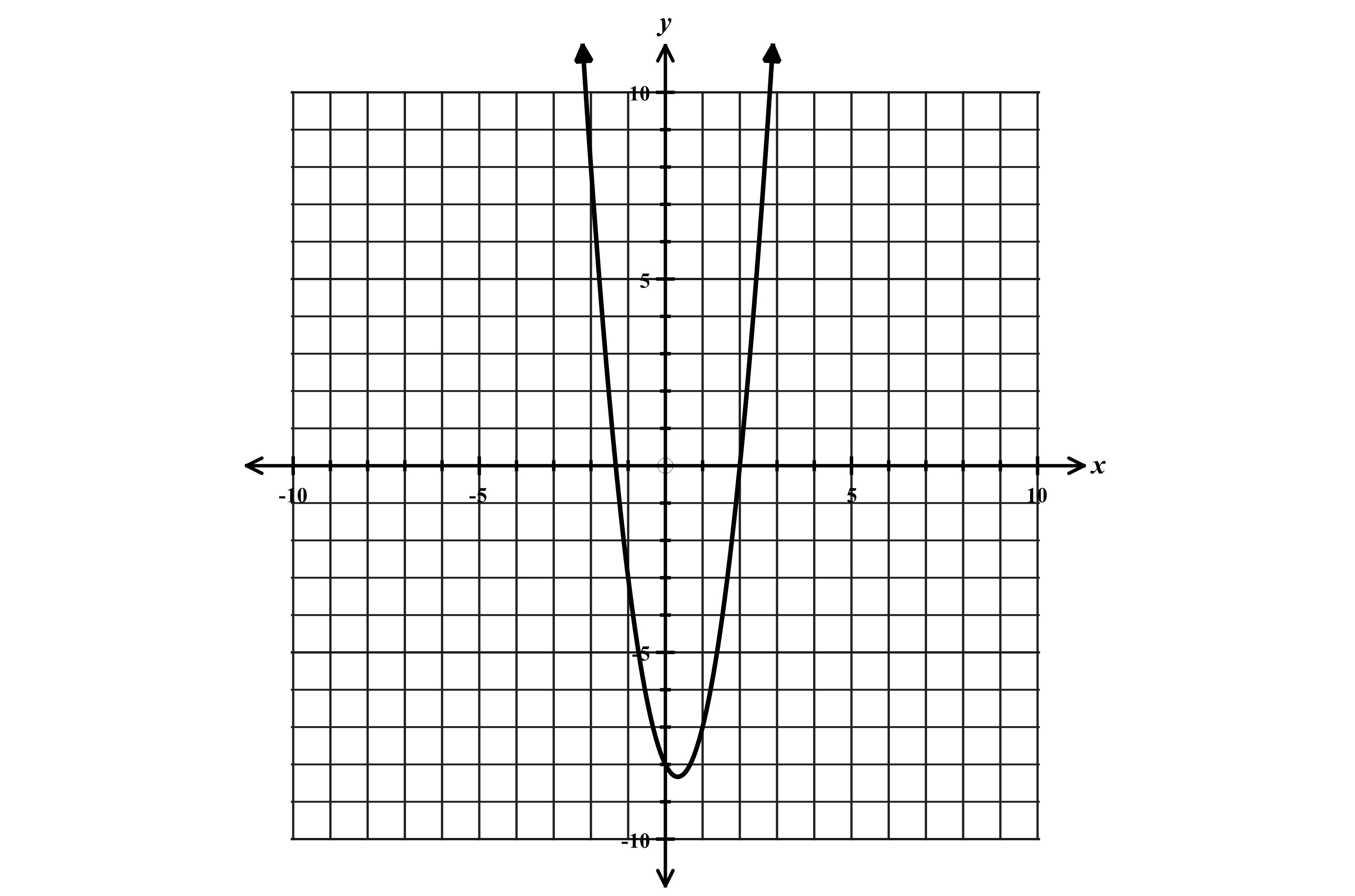


Shifted down 4 units Shifted left and down “Compressed” “Stretched”

“More narrow” “Wider”

**Roots of a quadratic**

****

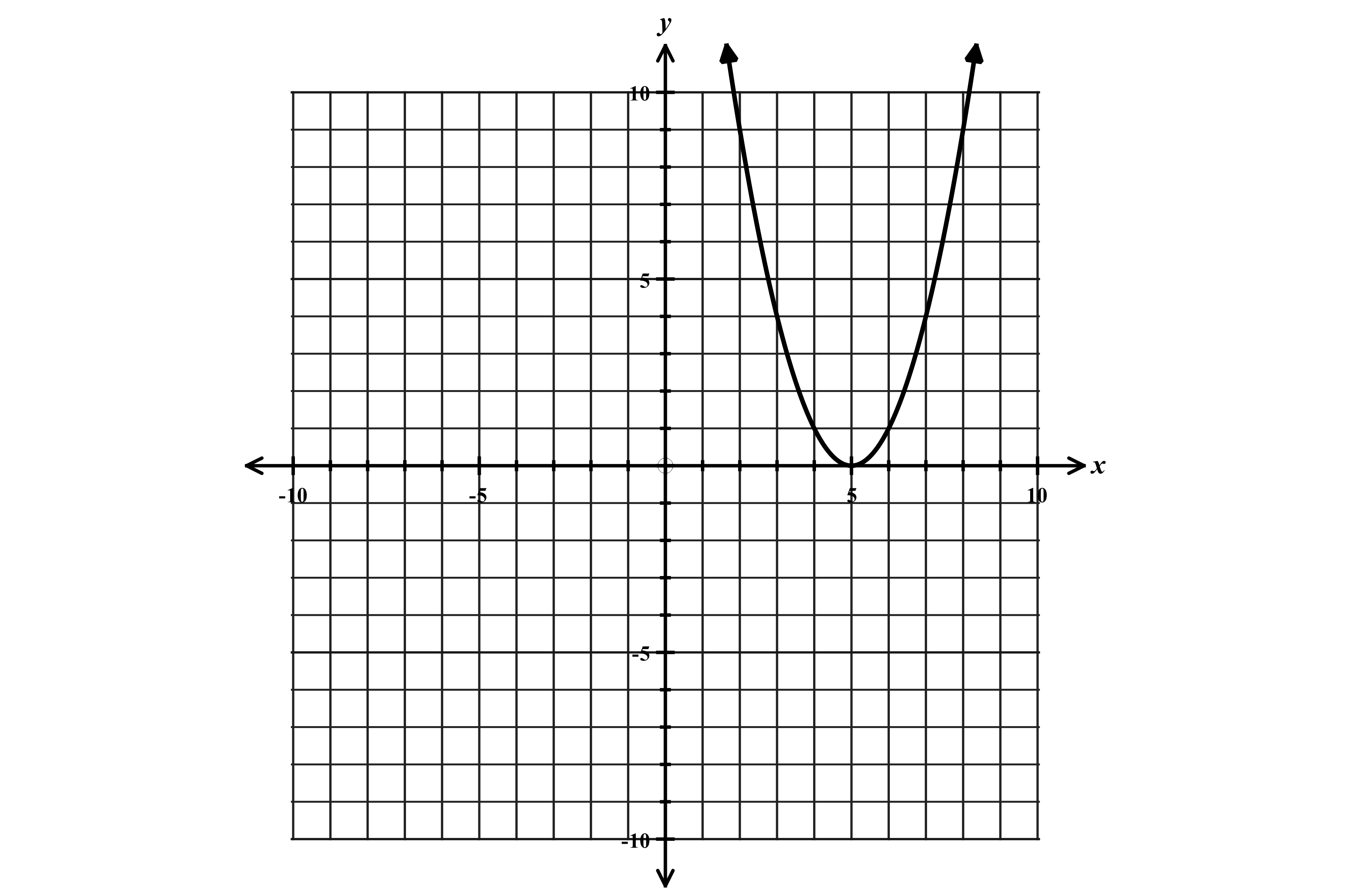
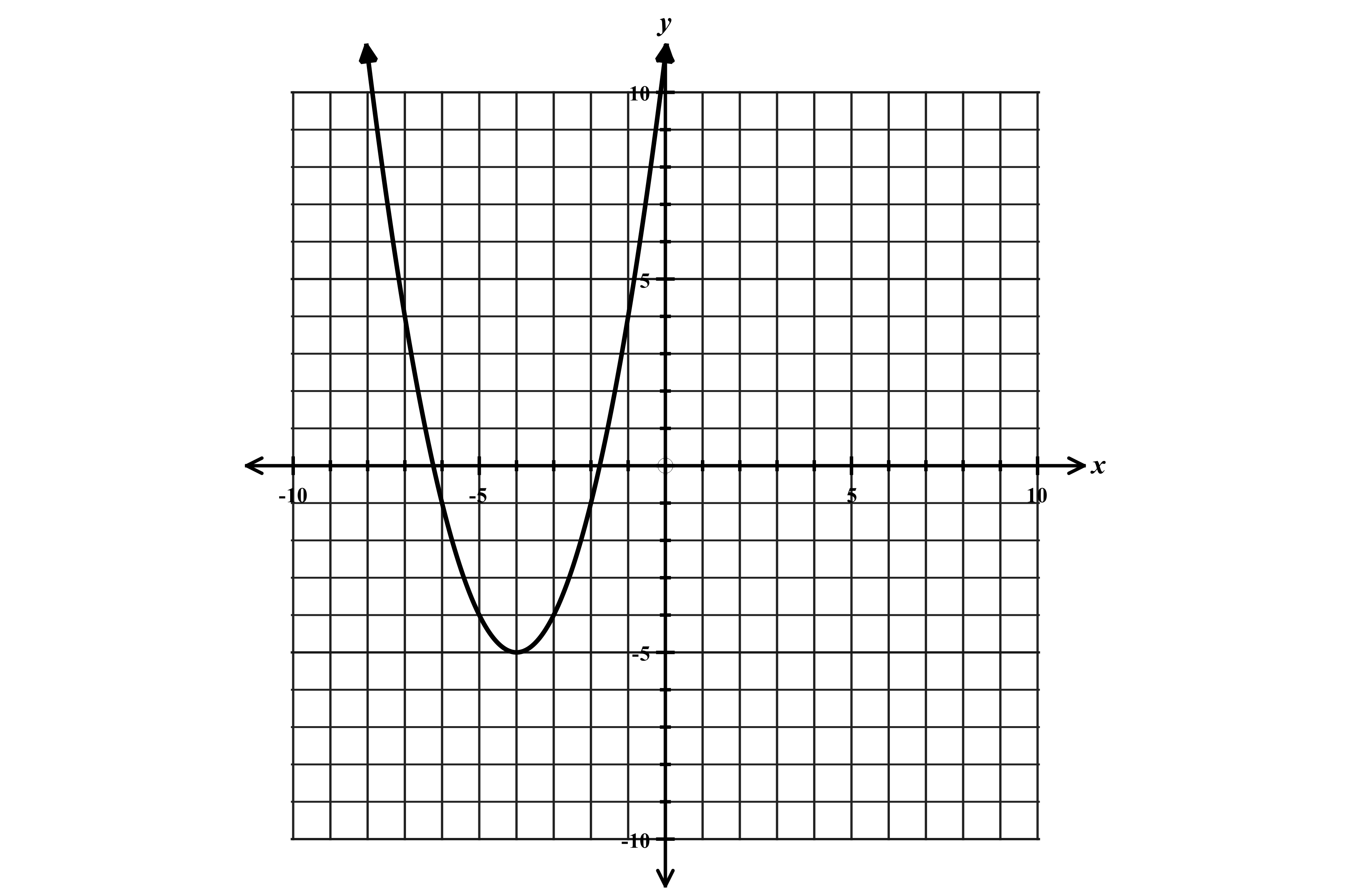
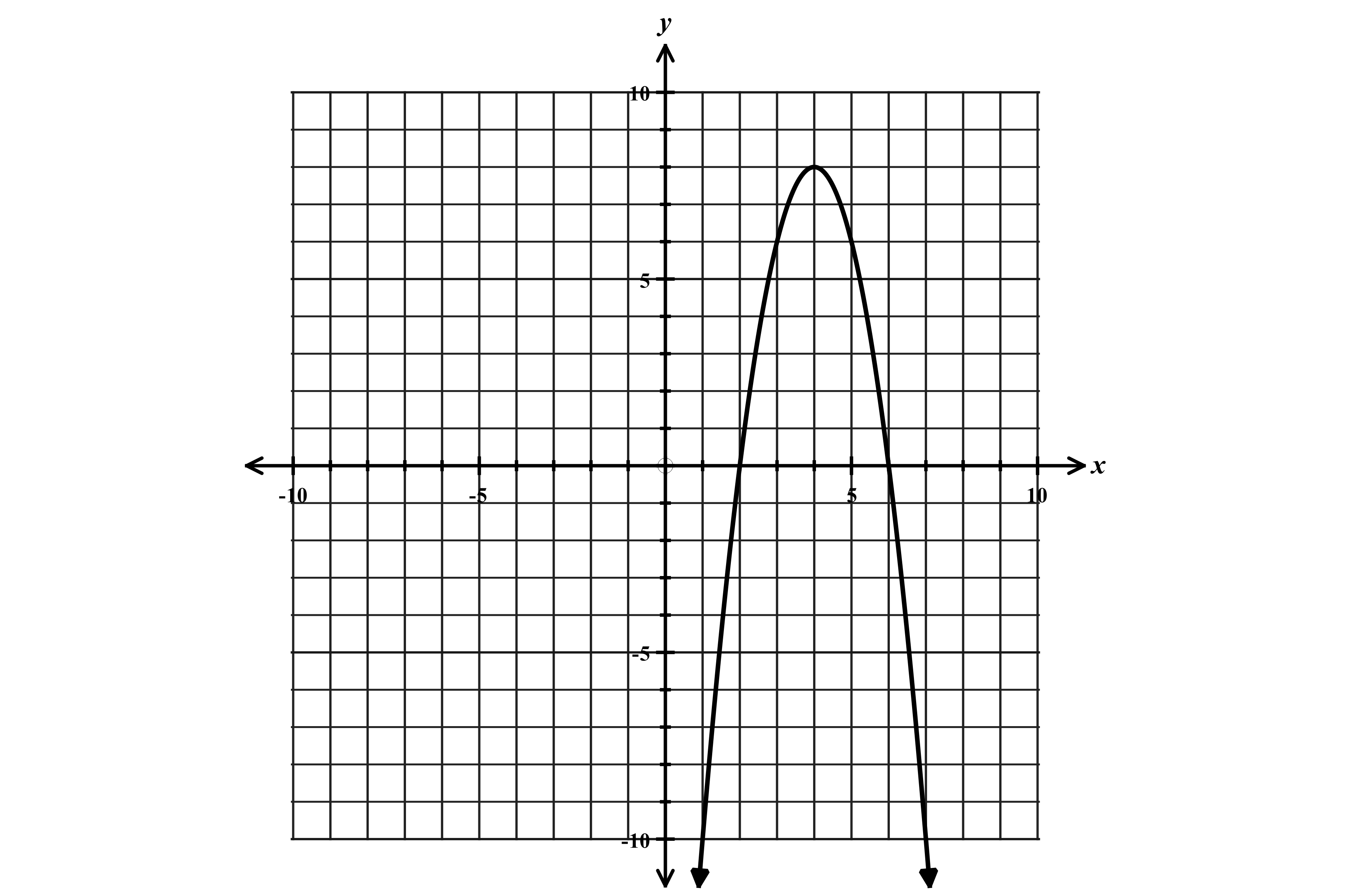
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Two rational roots Two rational roots Two irrational roots – Won’t factor

Factored form of equation Factored form Need completing the square

Roots or Roots or Quadratic formula

**Vertex form of a quadratic**



Vertex: Vertex: Vertex:

Shifted right 5 units Shifted left 4 units and down 5 units Shifted right 4 units and up 8 units

Domain: or Domain: or Flipped: : a is negative

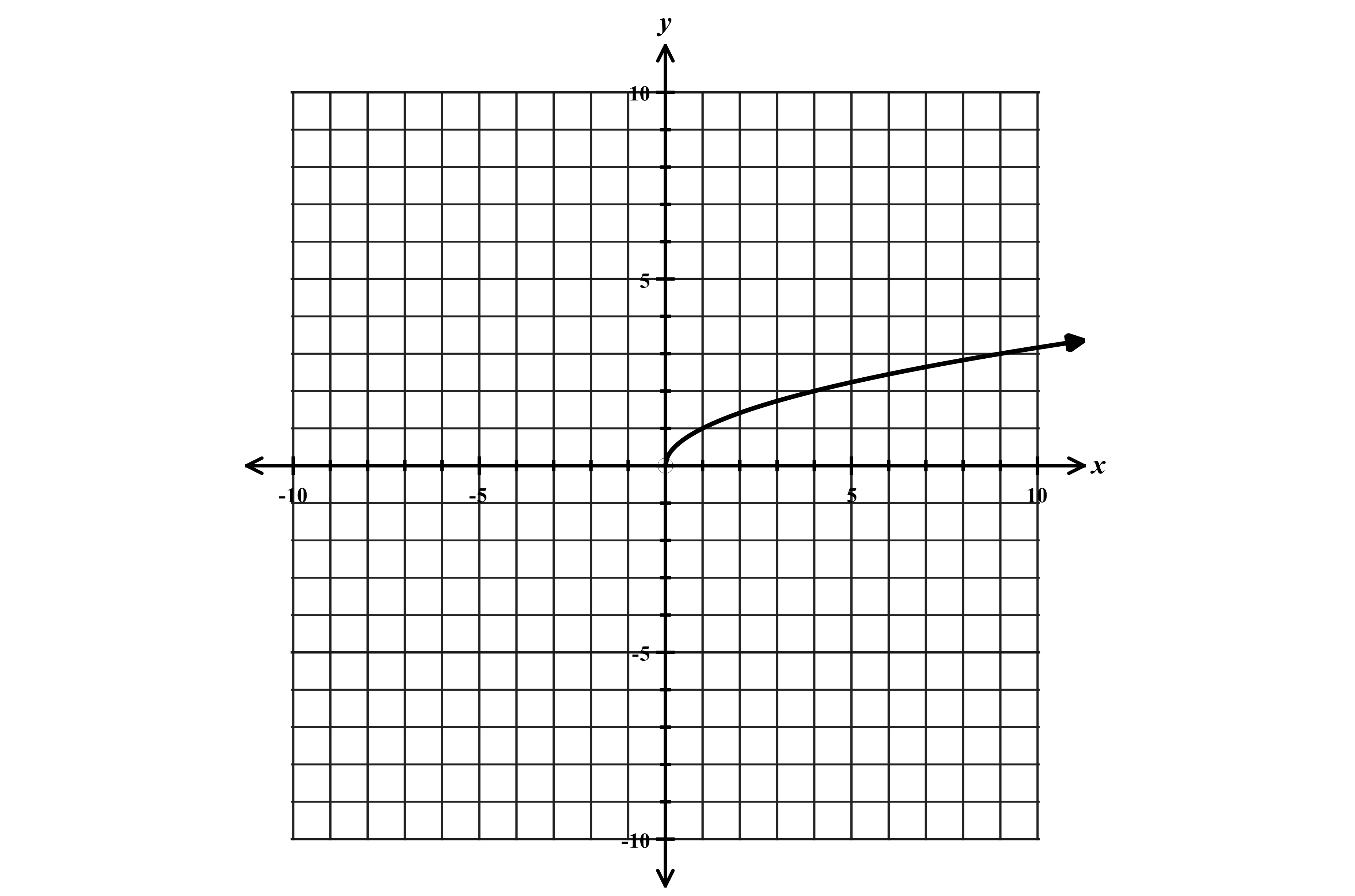
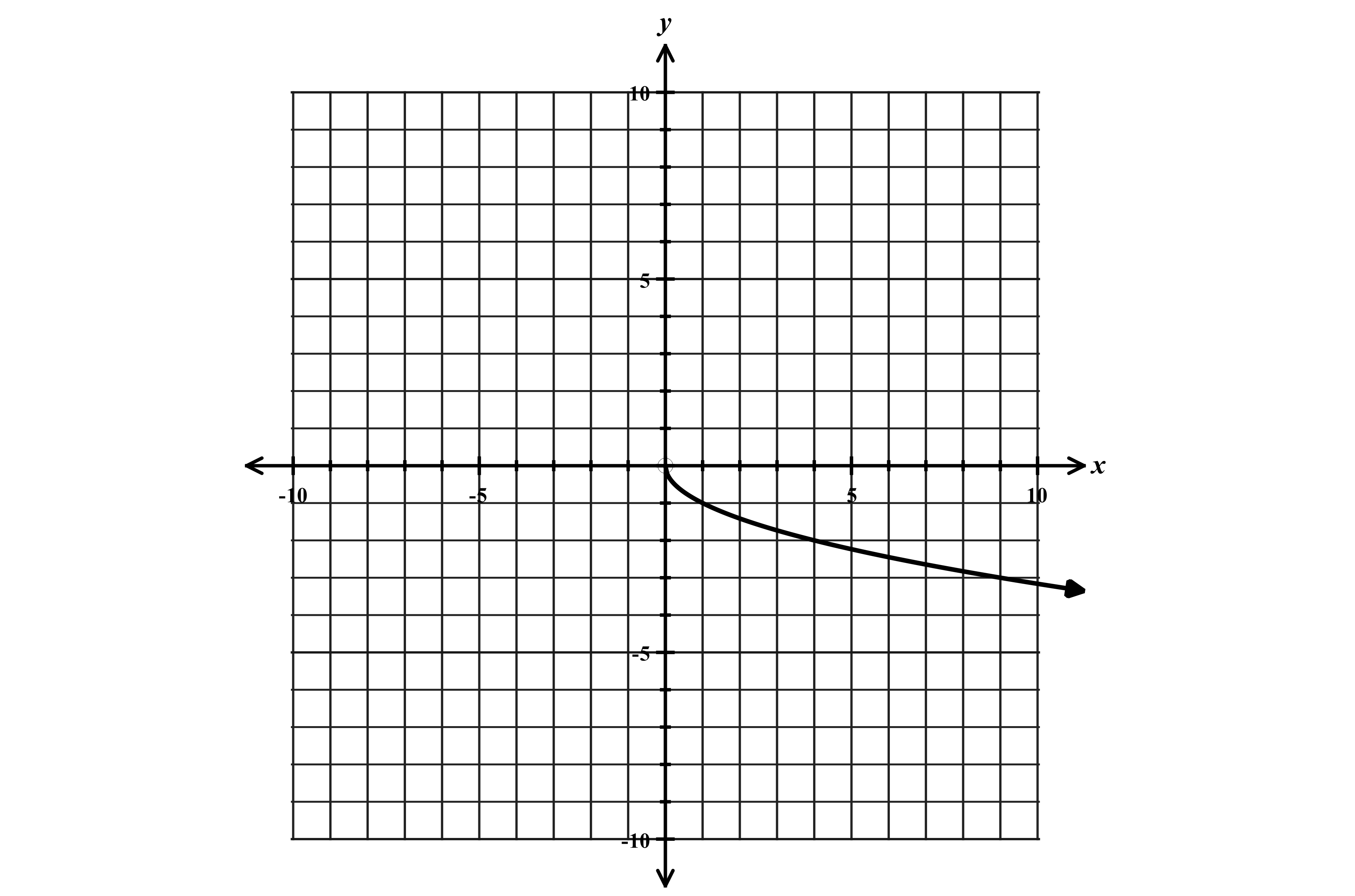
Range: or Range: or Compressed or narrower

Domain: or

Range: or

***Function 5: Square root function***

Parent Function: General form of square root function:

 Graph of Graph of

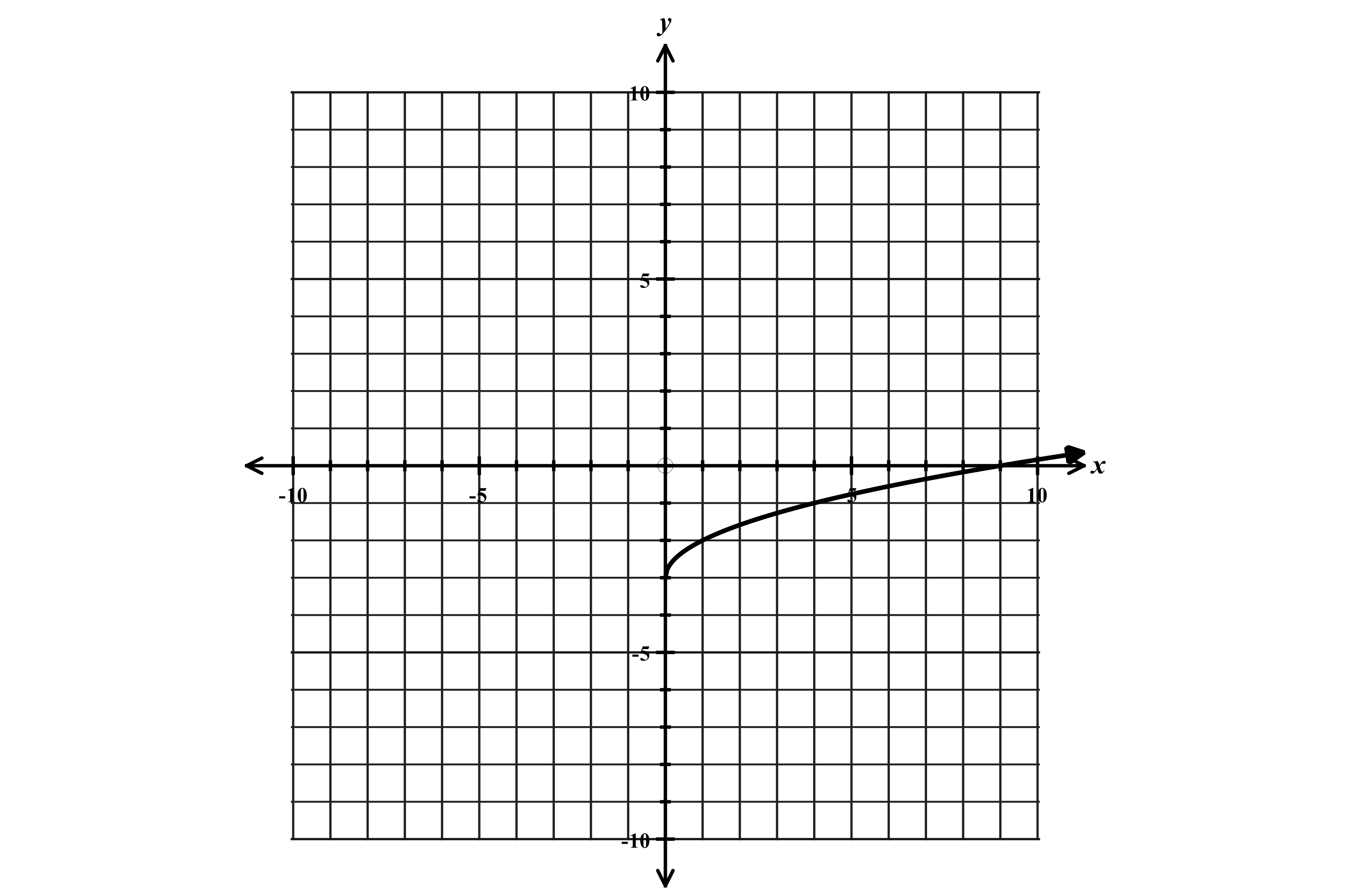
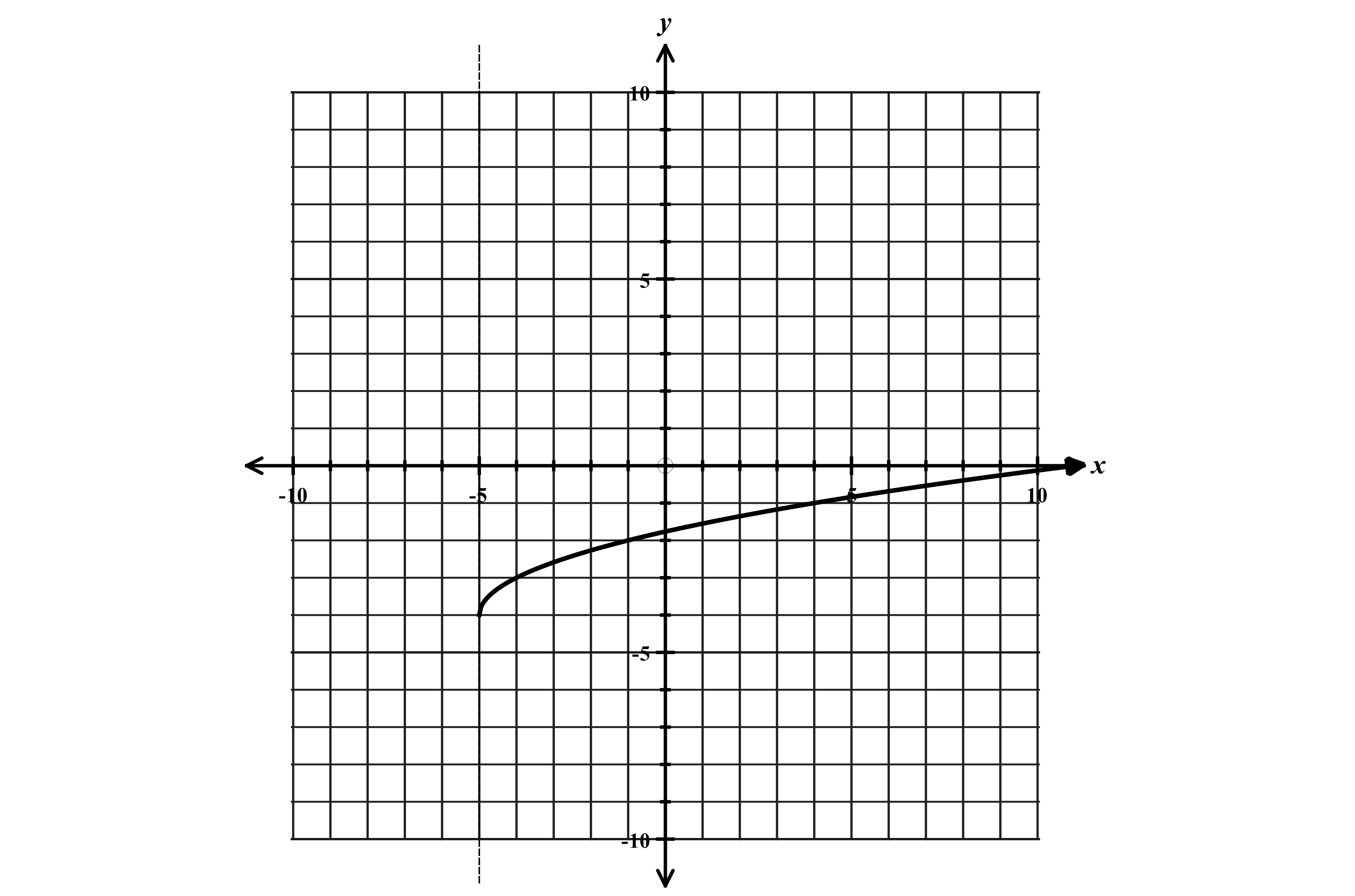
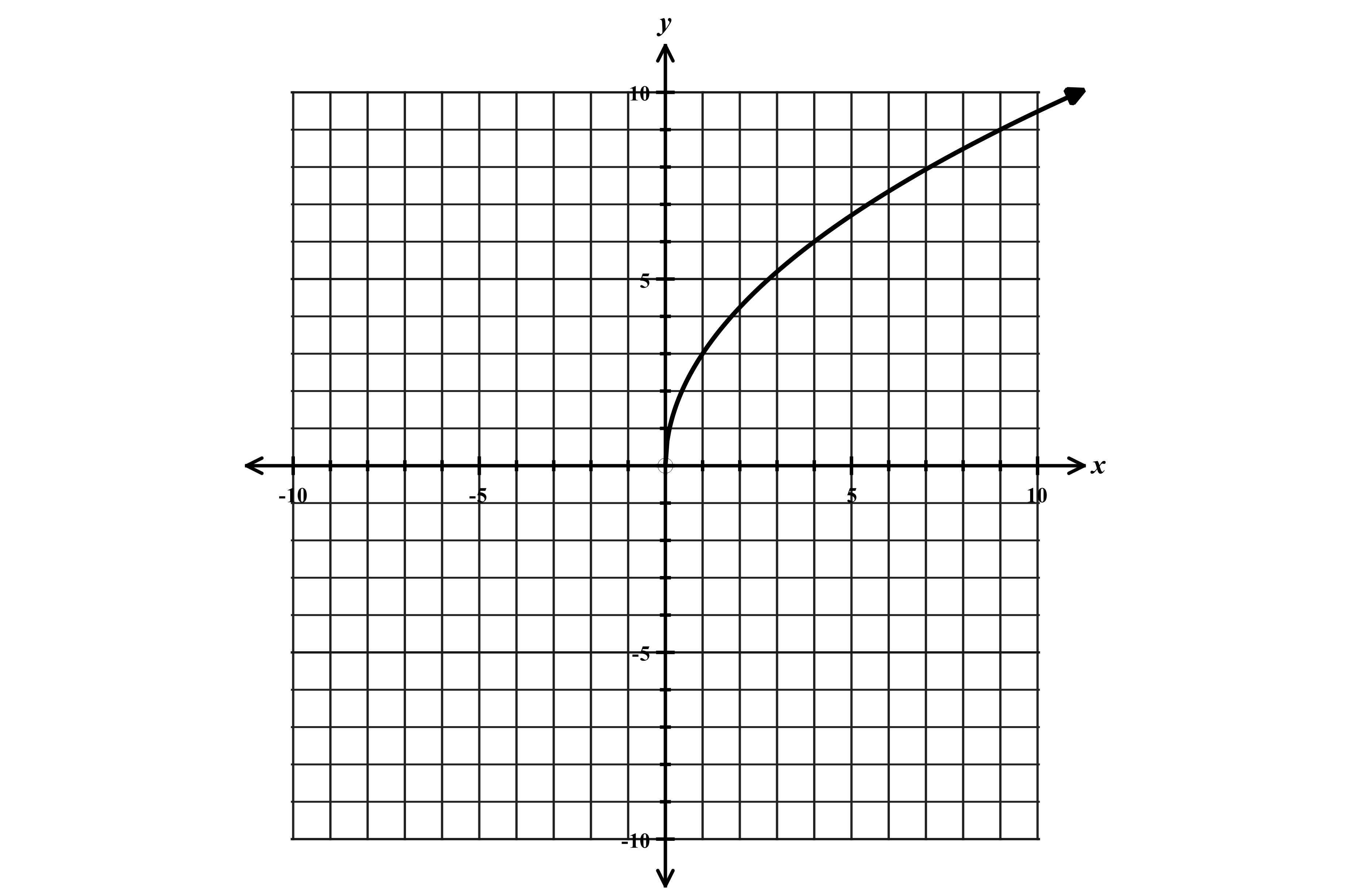
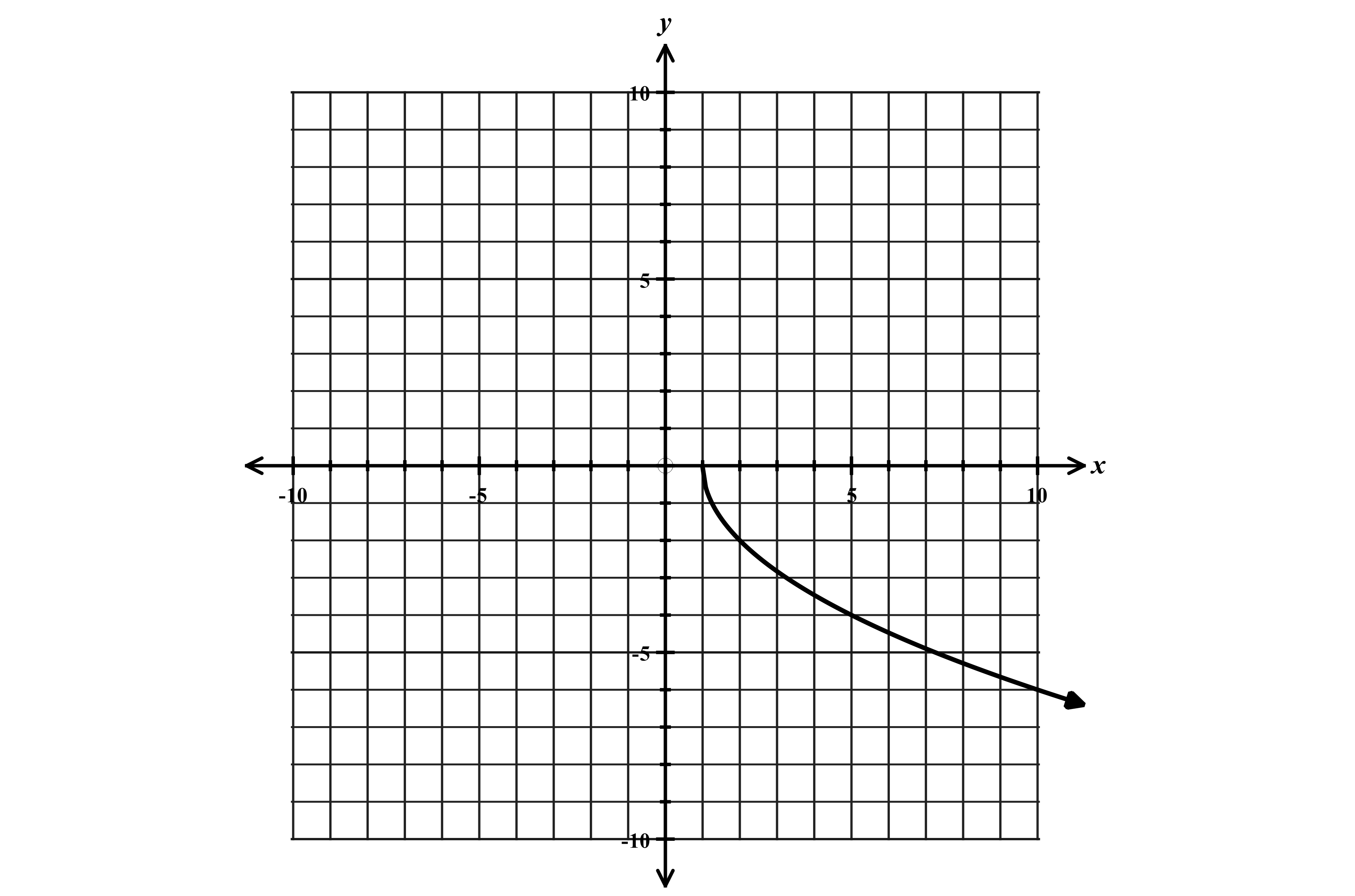
Increasing over the interval or Decreasing over the interval or “Flipped”

|  |  |
| --- | --- |
|  |  |
| 0 | 0 |
| 1 | 1 |
| 4 | 2 |
| 9 | 3 |
| 16 | 4 |
| 25 | 5 |

Domain or Domain or

Range or Range or

**Shifting, compressing, and stretching square root functions**



Shifted down 3 units Shifted left 5 down 4 Stretched vertically Flipped, stretched, and right 1

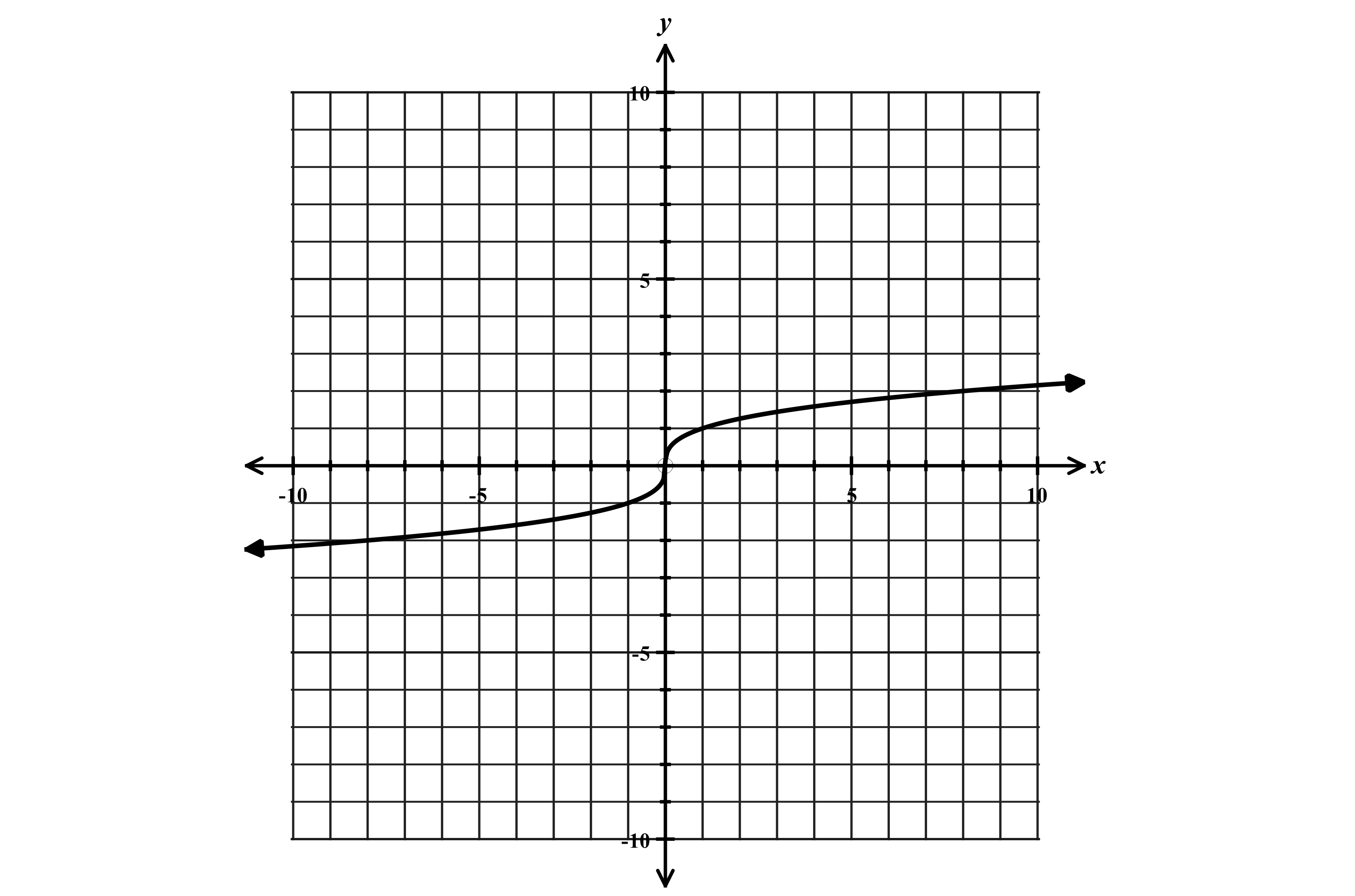
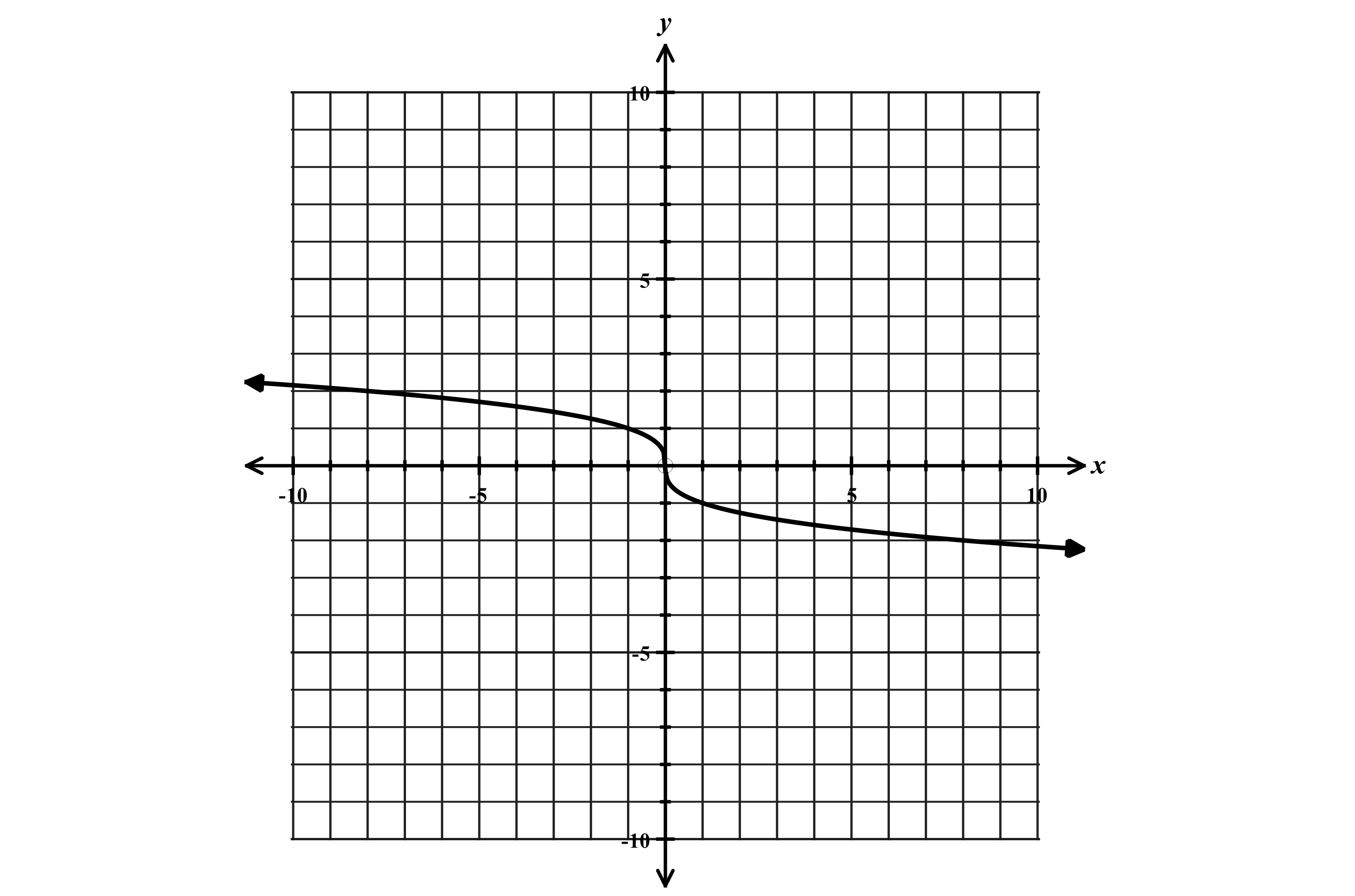
Domain or Domain or Domain or Domain or

Range or Range or Range or Range or

***Function 6: Cube root function***

Parent function: General form of a cube root function

Graph of Graph of



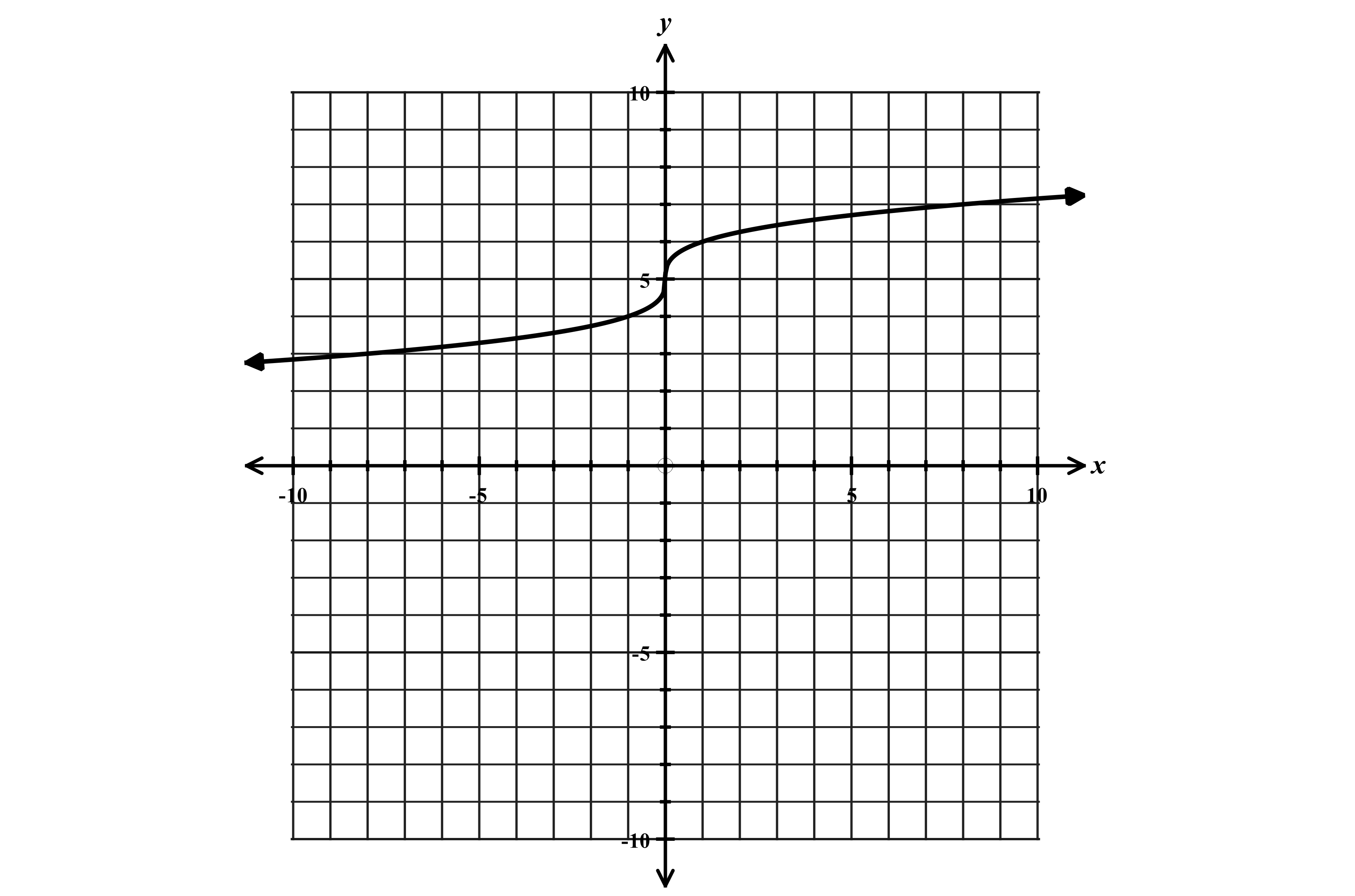
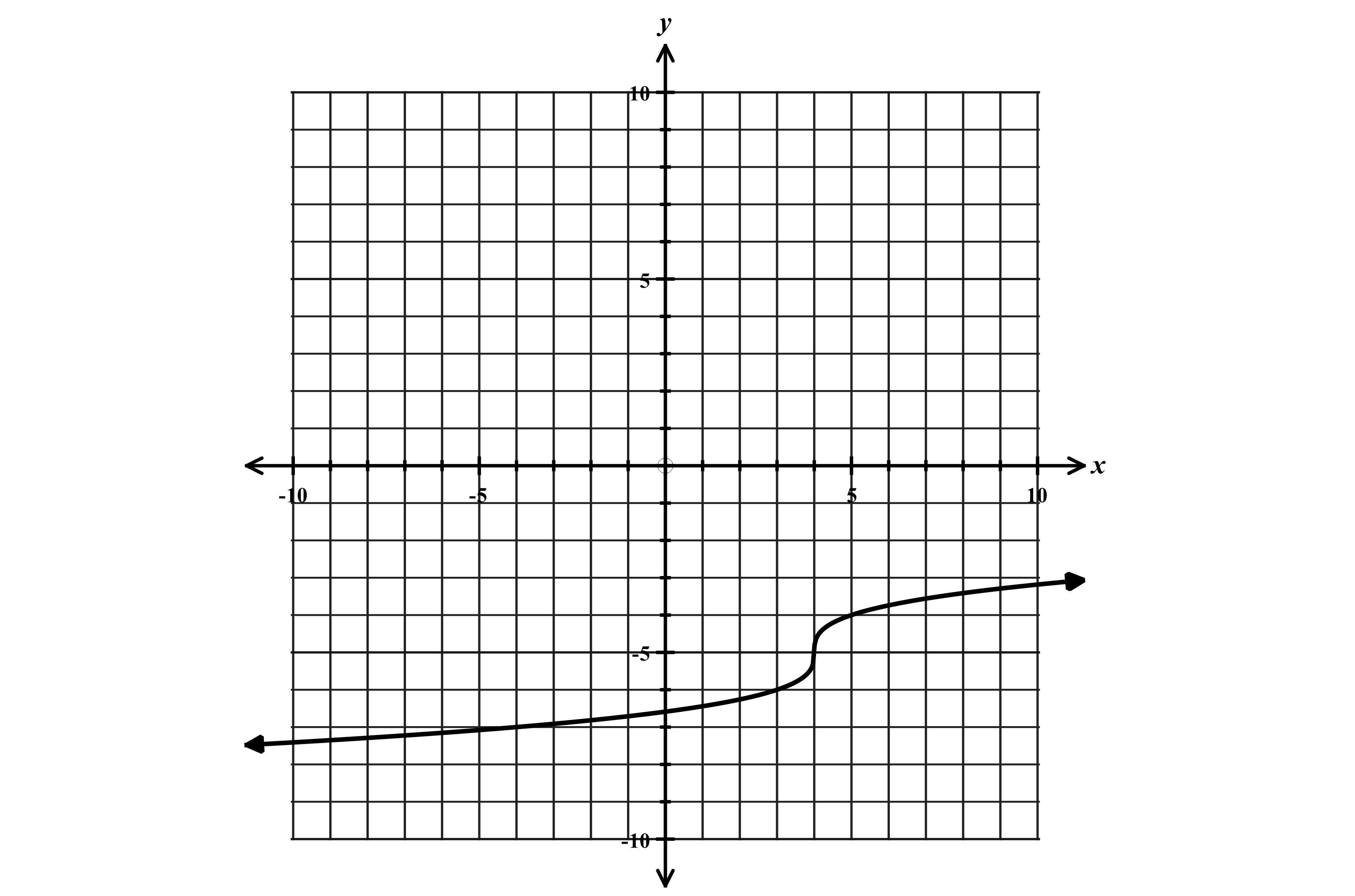
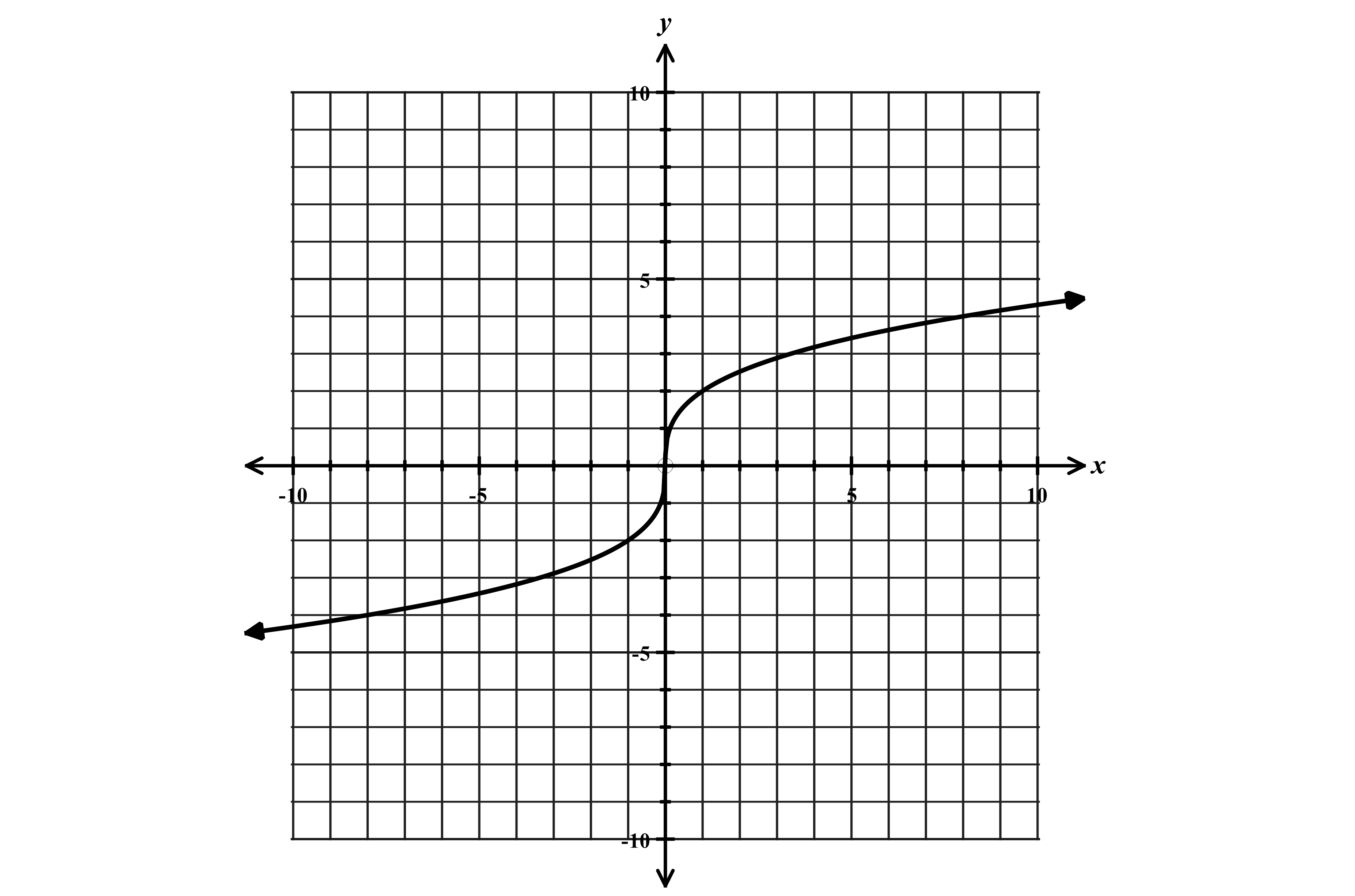
|  |  |
| --- | --- |
|  |  |
| -8 | -2 |
| -1 | -1 |
| 0 | 0 |
| 1 | 1 |
| 8 | 2 |
| 27 | 3 |

Domain: or Domain: or

Range: or Range: or

Flipped (negative coefficient)

**Shifting, compressing, and stretching cube root functions**

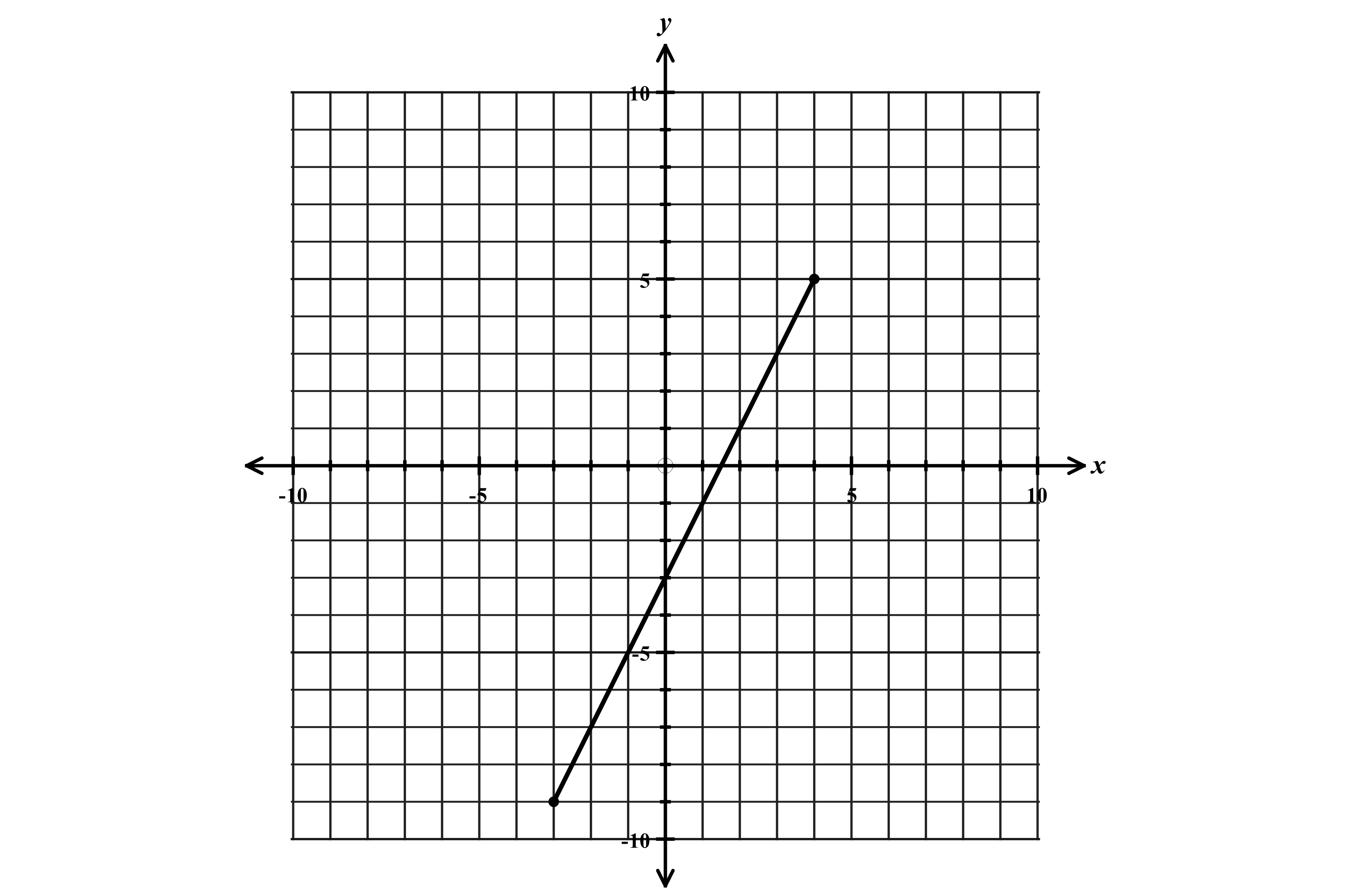


Shifted up 5 units Shifted right 4 units and down 5 stretched vertically

***Restricting the Domain of Functions and the Effect on the Range***

Often times we are asked to restrict the domain of a function and only graph the function over a specified interval.

The examples below show how to determine the range of a function when the domain is restricted.



1. Graph the function over the interval

Create a table that only includes domain values from -3 to 4

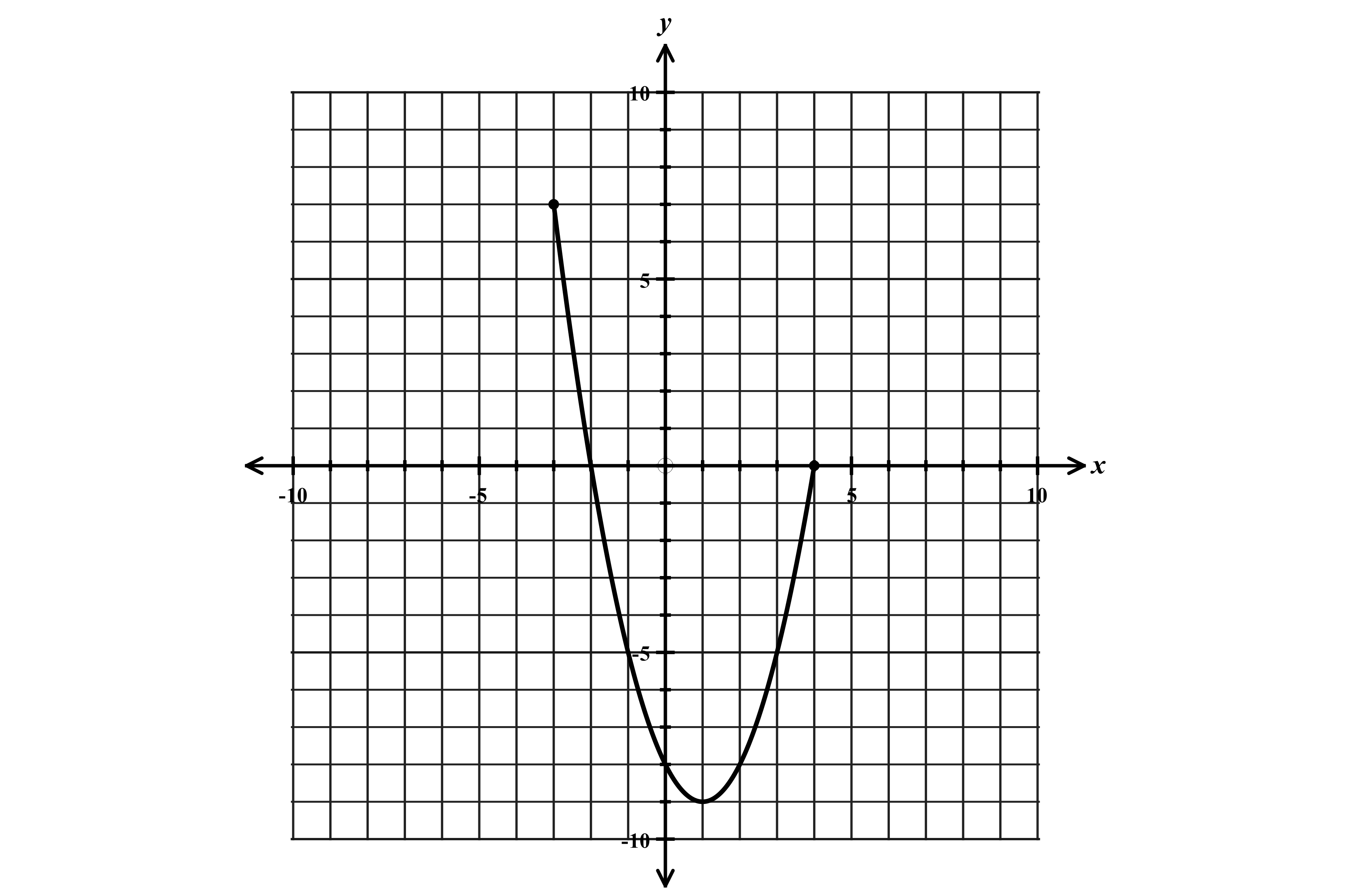
Then graph the function with endpoints.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | -3 | -2 | -1 | 0 | 1 | 2 | 3 | 4 |
|  | -9 | -7 | -5 | -3 | -1 | 1 | 3 | 5 |

Careful of the included and excluded domains!! (closed vs. open endpoints)

The range can be determined from the table or the graph.

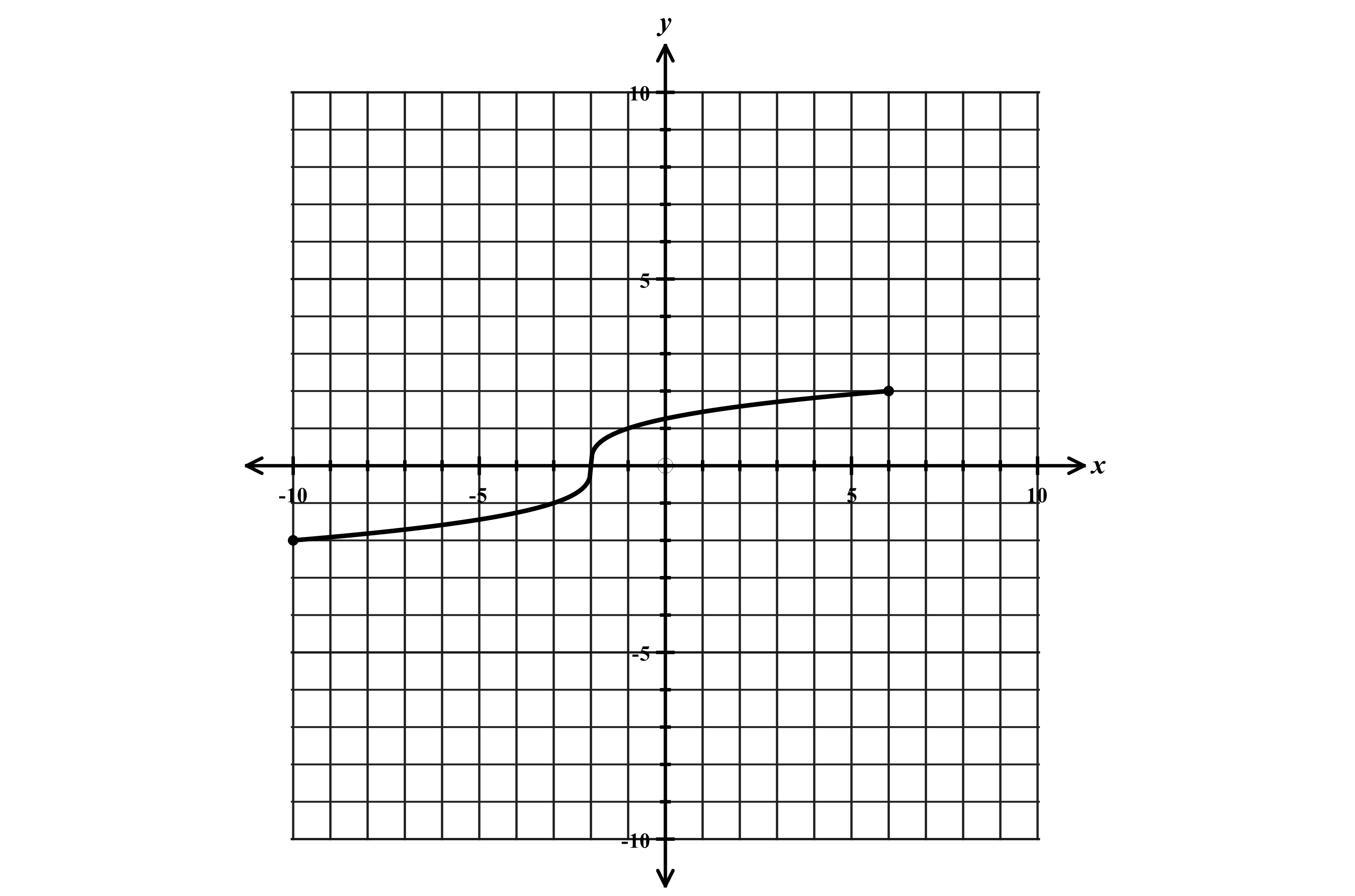
Range: or

2. Graph the function over the domain

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | -3 | -2 | -1 | 0 | 1 | 2 | 3 | 4 |
|  | 7 | 0 | -5 | -8 | -9 | -8 | -5 | 0 |

Range: or

Find the minimum and maximum range values from the table or the graph



3. Graph the function over the given domain.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | -10 | -3 | -2 | -1 | 6 |
|  | -2 | -1 | 0 | 1 | 2 |

Range: or