MATH 1314

Section 5.1

The Exponential Function

An exponential function is defined as a function of the form:

$$f(x) = a^x$$

where a > 0. This is considered an exponential function with base a.

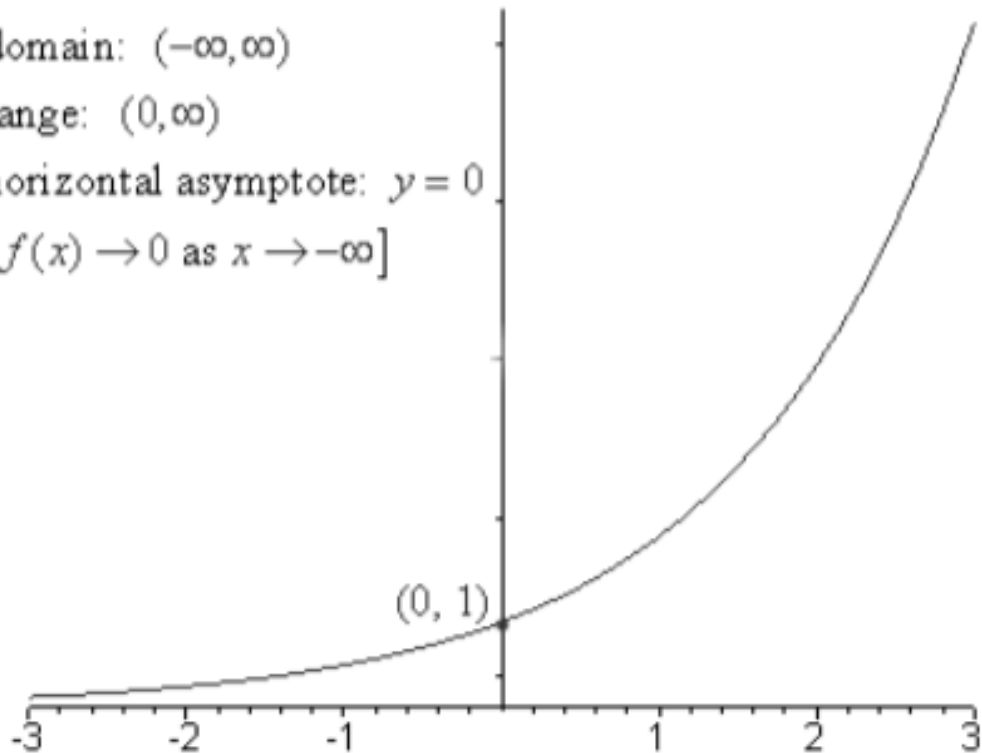The graph of $f(x) = a^x$ for $a > 1$ has the following shape:
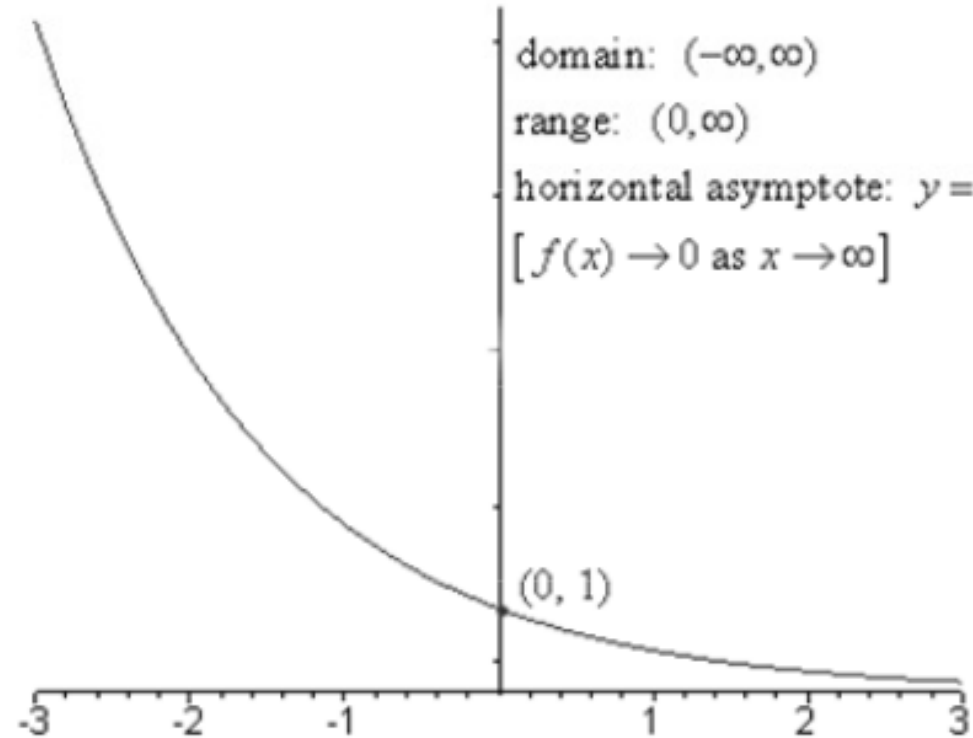
The graph of $f(x) = a^x$ for $0 < a < 1$ has the following shape:

domain: $(-\infty, \infty)$
range: $(0, \infty)$
horizontal asymptote: $y = 0$
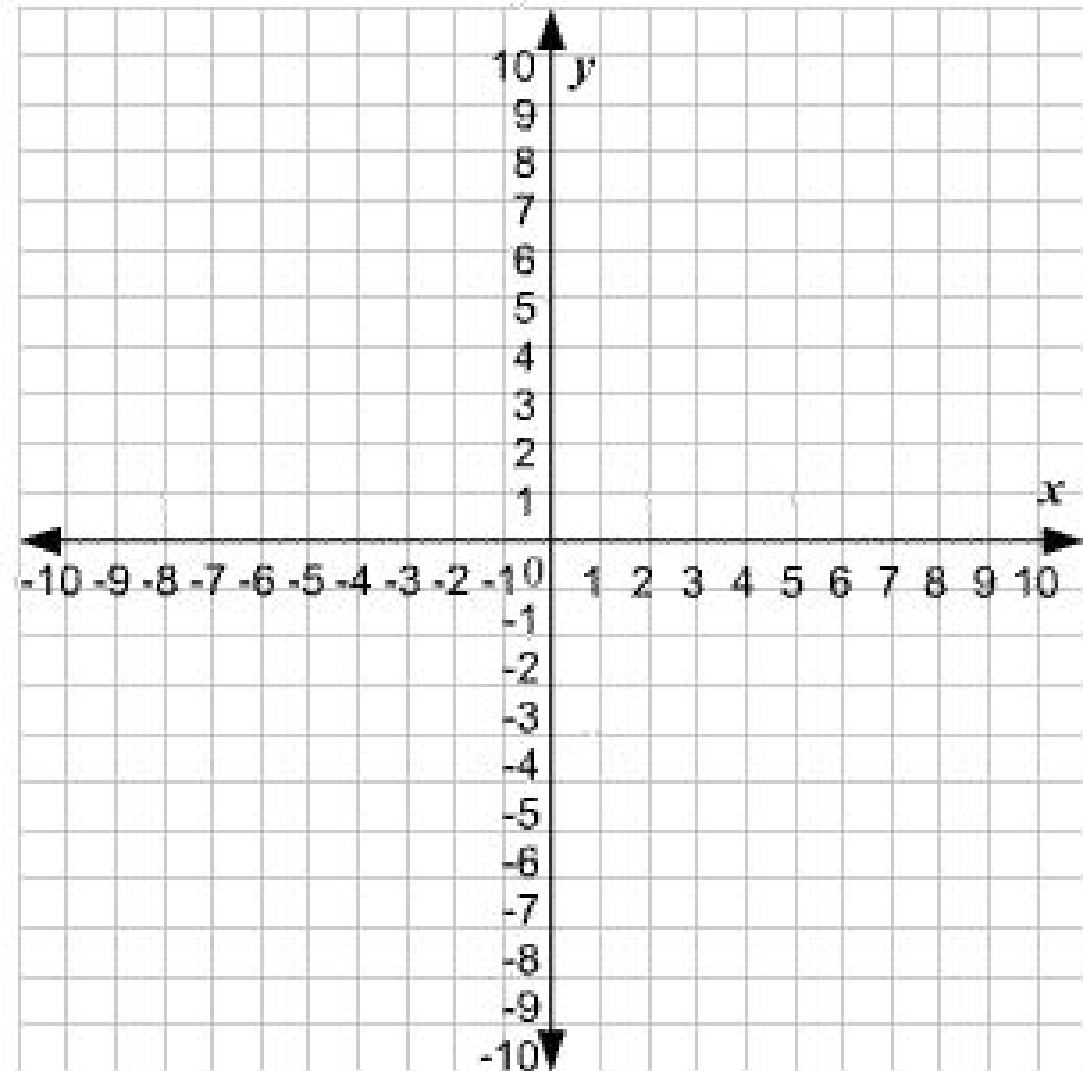$\left[f(x) \rightarrow 0 \text{ as } x \rightarrow -\infty \right]$

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horizontal asymptote: $y = 0$
$\left[f(x) \rightarrow 0 \text{ as } x \rightarrow \infty \right]$

(0, 1)

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-3   -2   -1   1   2   3

-3   -2   -1   1   2   3

Example Problem 1:

Sketch the graph of the function $f(x) = -2^x$ by starting from the graph of $y = 2^x$.
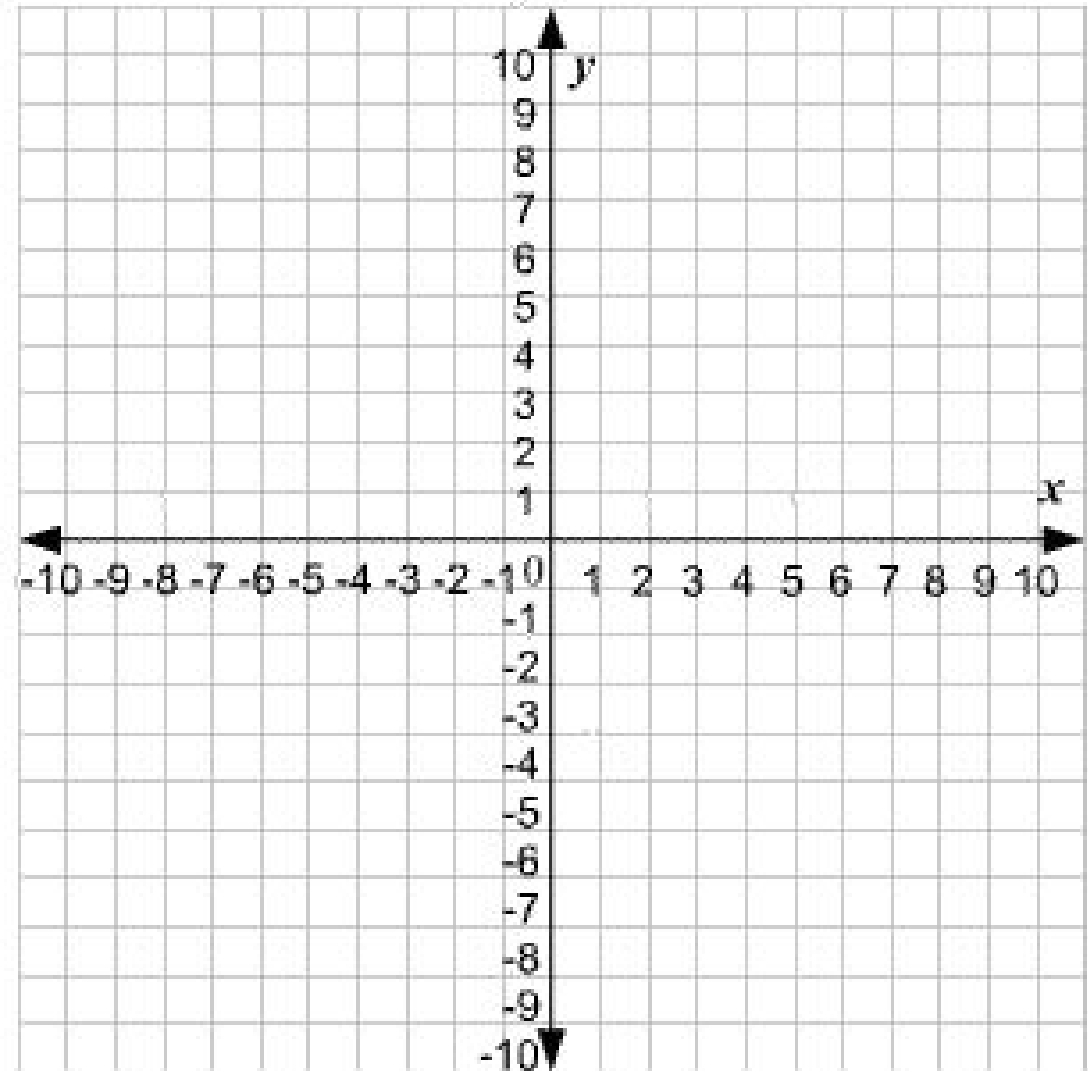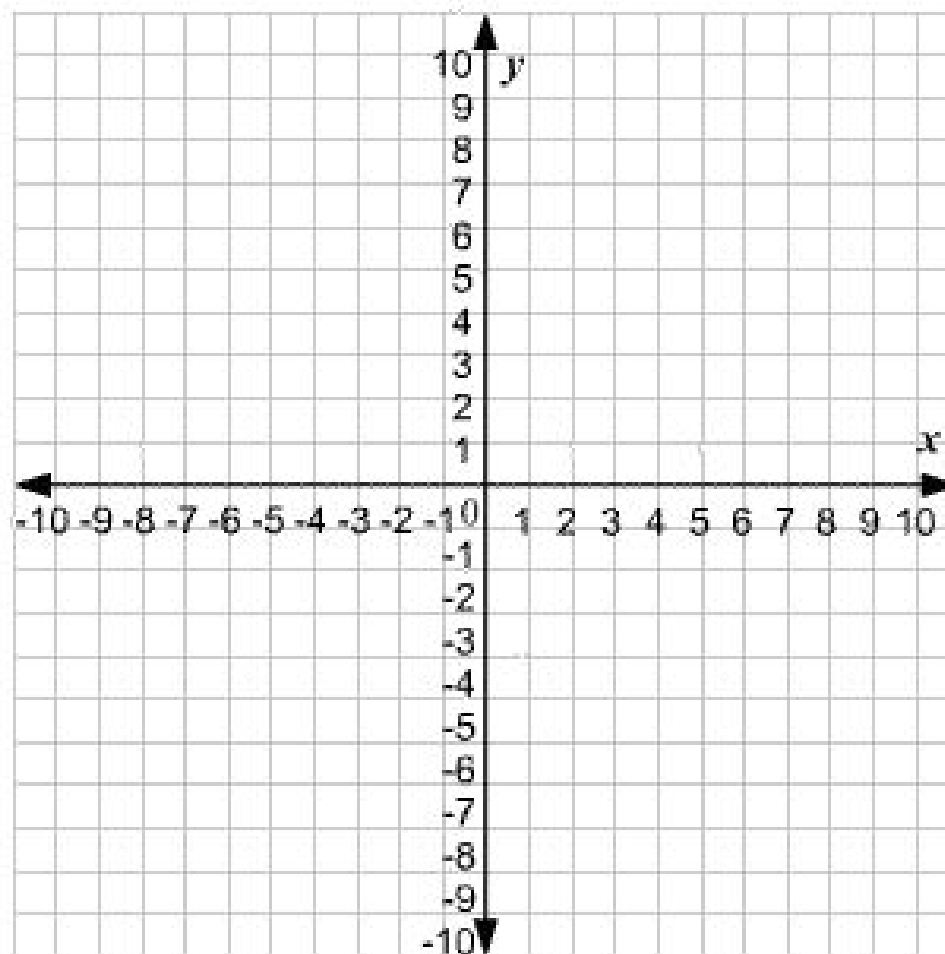State the domain, range, and asymptote.

Example Problem 2:

Sketch the graph of the function $f(x) = 2^{x-1}$ by starting from the graph of $y = 2^x$.
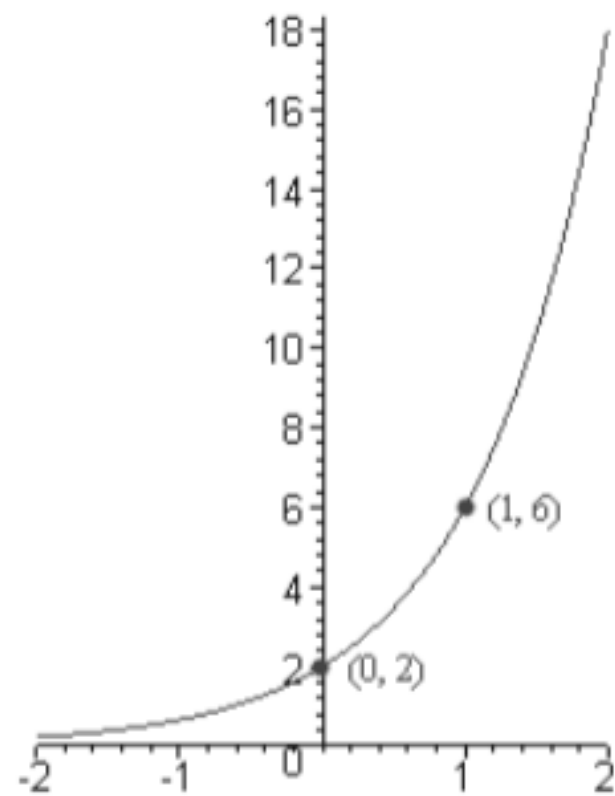State the domain, range, and asymptote.

Example 3:

Sketch the graph of the function $f(x) = -4^x + 10$. Do not plot points, but instead apply transformations to the graph of the function $y = 4^x$. Identify the domain, range, and asymptote.

Example 4:

Find the function $f(x) = Ca^x$ whose graph is shown below.

$f(x) = c\, a^x$ (1,6) and (2, 12)

Consider the function: $f(x) = 4\left(\frac{2}{3}\right)^{x-1} + 5$

What is this function called?

Is this function increasing or decreasing?

What is the horizontal asymptote of the function?

What is the domain of the function?

What is the range of the function?

Identify the y-intercept of the function.

Which transformations are present?

Sketch the graph: $f(x) = 4\left(\frac{2}{3}\right)^{x-1} + 5$