11.3

Date:

Objective:

A. Warm-up: Practice ***Laws of Exponents.***

$a^s \cdot a^t =$ $\qquad (a^s)^t =$ $\qquad (ab)^s =$ $\qquad 1^s =$ $\qquad a^{-s} =$ $\qquad a^0 =$

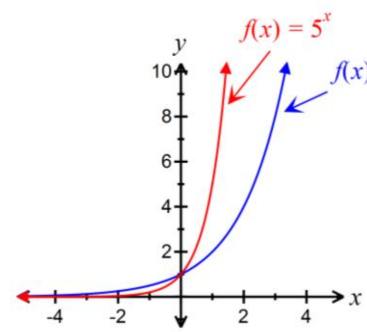
B. Properties of Exponential Functions

An ***exponential function*** is a function of the form________________ where *a* is a positive real number $(a > 0)$ and $a \neq 1$. The domain of f is the set of all real numbers.

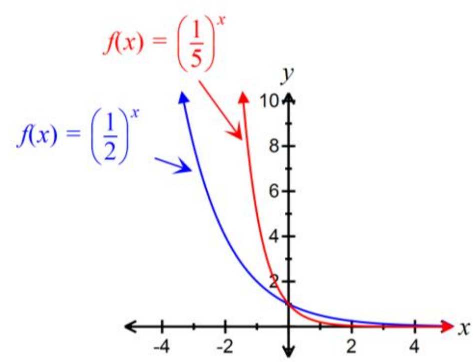
Properties of the Exponential Function $f(x) = a^x,\ a > 0,\ a \neq 1$

- Domain: ____________ Range: ______________
- There are no ______________; the *y*-intercept is ________.
- The *x*-axis $(y = 0)$ is a ______________________.
    - For $a > 1$, the graph approaches the *x*-axis as __________________
    - For $0 < a < 1$, the graph approaches the *x*-axis as _________________
- $f(x) = a^x$ is one-to-one.
    - For $a > 1$, $f(x) = a^x$ is an _________________ function.
    - For $0 < a < 1$, $f(x) = a^x$ is a ________________ function.
- The graph of f contains the points ______________, ______________, and ______________.

$a > 1$



$0 < a < 1$

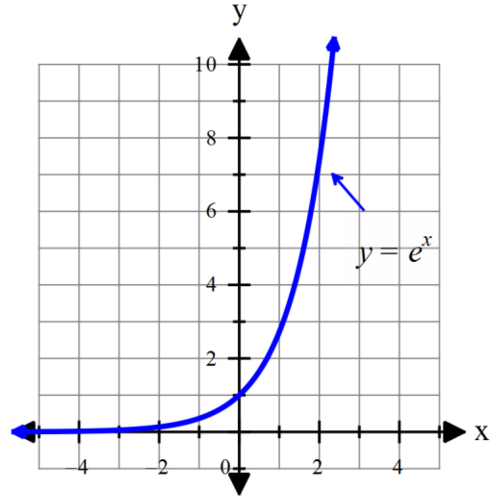


Asymptote:

Asymptote Equation:

C. The number *e*

- The **number *e*** (approximately 2.71828…) is defined as the number that the expression $\left(1+\frac{1}{n}\right)^n$ approaches as $n \to \infty$. In calculus, this is expressed using limit notation as $e = \lim\limits_{n\to\infty}\left(1+\frac{1}{n}\right)^n$.



- Find e^2

D. Review Transformations. (No Calculators!)

- The general equation for an exponential function is: $y = b\cdot a^{c(x-h)} + k$
List the transformation that corresponds with each variable.

b =________________ c = ______________ h = _______________ k = _______________

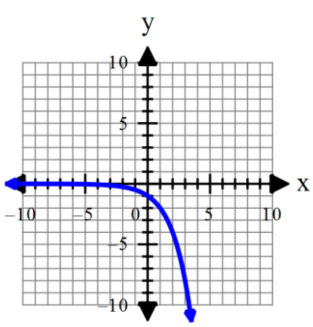
Negative function ____________________ Negative exponent ___________________

- Without a Calculator, match each equation to the appropriate graph.

$a)\ y = 2^x$ $b)\ y = -2^x$ $c)\ y = 2^{-x}$ $d)\ y = 2^x - 1$

$e)\ y = -2^{-x}$ $f)\ y = 2^{x-1}$ $g)\ y = 1-2^x$ $h)\ y = 2^{1-x}$

1.



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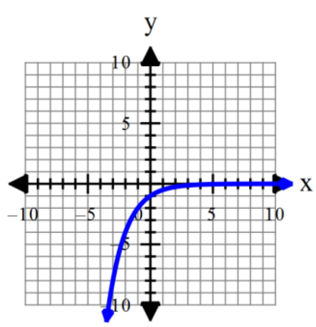

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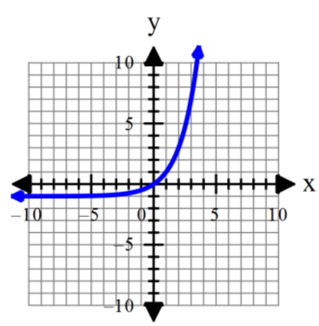

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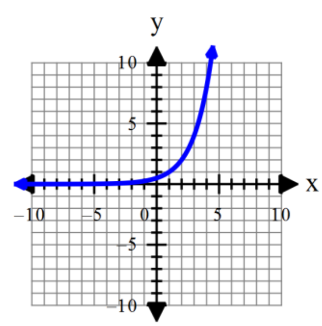

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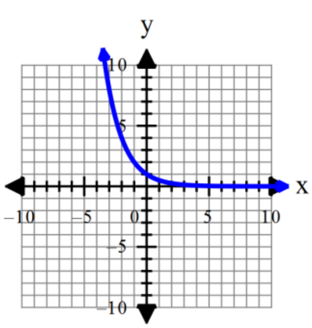

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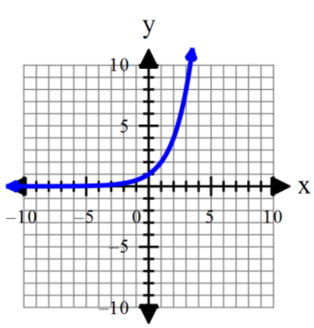

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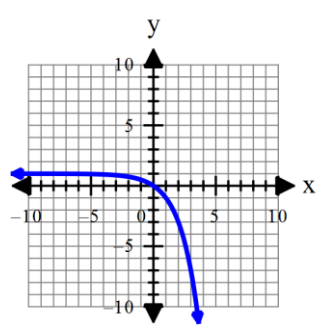

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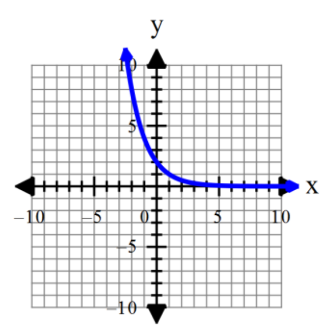
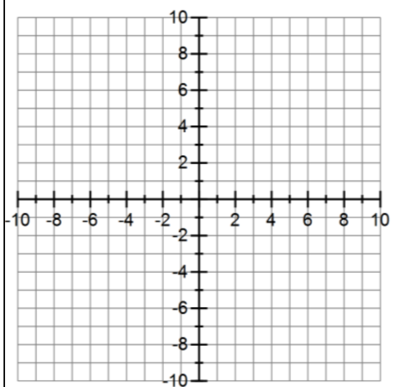


E. Graphing using transformations and 3 key points.

Examples: Use 3 key points and transformations to graph. (No Calculators!) Find domain, range, and horizontal asymptote.

a) Graph $f(x) = 3^x$.

a =



Domain:

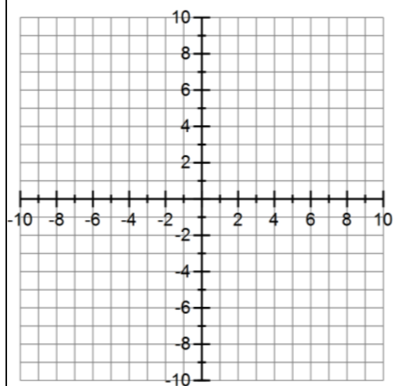
Range:

Horizontal asymptote:

Key points and transformations:

b) Graph $f(x) = 2 \cdot \left(\frac{1}{3}\right)^x$.

a =



Domain:

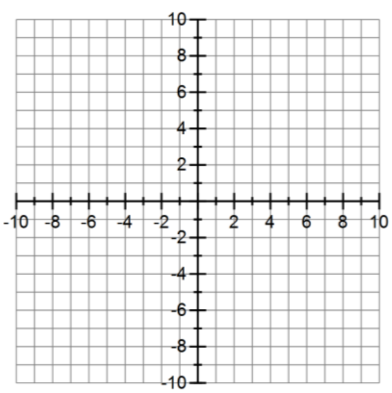
Range:

Horizontal asymptote:

Key points and transformations:

c) Graph $f(x) = 5^{x+3}$.

a =



Domain:

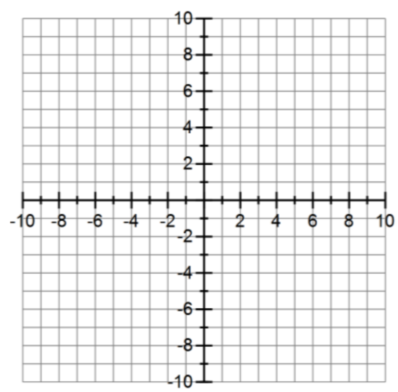
Range:

Horizontal asymptote:

Key points and transformations:

d) Graph $f(x) = \left(\frac{1}{2}\right)^x + 3$.

a =



Domain:

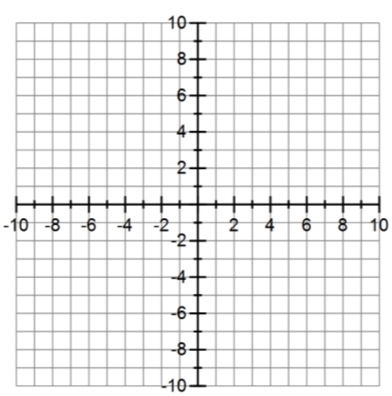
Range:

Horizontal asymptote:

Key points and transformations:

e) Graph $f(x) = 2^{-x}$.

a =



Domain:

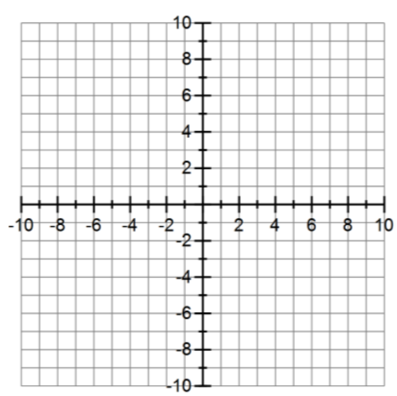
Range:

Horizontal asymptote:

Key points and transformations:

f) Graph $f(x) = -3^x$

a =



Domain:

Range:

Horizontal asymptote:

Key points and transformations:

F. Review finding domain algebraically

Domain is always ________________ unless there is a restriction.

The 3 types of restrictions are:

1.

2.

3.

EXAMPLES:

a. $f(x) = 3x + 4$

b. $f(x) = 5x^2 - 13x - 6$

c. $f(x) = 5\sqrt{x+4}$

d. $f(x) = \dfrac{5}{x+2}$

e. $f(x) = \dfrac{2x-3}{4x-1}$

f. $f(x) = (x+4)^3 - 8$

G. Stories

When the interest due at the end of a payment period is added to the principal so that the interest computed at the end of the next payment period is based on the new principal amount (old principal plus interest), the interest is said to have been ***compounded. Compound interest*** is interest paid on principal and previously earned interest.

Compound Interest Formula

The amount A after t years due to a principal P invested at an annual interest rate t compounded n times per year is $\boldsymbol{A = P \cdot \left(1 + \frac{r}{n}\right)^{nt}}$.

Continuous Compounding

The amount A after t years due to a principal P invested at an annual interest rate r compounded continuously is $\boldsymbol{A = Pe^{rt}}$.

Example: Investing $1000 at an annual rate of 9% compounded annually, semiannually, quarterly, monthly, and daily will yield the following amounts after 1 year:

Annual Compounding (*n* = 1):

Semiannual Compounding (*n* = 2):

Quarterly Compounding (*n* = 4):

Monthly Compounding (*n* = 12):

Daily Compounding (*n* = 365):

Continuously Compounding (use *e*):