	B) Initial Population = 20, Max Capacity (Limit to growth) = 100 Passing through (4, 75) 32. Exponential Growth: The population of River City in the year 1910 was 4200. Assume the population increased at a rate of 2.25% per year. a) Estimate the population in 1930. b) Predict when the population reached 20,000.
0, 5 20, 2.5 40, 1.25	$y = ab^x$ Example 4: Suppose the half-life of a certain radioactive substance is 20 days and there are 5 grams present initially. A) Express the amount of the substance remaining as function of time. $y = 5b^x$ B) Find the time when there will be 1 gram of the substance remaining. $2.5 = 5b^{20}$ $y = 5(.9659)^x$

$b^{20} = \frac{1}{2}$

$b = \sqrt[20]{\frac{1}{2}} = .9659$

$$S(t) = \frac{1200}{1+39e^{-.9t}}$$

Watauga High School has 1200 students. Bob, Carol, Ted and Alice start a rumor, which spreads logistically so that $S(t) = \frac{1200}{1+39e^{-0.9t}}$ models the number of students who have heard the rumor by the end of day t.

A) How many students have heard the rumor y the end of Day 0.

$$S(0) = \frac{1200}{1+39e^{-.9(0)}}$$

$$= \frac{1200}{40} = 30 \text{ students}$$

B) How long does it take for 1000 students to hear the rumor?

$$1000 = \frac{1200}{1+39e^{-.9t}}$$

$$t = 5.86$$

Use the data in the table and exponential regression to predict Dallas, TX population in 2015.

	L_1	L_2
1950	0	434,462
1960	10	679,684
1970	20	844,401
1980	30	904,599
1990	40	1,006,877
2000	50	1,188[redacted],589

3.3: Logarithmic Functions and their graphs

What you'll Learn About

Changing between Logarithmic and exponential form:

If $x > 0$, $b > 0$ and $b \neq 1$, then
$y = \log_b x$ if and only if $b^y = x$

Find the inverse function for $y = 2^x$

Properties:

If $x > 0$, $b > 0$ $b \neq 1$, and any real number y

- $\log_b 1 = 0$ because $b^0 = 1$
- $\log_b b = 1$ because $b^1 = b$
- $\log_b b^y = y$ because $b^y = b^y$
- $b^{\log_b x} = x$ because $\log_b x = \log_b y$

Evaluate the logarithmic expression without using a calculator

$a)\ \log_2 8 =$

$b)\ \log_3 \sqrt{3} =$

$c)\ \log_5 \frac{1}{25} =$

$d)\ \log_4 1 =$

$e)\ \log_7 7 =$

Evaluate the logarithmic expression without using a calculator

a) $\log 100 =$ 2

$10^x = 100$

b) $\log \sqrt[5]{10} =$ $\frac{1}{5}$

$10^x = \sqrt[5]{10}$

$10^x = 10^{1/5}$

c) $\log \frac{1}{100} =$ -2

$10^x = \frac{1}{100}$

d) $\ln \sqrt{e} =$ $\frac{1}{2}$

$e^x = \sqrt{e}$

$e^x = e^{1/2}$

e) $\ln e^5 =$ 5

$e^x = e^5$

f) $\ln \sqrt[5]{e} =$ $\frac{1}{5}$

$e^x = \sqrt[5]{e}$

$e^x = e^{1/5}$

Evaluate the logarithmic expression without using a calculator

a) $6^{\log_6 11} =$

$\underline{6}^{\log_{\underline{6}} \boxed{11}} = 11$

b) $10^{\log 6} =$

$\underline{10}^{\log 6} = 6$

c) $e^{\ln 4} =$

$e^{\ln 4} = e^{\log_e 4} = 4$

	Use a calculator to evaluate the logarithmic expression if it is defined and check your result by evaluating the corresponding exponential expression a) $\log 34.5 =$ b) $\log 0.43 =$ c) $\log(-3) =$ $10^x = -3$ d) $\ln 23.5 =$ e) $\ln 0.48 =$ f) $\ln(-5) =$ $e^x = -5$ Solve the equation a) $\log x = 3$ $10^3 = x$ $\log 1000 =$ $10^x = 1000$ b) $\log_2 x = 5$ $2^5 = x$ $32 = x$

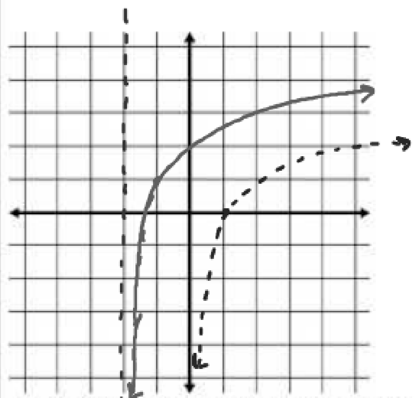
$\lim_{x \to -2} f(x) = -\infty$

$\lim_{x \to \infty} f(x) = \infty$

Describe how to transform the graph of y = ln x into the graph of the given function. Sketch the graph by hand.

a) $g(x) = \ln(x+2)+1$

Left 2 up 1



1) Determine the vertical asymptotes

$x = -2$

2) Determine the x-intercept

3) Determine the domain and range

D: $(-2, \infty)$

R: $(-\infty, \infty)$

4) Intervals of Increase or Decrease

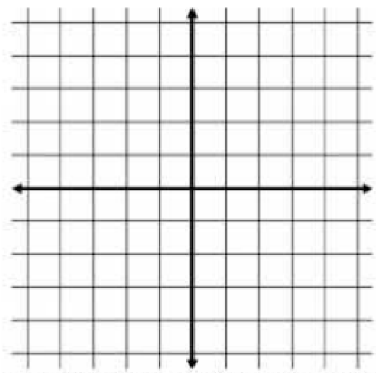
Inc $(-2, \infty)$

5) Determine the end behavior

6) Intervals of Concavity

Concave Down $(-2, \infty)$

b) $h(x) = \ln(3-x)$



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