$f(x) = ab^x$

Determine a formula for the exponential function whose values are given

20)

x	g(x)
-2	-9.0625
-1	-7.25
0	-5.8
1	-4.64
2	-3.7123

$a = -5.8$

$y = -5.8(0.8)^x$

$y = ab^x$

$y = -5.8b^x$

$\frac{-4.64}{-5.8} = \frac{-5.8b^1}{-5.8}$

$b = 0.8$

$y = ab^x$

Determine a formula for the exponential function whose points are given

21) (0, 4) (5, 8.05)

$a = 4$

$y = 4b^x$

$\frac{8.05}{4} = \frac{4b^5}{4}$

$\sqrt[5]{2.0125} = \sqrt[5]{b^5}$

$b = 1.15$

$y = 4(1.15)^x$

$y = \frac{max}{1+ab^x}$

Find the logistic function that satisfies the given conditions

A) Initial Value 6 (0,6): Max Capacity (Limit to growth) = 30 → max

Passing through (1, 15)

$6 = \frac{30}{1+ab^0}$

$6 = \frac{30}{1+a}$

$\frac{6(1+a)}{6} = \frac{30}{6}$

$1 + a = 5$

$a = 4$

$y = \frac{30}{1+4b^x}$

$(1+4b)(15) = \left(\frac{30}{1+4b^1}\right)(1+4b)$

$\frac{15(1+4b)}{15} = \frac{30}{15}$

$1 + 4b = 2$

$-1 \quad -1$

$4b = 1$

$b = \frac{1}{4}$

$y = \frac{30}{1+4(\frac{1}{4})^x}$

$y = \frac{100}{1+ab^x}$

$y = \frac{100}{1+4b^x}$

$y = \frac{100}{1+4(.537)^x}$

B) Initial Population = 20, Max Capacity (Limit to growth) = 100
Passing through (4, 75)

Find a Let $x=0$

$20 = \frac{100}{1+ab^0}$

$20(1+a) = 100$

$1+a = 5$

$a = 4$

$75 = \frac{100}{1+4b^4}$

$1+4b^4 = \frac{100}{75} = \frac{4}{3}$

$-1 \qquad -1$

$4b^4 = \frac{1}{3}$

$\sqrt[4]{b^4} = \sqrt[4]{\frac{1}{12}}$

$b = .537$

$y = ab^x$

$b = 1+r$

$r = \%$ of Growth as decimal

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

a) Estimate the population in 1930.

$y = 4200(1+.0225)^x$

$4200(1.0225)^x$

$= 4200(1.0225)^{20}$

6554

b) Predict when the population reached 20,000.

About 1981

$y = a(1+r)^x$ Growth

$y = a(1-r)^x$ Decay

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.

B) Find the time when there will be 1 gram of the substance remaining.

Watauga High School has 1200 students. Bob, Carol, Ted and Alice start a rumor, which spreads logistically so that

$S(t) = \dfrac{1200}{1+39e^{-0.9t}}$ 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.

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

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

1950	434,462
1960	679,684
1970	844,401
1980	904,599
1990	1,006,877
2000	1,1888,589

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 $b^y = x$

switch x + y

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

$x = 2^y = y = \log_2 x$

Read "log base 2 of 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) $\log_2 8 = 3$

$2^x = 8$

b) $\log_3 \sqrt{3} = \frac{1}{2}$

$3^x = \sqrt{3}$

$3^x = 3^{\frac{1}{2}}$

c) $\log_5 \frac{1}{25} = -2$

$5^x = \frac{1}{25}$

$5^{-2} = \frac{1}{5^2}$

$= \frac{1}{25}$

d) $\log_4 1 = 0$

$4^x = 1$

e) $\log_7 7 = 1$