

Logistic Function Student tns. Screens

1.1 1.2 1.3 1.4 ▶ RAD AUTO REAL

Logistic functions:

are of the form $y = \frac{c}{1 + ae^{-rx}}$,

where a, c and r are positive constants.

You will be investigating logistics functions as you graph various functions. You will discover properties of logistic functions.

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Graph $y = \frac{1}{1 + e^{-x}}$

Press Menu

1.1 1.2 1.3 1.4 ▶ RAD AUTO REAL

Press Menu

Graph $y = \frac{10}{1 + 5e^{-2x}}$

1.2 1.3 1.4 1.5 ▶ RAD AUTO REAL

Graph

$y = \frac{5}{1 + 10e^{-3x}}$

noting:

horz asyt

y-int

domain

Press Menu

1.3 1.4 1.5 1.6 ▶ RAD AUTO REAL

Graph

$y = \frac{100}{1 + 9e^{-2x}}$

note:

graph behavior

left to right

Press Menu

1.4 1.5 1.6 1.7 ▶ RAD AUTO REAL

Look at the graphs of the previous functions; determine the following in terms of the constants a and c.

horizontal asymptotes:

y-intercept:

domain:

range:

1.5 1.6 1.7 1.8 ▶ RAD AUTO REAL

Create a logistic function that has the following characteristics:

Horizontal asymptotes $y=0$ and $y=8$.

y-intercept (0,2)

Point of max growth (1.09861 2289,4)

Insert a graph and geometry page and graph the created function.

1.6 1.7 1.8 1.9 ▶ RAD AUTO REAL

Question

What is the domain and range of the logistic function graphed on previous page.

Answer

1.7 1.8 1.9 1.10 ▶ RAD AUTO REAL

Show solution steps on a notes page and a calculator page; then take the natural log of each side to solve the following equation:

$$\frac{50}{1 + 10e^{-3x}} = 40$$

The next page is partially completed to indicate how to show the steps.

1.8 1.9 1.10 1.11 ▶ RAD AUTO REAL

$$\frac{50}{1 + 10e^{-3x}} = 40 \quad m(1 + 10e^{-3x}) \text{ each side}$$

result: $50 = 40 + 400e^{-3x}$ s(40) each side

result: $10 = 400e^{-3x}$ d(400) each side

0/99

1.9 1.10 1.11 1.12 ▶ RAD AUTO REAL

Solve $\frac{10}{1 + 2e^{-4x}} = 9$

Insert a new page. Use a split layout showing step-by-step solution on the top using a notes application and final calculated result on the bottom using a calculator application.

1.10 1.11 1.12 2.1 ▶ RAD AUTO REAL

**Applications
involving
Logistic Functions**

1.11 1.12 2.1 2.2 ▶ RAD AUTO REAL

A prepared petri dish has a colony of bacteria growing in it.

The bacteria growth model is:

$$A = \frac{49.9}{1 + 134e^{-1.96t}}$$

where t is the elapsed time in days.

On the next page, graph and describe

1.12 2.1 2.2 2.3 ▶ RAD AUTO REAL

Graph of $y = \frac{49.9}{1 + 134e^{-1.96t}}$

Conclusions:

2.1 2.2 2.3 2.4 ▶ RAD AUTO REAL

Question

What does 49.9 probably represent?

Answer

2.2 2.3 2.4 2.5 RAD AUTO REAL

Question

What would the radius of the petri dish be?

Answer ▾

2.3 2.4 2.5 3.1 RAD AUTO REAL

Application
involving data of
sunflower growth

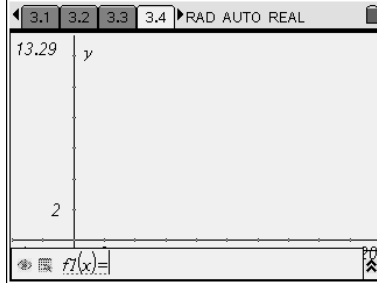
2.4 2.5 3.1 3.2 RAD AUTO REAL

The next page provides data, time is in weeks and height is in centimeters.

Draw a scatter plot, time versus height, and find the model function. Use discretion as to page layout (single page scatter plot or split page).

2.5 3.1 3.2 3.3 RAD AUTO REAL

	A t	B ht	C	D	E	F	G
1	0	18					
2	1	33					
3	2	56					
4	3	90					
5	4	130					
A7	0						



3.2 3.3 3.4 3.5 RAD AUTO REAL

Use the model function and a calculator application to find the y-intercept and the point of maximum growth.

Press Menu

3.3 3.4 3.5 3.6 RAD AUTO REAL

Question

How tall was the sunflower in $5\frac{1}{2}$ weeks?

Answer ▾

3.4 3.5 3.6 4.1 RAD AUTO REAL

Application
population comparing two models

3.5 3.6 4.1 4.2 RAD AUTO REAL

The population, pop, (in millions) of the US from 1800 to 1870 with time representing the number of years since 1800.

	A time	B pop	C
1	0	5.3	
2	10	7.2	
3	20	9.6	
4	30	12.9	
5	40	17.	
A7	0		

3.6 4.1 4.2 4.3 RAD AUTO REAL

Insert a new page,copy and paste the lists.

Use statistics regressions to find an exponential growth model and a logistic growth model for the population data.

Insert agraph and geometry and graph both models.

Use the features of nspire and the graph to answer the questions that follow.

4.1 4.2 4.3 4.4 RAD AUTO REAL

Question

Use both models to find when the population was about 108 million.

Answer ▾

4.2 4.3 4.4 4.5 RAD AUTO REAL

Question

The predicted population is 297.7 million in 2010, which model gives a closer value?

Answer ▾

4.3 4.4 4.5 4.6 RAD AUTO REAL

Discuss the point of maximum growth in the population problem. (You may insert a calculation page to show your calculations. The discussion should be in complete sentences on a note page.)