MATH 101
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Domain of Logarithmic functions. Exponential, Logarithmic and Logistic Regressions

Domain. Find the domain of:

a) $y = e^{2x} + 5e^x - 3$

b) $y = \frac{\log(x-2)}{x^2-9}$

c) $y = \frac{\log_3(x^2-4)}{x-3}$

d) $y = \frac{x-5}{\ln(x-2)}$

e) $y = \log(5-x) + \log_2(x-1)$

f) $y = \log(x-5) + \log_2(x-1)$

g) $y = \sqrt{5-x} + \log_2(x-1)$

h) $y = \log(\frac{(x-3)^3(x+5)}{(x-2)^4})$

i) $y = \ln(x^5 - 2x^4 - 8x^3)$

Regressions.

1. The table below shows the number of rabbits in a local forest from 1982 to 1996.

year	1982	1985	1988	1991	1994	1996
number of rabbits	20	67	139	182	196	198

   Find a logistic model to fit this data. In what year were there 99 rabbits?

2. The table below shows the concentration of a drug in a patients bloodstream t hours after it was administered.

time (hours)	0	1	2	3	4	5
concentration (mg/cc)	2.5	2.29	2.1	1.95	1.81	1.7

   Find the exponential model that fit this data. When will the concentration drop bellow 1.2 mg/cc?

3. A new drug was put on the market in 1990. The table below shows the number of prescriptions written for this drug over a 10 year period.

year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
numb. of prescr.	142	149	154	155	159	161	163	164	164	166

   Find a logarithmic model for this data. Using the model, how many prescriptions will be written in 2006? In what year will there be 178 prescriptions?

4. The table below shows the yield (in mg) of a chemical reaction in the first 6 minutes.

time (minutes)	1	2	3	4	5	6
yield (mg)	1.2	6.9	9.3	12.7	14.1	15.7

   Use the scatterplot to find the best model to fit this data. Using that model, determine in how many minutes will the yield be 20mg.

5. The table below shows the number of bacteria present in a culture t hours after the start of the experiment.

time (hours)	0	1	2	3	4	5
number of bacteria	250	342	521	736	1015	1483

Use the scatterplot to find the best model to fit this data. According to that model, how many bacteria will be in the culture in 7 hours? When will there be 5000 bacteria?

Solutions.

Domain. a) all real numbers b) $x > 2$ and $x \neq 3$ c) $x < -2$ or $x > 2$ and $x \neq 3$ d) $x > 2$ and $x \neq 3$ e) $1 < x < 5$ f) $x > 5$ g) $1 < x \leq 5$ h) $x < -5$ or $x > 3$ i) $-2 < x < 0$ or $x > 4$

Regressions. 1. In 1986. 2. 9.36 hours (approximately 9 hours and 20 minutes). 3. 172 prescriptions. In year 2021. 4. Logarithmic model. 10.34 min. 5. Exponential model. 3025 bacteria. 8.4 hours (8 hours 24 minutes).