Analysing Graphical Models

Learning Goals

- **able to determine the type of graph needed**
- **able to use table of values and graphs to solve real life questions**

Nov 12-9:36 AM

In the previous lessons we learned about linear, quadratic and exponential graphs.

How do we determine the type of graph we need using the table of values?

Type of Regression Model	Identifier in a Table of Values
Linear	1st diff are same
Quadratic	2nd diff are same
Exponential	common ratio

Nov 12-9:41 AM

Simple and Compound Interest

Simple interest

Compound Interest

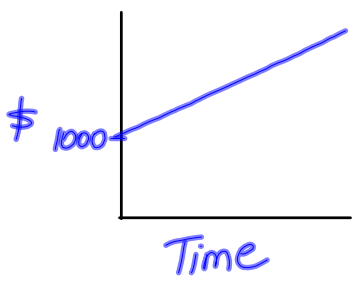
- interest is earned on the principal
and on the interest already earned

Nov 12-9:44 AM

Simple interest - $1000 invested at 10%

Year	Principal	Interest Earned	Amount at the End of the Year
1	1000	100	1100
2	1000	100	1200
3	1000	100	1300
4	1000	100	1400
5	1000	100	1500
6	1000	100	1600
7	1000	100	1700

1000 × 0.10

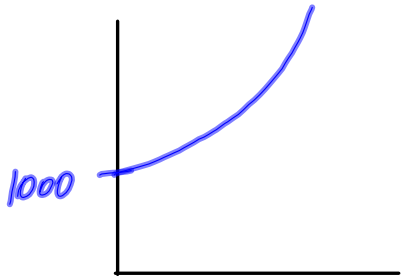


Nov 12-9:47 AM

Compound Interest - $1000 invested at 10% compounded annually

Year	Principal	Interest Earned	Amount at the End of the Year
1	1000	100	1100
2	1100	110	1210
3	1210	121	1331
4	1331	133.10	1464.10
5	1464.10	146.41	1610.51
6	1610.51	161.05	1771.56
7	1771.56	177.16	1948.72

1100 × 0.10



Nov 12-9:49 AM

Diagnosis of an Infection

An important part of medical diagnosis is detrmining the type of bacteria infecting a patient. Swabs ar taken from suspected areas of infection and sent ot a microbiology lab for testing. The bacteria are transferred to dishes containing nutrient-rich material and are allowed to grow.
Supposed that dish A is infected with 100 bacteria and dish B is infected with 200 bacteria. Both types of bacteria grow at a rate of 20%per day.

a. The initial difference in the population of bacteria in the two dishes is 100 bacteria. Predict whether this difference will remain constant as the bacteria multiply.

No, because 20% of 200 is larger than 20% of 100.

Nov 13-7:58 AM

b. Make a table of values for one week. Use the table to determine what kind of graph you will get.

Day	# of bacteria	1st differences	2nd differences	ratio
0	100			
1	120	20		
2	144	24	4	1.2
3	172.8	28.8	4.8	1.2
4	207.4	34.6	5.8	1.2
5	248.8	41.4	6.8	1.2
6	298.6	49.8	8.4	1.2
7	358.3	59.7	9.9	

not linear not quadratic exponential

Nov 13-8:10 AM

Day	# of bacteria	1st differences	2nd differences	ratio
0	200			
1	240			
2	288			1.2
3	345.6			1.2
4	414.72			1.2
5	497.66			1.2
6	597.2			1.2
7	716.6			

∴ exponential

c. Use your graphing calculator to make a graphfor both populations. (time goes on the x-axis)

d. Was your prediction correct?

e. Write an equation for the two situations.

$y = a b^{x}$ ← ~~time~~ growth/decay rate

↑ initial value

100 bacteria ⇒ $y = 100(1.2)^{x}$

200 bacteria ⇒ $y = 200(1.2)^{x}$

Nov 13-8:11 AM

Example: Electrical appliances such as a PS3 or a digital clock contain a capacitor for power during brief electrical outages. The table shows how the voltage in a capacitor decreases over time after a power outage.

Time (s)	0	2	4	6	8	10
Voltage (V)	9.0	7.0	5.2	3.9	3.0	2.3

What type of relationship seems to exist between voltage and time? Justify your answer.

Solution: To find out which regression model calculate the first differences, second differences, and growth/decay factor.

Time (s)	Voltage (V)	First differences	Second differences	Decay factors
0	9.0			0.77
2	7.0			0.74
4	5.2			0.75
6	3.9			0.77
8	3.0	2.3 − 3.0		0.77
10	2.3			

not linear

not quadratic

exponential

The first differences are different

The second differences are different

The decay factors are approximately same

This relationship appears to be exponential

Nov 25-10:56 AM

Seatwork

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Dec 4-8:16 AM