Lesson 5.4 Selecting a Regression Model

> **Goal:** **Select an appropriate regression model to analyze and predict behaviour of real-world situations**

Until now we were told which regression model to use to model data. In practical applications however, we may not know which model is most appropriate simply by looking at the data.

To help decide which model might be **best** to use when modeling data, you can:

1. Examine the first and second differences and the growth/decay factors

2. Create a scatter plot of the data

3. Look at the R^2 value of a regression model

Identifying Relationships in Data

EXAMPLE 1   Electrical appliances such as a VCR or 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.

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

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

Graph:

→ Definitely not linear

⇒ Try quadratic regression.
$$y = 0.045x^2 - 1.119x + 9.011$$
$$r^2 = 0.99969902 \leftarrow higher$$

⇒ Try exponential regression
$$y = 9.0559(0.871)^x$$
$$r^2 = 0.9994864399$$

∴ There appears to be a quadratic relationship.

Selecting a Model to Represent Data

EXAMPLE 2   In a science experiment, students punched a hole near the bottom of a 2-L pop bottle. They filled the bottle with water and measured how the water level changed over time. The results are shown in the table below.
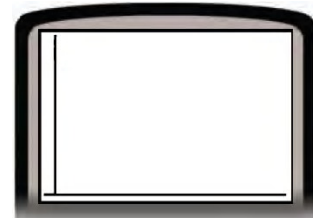
Time (s)	0	25	50	75	100
Water Level (cm)	30.0	22.3	16.1	11.2	7.8

a)   Use a **_graphing calculator_** to perform linear, quadratic, and exponential regressions on the data.

Some graphing pointers: Draw a sketch of all 3 graphs
- Turn Diagnostics On
- Store each equation in Y1, Y2, and Y3, respectively
- Set xMax = 200

LINEAR: R^2: 0.97777

$$y = -0.222x + 28.58$$

QUADRATIC: R^2: 0.9999927

$$y = 0.0011x^2 - 0.335x + 29.99$$

EXPONENTIAL: R^2: 0.9891455

$$y = 30.799(0.98656)^x$$

b)   Which model best represents the data? Justify your answer.

A quadratic model best represents the data (highest r^2 value)

c)   Determine the height of the hole in the bottle. Justify your answer.
Hint: Use the TRACE MINIMUM feature on the graphing calculator

The minimum height is about 5.2cm above the bottom of the bottle.

Practice: Page 323 #4 – 8, *10, *12   ***technology needed for questions marked with an asterisk**