# U5D8 - Regression Analysis

Saturday, November 18, 2017 12:35 PM

U5D8 - Regressio...

Unit 5 lesson 8 HW: pg. 316 #1, 2, 3, 5, 8

# Analyse Graphical Models

Date: _____

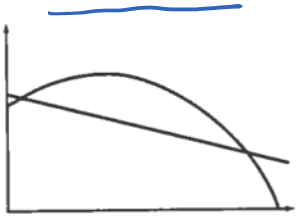
Section 5.4

1. Match each situation with its graph.
   a) The number of bacteria in Colony X remained the same over time. Colony Y started with 50 bacteria and doubled every half-hour. (C)

   b) Two cups of water were cooled in different controlled environments. Cup X cooled at a constant rate. The temperature of Cup Y decreased by one-half every 20 min.

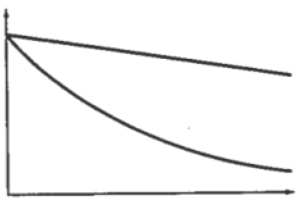
   c) Ball X rolled down a ramp. Ball Y was thrown from a point above the ground.

A



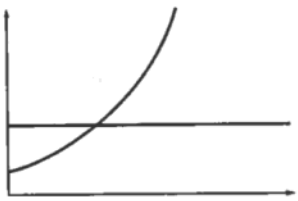
(c)

B



(b)

C



(a)

2. The population of Town X started at 90 000 and increased by 25 000 every year. The population of Town Y started at 4000 and doubled every year. Which statement is true?

   linear

   exponential growth

   A The population of Town X is always greater than the population of Town Y. X

   B The rate of change of the population of Town X is increasing. X

   C The rate of change of the population of Town Y is increasing. ✓ getting steeper.

   slope

   D The population of Town Y is greater than the population of Town X after 4 years. X

   see table next page

Date: _____

Section 5.4

3. Refer to question 2.
   a) Complete the table of values.

| Year | Town X Population | Town Y Population |
|---|---|---|
| 0 | 90 000 | 4000 |
| 1 | 115 000 | 8000 |
| 2 | 140 000 | 16 000 |

b

| | | |
|---|---|---|
| 1 | 115 000 | 8000 |
| 2 | 140 000 | 16000 |
| 3 | 165000 | 32 000 |
| 4 | 190 000 | 64 000 |
| 5 | 215 000 | 128 000 |
| 6 | 240 000 | 256 000 |

$y = a(b)^x$

b) Determine an equation to model the population of each town.

Town X: $y = 25000x + 90000$ Town Y: $y = 4000(2)^x$

c) In what year is the population of Town Y greater than the population of Town X?

In the 6th year, town Y will have a greater population.

4. Ing has the choice of two payment options for her new job.

**Option A:** Starting salary of $48 000, with a $1000 raise every following year.

**Option B:** Starting salary of $45 000, with a 2.5% raise every following year.

a) Complete the table of values.

↳ growth rate ... multiplying factor 102.5% ⇒ 1.025

$y = 45000(1.025)^x$

| Year | Option A Salary ($) | Option B Salary ($) |
|---|---|---|
| 0 | 48000 | 45000 |
| 1 | 49000 | 46125 |
| 2 | 50 000 | 47278 |
| 3 | 51 000 | 48460 |
| 4 | 52 000 | 49672 |
| 5 | 53 000 | 50913 |
| 6 | 54 000 | 52186 |
| 7 | 55 000 | 53491 |

$y = 1000x + 48000$

b) Which option should Ing choose? Why?

If she plans to stay at the job VERY long-term (35 or 40 years) option B is best for under 20 years option A is definitely better.

$x = 20$ $y = 68000$

$x = 20$ $y = 73737$

**Lesson 8: Analyzing Real Life Data -**
**Population of British Columbia**

| Year | Pop'n (millions) actual | 1st Diff | 2nd Dif | | Ratio |
|---|---|---|---|---|---|
| 1921 | 0.52 | | | | |
| 1931 | 0.69 | | | | |
| 1941 | 0.82 | | | | |
| 1951 | 1.17 | | | | |
| 1961 | 1.63 | | | | |
| 1971 | 2.18 | | | | |
| 1981 | 2.82 | | | | |
| 1991 | 3.37 | | | | |
| 2001 | 4.08 | | | | |

See next page

1. Complete the table above filling in the first and second differences and the ratios.

**Lesson 8: Analyzing Real Life Data - Population of British Columbia**

The data given below is the population of British Columbia since 1921

| Year | Pop'n (millions) actual | 1st Diff | 2nd Dif | Ratio |
|---|---|---|---|---|
| 1921 | 0.52 | | | |
| | | 0.170 | | |
| 1931 | 0.69 | | -0.040 | 1.33 |
| | | 0.130 | | |
| 1941 | 0.82 | | 0.220 | 1.19 |
| | | 0.350 | | |
| 1951 | 1.17 | | 0.110 | 1.43 |
| | | 0.460 | | |
| 1961 | 1.63 | | 0.090 | 1.39 |
| | | 0.550 | | |
| 1971 | 2.18 | | 0.090 | 1.34 |
| | | 0.640 | | |
| 1981 | 2.82 | | -0.090 | 1.29 |
| | | 0.550 | | |
| 1991 | 3.37 | | 0.160 | 1.20 |
| | | 0.710 | | |
| 2001 | 4.08 | | | 1.21 |

1. Complete the table above filling in the first and second differences and the ratios.
2. Which model fits the data the best?

***Regression Analysis: The regression equations for this data are given by:***

| | |
|---|---|
| linear | $y=0.0455x+.1007$ |
| quadratic | $y=0.0004x^2+0.0121x+0.4901$ |
| exponential | $y=0.5252(1.02718)^x$ |

where x is the number of years since 1921

$y = 0.0455(0) + .1007$
$y = 0.0455(10) + .1007$

3. Calculate the population for each year, using the given regression equations.

| Year | x | Actual Pop | Calculated Population | | |
|---|---|---|---|---|---|
| | | | Linear | Quadratic | Exponential |
| 1921 | 0 | 0.52 | 0.1007 | 0.4901 | 0.5252 |
| 1931 | 10 | 0.69 | 0.5557 | | |
| 1941 | 20 | 0.82 | | | |
| 1951 | 30 | 1.17 | | | |
| 1961 | 40 | 1.63 | | | |
| 1971 | | 2.18 | | | |
| 1981 | | 2.82 | | | |
| 1981 | | 3.37 | | | |
| 2001 | | 4.08 | | | |
| 2011 | | 4.40 | | | |

See next page

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where x is the number of years since 1921.

| Year | x | Actual Pop | Calculated Population | | |
|---|---|---|---|---|---|
| | | | Linear | Quadratic | Exponential |
| 1921 | 0 | 0.52 | 0.101 | 0.490 | 0.525 |
| 1931 | 10 | 0.69 | 0.556 | 0.651 | 0.687 |
| 1941 | 20 | 0.82 | 1.011 | 0.892 | 0.898 |
| 1951 | 30 | 1.17 | 1.466 | 1.213 | 1.174 |
| 1961 | 40 | 1.63 | 1.921 | 1.614 | 1.535 |
| 1971 | 50 | 2.18 | 2.376 | 2.095 | 2.007 |
| 1981 | 60 | 2.82 | 2.831 | 2.656 | 2.625 |
| 1991 | 70 | 3.37 | 3.286 | 3.297 | 3.432 |
| 2001 | 80 | 4.08 | 3.741 | 4.018 | 4.488 |
| 2011 | 90 | 4.40 | 4.196 | 4.819 | 5.868 |

Quadratic is the best fit (closest to actual data)

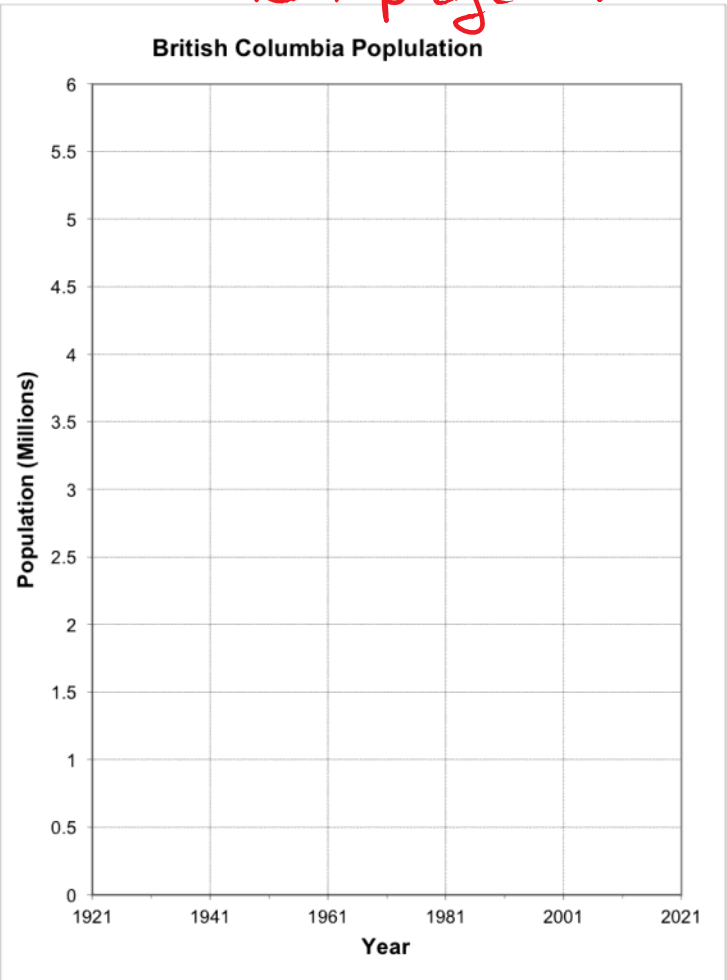
4. Estimate the population of BC in 2011. Then look up actual on-line. → 4.4 million

Using quadratic model $x=90$

$y=0.0004(90)^2+0.0121(90)+0.4901$ → 4.8 million

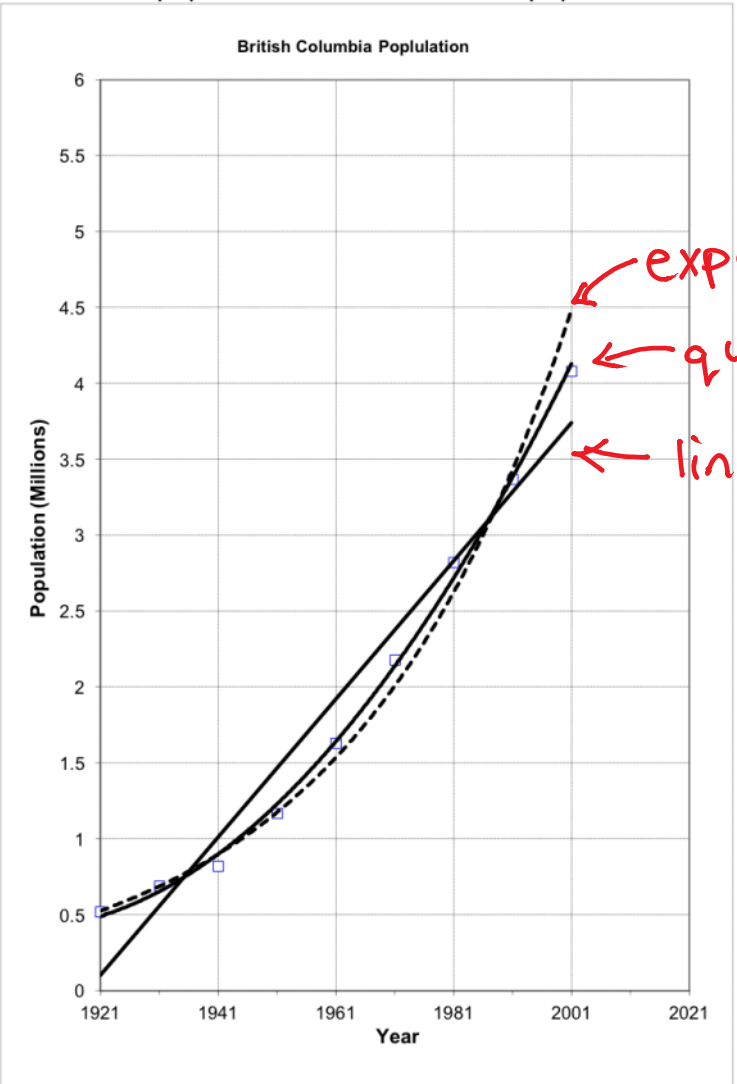
5. Plot the actual population and the calculated populations on the same graph.

See next page ...




6. Which equation best describes the relationship how the population of BC changes over time?

5. Plot the actual population and the calculated populations on the same graph.




6. Which equation best describes the relationship how the population of BC changes over time?

Quadratic most closely models the data.