5.3: Applications of Exponentials and Logarithms

Math 111

Objectives:

1. The importance of negotiation!
2. Comparing linear and exponential growth
3. Comparing exponential growth and exponential decay

***1. The Importance of Negotiation!***

According to a study by the National Association of Colleges and Employers, the average salary for a nursing graduate with a bachelor’s is $52,129.

Source: <http://www.cnn.com/2008/LIVING/worklife/04/28/cb.salaries.grads/index.html>

Imagine that Olivia and Ahmed both graduated with a B.S. in nursing in 2008 and go to work at Highline Hospital. Olivia is offered $45,000 per year and takes it. Ahmed negotiates his salary and starts at $55,000. Both receive a 5% raise each year. After 10 years how much higher will Ahmed’s salary be compared to Olivia? To answer this question, fill in the table below:

|  |  |  |
| --- | --- | --- |
| **Year** | **Ahmed’s Salary** | **Olivia’s Salary** |
| 0 | 55,000 | 45,000 |
| 1 |  |  |
| 2 |  |  |
| 3 |  |  |
| 4 |  |  |
| 5 |  |  |
| 6 |  |  |
| 7 |  |  |
| 8 |  |  |
| 9 |  |  |
| 10 |  |  |

Can you figure out how much higher Ahmed’s salary will be after 20 years compare to Olivia’s?

***2. Comparing linear and exponential growth***

Jill starts a job in 2005 and her salary per year can be modeled by where is the number of years after 2005. Allan’s salary can be modeled by  under the same conditions.

1. Fill out the following tables.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  |  |  |
| 0 |  |  | 0 |  |
| 1 |  |  | 1 |  |
| 2 |  |  | 2 |  |
| 3 |  |  | 3 |  |
| 4 |  |  | 4 |  |
| 5 |  |  | 5 |  |

 Table J Table A

1. Which table models a linear growth? How do you know? What is your slope?
2. Which table models the exponential growth? How do you know? What is your multiplier?
3. Explain each model in everyday language.
4. Findandthen explain what these numbers mean in everyday language.
5. Solve and then explain these numbers in everyday language.
6. Graph the two functions in the window [0, 100] x [53500, 300000]. What is the moral of the story?

***3. Comparing exponential growth and exponential decay***

China’s current population is 1.3 billion, with growing rate of 0.49% per year.

Source: <https://www.cia.gov/library/publications/the-world-factbook/geos/ch.html>

1. What is the mathematical model of this growth?
2. Sketch its graph.
3. What is the population of China in 100 years?
4. When does their population double?

Germany’s current population is 82 million, with growing rate of -0.06% (decay of 0.06%) per year. Source: <https://www.cia.gov/library/publications/the-world-factbook/geos/gm.html>

1. What is the mathematical model of this decay?
2. Sketch its graph.
3. What is the population of Germany in 100 years?
4. When does their population reduce to half of their current one?