Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Applied Discrete Math – Applying Sequences

**Tech Prep Applications**

**Clinical Laboratory Technologists**

***Profile:*** Clinical laboratory technologists perform tests on blood, other fluids and tissues. Some of these tests detect diseases, others check concentrations of substances like cholesterol, and still others test concentrations of medications to see how well a patient is responding to treatment. A laboratory technologist in a small lab may conduct a wide variety of tests; a technologist in a large lab may specialize in a specific area such as testing and preparing blood for transfusions or examining cells for signs of cancer.

Latanya is a microbiology technologist who specializes in testing for bacterial infections. She has noticed the number of cases for E. Coli, an organism associated with food poisoning, in the past few months, and she wonders if there has been a nationwide outbreak.

1) Nationwide statistics for this disease show that a total of 100 E. Coli cases had been detected up to the beginning of this week (week 1). Eighteen more cases were detected this week. So, at the beginning of the second week, Latanya can expect 118 cases.

 a) Suppose that the total number of cases is following an arithmetic sequence. What is $d, $the common difference, for this sequence?

b) Let $t\_{1}=100$. Write a formula for the arithmetic sequence.

c) Predict the total number of cases of E. Coli at the beginning of week 10.

d) Suppose that there are actually 261 cases at the beginning of week 10. Does it seem as if an arithmetic sequence is a good model for the total number of E. Coli cases? Explain.

e) Does there seem to an “outbreak” of E.coli infection? Explain.

2) By the beginning of week 16, a total of 533 cases of E. coli infection had been reported. Would this data suggest an unusual outbreak of infection? Explain.

Mark is a *cytotechnologist* who looks at slides for pre-cancerous cell. Cancer cells multiply much more rapidly than normal cells.

3) Suppose that, in the beginning stages of cancer, the number of cells in a tumor follows the growth pattern shown in the table below.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Day** | 1 | 2 | 3 | 4 | 5 | 6 |
| **Number of cancerous cells** | 15 | 45 | 135 | 405 | 1215 | 3645 |

 a) Write a formula for the number of cancerous cells present at day *n.*

 b) Predict the number of cancerous cells at day 9.

4) Since 1970, the number of malaria cases in a certain South American country has been growing geometrically. As part of a 6-year study of the disease, Melissa’s company has been employed to help analyze blood samples from this country. The presence of a particular parasite in a blood sample indicates that the patient has malaria.

Suppose that the number of malaria cases in the country was 856 in year 1 of a study and is growing at 9% per year.

 a) Write a formula for the number of malaria cases in year *n.*

b) Use the formula you wrote in part **a** to predict the number of malaria cases for year 4 of the study.

c) According to this model, what will the total number of malaria cases be for years 1 through 6 of the study? Explain.

Will works in the test laboratory of a drug company that produces antibiotics. He is studying how the amount of a particular antibiotic in a patient’s bloodstream changes over time.

5) Will’s tests indicate that the concentration of the antibiotic reaches a maximum one hour after it is administered. For a 2000 milligram dose, the concentration follows the sequence shown below.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Time (hours)** | 1 | 2 | 3 | 4 |
| **Concentration (micrograms per milliliter)** | 8 | 7.6 | 7.22 | 6.859 |

 a) Write a formula for the concentration of the antibiotic after *n* hours.

b) Use the formula you wrote in part **a** to predict that concentration of the antibiotic after 7 hours.

7) Will discovers that the antibiotic becomes ineffective when its concentration drops below 3 micrograms per milliliter. He recommends that the patient take a second dose of the antibiotic *one hour before* the concentration drops below this level. When should the next dose of the antibiotic be taken?

8) Explain why the next dose should be administered an hour *before* the antibiotic drops below 3 micrograms per milliliter.

9) The new antibiotic produced by Will’s company is effective in treating *campylobacteriosis*, a bacterial infection that can produce fever and abdominal pain. The number of cases of this disease for four consecutive years are given below.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Year** | 1 | 2 | 3 | 4 |
| **Number of cases** | 1445 | 1369 | 1117 | 968 |

a) Neither an arithmetic nor a geometric sequence models this data exactly. Which do you think is a *better* model for the data? Justify your answer.

b) Based on your answer to part **a**, give the formula for the geometric or arithmetic sequence to model this data.