Name: _____ Date: _____

## 5.6 Use Sinusoidal Functions to Model Periodic Phenomena Not Involving Angles

**BLM 5–11**

**1.** A sine graph can be used to model how light travels. Green light completes one full cycle in 530 nm (a nanometre is $10^{-9}$ metres). Yellow light completes one full cycle in 580 nm, and red light completes one full cycle in 720 nm. The amplitude is a measure of how bright the light shines. Assume that the three colours are equally bright (use an amplitude of 1 for each).

**a)** Write each colour as a sine function, using nanometres as units.

**b)** Graph all three functions on the same set of axes from $x = 0$ to $x = 2000$.

**c)** Estimate the number of cycles each function has in this interval.

**d)** Use this to explain why red light experiences the smallest path change when passing through a prism.

**e)** Based on your answer in part d) which of the other two colours should experience a greater path change?

**2.** A wave pool at an amusement park sends out a 5-m high wave every minute.

**a)** What is the amplitude of the wave?

**b)** What is the period of the wave?

**c)** Model the wave using a cosine function.

**d)** Graph the function from $t = 0$ to $t = 6$.

**e)** Explain why a cosine function is the best choice for the situation.

**3.** The amount of sunlight a city gets can be modelled with the function $h = 4\sin\left[\frac{72}{73}(n-80)\right] + 12$, with $h$ representing the number of hours of sunlight on the $n$th day of the year.

**a)** What is the period of the function?

**b)** Determine the maximum and minimum number of hours of sunlight the city gets.

**c)** How much sunlight does the city get on the 21st of February?

**d)** How much sunlight will the city get tomorrow?

**4.** The fraction of the moon that is visible on a clear night is recorded.

| Day of the Year | Fraction Visible |
|---|---|
| 1 | 0.24 |
| 2 | 0.17 |
| 3 | 0.1 |
| 4 | 0.05 |
| 5 | 0.03 |
| 6 | 0.00 |
| 10 | 0.1 |
| 15 | 0.56 |
| 20 | 0.97 |
| 21 | 1.00 |
| 25 | 0.81 |
| 30 | 0.33 |
| 35 | 0.03 |
| 40 | 0.15 |
| 45 | 0.67 |
| 50 | 1.00 |
| 55 | 0.75 |
| 60 | 0.30 |
| 65 | 0.02 |
| 66 | 0.00 |

**a)** Graph the data.

**b)** Determine the equation of a sinusoidal function that can be used to describe the data.

**c)** Display a graph of the data and the sinusoidal function on the same set of axes.

**d)** Comment on the fit of the function.

**5.** The rabbit population in a large wooded area is given by the function $R = 2000 \cos 15t + 4000$, and the fox population in the same area is given by the function $F = 250 \sin 15t + 500$.

**a)** What property do the two functions have in common?

**b)** Create a graph with the two functions on the same set of axes for $t = 0$ to $t = 24$.

**c)** Explain the behaviour of the two graphs.




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