Trig Modelling Practice

The following problems are snippets from the textbook with the core function erased. Determine the general function for them, use the function to predict a value, and use the function to solve a problem.

1.
   a. A point on saw blade experiences motion around a circle with radius r. It makes n rotations per second. The blade sits so that the center is d units below the top of the table. Determine a function for the height of the point at time t. State the mapping notation of your function and describe its domain.

   b. If the radius is 10 cm and it sits 8 cm below the top of the table, what percentage of one rotation will the point be above the table?

2.

a. A satellite follows a sinusoidal path over the Earth in orbit. It takes the satellite m minutes to orbit the Earth. On one side of the Earth, it reaches a maximum height of h_1 (km) and on the opposite side is reaches a min height of h_0 (km). At t_0 minutes after noon, the satellite is at the min height. Determine a function for the height of the satellite at time t. State the mapping notation of your function and describe its domain.

b. If $m = 200$ minutes, $h_1 = 300$ km and $h_0 = 220$ km, and at $12{:}47$ pm the satellite is at the min height, determine the intervals of time from midnight to 6:00 am of that day that the satellite was more then 280 km above the Earth.

3.

a. The population of foxes in a region cycles from a minimum P_0 to maximum P_1 during a m month period (that is from P_0 to P_1 in m months). The population starts at P_1 on the first of month m_0. Determine a function for the population of foxes at time t in months. State the mapping notation of your function and describe its domain.

b. If $P_0 = 600$ and $P_1 = 1600$, $m = 12$ months, and m_0 is March 2020, determine the approximate dates between Jan 1, 2020 to December 31, 2024, the population of foxes is greater than 1000.

4.

a. The altitude of the Sun follows a sinusoidal path. The maximum altitude it reaches is θ_1 degrees above the horizon at time t_1 (hours). The lowest it reaches is θ_2 degrees below the horizon at time t_2 (hours). Determine a function for the height of the Sun as a function of time t. State the mapping notation of your function and describe its domain.

b. If $\theta_1 = 63°$ at 1:10 pm on June 3, 2021 and $\theta_2 = -18°$ at 1:10 am on June 4, 2021. Then Determine the time of sunrise and sunset on June 4, 2021.

5.

a. Daily temperature follows a sinusoidal curve. In Vancouver, it reaches a minimal temperature of T_0 degrees Celsius at time t_0 and a maximal temperature of T_1 at time t_1. Determine a function for the temperature as a function of the time t. State the mapping notation of your function and describe its domain.

b. If $T_0 = 15°C$ at 6:00 am and $T_1 = 28°C$ at 6:30 pm. Then determine the interval of times in the day when the temperature is above 5°C.

Generalize the scenarios in the textbook page 278-280 # 17-23. Think about a problem you could ask about them.