TASK: We are continuing our work with modeling trig functions in the real world today. The regents like to ask multiple questions on this topic, sometimes just asking for a key feature or asking you to graph the function and more. Complete the problem set below of a variety of mostly regents questions analyzing the real world trig model to determine a key feature.

1. A sine function increasing through the origin can be used to model light waves. Violet light has a wavelength of 400 nanometers. Over which interval is the height of the wave *decreasing*, only?

(1) (0, 200) (2) (100, 300) (3) (200, 400) (4) (300, 400)

2. The height above ground for a person riding a Ferris wheel after t seconds is modeled by $h(t) = 150\ sin\ (\frac{\pi}{45}t + 67.5) + 160$ feet. How many seconds does it take to go from the bottom of the wheel to the top of the wheel?

(1) 10 (2) 45 (3) 90 (4) 150

3. Based on climate data that have been collected in Bar Harbor, Maine, the average monthly temperature, in degrees *F*, can be modeled by the equation $B(x) = 23.914sin(0.508x - 2.116) + 55.300$. The same governmental agency collected average monthly temperature data for Phoenix, Arizona, and found the temperatures could be modeled by the equation $P(x) = 20.238sin(0.525x - 2.148) + 86.729$. Which statement can not be concluded based on the average monthly temperature models *x* months after starting data collection?

(1) The average monthly temperature variation is more in Bar Harbor than in Phoenix.
(2) The midline average monthly temperature for Bar Harbor is lower than the midline temperature for Phoenix.
(3) The maximum average monthly temperature for Bar Harbor is 79° *F*, to the nearest degree.
(4) The minimum average monthly temperature for Phoenix is 20° *F*, to the nearest degree.

4. A person's lung capacity can be modeled by the function $C(t) = 250sin\ (\frac{2\pi}{5}t) + 2450$, where $C(t)$ represents the volume in mL present in the lungs after *t* seconds. State the maximum value of this function over one full cycle, and explain what this value represents.

5. Griffin is riding his bike down the street in Churchville, NY at a constant speed, when a nail gets caught in one of his tires. The height of the nail above the ground, in inches, can be represented by the trigonometric function $f(t) = -13cos(0.8\pi t) + 13$, where t represents the time (in seconds) since the nail first became caught in the tire.

(a) Determine the period of $f(t)$. (b) Interpret what the period represents in this context.

6. The height of a yo-yo above the ground can be well modeled using the equation $h = 1.75\cos(\pi t) + 2.25$, where h represents the height of the yo-yo in feet above the ground and t represents time in seconds since the yo-yo was first dropped from its maximum height.

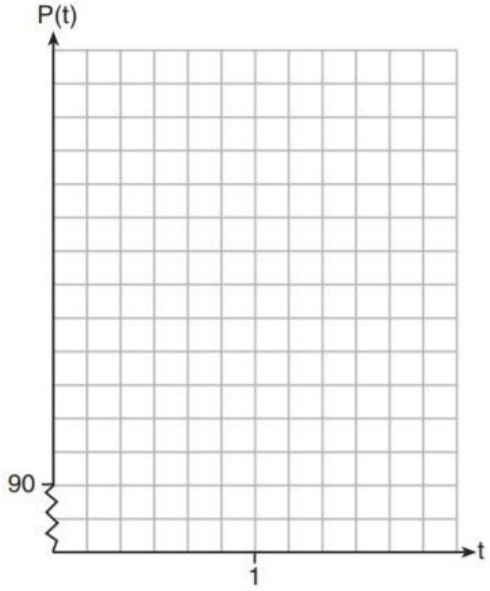
(a) Determine the maximum and minimum heights that the yo-yo reaches above the ground. Show the calculations that lead to your answers.

(b) How much time does it take for the yo-yo to return to the maximum height for the first time?

7. The resting blood pressure of an adult patient can be modeled by the function P below, where $P(t)$ is the pressure in millimeters of mercury after time t in seconds.

$$P(t) = 24\cos(3\pi t) + 120$$

On the set of axes below, graph $y = P(t)$ over the domain $0 \le t \le 2$.



(b) Determine the period of P. Explain what this value represents in the given context.

(c) Normal resting blood pressure for an adult is 120 over 80. This means that the blood pressure oscillates between a maximum of 120 and a minimum of 80. Adults with high blood pressure (above 140 over 90) and adults with low blood pressure (below 90 over 60) may be at risk for health disorders. Classify the given patient's blood pressure as low, normal, or high and explain your reasoning.