MATH 101
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Function Applications

1. The number of bacteria in a colony after t hours is given by $f(t) = t^2 + 8t + 2000$, $0 \leq t \leq 24$, where t is the number of hours since the colony was established and $f(t)$ is the number of bacteria. How many bacteria are there after 3 hours? When will the number of bacteria be 2020?

2. The number of milligrams of cholesterol consumed each day per person in the United States can be modeled by $0.11x^2 - 4.04x + 445.02$, $1 \leq x \leq 23$ where x represents the number of years since 1974 and $f(x)$ represents the amount of cholesterol consumed each day per person. How many milligrams per person is consumed in 1982? In what year is the amount of cholesterol consumed each day per person minimal?

3. An object is thrown upward. Its height after t seconds is given by $h(t) = 32t - 16t^2$ where the height is given in feet. What is the maximum height of the object? At what time will object hit the ground? What are domain and range of this function?

4. The weight (in grams) of a human brain during the last trimester of gestation and the first two years after birth can be approximated by function $w(x) = \frac{x^3}{100} - \frac{1500}{x}$ where x is circumference of the head in cm. What is the approximate weight of brains with a circumference of 30 cm? If an infant brain weights 700 g, what is the circumference of the head? What is the domain of this function?

5. The function $A(x) = -0.015x^3 + 1.058x$ gives the approximate alcohol concentration (in tenth of percent) in an average person's bloodstream x hours after drinking about eight ounces of 100-proof whiskey. The function is approximately valid for x in interval [0,8]. At what time is the concentration maximal? What is the maximal concentration? In many states, a person is legally drunk if the blood alcohol concentration exceeds .08%. Estimate the period when person is legally drunk.

6. Researchers are monitoring the blood flow through the splenic artery of fetuses. They have found that the index of splenic artery resistance is given by the formula $y = .057x - .001x^2$, where x is the number of weeks of gestation. After how many weeks is the splenic artery resistance 0.5? What is the splenic artery resistance in the 20th week of gestation? What are domain and range of this function?

Solutions.

1. 2033 bacteria. After 2 hours.

2. 419.74 mg/person. Min. value at $x = 18$ approx. which corresponds to year 1992.

3. Maximum height is 16 feet. It will hit the ground after 2 sec. Domain [0,2], range [0,16].

4. 220 grams. Approx. 42 cm. Domain: $x \geq 19.68$ cm.

5. Maximal concentration is .3%. It is reached 4.8 hours after consuming whiskey. Person is legally drunk approximately between 45 minutes and 8 hours after consuming whiskey.

6. The splenic artery resistance is .5 in 11th week (solution $x = 46$ is discarded because 46 weeks is not a reasonable pregnancy). In the 20th week of gestation the splenic artery resistance is .74 . Domain [0, 40], range [0, .81].