Algebra II checkpoint examples

Benchmark 1

1. A 40-ounce solution that is 45 percent acid has x ounces of pure acid added to it. The researcher uses the expression $\frac{0.45(40)+x}{40+x}$ to answer some questions about the situation.

   a. What does the expression $40+x$ represent in the situation?

   b. What does $0.45(40)+x$ represent in the situation?

2. A box in the shape of a rectangular prism has a width that is 5 inches greater than the height and a length that is 2 inches greater than the width. Write a polynomial expression in standard form for the volume of the box. Explain the meaning of any variables used.

Benchmark 2

1. Darah has 200 milliliters of a salt and water solution that is 12% salt. She begins to add a salt and water solution that is 5% salt to the 12% solution. The percent of salt in Darah's combined solution when x milliliters of the 5% solution have been added can be modeled by $C(x) = \frac{2,400 + 5x}{200 + x}$.

   Two different tables of values for $C(x)$ are given below. Use the tables to answer the questions that follow.

x	$C(x)$
50	10.6
100	9.67
150	9.0
200	8.5
250	8.11
300	7.8
350	7.55
400	7.33
450	7.15
500	7.0

x	$C(x)$
500	7.0
1,000	6.17
5,000	5.27
10,000	5.14
50,000	5.03
100,000	5.01
1,000,000	5.001

   Part A Is the function increasing or decreasing? What does this mean in the context of the problem?

   Part B What is the horizontal asymptote of the functions? Interpret the meaning of the asymptote in the context of the problem.

2. At a diving competition, Holly jumps from a springboard that is 3 meters above the surface of the water at time $t = 0$ seconds. She reaches a maximum height of 4.5 meters above the surface of the water after 0.5 seconds and enters the water 1.5 seconds after jumping. She then sinks to a minimum height of 1.5 meters below the surface of the water 1 second after entering the water and rises back to the surface of the water 2.5 seconds later.

   Sketch a possible graph of Holly's height above the water, *h*, from the time she jumps until she rises to the surface of the water. Provide labels and scales for the axes.

Benchmark 3

1. A ball is dropped, and for each bounce after the first bounce the ball reaches a height that is a constant percent of the preceding height. After the first bounce it reaches a height of 10 feet, and after the third bounce it reaches a height of 4.9 feet.

   Part A: The height the ball reaches after the *n*th bounce is represented by a_n below. Write the value for each a_n below.

   $a_1 = 10$ feet
   $a_2 =$ ______
   $a_3 = 4.9$ feet
   $a_4 =$ ______
   $a_5 =$ ______

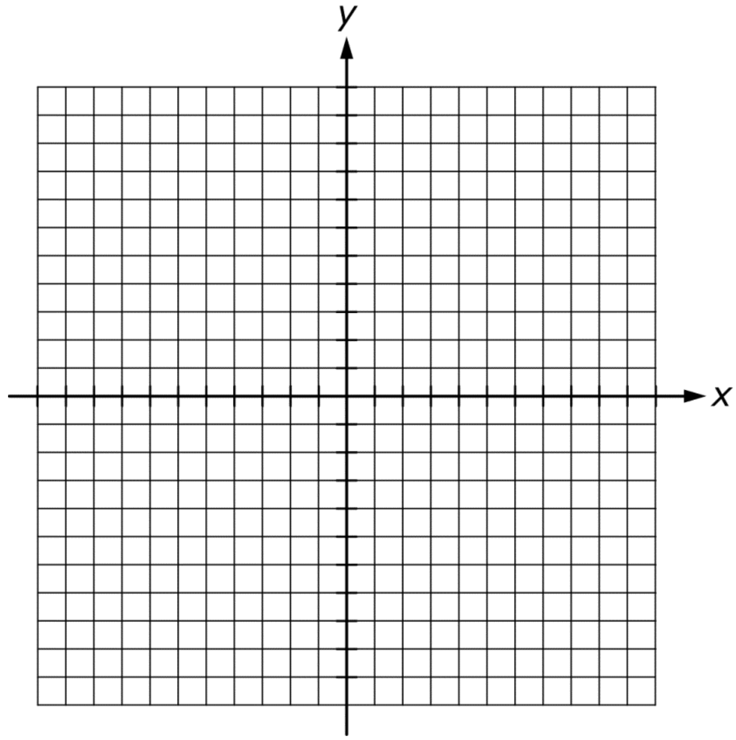
   Part B: Write an explicit rule for the height after the *n*th bounce, a_n, where n represents the bounce number.

   Explicit rule: ____________________

2. The area of a rectangular garden is expressed by the function $A(x) = x(8 - x)$, where the length of the garden is x feet and the width of the garden is $(8 - x)$ feet.

   Part A: What values of x make sense in the context of the problem?

   Part B: Graph the function $A(x)$ in the coordinate plane below for the x-values you identified in Part A.



Part C: What are the dimensions of the garden that will result in the maximum possible area?

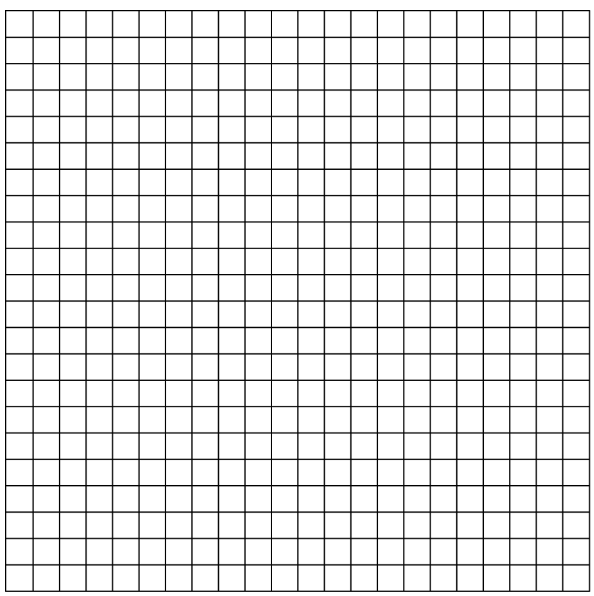
Benchmark 4

1

$$h(x) = \begin{cases} 3 & 0 \le x < 10 \\ \frac{1}{3}(x-1) & 10 \le x < 28 \\ 9 & 28 \le x \le 50 \end{cases}$$

A person standing at the wall at the shallow end of an empty swimming pool begins walking toward the wall at the deep end of the pool. The height from the bottom to the top of the swimming pool varies depending on the number of feet, x, the person has walked away from the wall at the shallow end. The function $h(x)$ above gives the height, in feet, from the bottom to the top of the pool, where x is measured in feet.

Part A: Graph the function $h(x)$ on the coordinate plane below.



Part B: Describe the change in the height of the pool as the person walks 50 feet from the wall at the shallow end toward the wall at the deep end.

2.An object is dropped from a height of 1,000 feet. The distance $s(t)$, in feet, that the object has fallen after t seconds can be modeled by the function $s(t) = 16t^2$.

Part A: Write a function that relates the height of the object above the ground to the time that the object has been falling.

Part B: At what time is the height 0 feet?