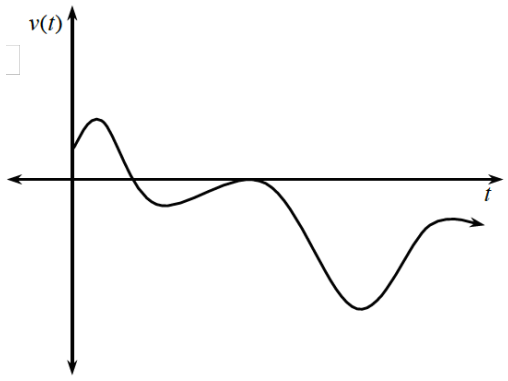
Homework #18

First & Last Name: _____ **Class:** _____

For homework to be graded, it must be *fully completed*. This means you must **show your work**.

1. The graph below represents the velocity of an object as a function of time. Redraw it on your paper.



- **a.** Put a star (*) at the point where velocity is the greatest.
- **b.** With another color, sketch a graph of the speed on the same set of axes.
- **c.** Indicate with a double star (**) the position where speed is the greatest.
- **d.** Explain why the greatest velocity and the greatest speed do not occur at the same position.
- **e.** Sketch a new graph where speed and velocity have the same maximum value.

2. Marni loves pancakes and likes to eat them in a tall stack. Assume that she always makes 8 pancakes each with a thickness of inch.

- **a.** Last Saturday, Marni decided to make square pancakes. If the largest pancake had an edge of 9 inches and each pancake had an edge 1/4 inch shorter than the one below it, calculate the volume of pancakes Marni ate last Saturday.
- **b.** Next Sunday, Marni will make circular pancakes. Each pancake will have a diameter 1 inch smaller than the one below it and the smallest pancake will have a radius of 2 inches. How much volume is Marni planning to eat?

3. Theo lost his graph again! Luckily, he used his distance-time graph to determine the following properties of his motion. Help him re-create a possible graph of his motion. Desmos (desmos.com/calculator/nncakzgm7p).
Details:

- He walked in one direction during the entire 5 seconds, except during the 2 seconds when he was temporarily still.
- His average velocity was –2 feet per second.
- He began his motion 12 feet away from the motion detector.

4. As a cheetah runs, its velocity is given by where $v(t)$ is measured in feet per second.

$$v(t) = \begin{cases} 12\,t^2 & \text{for } 0 \le t \le 2 \\ -t^2 + 52\,t - 52 & \text{for } t > 2 \end{cases}$$

- **a.** Sketch a graph of the cheetah's velocity.
- **b.** Approximately how fast is the cheetah running at $t = 1$ second? How did you get your answer?
- **c.** To catch prey, such as an antelope, the cheetah runs for 3 seconds. Approximately how far does the cheetah need to run to catch its prey? Describe your method.
- **d.** **[Challenge]** Annalou the Antelope standing 50 feet north of the Great Pond. The cheetah spots Annalou and runs south in a direct line towards her, catching her in exactly 3 seconds. What was the cheetah's initial position relative to the pond?

5. **[Challenge]** Rewrite $f(x) = |x^2 - 4| + 1$ as a piecewise-defined function. State the domain and range of f using interval notation.

6. Write an equation for the end-behavior function of $f(x) = \frac{x^3+3x^2-4x-1}{x^2-1}$. Then, write a complete set of approach statements for f.

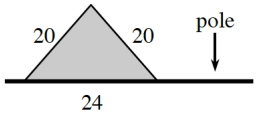
7. **[Challenge]** Solve the following equations for all values of x in the domain $[0,\ 2\pi)$. Use exact values.

a. $\sin(2x) = \sin(x)$

b. $\sin(x+\pi) + \cos\left(x - \frac{\pi}{2}\right) = 1$

c. $\cot(x) - \tan(x) = 2\sqrt{3}$

8. The shaded region below represents a triangular "flag".
To help you visualize this, use Desmos (desmos.com/calculator/yv6wntzdze).



a. Imagine rotating this flag about its "pole" and describe the resulting three-dimensional figure. Draw a picture of this figure on your paper.

b. Calculate the volume of the rotated flag.

9. Let $g(x) = (3x-1)^2$.

a. What is $g(-5)$?

b. Write an expression for $g(a+1)$ and simplify.

c. If $g(x) = 49$, what are the possible values of x?

d. Write an equation for $g^{-1}(x)$.