

Name:

Date:



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Spinner Rotation vs Time - Integral

The tasks in this handout refer to three outside resources: 1) the Spinner Simulator; 2) the Spinner Simulation Tasks; and 3) the Spinner Rotation Videos. These resources can be found online at the Spinner Math homepage at <http://www.harryomalley.com/spinnermath>.

Math To Simulations To Words

Let x = time, in seconds and $f(x)$ = spinner rotation, in degrees. Let $\int 30 dx$, $0 \leq x \leq 5$ describe the relationship between rotation and time for the spinner. Using the Spinner Simulator, find the value of $f(0)$, $f(1)$, $f(2)$, $f(3)$, $f(4)$, and $f(5)$ and be prepared to explain the meaning of the input and output for each. You will have to input the expression as **integral[30]**. Fill out your answers in the table below.

x	$f(x)$
0	
1	
2	
3	
4	
5	

Without pressing the Play button on the Spinner Simulator, try using the data in the table to describe, in your own words, what the spinner does from 0 to 5 seconds.

Press the play button on the Spinner Simulator to watch what the spinner does. Add more detail to your description below based on anything new that you notice from the simulation:

Words to Words

Each of the following shows precise and accurate language to use when describing a spinner that is spinning according to the functions in this module. For each one, read it and rehearse it in your head until you think you can re-write it without looking at it. Then try to write it. Only look if you really need to.

1. A spinner's rotational speed remains at a constant 20 degrees per second from 0 seconds to 5 seconds.
2. A spinner's rotational speed increases linearly from 0 degrees per second to 56 degrees per second from 0 seconds to 8 seconds.
3. A spinner's rotational speed decreases quadratically from 160 degrees per second to -36 degrees per second from 0 seconds to 7 seconds. At 7 seconds, the speed reverses direction and begins to increase quadratically from -36 degrees per second to 108 degrees per second from 7 seconds to 13 seconds.

Math to Simulation to Words

Mentally predict what each of the following simulations will do. Then simulate each one. Finally, for each one, describe the rotation of the spinner over time in words.

4. $\int 120 \, dx$, $0 \leq x \leq 10$

5. $\int 15x \, dx$, $2 \leq x \leq 8$

6. $\int 20(x - 6)(x - 8) \, dx$, $4 \leq x \leq 10$

Words to Math to Simulation

Translate the following descriptions into mathematical functions. Verify your results by simulating them.

7. A spinner's rotational speed remains at a constant 128 degrees per second from 13 seconds to 33 seconds.

8. A spinner's rotational speed increases linearly from 0 degrees per second to 81 degrees per second from 0 seconds to 9 seconds.

9. A spinner's rotational speed decreases quadratically from 450 degrees per second to -30 degrees per second from 0 seconds to 6 seconds. At 6 seconds, the speed reverses direction and begins to increase quadratically from -30 degrees per second to 1050 degrees per second from 6 seconds to 12 seconds.

10. A spinner's rotational speed increases quadratically from -1280 degrees per second to 160 degrees per second from 8 seconds to 14 seconds. At 14 seconds, the speed reverses direction and begins to decrease quadratically from 160 degrees per second to -1280 degrees per second from 14 seconds to 20 seconds.

Simulation to Simulation

Problems 11-14 involve completing the 4 Integral Spinner Simulation Tasks online. The answer to each puzzle is a function. Once you've solved each puzzle, record the answer function below.

11. _____

12. _____

13. _____

14. _____

Concrete to Words

Problems 15 and 16 involve watching the Integral Spinner Rotation Video. In the video, there are two different spinner rotation sequences. Describe each rotation sequence in words.

15. Description of the first spinner movement:

16. Description of the second spinner movement:

Concrete to Math to Simulation

Problems 17 and 18 involve watching the Integral Spinner Rotation Video. In the video, there are two different spinner rotation sequences. Write a function to describe each. Verify your results by simulating them.

17. Function for the first spinner movement:

18. Function for the second spinner movement:

Concrete to Concrete

Problems 15 and 16 involve watching the Integral Spinner Rotation Video and trying to copy what you see using your own fidget spinner and straw. For best results controlling the spinner with your straw, use a flexible elbow straw. Lay the straw flat on the surface that the spinner is on and bend the elbow up to blow. Having the straw laying flat on the surface makes controlling the spinner a lot easier.

19. I recreated the first spinner movement:



20. I recreated the second spinner movement:



Math to Concrete

Using a real fidget spinner, translate the following math functions into reality. Check off each one when you finish.

21. $\int 720 dx, 0 \leq x \leq 7$

22. $\int -7200 dx, 0 \leq x \leq 6$

23. $\int -200x dx, 0 \leq x \leq 5$

24. $\int 20(x - 3)(x - 5) dx, 0 \leq x \leq 8$

Words to Concrete

Translate the following descriptions into reality. In other words, make your spinners do what these words describe. Check off each one when you finish.

25. A spinner's rotational speed remains at a constant 1080 degrees per second from 0 seconds to 10 seconds.

26. A spinner's rotational speed remains at a constant -540 degrees per second from 0 seconds to 15 seconds.

27. A spinner's rotational speed increases linearly from 0 degrees per second to 1800 degrees per second from 0 seconds to 6 seconds.

28. A spinner's rotational speed decreases quadratically from 375 degrees per second to -25 degrees per second from 0 seconds to 4 seconds. At 4 seconds, the speed reverses direction and begins to increase quadratically from -25 degrees per second to 375 degrees per second from 4 seconds to 8 seconds.

Manifest

Create your own spinner rotation. Describe it in words and math symbols. Then simulate it and make it a reality with your spinner. Post your results at #spinnermath!