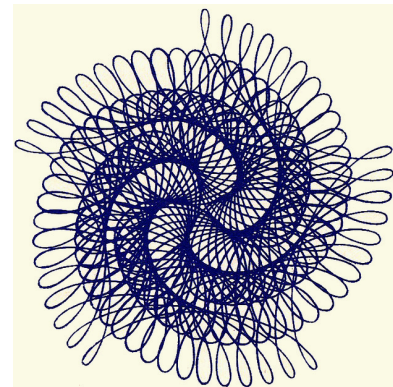


7.8H Parametrically-Defined Curves

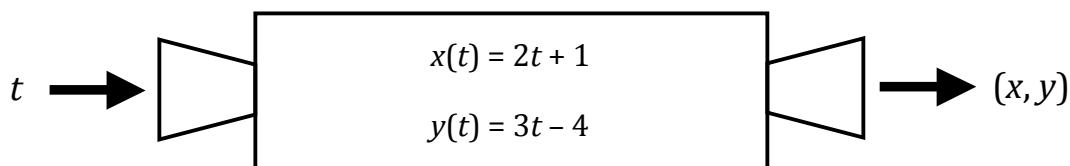
A Solidify and Practice Understanding Task

A **parametric curve** is defined by a set of equations that give the coordinates of points on the curve in terms of another variable called a *parameter*.



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The following diagram suggests that a parametric curve can be defined as a function in which the input is a parameter variable t and the output is an ordered-pair (x, y) . The rule that defines the output is a set of equations defined by $x(t)$ and $y(t)$.



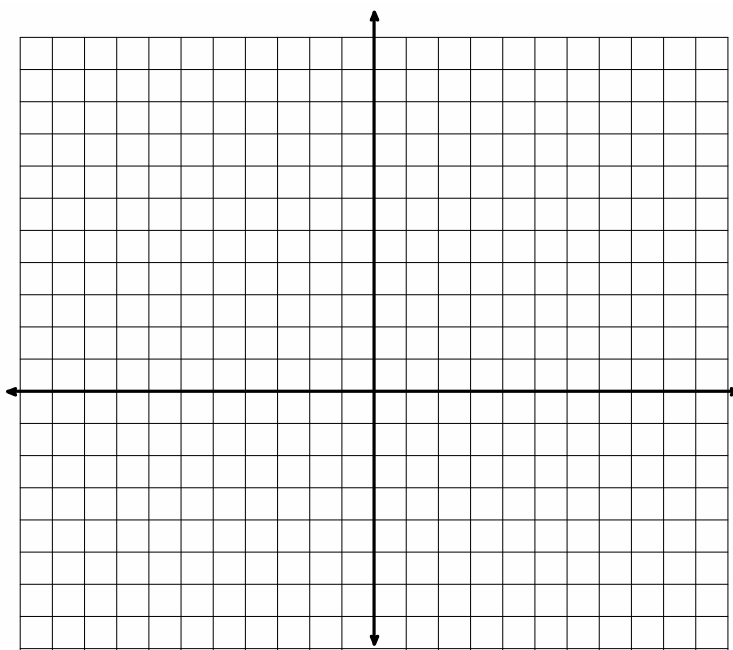
1. The parametric curve defined in the diagram is a line.
 - a. Find the slope of the line.
 - b. How does the slope of the line show up in its parametric representation?
 - c. Find the y -intercept of the line.
 - d. How does the y -intercept of the line relate to the parametric representation?
 - e. Write the equation of the line $y = 2x + 3$ in parametric form.
 - f. Write the equation of the line $y = \frac{1}{2}(x - 2) + 4$ in parametric form.



2. Given the following two parametrically-defined curves defined on the interval $-3 \leq t \leq 3$:

$$\begin{array}{lcl} x_1(t) = 2t & & x_2(t) = 2t + 2 \\ y_1(t) = t^2 & \text{and} & y_2(t) = t + 3 \end{array}$$

a. Graph the two curves on the same coordinate grid.



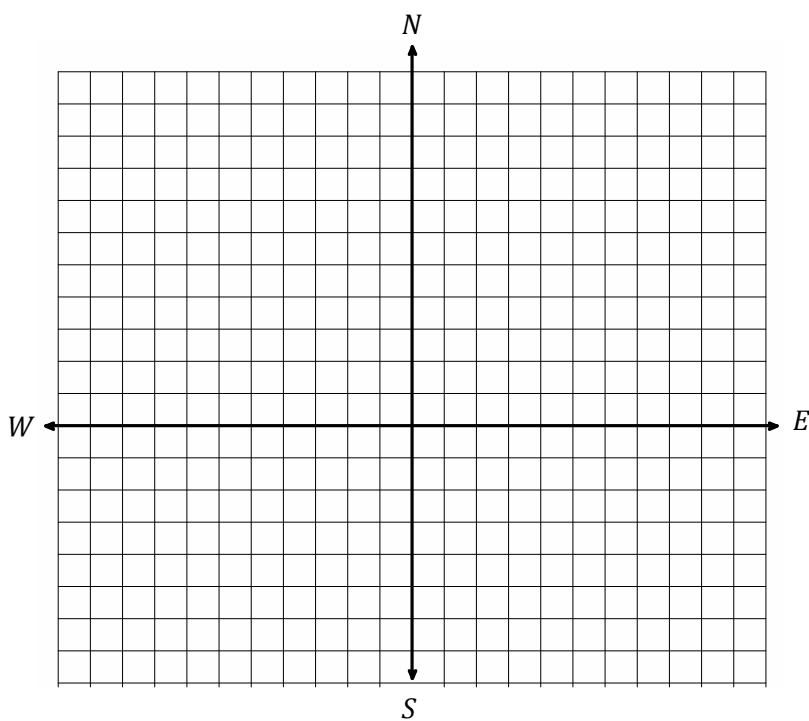
- b. Each of these two curves is an easily recognizable function. Write the standard function equation for each of the curves.
- c. Examine the relationship between the parametric form for each of these curves written in terms of the parameter t and its standard function form. Can you suggest a strategy for eliminating the parameter t in the parametric form of each curve to obtain the more familiar function form?
- d. Find the points of intersection of these two curves.



3. A flight controller is monitoring the flight paths of two planes, as given by the following two parametrically defined functions. The control tower is located at the origin and horizontal and vertical distances are measured in miles.

$$\begin{array}{l} x_1(t) = 200t \\ y_1(t) = -200t + 800 \end{array} \quad \text{and} \quad \begin{array}{l} x_2(t) = -300t + 900 \\ y_2(t) = -100t + 700 \end{array}$$

- a. Graph the projected paths for each plane if they continue on their same course for the next four hours (that is, on the interval of time $0 \leq t \leq 4$).



- b. Should the flight controller be concerned about a possible midair collision? Explain your reasoning.



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Modeling With Functions | 7.8H

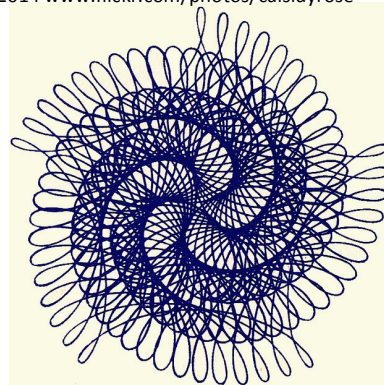
Ready, Set, Go!

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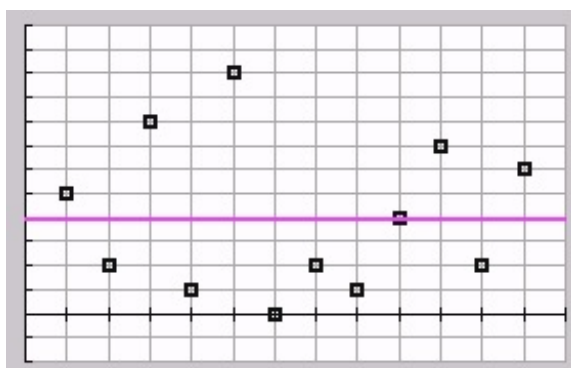
Ready

Topic: Measures of central tendency

1. Find the mean, median, and mode of the following test scores:
98, 74, 70, 68, 85, 82, 85, 94, 90, 91, 99, 85, 88, 79, 96, 98, 85, 82, 80, 86



2. The graph to the right shows 12 points whose y-values add up to 48. The $y = 4$ line is graphed. Use the position of the points on the graph to explain why 4 is the average of the 12 numbers.



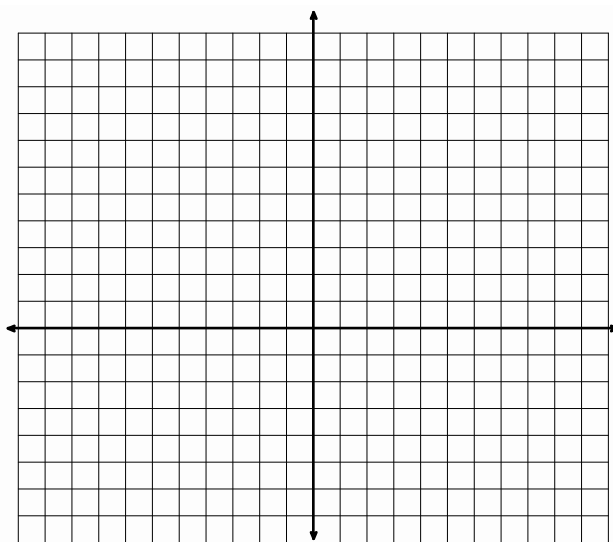
Set Topic: Parametric equations

For each set of parametric equations,

- Create a table of x- and y-values
- Plot the points (x, y) in your table and sketch the graph. (Indicate the direction of the curve.)
- Find the rectangular equation.

3. $x = 3t - 3$ Rectangular equation:
 $y = 2t + 1$

t	x	y



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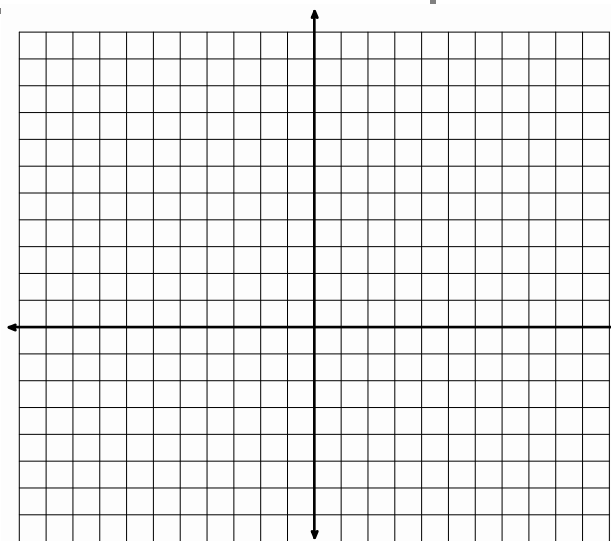
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4. $x = t + 2$
 $y = t^2$

Rectangular equation:

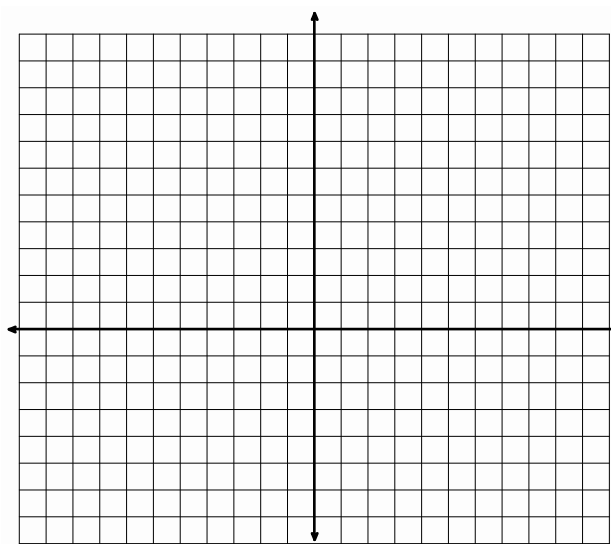
t	x	y



5. $x = 4 \sin 2\theta$
 $y = 2 \cos 2\theta$

Rectangular equation:

t	x	y

**Match the parametric equations with their graphs.**

(You may use a calculator.)

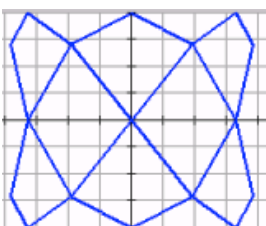
6. $x = 5 \cos t$ and $y = \sin 3t$

7. $x = 6 \sin(4t)$ and $y = 4 \sin(6t)$

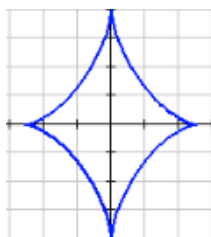
8. $x = 4 \cos^3 t$ and $y = 4 \sin^3 t$

9. $x = \frac{1}{2}(\cos t + t \sin t)$ and $y = \frac{1}{2}(\sin t - t \cos t)$

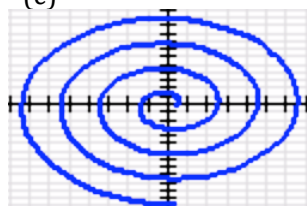
(a)



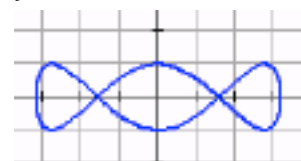
(b)



(c)



(d)



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Modeling With Functions | 7.8H

Go

Topic: Composition of functions

10. Given $f(x) = 3x + 2$ and $g(x) = 4 - x^2$, find the following.

- a)
- $(f \circ g)(x)$
- b)
- $(g \circ f)(x)$
- c)
- $(f \circ g)(-4)$
- d)
- $(g \circ f)(-2)$

11. Is there a restriction on the domain in any of the exercises (a – d) in problem 10? Explain.

12. Given $f(x) = \frac{3x+2}{x-1}$ and $g(x) = 3x + 3$, find the following.

- a)
- $(f \circ g)(x)$
- b)
- $(g \circ f)(x)$
- c)
- $(f \circ g)(10)$
- d)
- $(g \circ f)(4)$

13. Is there a restriction on the domain in any of the exercises (a – d) in problem 12? Explain.

