

# Building a Smaller, More Powerful Toolbox

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[Do Now](#): GEMA Tables

Jigsaw Options

1. [Solving Equations with GEMA Tables](#)
2. [Modeling Lines & Parabolas](#)
3. [Composition & Generic Functions](#)
4. [Graphing & Modeling Trig Functions](#)

(More!) [Some Other Cool Stuff That Didn't Fit Anywhere Else](#)

The Section I Chose To Think About: \_\_\_\_\_

“A-ha”s/Noticings:

**G**rouping  
**E**xponents  
**M**ultiplication  
**A**ddition

How might using GEMA tables support Shira to teach according to her values?

End of Session Reflection:

# 1. Solving Equations with GEMA Tables

1. Fill in the GEMA table:

x	$x+2$	$5(x+2)$	$5(x+2)-3$
4			
-2			
	10		
		35	
			27

2. If  $f(x) = 5(x+2) - 3$ , what is...

- $f(4)$ ?
- $f(-2)$ ?

3. If  $5(x+2) - 3 = 27$ , what is...

- $5(x+2) = ?$
- $x+2 = ?$
- $x = ?$
- How could you find these values on the GEMA table?

4. How could you solve  $5(x+2) - 3 = 12$  using the GEMA table?

5. How could you use ideas of a GEMA table to...

- Solve  $\frac{3x+7}{4} + 9 = 22$
- Solve  $7 - 3x = 25$
- Find the inverse function of  $\frac{3x+7}{4} + 9 = y$

6. Siyani remembered that you can find intercepts of a function by looking at where the input and output are 0. Fill in the table to help her find the intercepts of  $f(x) = 2(x-5)^2 - 32$ .

x					
0					
					0

					0
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## 2. Modeling Lines & Parabolas

- See if you can figure out how to fill in the missing boxes and headings!

	$\times \boxed{-3/2}$	$+$ $\boxed{\phantom{00}}$	
	$\swarrow$	$\swarrow$	
	<b>x</b>	<b><math>-3/2x</math></b>	<b><math>-3/2x + \underline{\phantom{00}}</math></b>
	8		-5
$\boxed{+2}$ $\swarrow$	10		-8
			$\nwarrow \boxed{-3}$

- See if you can figure out how to fill in the missing boxes and headings!

	$\times \boxed{\phantom{00}}$	$+$ $\boxed{\phantom{00}}$	
	$\swarrow$	$\swarrow$	
	<b>x</b>	<b><math>\underline{\phantom{00}}x</math></b>	<b><math>\underline{\phantom{00}}x + \underline{\phantom{00}}</math></b>
	5		14
$\boxed{\phantom{00}} \swarrow$	7		18
			$\nwarrow \boxed{\phantom{00}}$

- Write the equation of a line through the points (5,14) and (7,18). How does the GEMA table help?
- Part of this GEMA table is missing. You have filled in what you know. Figure out how to fill in the boxes to complete it.

	$- \boxed{\phantom{00}}$	$(\phantom{00})^2$	$\times \boxed{\phantom{00}}$	$+$ $\boxed{\phantom{00}}$
	$\swarrow$	$\swarrow$	$\swarrow$	$\swarrow$
<b>x</b>				
5	0			9
7				5

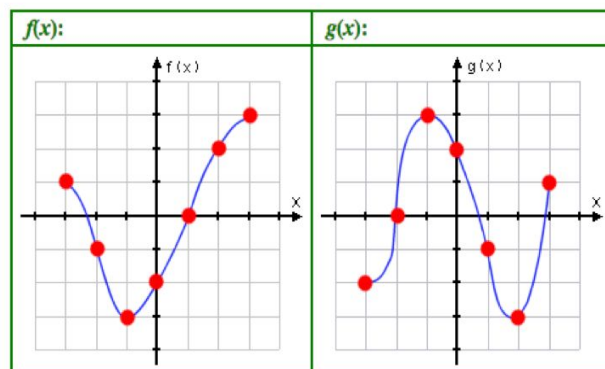
- Evan argues that (5,9) must be the vertex. Thoughts?
- Write the equation of a parabola in whose vertex is (5,9) & goes through (7,5).

7. Use a GEMA table to write an equation of a parabola with vertex  $(-4,7)$  & goes through  $(-2,15)$ .

### 3. Composition & Generic Functions

1. Fill in the first three columns of the GEMA table using the functions below. Choose any 5 points.

$x$	$f(x)$	$g(x)$			



2. How could we use the above table to...
- Graph  $(f + g)(x)$ ?
  - Graph  $2f(x)$ ?
  - Decide when is  $g(x) > f(x)$ ?
3. We want to create the function  $h(x) = f(x - 2)$ ? Emmeline thinks that you could start by just copying two of the columns from table above. What do you think? Where would the values in our first table belong in this second one?

$x$	$x - 2$	$f(x - 2)$

4. How could you extend the table to find  $p(x) = 3f(x - 2) + 4$ ?
5. Fill in the table headings (the bolded sections) on the table below.
6. If  $f(x) = 3x - 4$  and  $g(x) = x^2 - 5$ , what function does the GEMA table below represent?

<b><math>x</math></b>	<b><math>3x</math></b>			
-2	-6	-10	100	95
0	0	-4	16	11
4	12	8	64	59

7. Find  $g(f(3))$  using the GEMA table.

8. Find the value(s) of  $x$  such that  $g(f(x)) = 4$  using the GEMA table.

## 4. Graphing & Modeling Trig Functions

1. Fill in the GEMA table:

$x$	$2x$	$2x-\pi$	$\sin(2x-\pi)$	$3\sin(2x-\pi)$	$3\sin(2x-\pi)+4$
$\pi/2$					
	$3\pi/2$				
		$\pi$			
			-1		
		$2\pi$		0	4

2. Use arrows or colors to show where you see the amplitude, midline, frequency and period in the table.
3. There is a table of  $y=\sin(x)$  hidden inside the GEMA table. Where do you see it?
4. If you were to make this table from scratch, which columns would you start with? Why? *Hint: You do not need to start on the left!*
5. Make a GEMA table for the function  $f(x) = 2\cos(3x + \pi/2) - 1$

6. **Challenge:** Part of this GEMA table is missing. Figure out how to fill in the boxes to complete it.



$x$			$\sin(\quad)$		
$\pi/6$					2
$\pi/3$					8
$\pi/2$					2
$2\pi/3$					-4
$5\pi/6$					2

7. Extensions: What are other ways you could have written equations for the above 2 functions? How could a GEMA table help you see all of the possibilities?