

Function Shift Detectives

Use tables to uncover each function rule.

HIGH SCHOOL • MA.912.F.2.4

MA.912.F.2.4 "Given the graph or table of values of two or more transformations of a function, state the type of transformation and find the values of the real number that defines the transformation."

NAME _____

DATE _____

READ THE TABLE

If $g(x)=a f(x-h)+k$, h moves the graph right when it is positive, and k moves it up when it is positive. The number a stretches or compresses the outputs, and a negative a reflects the graph across the x -axis.

WORKED EXAMPLE

Tables: f , x : 10, 11, 12; $f(x)$: 7, 9, 13.
 g , x : 17, 18, 19; $g(x)$: 23, 31, 47. Find g in terms of f .

1. The g inputs are 7 more than the matching f inputs, so use $f(x-7)$.
2. From 7 to 23, the output rule is $4(7)-5$.
3. Check: $4(13)-5=47$.

Answer: $g(x)=4f(x-7)-5$. Shift right 7, vertical stretch by 4, then shift down 5.

PRACTICE 5 problems

- 1** Tables: f , x : -2, 0, 2; $f(x)$: -6, 0, 6. g , x : -2, 0, 2; $g(x)$: 2, 8, 14. State the transformation and write g in terms of f .

ANSWER _____

- 2** Tables: f , x : 1, 3, 6; $f(x)$: 2, -1, 8. g , x : 1, 3, 6; $g(x)$: -2, 1, -8. State the transformation and write g in terms of f .

ANSWER _____

- 3** Tables: f , x : -8, -3, 1; $f(x)$: 16, 24, 32. g , x : 0, 5, 9; $g(x)$: 16, 24, 32. State the transformation and write g in terms of f .

ANSWER _____

- 4** Tables: f , x : 0, 2, 6; $f(x)$: -6, 0, 16. g , x : 0, 2, 6; $g(x)$: 0, 3, 11. State the transformations and write g in terms of f .

ANSWER _____

- 5** Tables: f , x : -8, -3, 2; $f(x)$: 6, 15, -6. g , x : 8, 3, -2; $g(x)$: 6, 15, -6. State the transformation and write g in terms of f .

ANSWER _____

APPLY IT Show your work

- 1** A music channel models its usual video views with $f(t)$, where t is hours after a post and each output is in hundreds of views. For t : 1, 2, 3, the values of $f(t)$ are 20, 30, 40. A paid promotion produces $g(t)$: 43, 63, 83 at the same times. Describe the transformations and write g in terms of f .

WORK SPACE

ANSWER _____

- 2** At a student gaming event, $f(t)$ models the number of players in the lounge t hours after opening. At t : 3, 8, 15, the values are 22, 26, 34. A delayed opening has values $g(t)$: 22, 26, 34 at t : 9, 14, 21. Describe the transformation and write g in terms of f .

WORK SPACE

ANSWER _____

CHALLENGE One step up

CHALLENGE

Tables: f , x : -6, 0, 6; $f(x)$: 2, -3, 8. g , x : -9, -3, 3; $g(x)$: -2, 8, -14. Write g in terms of f . Then explain how the inputs and outputs show each transformation.

PART 1 • PRACTICE

#	PROBLEM	ANSWER
1	Tables: $f, x: -2, 0, 2$; $f(x): -6, 0, 6$. $g, x: -2, 0, 2$; $g(x): 2, 8, 14$. State the transformation and write g in terms of f .	Shift up 8; $g(x)=f(x)+8$.
2	Tables: $f, x: 1, 3, 6$; $f(x): 2, -1, 8$. $g, x: 1, 3, 6$; $g(x): -2, 1, -8$. State the transformation and write g in terms of f .	Reflect across the x-axis; $g(x)=-f(x)$.
3	Tables: $f, x: -8, -3, 1$; $f(x): 16, 24, 32$. $g, x: 0, 5, 9$; $g(x): 16, 24, 32$. State the transformation and write g in terms of f .	Shift right 8; $g(x)=f(x-8)$.
4	Tables: $f, x: 0, 2, 6$; $f(x): -6, 0, 16$. $g, x: 0, 2, 6$; $g(x): 0, 3, 11$. State the transformations and write g in terms of f .	Vertical compression by $1/2$, then shift up 3; $g(x)=(1/2)f(x)+3$.
5	Tables: $f, x: -8, -3, 2$; $f(x): 6, 15, -6$. $g, x: 8, 3, -2$; $g(x): 6, 15, -6$. State the transformation and write g in terms of f .	Reflect across the y-axis; $g(x)=f(-x)$.

PART 2 • APPLY IT

- Vertical stretch by 2, then shift up 3; $g(t)=2f(t)+3$.** Each g output is twice the matching f output plus 3. For example, $2(30)+3=63$.
- Shift right 6; $g(t)=f(t-6)$.** Each matching output occurs 6 hours later for g . A right shift of 6 uses $f(t-6)$.

CHALLENGE

$g(x)=-2f(x+3)+2$. The g inputs are 3 less than the matching f inputs, so the graph shifts left 3. Each output is multiplied by -2 , then 2 is added, so there is a reflection across the x-axis, a vertical stretch by 2, and a shift up 2.

Accept equivalent wording such as vertical shrink for compression and horizontal reflection for reflection across the y-axis. Require both the transformation description and a correct function rule.