Spot the Structure

Sort functions by where the input appears.

A2S.AF.G "Functions that are members of the same family have distinguishing attributes (structure) common to all functions within that family."

NAME _____ DATE _____

QUADRATIC	EXPONENTIAL
After you expand and combine terms, the highest power of the input is 2. $Q(t) = 11(t - 9)^2 + 13$	The input is in the exponent of a fixed positive base other than 1. $E(t) = 17(10)^t - 19$

1 SORT

8 items

Circle SQUARED or EXPONENT for each function, then choose one item from each category and explain how its structure helped you decide.

1. $f(x) = 2(x - 3)^2 + 5$ SQUARED EXPONENT

2. $f(x) = (x - 5)(x + 5)$ SQUARED EXPONENT

3. $f(x) = 3^x + 2$ SQUARED EXPONENT

4. $f(x) = 6x^2 - x + 1$ SQUARED EXPONENT

5. $f(x) = 5(1/2)^x - 3$ SQUARED EXPONENT

6. $f(x) = 2^{x - 4}$ SQUARED EXPONENT

7. $f(x) = -4(x + 1)^2$ SQUARED EXPONENT

8. $f(x) = -3(4)^x + 8$ SQUARED EXPONENT

2 PROVE IT

Explain your thinking

Choose one item from each category and explain how its structure helped you decide.

ITEM # _____ **HOW I KNEW** _____

ITEM # _____ **HOW I KNEW** _____

3 MAKE YOUR OWN

One of each

Write one new quadratic function and one new exponential function that are not already on this page.

SQUARED

EXPONENT

CHALLENGE

Write one quadratic function and one exponential function that both equal 5 when x = 0, and show each substitution.

PART 1 · SORT

#	ITEM	CATEGORY	WHY
1	$f(x) = 2(x - 3)^2 + 5$	**SQUARED**	The squared expression makes this a quadratic function.
2	$f(x) = (x - 5)(x + 5)$	**SQUARED**	Expanding gives $x^2 - 25$, which has degree 2.
3	$f(x) = 3^x + 2$	**EXPONENT**	The input x is an exponent on the fixed base 3.
4	$f(x) = 6x^2 - x + 1$	**SQUARED**	The highest power of x is 2.
5	$f(x) = 5(1/2)^x - 3$	**EXPONENT**	The input x is an exponent on the fixed base 1/2.
6	$f(x) = 2^{x - 4}$	**EXPONENT**	The exponent contains the input x.
7	$f(x) = -4(x + 1)^2$	**SQUARED**	Expanding produces a nonzero x^2 term, so the function is quadratic.
8	$f(x) = -3(4)^x + 8$	**EXPONENT**	The input x is an exponent on the fixed base 4.

PART 2 · PROVE IT

Task: Choose one item from each category and explain how its structure helped you decide. Accept any explanation that names the deciding feature from the rule box for the chosen item.

PART 3 · MAKE YOUR OWN (SAMPLE ANSWERS)

- **SQUARED**: $p(x) = 8x^2 + 3$
- **EXPONENT**: $q(x) = 6(3)^x + 1$

Challenge: $a(x) = x^2 + 5$ and $b(x) = 4^x + 4$. Then $a(0) = 0^2 + 5 = 5$ and $b(0) = 4^0 + 4 = 5$.

For the explanations, look for a squared input after expansion in one item and an input in the exponent in the other. Accept other valid functions for Part 3 and the challenge.