What Relation is It?

Learning Goals

Minds on Math

What might be some ways that you can mathematically distinguish between each these relations?

$P = 200(0.5)^t$

$P = 100t^2$

$P = 200(0.5t)$

i) Represent the following relation using a table of values, finite differences (1st and 2nd), and ratios between consecutive y-values), and a graph.
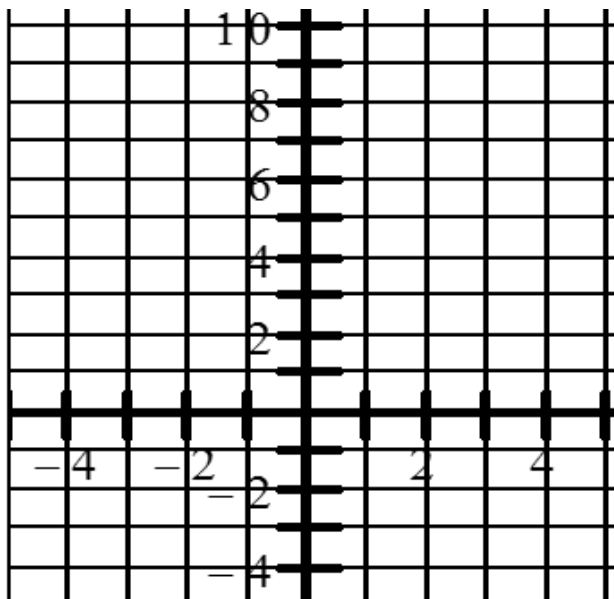
ii) Name the relationship.

$$y = 2x^2 - 3$$

x	y	1st differences	2nd differences	Ratio b/w Consecutive y-values
-2				
-1				
0				
1				
2				

Example (contd.)

$$y = 2x^2 - 3$$

Graph

Pull

i) Represent the following relation using a table of values, finite differences (1st and 2nd), and ratios between consecutive y-values), and a graph.

ii) Name the relationship.

$$y = 2x^2 - 3$$

-
-

Pull

Take Action

Your Task

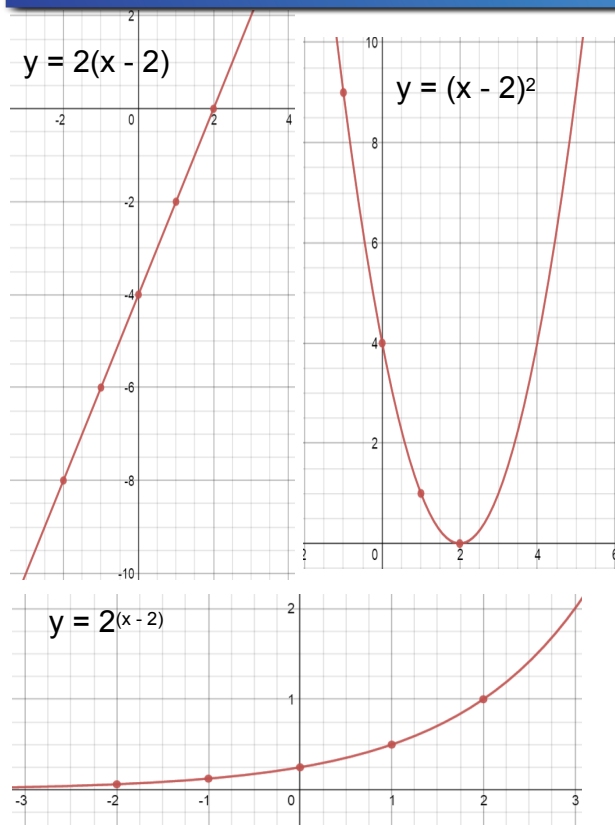Using various representations, clearly distinguish between the following relations:

1) **$y = 2(x - 2)$**

2) **$y = (x - 2)^2$**

3) **$y = 2^{(x - 2)}$**

Consolidate — Representation: Graph

$y = 2(x - 2)$

$y = (x - 2)^2$

$y = 2^{(x - 2)}$

Consolidate — Representation: Tables of Values

$y = 2(x - 2) = 2x - 4$

x	$2x - 4$	1ST diff.
-2	-8	
		$+2$
-1	-6	
		$+2$
0	-4	
		$+2$
1	-2	
		$+2$
2	0	

Note: The 1ST differences are equal

⇒ The relationship between y and x is LINEAR.

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$y = (x - 2)^2$

x	$(x-2)^2$	1ST diff	2ND diff
-2	16		
		-7	
-1	9		$+2$
		-5	
0	4		$+2$
		-3	
1	1		$+2$
		-1	
2	0		

Since the 2ND diff. are equal, the relationship between y and x is QUADRATIC.

$y = 2^{(x - 2)}$

x	$2^{(x-2)}$	Ratio
-2	0.0625	
-1	0.125	$0.125 \div 0.0625 = 2$
0	0.25	$0.25 \div 0.125 = 2$
1	0.5	$0.5 \div 0.25 = 2$
2	1	$1 \div 0.5 = 2$

Ratios of consecutive y-values are equal ⇒ EXPONENTIAL

Ex. When $x=-2$, 2^{x-2}
$= 2^{-2-2}$
$= 2^{-4}$ } Neg. exp. rule
$= \dfrac{1}{2^4}$
$= \dfrac{1}{16}$
$= 0.0625$

Similarly, when $x = -1$,
$2^{x-2} = 2^{-1-2}$
$= 2^{-3}$
$= \dfrac{1}{2^3}$
$= \dfrac{1}{8}$
$= 0.125$

y = 2(x - 2) = 2x - 4
- Graph is a straight line
  - > y-intercept -4, slope = 2
    - – slope is rate of change
- First differences are equal

=> linear relation

y = (x - 2)² = ~~x² - 4x + 4~~
- Second differences are equal
  - > relation is quadratic
  - > graph is a parabola
- Vertex is at (2, 0), y-intercept = 4, graph has a minimum, opens upward

y = 2$^{(x - 2)}$
- Ratios in consecutive y-values are equal
  - > relation is exponential
- Graph is increasing
  - > exponential growth
  - > growth factor is 2
  - > no x-intercept
  - > y-intercept 0.25 or 1/4

Independent Practice

i) Answer p392 #9 of the textbook

ii) Answer p391 #7 of the textbook (grid paper req'd)

In addition to #7abc, also do the following for #7:

-name the relation

-discuss how you know (i.e., how you could show)

-use the equation to determine the pressure, in pascals, after 10 seconds

Example

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ii) Name the relationship.

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x	y	1st differences	2nd differences	Ratio b/w Consecutive y-values
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