

Warm Up

Complete the Linear, Quadratic and Exponential Functions Investigation.



Linear, Quadratic and Exponential Functions

Lesson objectives

- I can identify the differences from a graph
- I can identify the differences from a table of values
- I can identify the differences from an equation

1.1

Lesson objectives

Teachers' notes

Lesson notes

Handout - Identify if data is linear, quadratic, exponential or something else

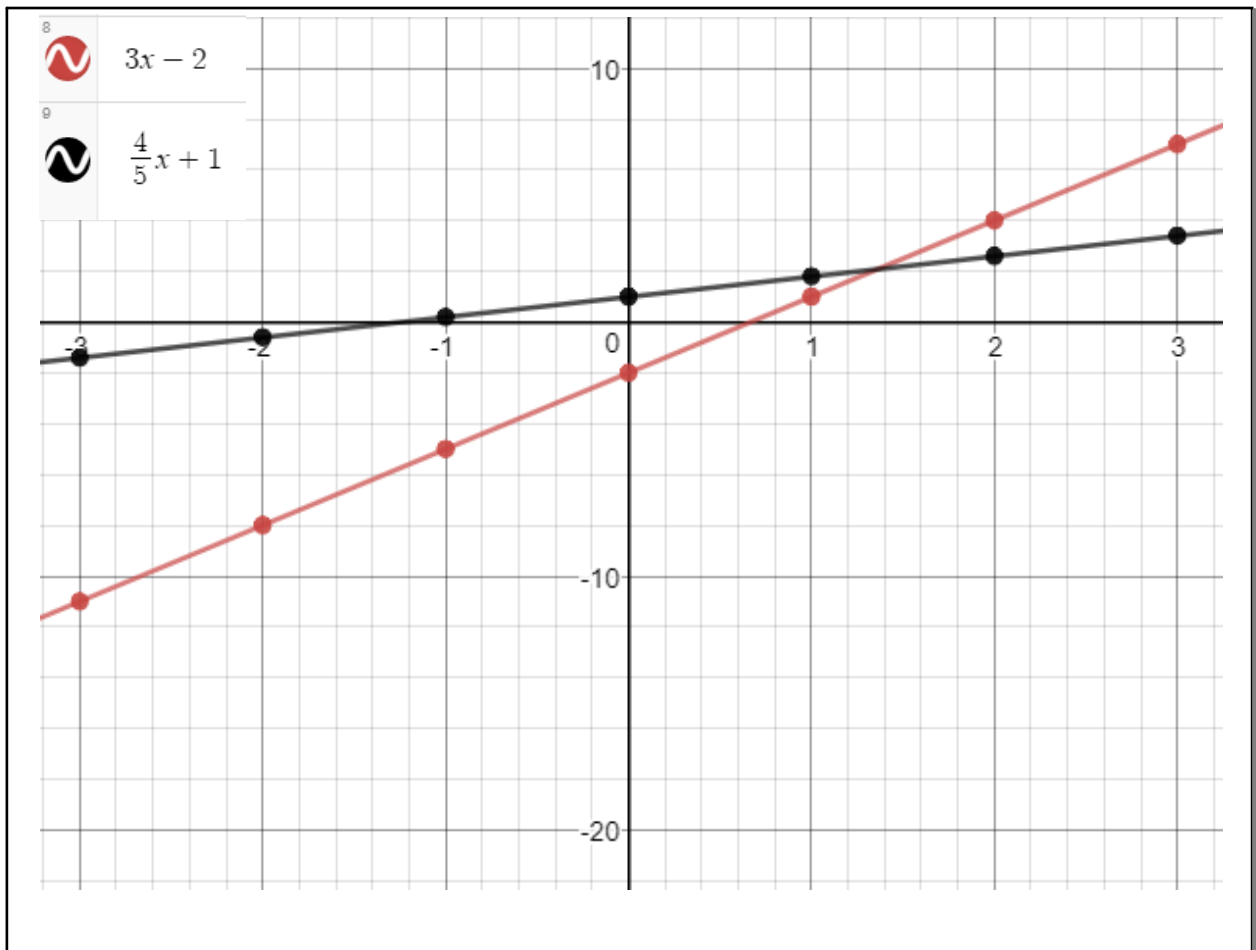
$y = 3x - 2$

| x | y | 1st diff | 2nd diff | 3rd diff | 4th diff |
|----|-----|----------|----------|----------|----------|
| -3 | -11 | | | | |
| -2 | -8 | 3 | | | |
| -1 | -5 | 3 | | | |
| 0 | -2 | 3 | | | |
| 1 | 1 | 3 | | | |
| 2 | 4 | 3 | | | |
| 3 | 7 | 3 | | | |

$y = \frac{4}{5}x + 1$

| x | y | 1st diff | 2nd diff | 3rd diff | 4th diff |
|----|------|----------|----------|----------|----------|
| -3 | -1.8 | | | | |
| -2 | -1.0 | 0.8 | | | |
| -1 | -0.2 | 0.8 | | | |
| 0 | 1.0 | 0.8 | | | |
| 1 | 1.8 | 0.8 | | | |
| 2 | 2.6 | 0.8 | | | |
| 3 | 3.4 | 0.8 | | | |

1ST differences
are constant
for LINEAR
functions.



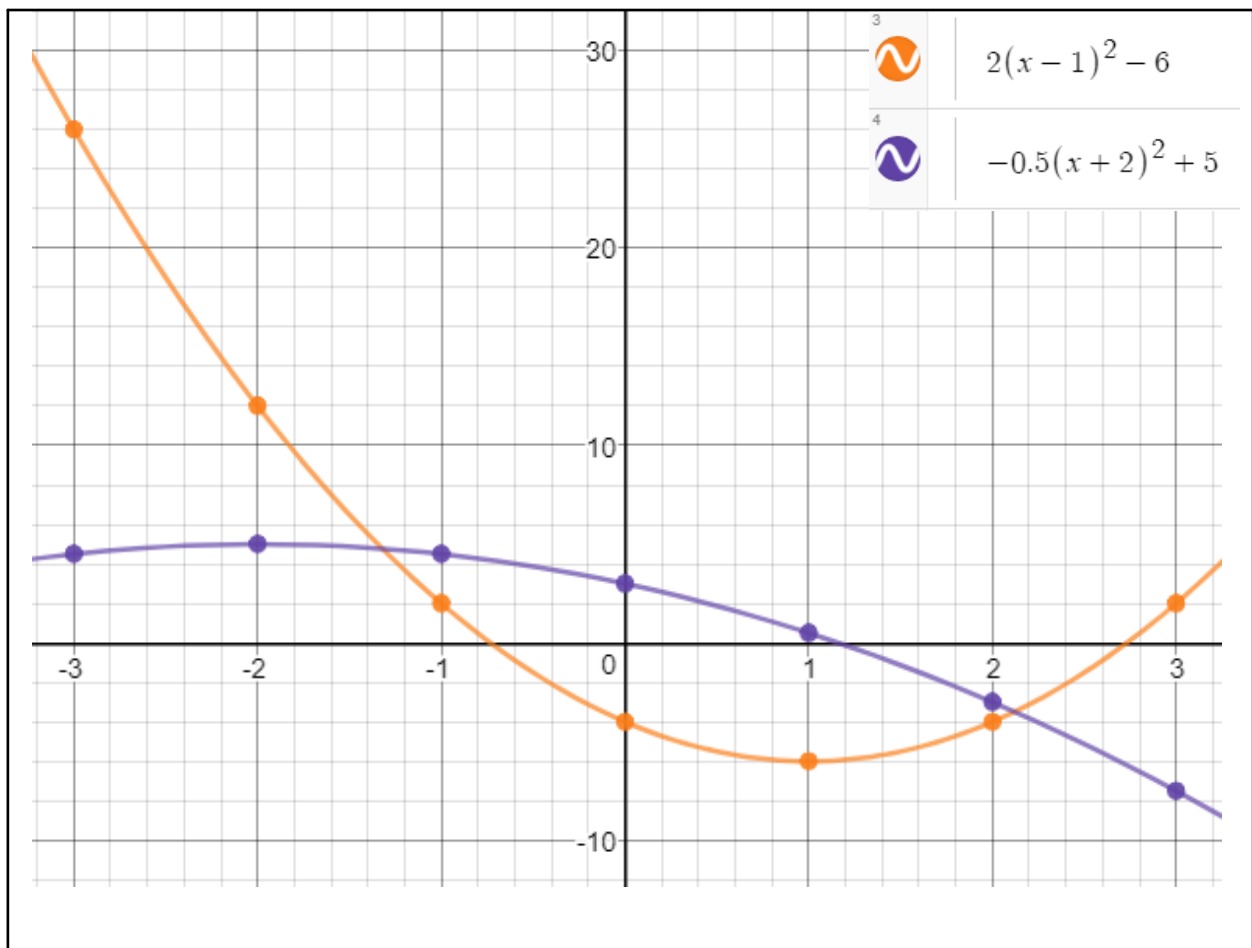
$$y = 2(x - 1)^2 - 6$$

| x | y | 1st diff | 2nd diff | 3rd diff | 4th diff |
|----|----|----------|----------|----------|----------|
| -3 | 26 | | | | |
| -2 | 12 | -14 | | | |
| -1 | 2 | -10 | 4 | | |
| 0 | -4 | -6 | 4 | | |
| 1 | -6 | -2 | 4 | | |
| 2 | -4 | 2 | 4 | | |
| 3 | 2 | 6 | 4 | | |

2ND differences
are constant
for QUADRATIC
functions.

$$y = -0.5(x + 2)^2 + 5$$

| x | y | 1st diff | 2nd diff | 3rd diff | 4th diff |
|----|------|----------|----------|----------|----------|
| -3 | 4.5 | | | | |
| -2 | 5 | 0.5 | | | |
| -1 | 4.5 | -0.5 | -1 | | |
| 0 | 3 | -1.5 | -1 | | |
| 1 | 0.5 | -2.5 | -1 | | |
| 2 | -3 | -3.5 | -1 | | |
| 3 | -7.5 | -4.5 | -1 | | |



$$y = 2^x$$

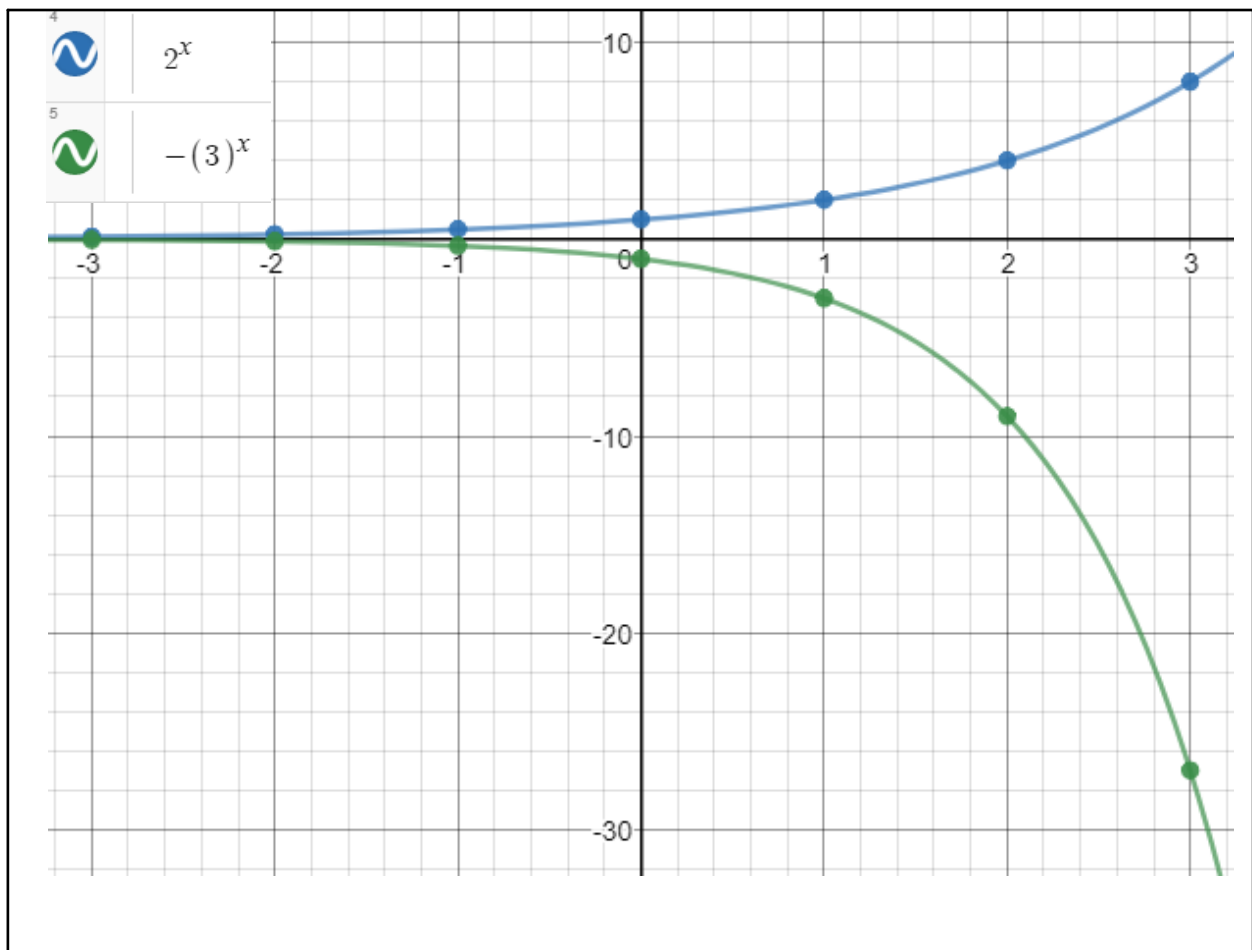
| x | y | 1st diff | 2nd diff | 3rd diff | 4th diff |
|----|-------|----------|----------|----------|----------|
| -3 | 0.125 | | | | |
| -2 | 0.25 | 0.125 | | | |
| -1 | 0.5 | 0.25 | 0.125 | | |
| 0 | 1 | 0.5 | 0.25 | 0.125 | |
| 1 | 2 | 1 | 0.5 | 0.25 | 0.125 |
| 2 | 4 | 2 | 1 | 0.5 | 0.25 |
| 3 | 8 | 4 | 2 | 1 | 0.5 |

No constant differences for EXPONENTIAL functions. However,

$$y = -(3)^x$$

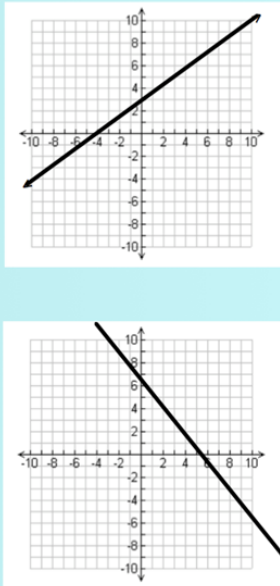
| x | y | 1st diff | 2nd diff | 3rd diff | 4th diff |
|----|-------|----------|----------|----------|----------|
| -3 | -1/27 | | | | |
| -2 | -1/9 | -2/27 | | | |
| -1 | -1/3 | -2/9 | -4/27 | | |
| 0 | -1 | -2/3 | -4/9 | -8/27 | |
| 1 | -3 | -2 | -4/3 | -8/9 | -16/27 |
| 2 | -9 | -6 | -4 | -8/3 | -16/9 |
| 3 | -27 | -18 | -12 | -8 | -16/3 |

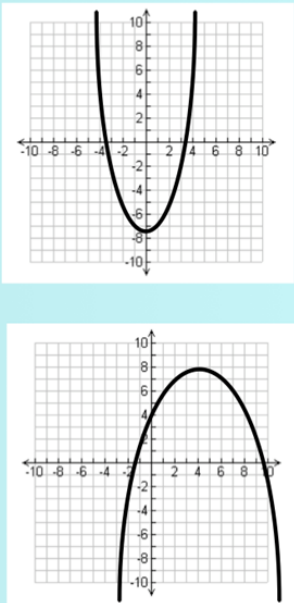
they do have a constant RATIO.

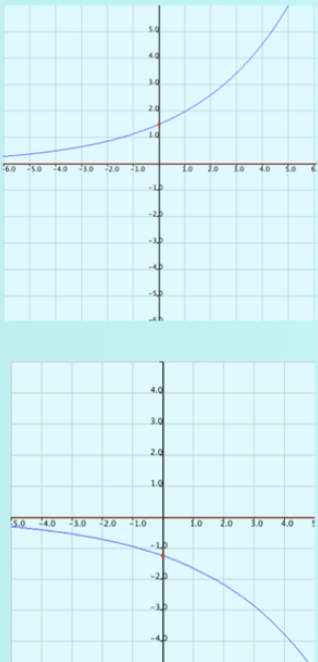


| | Equation | Graph | Table of Values |
|-------------|--------------------------------------|------------------------------------|--|
| Linear | All exponents have a degree of 1 | Straight line | 1 ST diffs are constant |
| Quadratic | Independent variable has degree of 2 | Parabola ↻ ↻ ↻ | 2 ND diffs are constant |
| Exponential | Independent variable is the exponent | Slow to rapid increase or decrease | y-values change by a common ratio/factor |

↘ ↗

| Function | Graph | Description |
|----------|---|---|
| Linear |  | <ul style="list-style-type: none"> - straight line - can go up or down - the steepness of the line is called slope - write other descriptions |

| Function | Graph | Description |
|------------------|---|---|
| <p>Quadratic</p> |  | <ul style="list-style-type: none"> - U shape called parabola - vertically symmetrical - has a minimum or maximum point called the vertex - write other descriptions |

| Function | Graph | Description |
|--------------------|---|---|
| <p>Exponential</p> |  | <ul style="list-style-type: none"> - increases in steepness $b^0 = 1$ This means when $x = 0$, $f(x)$ is the base. - can go up or down - write other descriptions |

Homework

Identify if the data is linear, quadratic, exponential or something else.

