**LINEAR/QUADRATIC/EXPONENTIAL TABLES**

**HOW TO RECOGNIZE THE TYPE OF GRAPH FROM A TABLE**

**To recognize if a function is linear, quadratic (a parabola), or exponential without an equation or graph, look at the differences of the** *y-***values between successive integral** *x-***values. If the difference is constant, the graph is linear. If the difference is not****constant but the second set of differences are constant, the graph is quadratic. If the differences are not constant but form a common ratio, the graph is exponential. See the examples below for clarity.**

**Examples**

**Based on each table, identify the shape of the graph.**

**Example 1**



|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| *x* | 3 | 2 | 1 | 0 | 1 | 2 | 3 |
| *y* | 7 | 5 | 3 | 1 | 1 | 3 | 5 |



2 2 2 2 2 2

**The difference in** *y-***values is always two, a constant.**

**The graph is linear and is verified at right.**

**Example 2**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| *x* | 3 | 2 | 1 | 0 | 1 | 2 | 3 |
| *y* | 9 | 4 | 1 | 0 | 1 | 4 | 9 |



|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 5 | 3 | 1 |  | 1 | 3 | 5 |
|  | 2 | 2 | 2 | 2 |  | 2 |



**The first difference in** *y-***values is not constant but the**

**second difference is. The graph is quadratic and is verified at right.**



**Example 3**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | *x* | 3 |  | 2 |  |  |  | 1 |  | 0 |  | 1 |  | 2 |  | 3 |  |
|  | *y* | 1 |  | 1 |  |  |  |  | 1 |  |  | 1 |  | 2 |  | 4 |  | 8 |  |
|  | 8 |  | 4 |  |  |  |  | 2 |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | x2 | x2 |  |  | x2 |  | x2 | x2 | x2 |  |



**The difference in** *y-***values is not constant.** The y-values

form a common ratio.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Problems** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Based on the difference in** *y-***values, identify the graph as linear, quadratic, exponential,** |  |  |
| **or neither.** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **1.** |  |  |  |  |  |  |  |  |  | **2.** |  |  |  |  |  |  |  |  |
|  | *x* | 3 |  | 2 | 1 | 0 | 1 | 2 | 3 |  |  | *x* | 3 | 2 |  | 1 |  | 0 |  | 1 |  | 2 |  | 3 |  |
|  | *y* | 14 |  | 10 | 6 | 2 | –2 | –6 | –10 |  | *y* | 1 | 1 |  | 2 |  | 4 |  | 8 |  | 16 |  | 32 |  |
|  |  |  | 2 |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **3.** |  |  |  |  |  |  |  |  |  | **4.** |  |  |  |  |  |  |  |  |
|  | *x* | 3 |  | 2 | 1 | 0 | 1 | 2 | 3 |  |  | *x* | 3 |  | 2 | 1 |  | 0 |  | 1 |  | 2 |  | 3 |  |
|  | *y* | 21 |  | 12 | 5 | 0 | –3 | –4 | –3 |  | *y* | –16 |  | –13 | –10 |  | –7 |  | –4 |  | –1 |  | 2 |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |



**5.**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *x* | 3 | 2 | 1 | 0 | 1 | 2 | 3 |  |
| *y* | –14 | –9 | –4 | 1 | 6 | 11 | 16 |  |
|  |  |  |  |  |  |  |  |
| **7.** |  |  |  |  |  |  |  |  |
| *x* | 3 |  | 2 |  | 1 |  | 0 | 1 | 2 | 3 |  |
| *y* | 4 |  | 8 |  | 16 |  | 32 | 64 | 128 | 256 |  |
|  |  |  |  |  |  |  |  |  |  |  |
| **9.** |  |  |  |  |  |  |  |  |  |  |  |
| *x* | 3 |  | 2 |  | 1 |  | 0 | 1 | 2 | 3 |  |
| *y* | 30 |  | 20 |  | 12 |  | 6 | 2 | 0 | 0 |  |
|  |  |  |  |  |  |  |  |  |  |  |

**6.**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | *x* | 3 | 2 | 1 | 0 | 1 | 2 | 3 |  |
|  | *y* | –18 | –6 | –2 | 0 | 2 | 6 | 18 |  |
|  |  |  |  |  |  |  |  |  |
| **8.** |  |  |  |  |  |  |  |  |
|  | *x* | 3 | 2 | 1 | 0 | 1 | 2 | 3 |  |
|  |  | 1 | 1 | 1 |  |  |  |  |  |
|  |  | 27 |  | 3 | 1 | 3 | 9 | 27 |  |
|  | *y* |  | 9 |  |  |  |  |  |  |
| **10.** |  |  |  |  |  |  |  |  |
|  | *x* | 3 |  | 2 |  | 1 |  | 0 | 1 | 2 | 3 |  |
|  | *y* | 11 |  | 9 |  | 7 |  | 5 | 3 | 1 | –1 |  |
|  |  |  |  |  |  |  |  |  |  |  |  |



|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **11.** |  |  |  |  |  |  |  | **12.** |  |  |  |  |  |  |  |  |
|  | *x* | 3 | 2 | 1 | 0 | 1 | 2 | 3 |  | *x* | 3 |  | 2 |  | 1 |  | 0 | 1 | 2 | 3 |  |
|  | *y* | 1 | 1 | 1 | 3 | 9 | 27 | 81 |  | *y* | –27 |  | –9 |  | –3 |  | 0 | 3 | 9 | 27 |  |
|  | 9 | 3 |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **13.** |  |  |  |  |  |  |  | **14.** |  |  |  |  |  |  |  |  |
|  | *x* | 3 | 2 | 1 | 0 | 1 | 2 | 3 |  | *x* | 3 | 2 | 1 | 0 | 1 | 2 | 3 |  |
|  | *y* | 0 | 5 | 8 | 9 | 8 | 5 | 0 |  | *y* | 3 | 0 | –1 | 0 | 3 | 8 | 15 |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **15.** |  |  |  |  |  |  |  | **16.** |  |  |  |  |  |  |  |  |
|  | *x* | 3 | 2 | 1 | 0 | 1 | 2 | 3 |  | *x* | 3 | 2 | 1 | 0 | 1 | 2 | 3 |  |
|  | *y* | 1 | 0 | –1 | –2 | –1 | 0 | 1 |  | *y* | 9 | 9 | 9 | 9 | 18 | 36 | 72 |  |
|  |  | 8 | 4 | 2 |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |



|  |  |  |
| --- | --- | --- |
| **Answers** |  |  |
| **1.** | **linear** | **2.** | **exponential** |
| **3.** | **quadratic** | **4.** | **linear** |
| **5.** | **linear** | **6.** | **quadratic** |
| **7.** | **exponential** | **8.** | **exponential** |
| **9.** | **quadratic** | **10.** | **linear** |
| **11.** | **exponential** | **12.** | **neither** |
| **13.** | **quadratic** | **14.** | **quadratic** |
| **15.** | **neither** | **15.** | **exponential** |

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