**3.1 – Properties of Quadratic Functions**

MCR3U Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

A quadratic function is a polynomial function of degree 2.

All quadratic functions have non-zero second differences.

* If the second differences are negative - opens down
* If the second differences are positive - opens up

Example: Find the first and second differences to determine if each table of values represents a quadratic function. If it does, determine the direction of opening.

|  |  |
| --- | --- |
| x | y |
|  -2 | -8 |
| -1 | -2 |
| 0 | 0 |
| 1 | -2 |
| 2 | -8 |

|  |  |
| --- | --- |
| x | y |
| -2 | 0 |
| -1 | 1 |
| 0 | 4 |
| 1 | 9 |
| 2 | 16 |

|  |  |
| --- | --- |
| x | y |
| -2 | 0 |
| -1 | -4 |
| 0 | -8 |
| 1 | -12 |
| 2 | -16 |

1.

 **b)**

 **c)**

**3.1 – Properties of Quadratic Functions Addendum**

The following is in addition to the lesson on Properties of Quadratic Functions. You can use this chart to help you recall what to do when a certain property is mentioned in a question. This is not to be used on quizzes or tests.

|  |  |  |  |
| --- | --- | --- | --- |
| **Function Property** | **Graph Feature** | **How to Find** | **Real World Example** |
| Zero | x-intercept | Set $f\left(x\right)=0$ and solve for *x*. | Where/when an object hits the ground. |
| $$f\left(0\right)$$ | y-intercept | Sub. $x=0$ and solve for $f\left(0\right).$ | Initial value of function (eg. Height when an object is thrown) |
| Maximum/Minimum Value (Max/Min) | y-coordinates of the vertex | Complete the square OR1) Find zeros/*x*-intercepts2) $x\_{vertex}=\frac{r+s}{2}$3) Sub. $x\_{vertex}$ into equation to find . $y\_{vertex}$. | Optimal value (max cost, most profit, least cost, highest point of flying object) |
| Axis of Symmetry | Equation for the vertical line through the vertex | Complete the square 🡪 then $x=h$OR1) Find zeros/*x*-intercepts2) $x=\frac{r+s}{2}$ | Optimal independent variable value (eg. Selling price) |
| Domain | Horizontal boundaries | Be clear whether a value is included or just up to that value is included (ex. $x>3$ is different from $x\geq 3$)Set Builder NotationNotation: | Time limits (can’t have negative time, time stops when object lands, etc.) |
| Range | Vertical Boundaries | Same notation as above, but replace *x* with $f\left(x\right).$ | Space limits (cant’ go below ground or above max. height) |