|  |  |
| --- | --- |
| **Role of a:**$$y=a\left(x-h\right)^{2}+k$$**Direction of Opening:*** When **a** is positive, the parabola opens \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* When **a** is negative, the parabola opens \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

**Shape:*** If $a>1$, the graph is **vertically stretched** by a factor of **a**
* If $0<a<1$, the graph is **vertically compressed** by a

 factor of **a*** If $a<0$, the graph is **reflected** across the x-axis
 | **Role of h:****Properties:*** If $h>0$, the graph is **translated horizontally h** units to the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* If $h<0$, the graph is **translated horizontally h** units to the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

**Relation to the Vertex**:* The value of h is the \_\_\_\_\_-coordinate of the vertex.
 |
| **Role of k:****Properties:*** If$k>0$, the graph is **vertically translated k** units \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* If $k<0$, the graph is **vertically translated k** units \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

**Relation to the Vertex:*** The value of k is the \_\_\_\_\_-coordinate of the vertex.
 |  Example: $y=-2\left(x-3\right)^{2}+5$**State:**1. Direction of opening: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Stretch or Compression: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. Transformations:
4. Coordinates of the vertex: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. Domain and Range: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
 |
| **Equation** | **Value of a** | **Value of h** | **Value of k** | **Vertex** $(h, k)$ | **Transformations starting from** $y=x^{2}$ | **Domain and Range** |  |
| $$y=3(x-2)^{2}+1$$ |  |  |  |  |  |  |  |
| $$y=-2\left(x-3\right)^{2}+3$$ |  |  |  |  |  |  |  |
| $$y=\frac{1}{2}(x+1)^{2}+5$$ |  |  |  |  |  |  |  |
| $$y=0.3(x+2)^{2}+15$$ |  |  |  |  |  |  |  |
| $$y=-\frac{2}{3}\left(x-4\right)^{2}-8$$ |  |  |  |  |  |  |  |
| $$y=2x^{2}+9$$ |  |  |  |  |  |  |  |
| $$y=-3(x+5)^{2}$$ |  |  |  |  |  |  |  |