## Warm-up:

Identify the transformations that map $f(x)$ to $g(x)$. Then write the quadratic function.

## Horizontal shift right 3 Vertical Shift down 5

$$
g(x)=(x-3)^{2}-5
$$



Given a basic function $y=f(x)$, you have learned how to identify

## the effects and graph a function written in the transformation form

$g(x)=A f(x-C)+D$. For quadratic functions written in transformation

In vertex form, the coefficient of $x$ is always 1. Therefore, the $B$-value in the transformation form in this case is also 1 and is left out of the expression.
form, $A \neq 0$.

For quadratic functions specifically, you will also see them written in the form
$f(x)=a(x-h)^{2}+k$, where $a \neq 0$. This is referred to asvertex form. $(h, k)$

1. What does the variable $h$ represent in the vertex form of a quadratic function?

## Axis of Symmetry, the $x$ coordinate of the vertex

2. What does the variable $k$ represent in the vertex form of a quadratic function? the $y$ coordinate of the vertex

$$
g(x)=A f(x-C)+D
$$

3. What key characteristics can you determine directly from the quadratic function when it is written in vertex form?

- The vertex (transformations)
- The axis of symmetry
- Direction of opening
- Vertical Dilation

4. Simone, Teresa, Jesse, Aricka, and Leon are working together to write a quadratic function to represent a parabola that opens upward and has a vertex at ( $-6,-4$ ).
simone
My function is $s(x)=3(x+6)^{2}-4$.

Jesse
My function is

$$
j(x)=-3(x+6)^{2}-4 .
$$

Teresa
My function is $t(x)=\frac{1}{4}(x+6)^{2}-4$.

Leon
My function is
$z(x)=2(x-6)^{2}-4$.

MY Function is

$$
D(x)=(x+6)^{2}-4
$$

5. Use technology to graph each function. Use the graph to rewrite the function in vertex form and in factored form.
a. $h(x)=x^{2}-8 x+12$
vertex: $\quad V(4,-4)$
vertex form: $h(x)=(x-4)^{2}-4$
zero(s):
$(2,0)$ and $(6,0)$
factored form:

$$
h(x)=(x-2)(x-6)
$$


b. $r(x)=-2 x^{2}+6 x+20$
vertex: $\quad V(1.5,24.5)$
vertex form! $r(x)=-2(x-1.5)^{2}+24.5$
zero(s): $\quad(-2,0)$ and $(5,0)$
factored form: $r(x)=-2(x+2)(x-5)$

c. $w(x)=-x^{2}-4 x$

d. $c(x)=3 x^{2}-3$
vertex: $\quad V(0,-3)$
vertex form: $c(x)=3 x^{2}-3$ zero(s): $\quad(-1,0)$ and $(1,0)$ factored form: $\quad c(x)=3(x+1)(x-1)$

6. Identify the form(s) of each quadratic function as either general form, factored form, or vertex form. Then state all you know about each quadratic function's key characteristics, based only on the given equation of the function.
a. $g(x)=-(x-1)^{2}+9$
vertex form; parabola opens down, vertex is $(1,9)$
c. $g(x)=-\frac{1}{2}(x-3)(x+2)$
factored form; parabola opens down, $x$-intercepts are $(3,0)$ and $(22,0)$, axis of symmetry is $x=1 / 2$, vertically compressed
b. $g(x)=x^{2}+4 x$
general form; parabola opens up, $y$-intercept is $(0,0)$, axis of symmetry is $x=-2$
d. $g(x)=x^{2}-5$
vertex form or general form; parabola opens up, the $y$-intercept is $(0,-5)$, vertex is $(0,-5)$, axis of symmetry is $x=0$.

Write an equation for a quadratic function with vertex $(1,-2)$ that passes through the point $(0,1)$.

Step 1: Substitute the coordinates of the vertex $\quad y=a(x-h)^{2}+k$ into vertex form of a quadratic function. $\quad y=a(x-1)^{2}-2$

Step 2: Substitute the coordinates of the $1=a(0-1)^{2}-2$ other point on the graph for $x$ and $y$.

Step 3: Solve for the value of $a$.

$$
\begin{aligned}
& 1=a(-1)^{2}-2 \\
& 1=a(1)-2 \\
& 1=a-2 \\
& 3=a
\end{aligned}
$$

Step 4: Rewrite the equation in vertex form, $f(x)=3(x-1)^{2}-2$ substituting the vertex and the value of $a$.
2. Dawson and Dave each wrote an equation for the function represented by the graph shown.

3. Write an equation for a quadratic function in vertex form with vertex $(3,1)$ that passes through the point $(1,9)$.

$$
\begin{aligned}
& y=a(x-3)^{2}+1 \\
& 9=a(1-3)^{2}+1 \\
& 9=a(-2)^{2}+1 \\
& \quad 9=4 a+1 \\
& 8=4 a \\
& \quad a=2 \quad f(x)=2(x-3)^{2}+1
\end{aligned}
$$

(1) $f(x)=2(x-3)^{2}+1$

4. Write an equation for a quadratic function in factored form with zeros at $x=-4$ and $x=0$ that passes through the point $(-3,6)$.

$$
\begin{aligned}
& y=a(x)(x+4) \\
& 6=a(-3)(-3+4) \\
& \quad 6=a(-3)(1) \\
& \quad 6=-3 a \\
& \quad a=-2 \quad f(x)=-2(x)(x+4)
\end{aligned}
$$


5. Write an equation for a quadratic function in vertex form with vertex $(-1,6)$ that passes through the point $(-3,4)$.
6. Write an equation for a quadratic function $g(x)$ in vertex form given the graph of $g(x)$.


