Graphing Translations of Quadratics

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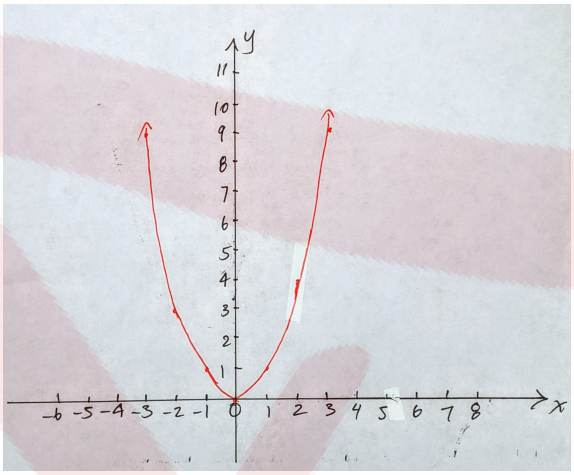
Graph Translations of quadratics

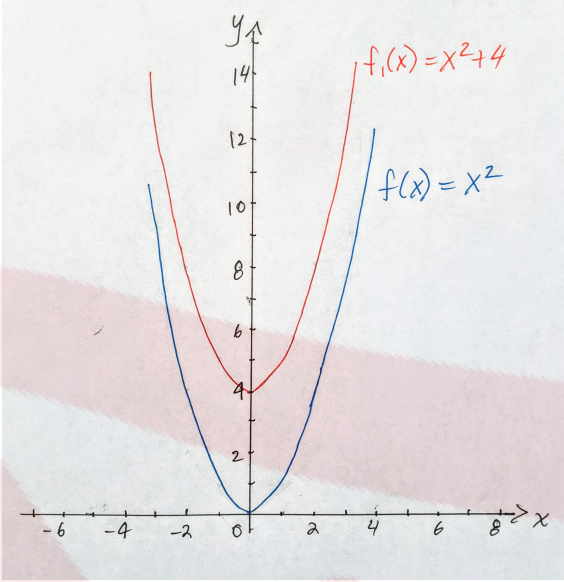
How do we determine the intervals of increase and decrease? We need to determine the vertices of the function. This brings us to sketching graphs and transformations of functions. We will consider sketching quadratics here. Let's consider the most basic quadratic, $f(x) = x^2$, and it's graph. Note, quadratics may also be called *parabolas*.



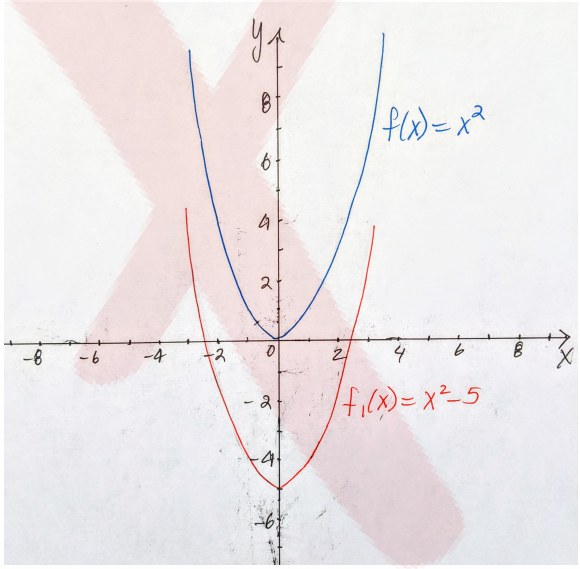
We will call this function a *parent function*. There are many other parent functions but we will start with this one to illustrate the basic transformations.

Translations

Vertical translation Below is a graph of a vertical translation up by 4 units of the parent function $f(x) = x^2$.



and below is a graph of a vertical translation down by 5 units.



A vertical translation moves the parent function $f(x) = x^2$ up or down along the y-axis. A general **vertical translation** is written as,

$$f(x) = x^2 + h,$$

where $h \in \mathbb{R}$.

When $h > 0$ then the vertical translation is **upwards** h units.

When $h < 0$ then the vertical translation is **downwards** h units.

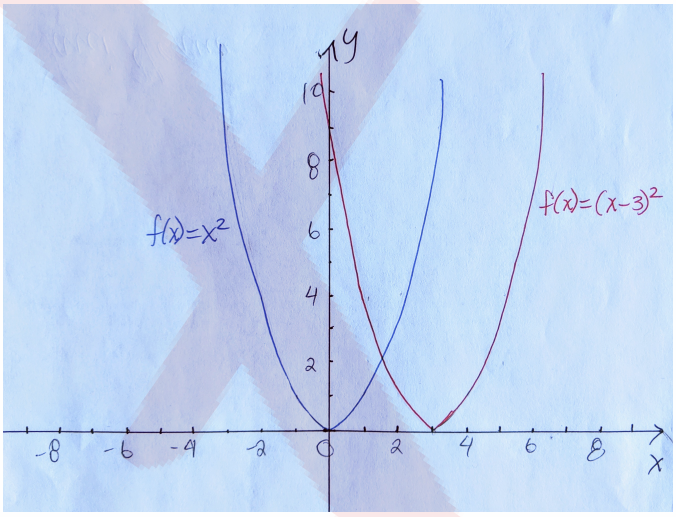
Horizontal translation A **horizontal translation** moves the parent function left or right along the x-axis. A general **horizontal translation** can be written as

$$f(x) = (x - k)^2,$$

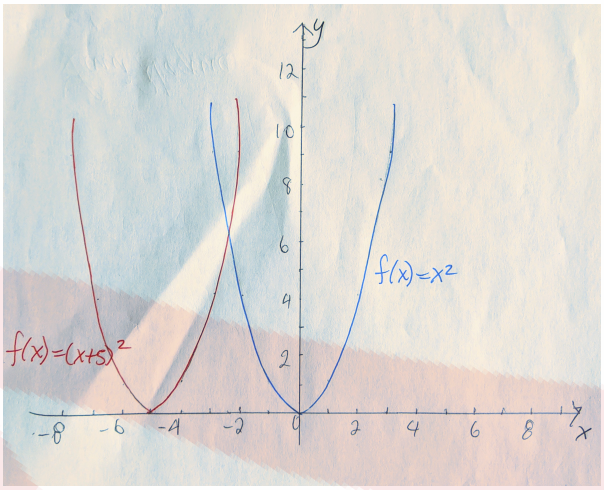
where $k \in \mathbb{R}$.

When $k > 0$ then the horizontal translation is to the **right** k units.

When $k < 0$ then the horizontal translation is to the **left** k units.
Below is a graph of a horizontal translation to the right 3 units



and below is a graph of a horizontal translation to the left 5 units.


y
x
12
10
8
6
4
2
-8
-6
-4
-2
0
2
4
6
8
f(x)=x²
f(x)=(x+5)²

Exercises

For each of the quadratics below,

a) Sketch.

b) Indicate if the translation is horizatonal or vertical; direction of translation; by how much the graph is being translated.

1. $y = x^2 - 4$
2. $y = (x - 3)^2$
3. $y = x^2 + 6$
4. $y = x^2 - 6$
5. $= (x + 5)^2$
6. $y = (x + 2)^2$
7. $y = x^2 + 12$
8. $y = (x - \frac{1}{2})^2$
9. $y = x^2 + 10$
10. $y = (x + 4)^2$