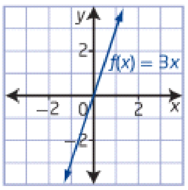
p 028, q3

**3.** Consider each graph of a function.

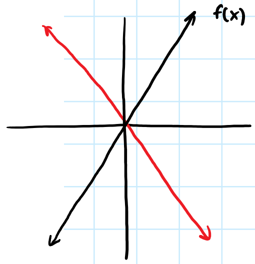
- Copy the graph of the function and sketch its reflection in the $x$-axis on the same set of axes.
- State the equation of the reflected function in simplified form.
- State the domain and range of each function.

A reflextion into the $x$-axis is a vertical reflection. The sketches appear in red below. The general formula of such a reflection is $g(x) = -f(x)$.

**a)**




a)




<u>the equation of the transformation:</u>

$g(x) = -f(x) = -(3x) = -3x$

thus the transformation is

$g(x) = -3x$

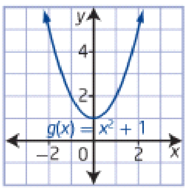
The domain is unchanged for <u>both</u> $f(x)$ and $g(x)$:

$D = \{x \mid x \in \mathbb{R}\}$

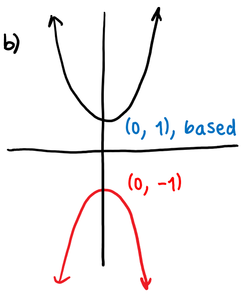
The range is also unchanged for both $f(x)$ and $g(x)$:

$R = \{y \mid y \in \mathbb{R}\}$

**b)**




b)




(0, 1), based on the y=intercept = g(0)

<u>the equation of the transformation:</u>

$t(x) = -g(x) = -(x^2+1) = -x^2 - 1$

$t(x) = -x^2 - 1$

<u>for the base function $g(x)$</u>

The domain is unrestricted: $D = \{x \mid x \in \mathbb{R}\}$

The range is limited by its vertex, which resides at the $y$ intercept:

$y = f(0) = x^2+1 = 0^2 + 1 = 1,$

and all y-s in the range are larger or equal to it:

$R = \{y \mid y \geq 1,\ y \in \mathbb{R}\}$

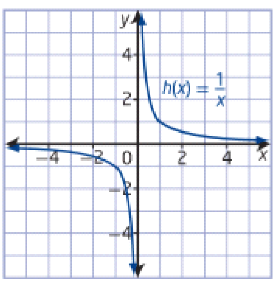
<u>for the transformation $t(x)$</u>

the domain is not changed b/c the transformation is not horizontal, it is only vertical, so it remains the same: $D = \{x \mid x \in \mathbb{R}\}$.

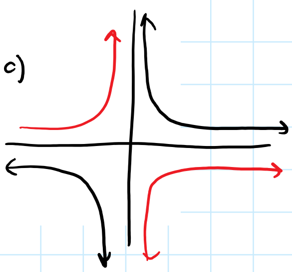
The range has flipped, every $y$ is less than the vertex, which has turned from a min to a max. This value was flipped from 1 to −1.

$\therefore R = \{y \mid y \leq -1,\ y \in \mathbb{R}\}$

**c)**




c)



<u>the equation of the transformation:</u>

$t(x) = -h(x) = -\left(\frac{1}{x}\right) = -\frac{1}{x}$

the transformation is:

$t(x) = -\frac{1}{x}$

<u>for the base function $h(x)$</u>

The domain of the parent functon $h(x)$ is all of R but interrupted by the vertical asymptote at $x = 0$. That is

$D = \{x \mid x \neq 0,\ x \in \mathbb{R}\}$

The range of the base function $h(x)$ is all of R but interrupted by the horizontal asymptote at $y = 0$. That is

$R = \{y \mid y \neq 0,\ y \in \mathbb{R}\}$

<u>for the transformation $t(x)$</u>

The red function $t(x)$ has flipped upside down, but the domain has the same asymptote, and the same rule applies, all of R but interrupted by the asymptote at $x = 0$. That is

$D = \{x \mid x \neq 0,\ x \in \mathbb{R}\}$

The range also has the same asymptote, and the same rule applies, all of R but interrupted by the horizontal asymptote at $y = 0$. That is

$R = \{y \mid y \neq 0,\ y \in \mathbb{R}\}$