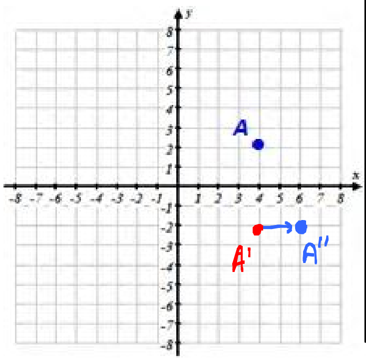
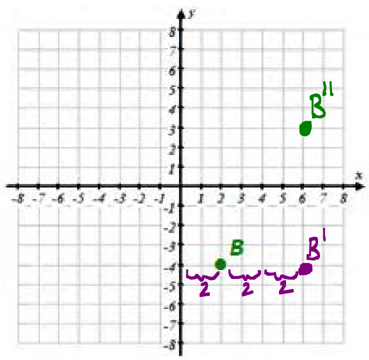
It may help to first review some transformations on the graph. Transform the following points as suggested.

1. Reflect ***point A*** over the x-axis and then translate the image right 2 units.

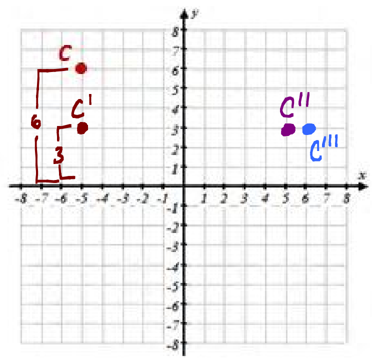


2. Horizontally stretch ***point B*** by a factor of 3 from the y-axis and translate the image up 7 units.

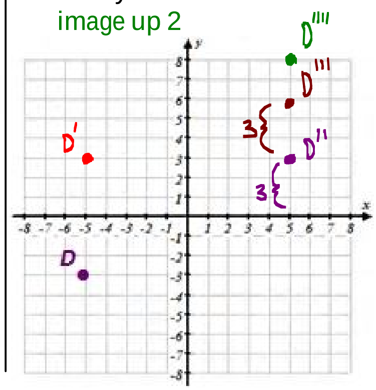
2·3 = 6 UNITS



3. Vertically compress ***point C*** by a factor of ½ from the x-axis, reflect the image over the y-axis, and finally, translate that image right 1 unit.



4. Reflect ***point D*** over the x-axis, then reflect that image over the y-axis, vertically stretch that image by a factor 2 from the x-axis, and finally translate the last image up 2



Consider the parent function of $f(x)$. The following would be a transformed function

$$t(x) = a \cdot f(b(x - c)) + d$$

a > 1: Vertical Stretch *(eg. a = 3)*
(factor 'a')

0 < a < 1: Vertical Compress *(e.g. a = 0.2)*
(factor 'a')

-1 < a < 0: Reflect over x-axis & Vertical Compress *(e.g. a =- 0.2)*
(factor 'a')

a = -1: Reflect over x-axis

a < -1: Reflect over x-axis & Vertical Stretch *(e.g. a =- 4)*
(factor 'a')

b > 1: Horizontal Compress *(eg. b = 3)*
(factor '$\frac{1}{b}$')

0 < b < 1: Horizontal Stretch *(e.g. b = 0.2)*
(factor '$\frac{1}{b}$')

-1 < b < 0: Reflect over y-axis & Horizontal Stretch *(e.g. b =- 0.2)*
(factor '$\frac{1}{b}$')

b = -1: Reflect over y-axis

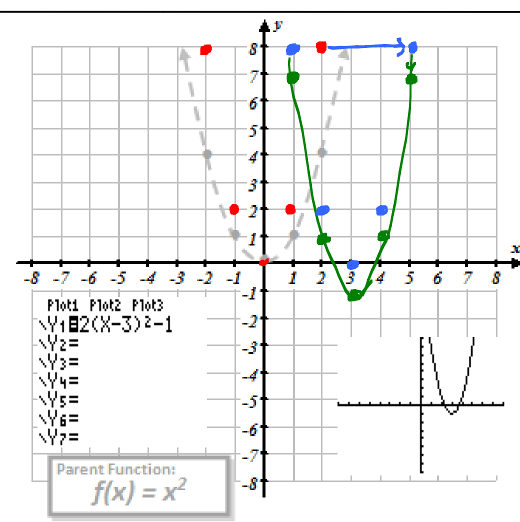
b < -1: Reflect over y-axis & Horizontal Compress *(e.g. b =- 4)*
(factor '$\frac{1}{b}$')

c = Horizontal Translation
(opposite direction)

d = Vertical Translation

First apply any **reflections** or **stretches/compresses** and then the **translations**

5. At the right the parent graph of $f(x) = x^2$ is shown as a light gray dashed line. Describe the transformations of $f(x)$ that would be required to match the transformed function shown below and sketch a graph by transforming a few of the points of $f(x)$.



$$t(x) = 2(x - 3)^2 - 1$$

VERTICAL STRETCH FACTOR 2

TRANSLATE RIGHT 3

TRANSLATE DOWN 1

6. At the right the parent graph of $f(x) = x^2$ is shown as a light gray dashed line. Describe the transformations of $f(x)$ that would be required to match the transformed function shown below and sketch a graph by transforming a few of the points of $f(x)$.

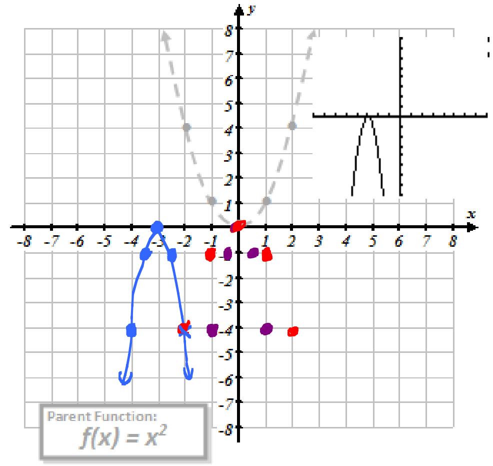
$$t(x) = -(2(x+3))^2$$

REFLECTION OVER X-AXIS

HORIZONTAL COMPRESS FACTOR $\frac{1}{2}$

TRANSLATE LEFT 3

```
Plot1 Plot2 Plot3
\Y1=-(2(X+3))²
\Y2=
\Y3=
\Y4=
\Y5=
\Y6=
\Y7=
```



---

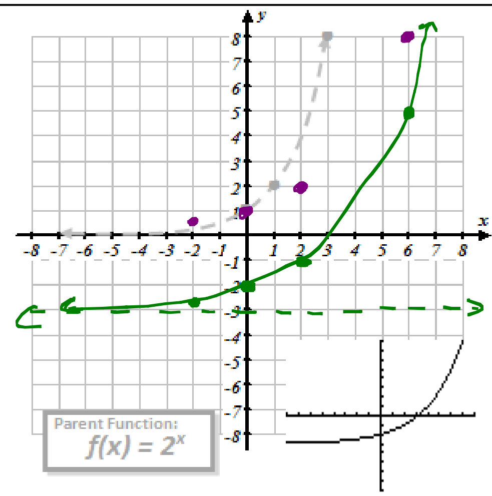
7. At the right the parent graph of $f(x) = 2^x$ is shown as a light gray dashed line. Describe the transformations of $f(x)$ that would be required to match the transformed function shown below and sketch a graph by transforming a few of the points of $f(x)$.

$$t(x) = 2^{\left(\frac{1}{2}(x)\right)} - 3$$

HORIZONTAL STRETCH FACTOR 2

TRANSLATE DOWN 3

```
Plot1 Plot2 Plot3
\Y1=2^(.5X)-3
\Y2=
\Y3=
\Y4=
\Y5=
\Y6=
\Y7=
```



---

8. At the right the parent graph of $f(x) = \sqrt{x}$ is shown as a light gray dashed line. Describe the transformations of $f(x)$ that would be required to match the transformed function shown below and sketch a graph by transforming a few of the points of $f(x)$.

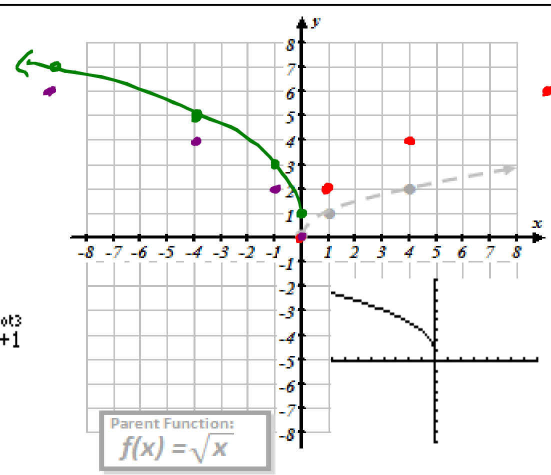
$$t(x) = 2\sqrt{-x} + 1$$

VERTICAL STRETCH FACTOR 2

REFLECT OVER Y-AXIS

TRANSLATE UP 1

```
Plot1 Plot2 Plot3
\Y1=2√(-X)+1
\Y2=
\Y3=
\Y4=
\Y5=
\Y6=
\Y7=
```



---

9. At the right the parent graph of $f(x) = x^3$ is shown as a light gray dashed line. Describe the transformations of $f(x)$ that would be required to match the transformed function shown below and sketch a graph by transforming a few of the points of $f(x)$.

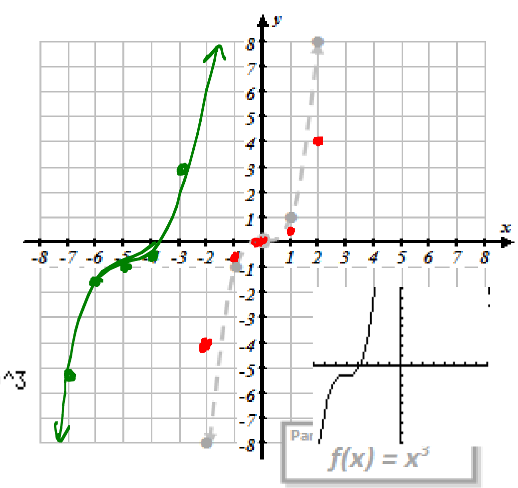
$$t(x) = \frac{1}{2}(x+5)^3 - 1$$

VERTICAL COMPRESS FACTOR $\frac{1}{2}$

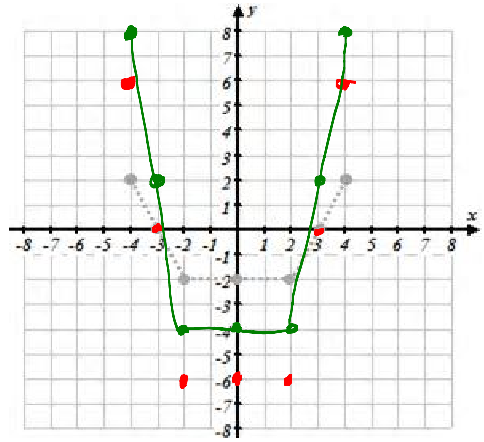
TRANSLATE LEFT 5

TRANSLATE DOWN 1

```
Plot1 Plot2 Plot3
\Y1=(1/2)(X+5)^3
-1
\Y2=
\Y3=
\Y4=
\Y5=
\Y6=
```



10. At the right the parent graph of $f(x)$ is shown as a light gray dashed line. Describe the transformations of $f(x)$ that would be required to match the transformed function shown below and sketch a graph by transforming a few of the points of $f(x)$.

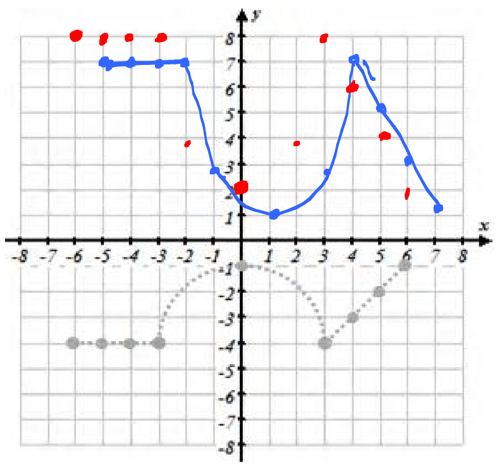


$$t(x) = 3 \cdot f(x) + 2$$

VERTICAL STRETCH FACTOR 3

TRANSLATE UP 2

11. At the right the parent graph of $f(x)$ is shown as a light gray dashed line. Describe the transformations of $f(x)$ that would be required to match the transformed function shown below and sketch a graph by transforming a few of the points of $f(x)$.



$$t(x) = -2 \cdot f(x-1) - 1$$

REFLECT OVER X-AXIS & VERTICAL STRETCH FACTOR 2

TRANSLATE RIGHT 1

TRANSLATE DOWN 1

12. Given a more elaborate parent function of $f(x) = x^3 - x$, describe how the parent function could be graphically transformed to create the functions below:

a. $g(x) = 4(x^3 - x)$

VERTICAL STRETCH FROM X-AXIS FACTOR 4

b. $h(x) = (4x)^3 - (4x)$

HORIZONTAL COMPRESSION FROM Y-AXIS FACTOR $\frac{1}{4}$

c. $p(x) = -\frac{1}{3}\left((x-2)^3 - (x-2)\right) + 1$

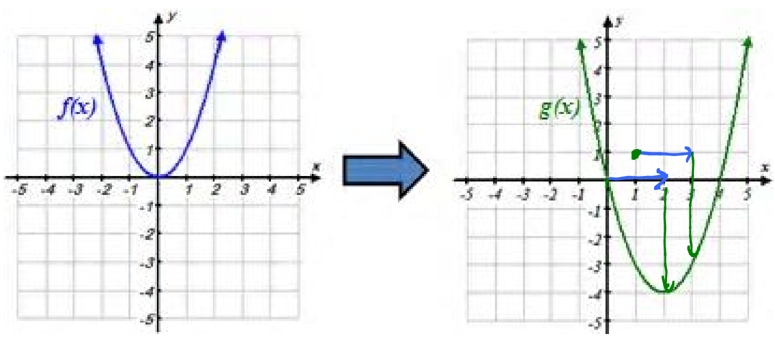
REFLECT OVER X-AXIS

VERTICAL COMPRESSION FACTOR 1/3

TRANSLATE RIGHT 2

TRANSLATE UP 1

13. Describe ***g(x)*** as a transformation of ***f(x)***.

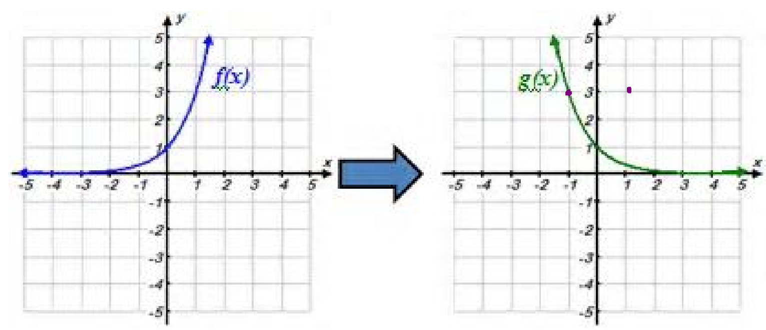


$g(x) = f(x-2) - 4$

RIGHT 2

DOWN 4

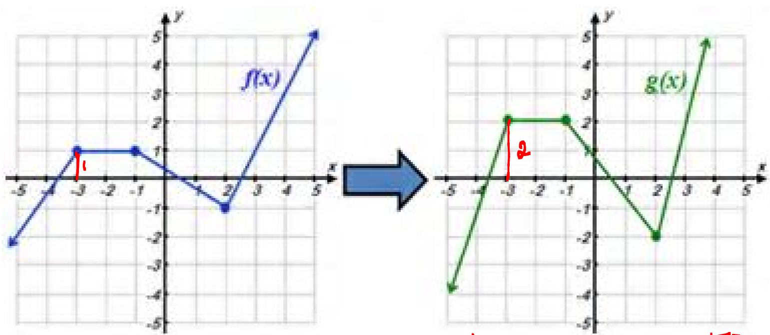
14. Describe ***g(x)*** as a transformation of ***f(x)***.



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

REFLECT OVER Y-AXIS

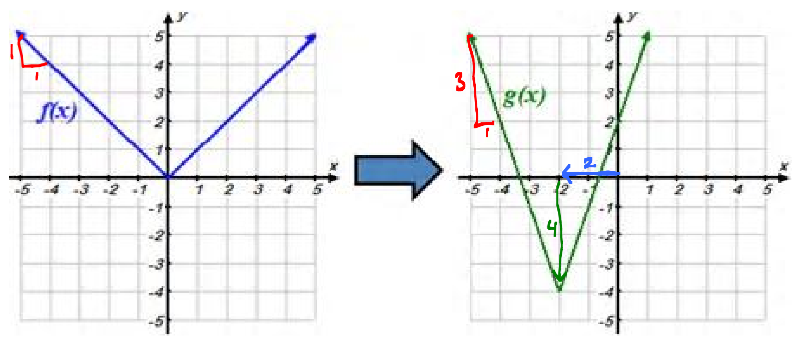
15. Describe ***g(x)*** as a transformation of ***f(x)***.



VERTICALLY STRETCHED FACTOR 2

$g(x) = 2 \cdot f(x)$

16. Describe ***g(x)*** as a transformation of ***f(x)***.



$g(x) = 3 \cdot f(x+2) - 4$

VERTICAL STRETCH FACTOR 3 LEFT 2 DOWN 4

17. Consider the partial set of values of the function $f(x)$, shown below. Determine the missing values in the second table given that $t(x)$ is the same as $f(x)$ **translated up 3 units**.

x	−2	−1	0	1	2
f(x)	−5	−3	−1	1	3

LEFT RIGHT UP DOWN

x	−2	−1	0	1	2
t(x)	-2	0	2	4	6
	-5+3	-3+3	-1+3	1+3	3+3

18. Consider the partial set of values of the function $f(x)$, shown below. Determine the missing values in the second table given that $t(x)$ is the same as $f(x)$ **translated right 2 units and down 2 unit**.

x	−2	−1	0	1	2
f(x)	5	2	3	−2	−4

LEFT RIGHT UP DOWN

	-2+2	-1+2	0+2	1+2	2+2
x	0	1	2	3	4
t(x)	3	0	1	-4	-6
	5-2	2-2	3-2	-2-2	-4-2

19. Consider the partial set of values of the function $f(x)$, shown below. Determine the missing values in the second table given that $t(x)$ is the same as $f(x)$ **vertically stretched by a factor of 2 from the x-axis**.

x	0	1	2	3	4
f(x)	−3	−1	0	2	3

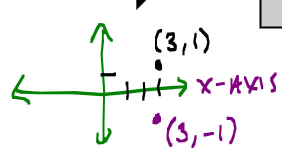
x	0	1	2	3	4
t(x)	-6	-2	0	4	6
	2·-3	2·-1	2·0	2·2	2·3

20. Consider the partial set of values of the function $f(x)$, shown below. Determine the missing values in the second table given that $t(x)$ is the same as $f(x)$ **reflected over the x-axis**.

x	−2	−1	0	1	2
f(x)	5	2	3	−2	−4

x	-2	-1	0	1	2
t(x)	-5	-2	-3	2	4

FOR EXAMPLE CONSIDER THE POINT (3,1) REFLECTED OVER THE X-AXIS



THE X-COORDINATE STAYED THE SAME AND THE Y-COORDINATE CHANGED SIGNS.