# C12 - 1.3 - VHTCER Point/s/Algebra/Factor/Order Notes

$(2,4)$ is on $f(x)$. Find the point on $g(x)$ if: $\quad g(x) = f(x-2) + 3$
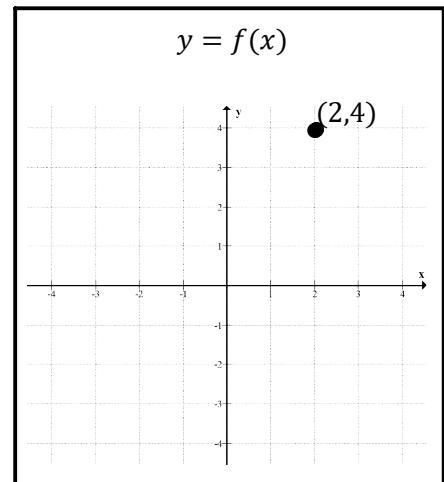
$\underline{(2,4)}$

$HT = +2 \qquad (4,4) \qquad$ Add 2 to x-value
$VT = +3 \qquad \boxed{(4,7)} \qquad$ Add 3 to y-value

$y = f(x)$

$(2,4)$

$(2,4)$ is on $f(x)$. Find the point on $g(x)$ if: $\quad g(x) = -2f(x+1) - 1$

$\underline{(2,4)}$

$VR \qquad\quad (2,-4) \qquad$ Multiply y-value by -1
$VE = 2 \qquad (2,-8) \qquad$ Multiply y-value by 2
$HT = -1 \qquad (1,-8) \qquad$ Subtract 1 from x-value
$VT = -1 \qquad \boxed{(1,-9)} \qquad$ Subtract 1 from y-value

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$(2,4)$ is on $f(x)$. Find the point on $g(x)$ if: $\quad g(x) = f\left(-\dfrac{1}{2}x\right)$

$\underline{(2,4)}$

$HR \qquad\quad (-2,4) \qquad$ Multiply x-value by -1
$HE = 2 \qquad \boxed{(-4,4)} \qquad$ Multiply x-value by 2

$(2,4)$ and $(4,6)$ are on $f(x)$. Find the point on $g(x)$ if: $\quad g(x) = f(2(x-2))$

$\underline{(2,4)} \qquad \underline{(4,6)}$

$HC = \dfrac{1}{2} \qquad (1,4) \qquad (2,6) \qquad$ Multiply x-value by a half
$HT = +2 \qquad \boxed{(3,4)} \qquad \boxed{(4,6)} \qquad$ Add 2 to x-value

Two Points

$g(x) = f(2x - 4) \qquad HC = \dfrac{1}{2} \qquad\bigg|\qquad y = f(1-x)$
$g(x) = f(2(x-2)) \qquad HT = +2 \qquad\bigg|\qquad y = f(-(-1+x))$
$\qquad\qquad\qquad\qquad\qquad\qquad\qquad\quad y = f(-(x-1))$

HR
$HT = +1$

Factor Brackets

; so x has a coefficient of 1

$2g(x) - 4 = f(x) \qquad\qquad Algebra$
$\quad 2g(x) = f(x) + 4 \qquad\qquad VC = \dfrac{1}{2}$
$\qquad g(x) = \dfrac{1}{2}f(x) + 2 \qquad\quad VT = +2$

$(2,4)$ is on $f(x)$. Find the point on $g(x)$ if: $\quad g(x) = f^{-1}(x+2)$

1.4

$\underline{(2,4)}$

$f^{-1} \qquad\quad (4,2) \qquad$ Function operations 1st
$HT = -2 \qquad \boxed{(2,2)} \qquad$ Subtract 2 from x

$$\boxed{y = f(x)}$$

$$\boxed{f(x) = x^2}$$

$$3f(-x) + 2 = ?$$

$$f(x) = x^2$$

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

Let's call it $d(x)$

$$3 \times f(-x) + 2$$

Function Notation

$$d(x) = ?$$

$$d(x) = 3f(-x) + 2$$

$$\boxed{d(x) = 3(-x)^2 + 2}$$

$$2f(x - 1) + 5 = ?$$

$$f(x) = x^2$$

$$\boxed{2f(x - 1) + 5 = 2(x - 1)^2 + 5}$$

Let's call it $n(x)$

$Put\ x - 1\ in\ for\ x$
$+5\ to\ 2f(x - 1)$

$$n(x) = ?$$

$$n(x) = 2f(x - 1) + 5$$

$$\boxed{n(x) = 2(x - 1)^2 + 5}$$

C12 - 1.3 - VHTCER y= Notes

Find the new equation.

$$y = x^2 + x$$

A Horizontal Reflection
A vertical expansion by a factor of 2
A vertical translation up 1
A horizontal translation left 5

$$y = x^2 + x$$
$$y = (-x)^2 + (-x) \longrightarrow \quad HR \longrightarrow \quad x \to -x$$
$$y = x^2 - x \qquad\qquad\qquad \text{Algebra}$$

$$\frac{1}{2}y = x^2 - x \longrightarrow \quad VE = 2 \longrightarrow \quad y \to \frac{1}{2}y$$
$$y = 2x^2 - 2x \qquad\qquad \text{Algebra}$$
$$y - 1 = 2x^2 - 2x \longrightarrow \quad VT = +1 \longrightarrow \quad y \to y - 1$$
$$y = 2x^2 - 2x + 1$$

$$y = 2(x+5)^2 - 2(x+5) + 1 \longrightarrow \quad HT = -5 \longrightarrow \quad x \to x + 5$$

Foil?

C12 - 1.3 - VHTCER Graph y= Notes

$y = x^2$
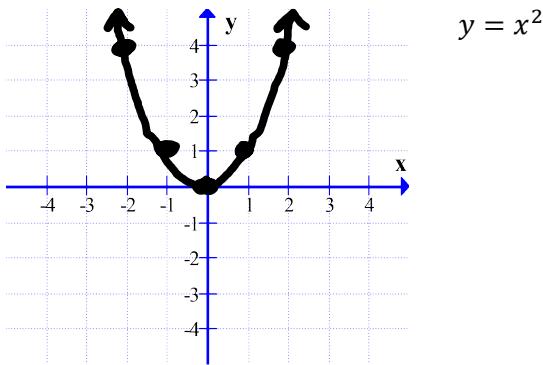
x	y
-2	4
-1	1
0	0
1	1
2	4

Vertical Expansion by a factor of 2 **AND A** Vertical Translation Up One

$y = x^2$
$\frac{1}{2}y = x^2 \qquad VE = 2 \qquad y \to \frac{1}{2}y$
$y = 2x^2$

$\boxed{Put \frac{1}{2}y \; in \; for \; y}$

Substitute the Opposite Operation for the Variable

$$VE = 2$$
$$y \times 2$$

Multiply y values by 2
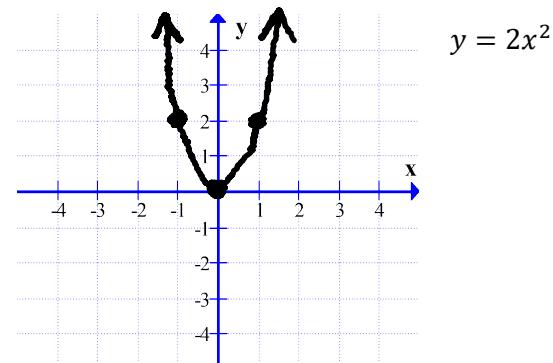
$y = 2x^2$

x	y
-2	8
-1	2
0	0
1	2
2	8

$y = 2x^2$
$y - 1 = 2x^2 \qquad VT = +1 \qquad y \to y - 1$

$\boxed{Put \; y - 1 \; in \; for \; y}$

Substitute the Opposite Operation for the Variable

$\boxed{y = 2x^2 + 1}$

$$VT = +1$$
$$y + 1$$
$$Up \; 1$$

Add 1 to the y − values

$y = 2x^2 + 1$
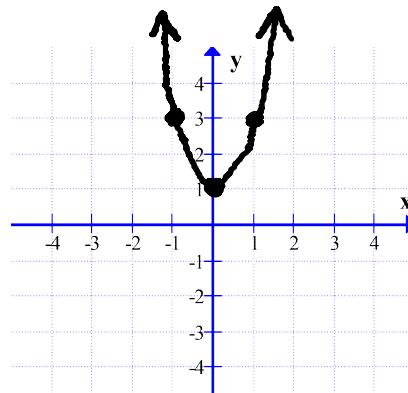
x	y
-2	9
-1	3
0	1
1	3
2	9

C12 - 1.3 - VHTCER Graph f(x) Notes

Find the transformed equation.

$$y = af(b(x - h)) + k$$
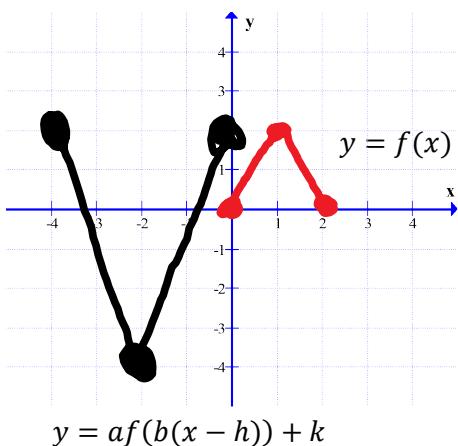
How wide is it?

2 units

How wide is it now?

4 units

What happened?

HE=2

$$x \to \frac{1}{2}x$$

How tall is it?

2 units

How tall is it now?

6 units

What happened?

VE=3

$$y \to \frac{1}{3}y$$

Any reflections?

VR

$$y \to -y$$

Or do multiple intercepts to make sure.

Pick a point, not an intercept, do expansions, compressions, and reflections.

$$
\begin{array}{ll}
 & (1,2) \\
HE = 2 & (2,2) \\
VE = 3 & (2,6) \\
VR & (2,-6)
\end{array}
$$

Has it moved?

$$
\begin{array}{ll}
 & (2,-6) \\
HT = -4 & (-2,-6) \\
VT = +2 & (-2,-4)
\end{array}
$$

$$x \to x + 4$$

$$y \to y - 2$$

$$y = f(x)$$

$$y = f\left(\frac{1}{2}x\right)$$

$$\frac{1}{3}y = f\left(\frac{1}{2}x\right)$$

$$y = 3f\left(\frac{1}{2}x\right)$$

$$-y = 3f\left(\frac{1}{2}x\right)$$

$$y = -3f\left(\frac{1}{2}x\right)$$

$$y = -3f\left(\frac{1}{2}(x + 4)\right)$$

$$y - 2 = -3f\left(\frac{1}{2}(x + 4)\right)$$

$$y = -3f\left(\frac{1}{2}(x + 4)\right) + 2$$