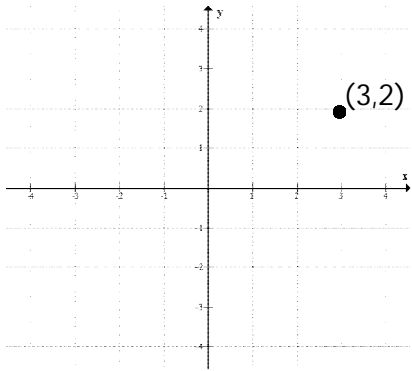


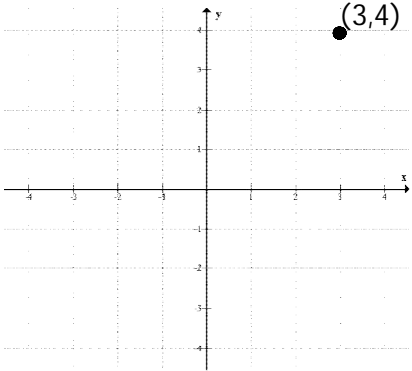
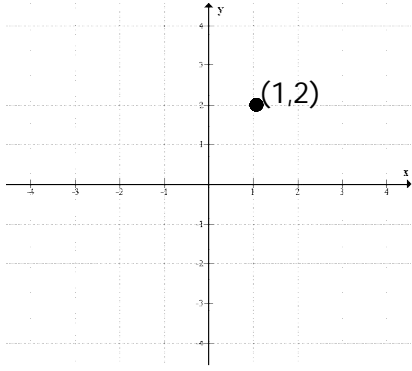
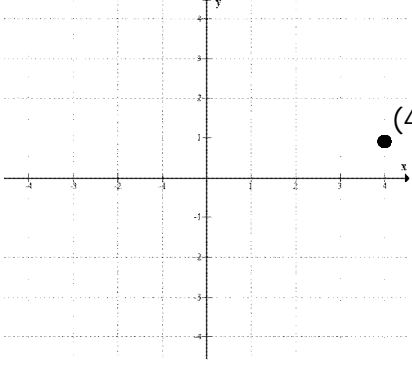
# C12 - 1.1 - Points Translations Notes



Point

$$(x, f(x)) = (3, 2)$$

Function Notation

		English Sentence	Mapping Notation
	<div>New Point</div> <div><math>f(x) + 2 = (3, 4)</math></div> <div>Operation</div> <div><math>y + 2</math></div> <div>Add 2 to y-value</div>	<div>A vertical translation up 2</div> <div><math>VT = +2</math></div>	<div><math>(x, y + 2)</math></div>
	<div><math>f(x + 2) = (1, 2)</math></div> <div><math>x - 2</math></div> <div>Subtract 2 from x-value</div>	<div>A horizontal translation left 2</div> <div><math>HT = -2</math></div>	<div><math>(x - 2, y)</math></div>
	<div><math>f(x - 1) - 1 = (4, 1)</math></div> <div><math>x + 1</math></div> <div><math>y - 1</math></div> <div>Add 1 to x-value</div> <div>Subtract 1 from y-value</div>	<div>A horizontal translation right 1</div> <div>A vertical translation down 1</div> <div><math>HT = +1</math></div> <div><math>VT = -1</math></div>	<div><math>(x + 1, y - 1)</math></div>

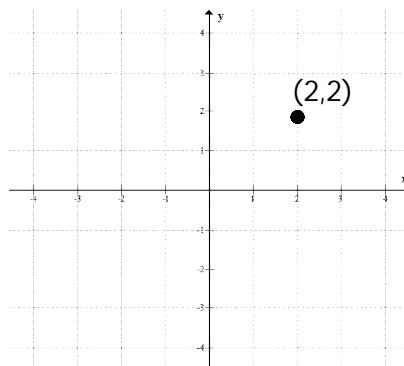
Remember: do exactly what you see outside of the brackets on the right-hand side to the y-value



Remember: do the opposite of what you see inside the brackets to x-value



# C12 - 1.2 - Points Expansion/Compression Notes



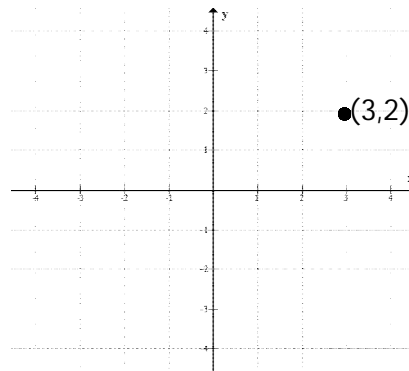
Point  
 $(x, f(x)) = (2, 2)$

Function Notation

	<p>New Point</p> <p><math>2f(x) = (2, 4)</math></p> <p>Operation</p> <p><math>2y</math></p> <p>Multiply y-value by 2</p>	<p>English Sentence</p> <p>A vertical expansion by a factor of 2</p> <p><math>VE = 2</math></p>	<p>Mapping Notation</p> <p><math>(x, 2y)</math></p>
	<p><math>f(2x) = (1, 2)</math></p> <p><math>\frac{1}{2}x</math></p> <p>Multiply x-value by <math>\frac{1}{2}</math></p>	<p>A horizontal compression by a half</p> <p><math>HC = \frac{1}{2}</math></p>	<p><math>(\frac{1}{2}x, y)</math></p>
	<p><math>f(\frac{1}{2}x) = (4, 2)</math></p> <p><math>2x</math></p> <p>Multiply x-value by 2</p>	<p>A horizontal expansion by 2</p> <p><math>HE = 2</math></p>	<p><math>(2x, y)</math></p>

Remember: do exactly what you see outside of the brackets on the right-hand side to the y-value  
 Remember: do the reciprocal of what you see inside the brackets to the x-value

# C12 - 1.3 - Points Reflection/Inverse Notes



Point

$$(x, f(x)) = (3, 2)$$

Function Notation

	New Point	Operation	English Sentence	Mapping Notation
	$-f(x) = (3, -2)$	$-y$  <i>Multiply y - value by - 1</i>	A vertical reflection  <i>VR</i>	$(x, -y)$
	$f(-x) = (-3, 2)$	$-x$  <i>Multiply x - value by - 1</i>	A horizontal reflection  <i>HR</i>	$(-x, y)$
	$f^{-1}(x) = (3, 2)$	$(x, y)$ $\downarrow$ $(y, x)$  <i>Switch x and y values</i>	Inverse	$(y, x)$

Remember: Always do inverse first



# C12 - 1.3 - Inverse Notes

$$y = f(x)$$

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

$$y = 2x - 4$$

$$x = 2y - 4$$

$$x + 4 = 2y$$

$$\frac{x}{2} + 2 = y$$

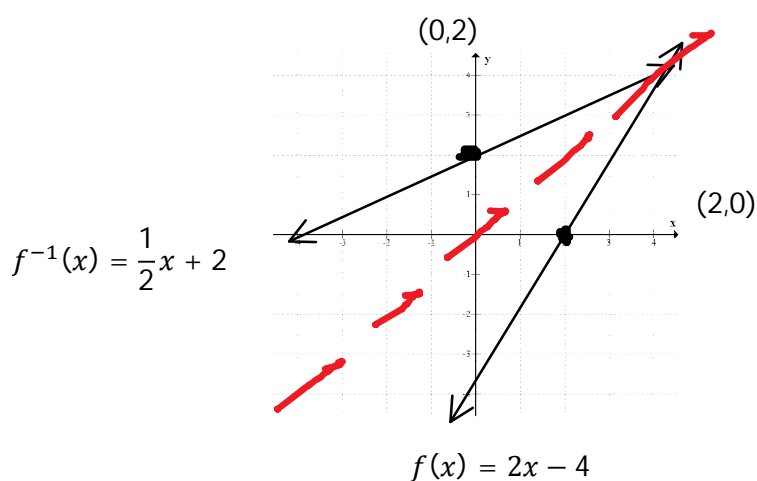
$$y = \frac{1}{2}x + 2$$

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

Switch x and y

Solve for y

Write in Function Notation



Remember: The inverse is a diagonal reflection over the line  $y=x$

$$\begin{aligned} f(x) &= \frac{x}{x+1} \\ y &= \frac{x}{x+1} \\ x &= \frac{y}{y+1} \\ x(y+1) &= y \\ xy + x &= y \\ x &= y - xy \\ x &= y(1-x) \quad GCF = y \\ \frac{x}{1-x} &= y \\ y &= \frac{x}{1-x} \end{aligned}$$

Switch x and y,  
Multiply  
Distribute  
Combine like terms (y's on one side)  
Factor  
Divide

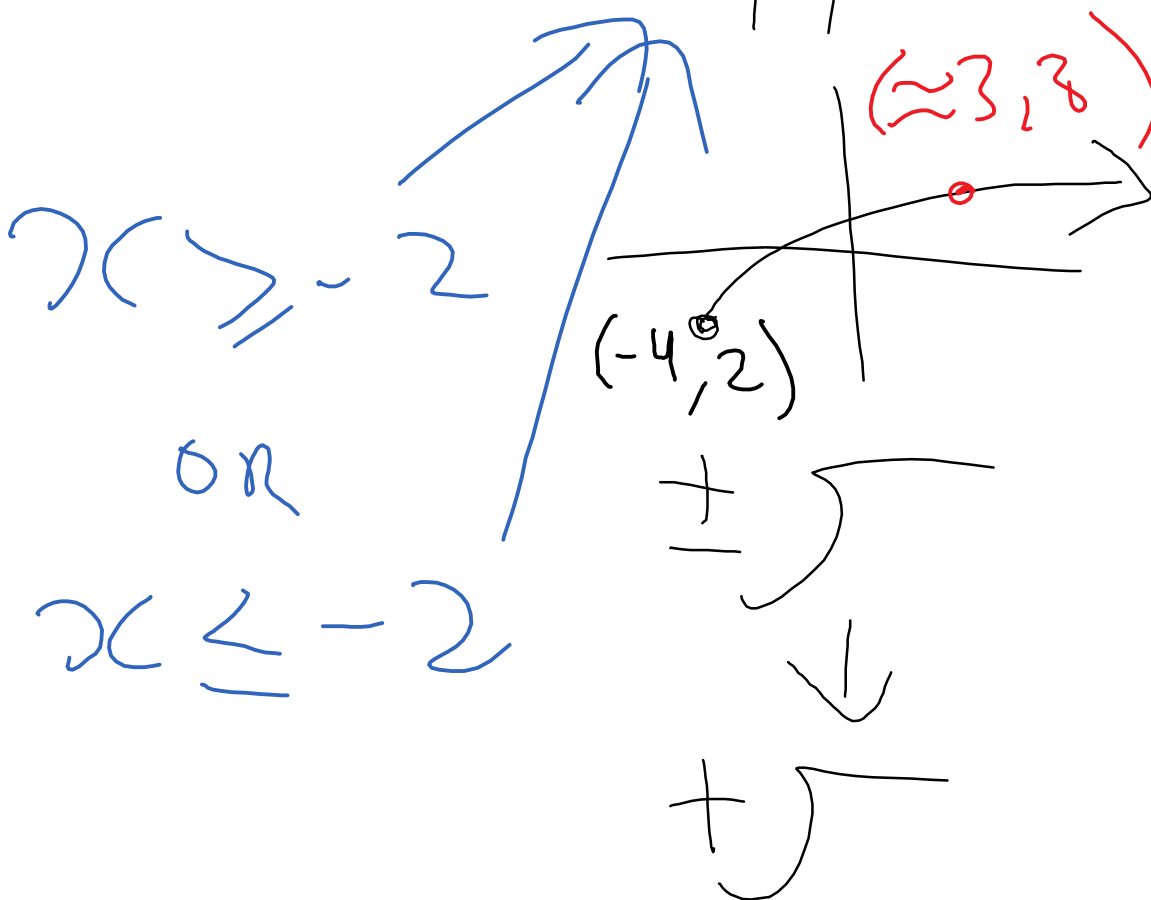
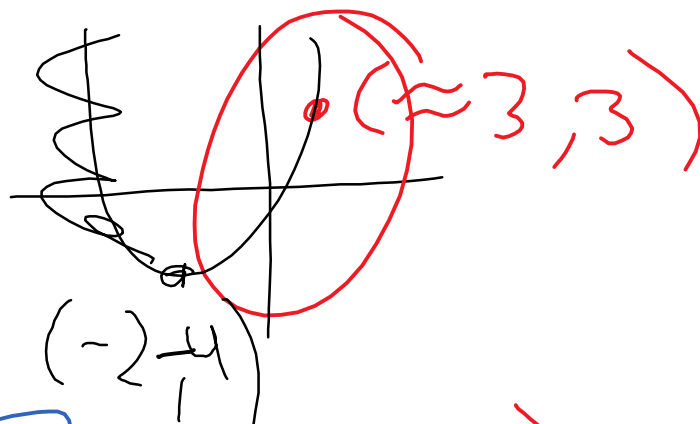
Remember: Methods such as square root both sides and removing a greatest common factor of "y".



# C12 - 1.3 - Inverse Notes

$$y = f(x)$$

$$\begin{aligned} y &= (x+2)^2 - 4 & x &\geq -2 \\ x &= (y+2)^2 - 4 \\ x+4 &= (y+2)^2 \\ \sqrt{x+4} &= y+2 \\ \sqrt{x+4} - 2 &= y \\ y &= \pm\sqrt{x+4} - 2 \\ y &= \sqrt{x+4} - 2 \end{aligned}$$



# C12 - 1.124 - Order Matters Point Eq. Eng. Trans Notes

Find the new point.

$$(x, f(x)) = (2, 1)$$

A vertical expansion by a factor of 2  
A vertical translation up 2

(2,1)	Old Point
(2,2)	VE = 2
(2,4)	VT = +2

A vertical translation up 2  
A vertical expansion by a factor of 2

(2,1)	Old Point
(2,3)	VT = +2
(2,6)	VE = 2

Find the new equation.

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

A vertical expansion by a factor of 4      $4f(x)$   
A vertical translation up 2      $f(x) + 2$

$f(x) = x^2$ $y = x^2$ $\frac{1}{4}y = x^2$ $y = 4x^2$ $y - 2 = 4x^2$ $y = 4x^2 + 2$	<i>Put <math>\frac{1}{4}y</math> in for <math>y</math></i>  <i>Put "<math>y - 2</math>" in for <math>y</math></i>
---	---

A vertical translation up 2      $f(x) + 2$   
A vertical expansion by a factor of 4      $4f(x)$

$f(x) = x^2$ $y = x^2$ $y - 2 = x^2$ $y = x^2 + 2$ $\frac{1}{4}y = x^2 + 2$ $y = 4x^2 + 8$	<i>Put "<math>y - 2</math>" in for <math>y</math></i>  <i>Put <math>\frac{1}{4}y</math> in for <math>y</math></i>
---	---

A horizontal compression by a factor of  $\frac{1}{2}$       $f(2x)$   
A horizontal translation left 2      $f(x + 2)$

$f(x) = x^2$ $y = x^2$ $y = (2x)^2$ $y = 4x^2$ $y = 4(x + 2)^2$ $y = 4x^2 + 16x + 16$	<i>Put <math>2x</math> in for <math>x</math></i>  <i>Put "<math>x + 2</math>" in for <math>x</math></i>
--	---

A horizontal translation left 2      $f(x + 2)$   
A horizontal compression by a factor of  $\frac{1}{2}$       $f(2x)$

$f(x) = x^2$ $y = x^2$ $y = (x + 2)^2$ $y = x^2 + 4x + 4$ $y = (2x)^2 + 4(2x) + 4$ $y = 4x^2 + 8x + 4$	<i>Put "<math>x + 2</math>" in for <math>x</math></i>  <i>Put <math>2x</math> in for <math>x</math></i>
---	---

Remember: We always substitute the opposite operation

Remember: Order matters. An addition then a multiplication is far different from the same multiplication and then the same addition. **Think about it!**

Remember: Do the operations in the order you are asked or follow BEDMAS

Notice: for  $x^2$  a vertical expansion by a factor of 4 is equal to A horizontal compression by a factor of  $\frac{1}{2}$ .

**Think about it!**



# C12 - 1.1234 - Point Eq. Eng. Factor Trans Notes

Find the new equation.

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

A vertical reflection

$$-f(x)$$

A vertical translation up 2

$$f(x) + 2$$

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

$$y = x^2$$

$$-y = x^2$$

$$y = -x^2$$

$$y - 2 = -x^2$$

$$y = -x^2 + 2$$

Put "- y" in for y

Put "y - 2" in for y

A horizontal translation right 4

$$f(x) + 2$$

A horizontal reflection

$$f(-x)$$

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

$$y = x^2$$

$$y = x^2$$

$$y = (x - 4)^2$$

$$y = x^2 - 8x + 16$$

$$y = (-x)^2 - 8(-x) + 16$$

$$y = -x^2 + 8x + 16$$

Put "x - 4" in for x

Put "- x" in for x

Vertical Reflection

$$-f(x)$$

A vertical expansion by a factor of 2

$$2f(x)$$

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

$$y = x^2$$

$$-y = x^2$$

$$y = -x^2$$

$$\frac{1}{2}y = -x^2$$

$$y = -2x^2$$

A vertical expansion by a factor of 2

$$2f(x)$$

Vertical Reflection

$$-f(x)$$

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

$$y = x^2$$

$$\frac{1}{2}y = x^2$$

$$y = 2x^2$$

$$-y = 2x^2$$

$$y = -2x^2$$

$$y = f(1 - x)$$

$$y = f(-(-1 + x))$$

$$y = f(-(x - 1))$$

Factor "-1" out of the inner brackets

HR, Right 1

$$y = f(2x + 2)$$

$$y = f(2(x + 1))$$

Factor "2" out of the inner brackets

HC =  $\frac{1}{2}$ , Left 1