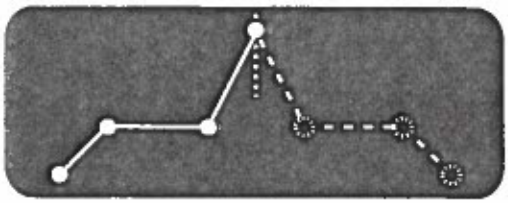
invariant pts :

Vertical stretch → x-intercept(s)

Horizontal stretch → y-intercept



Transformations and Operations
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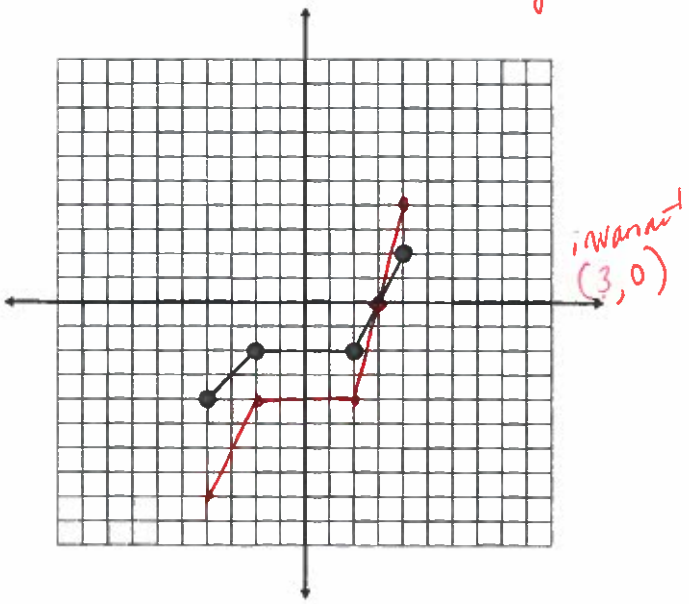
Example 1 Draw the graph resulting from each transformation. Label the invariant points.

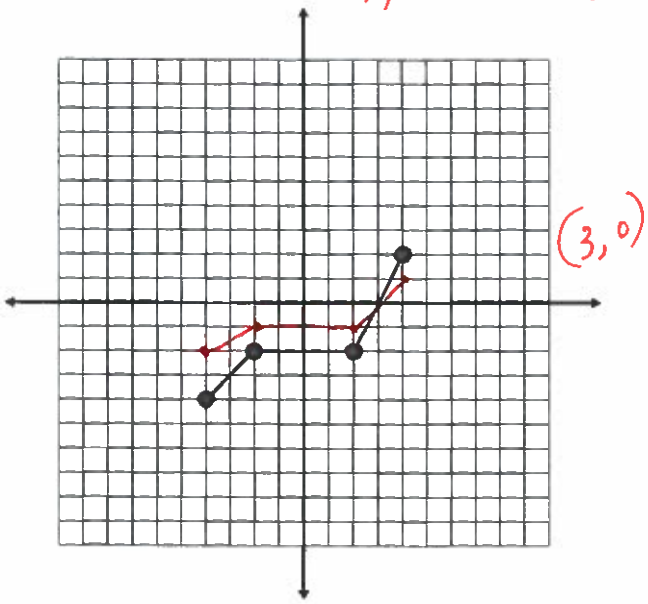
Graphing Stretches

Vertical Stretches

a) $y = 2f(x)$ $(x,y) \to (x, 2y)$

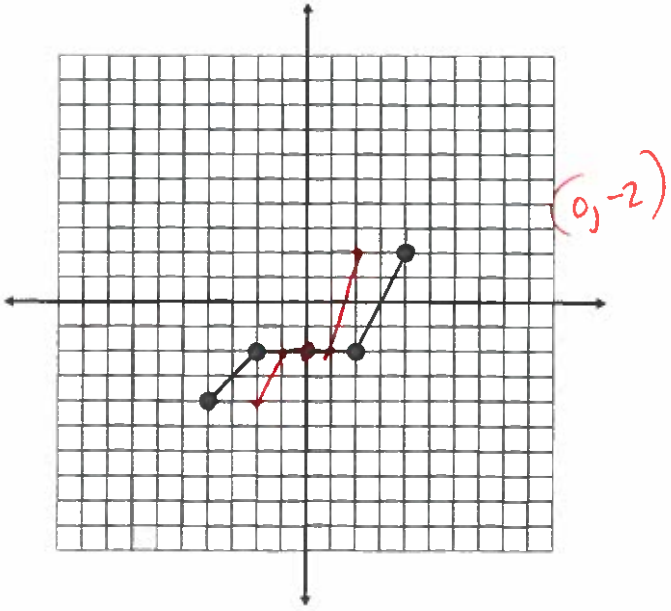


b) $y = \frac{1}{2} f(x)$ $(x,y) \to (x, \frac{1}{2}y)$

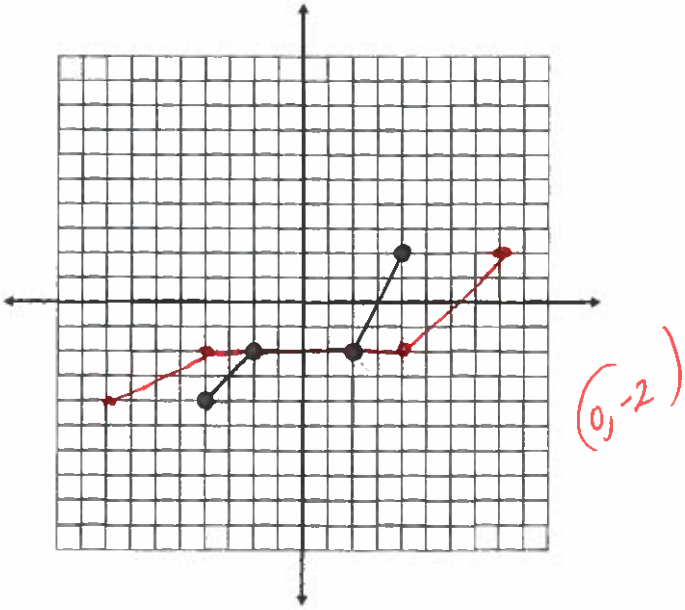


Horizontal Stretches

c) $y = f(2x)$ $(x,y) \to (\frac{1}{2}x, y)$



d) $y = f(\frac{1}{2}x)$ $(x,y) \to (2x, y)$



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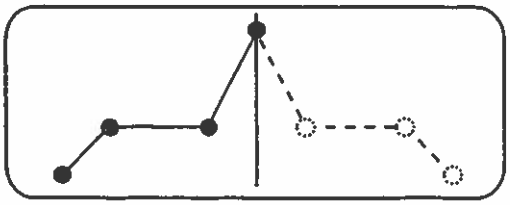
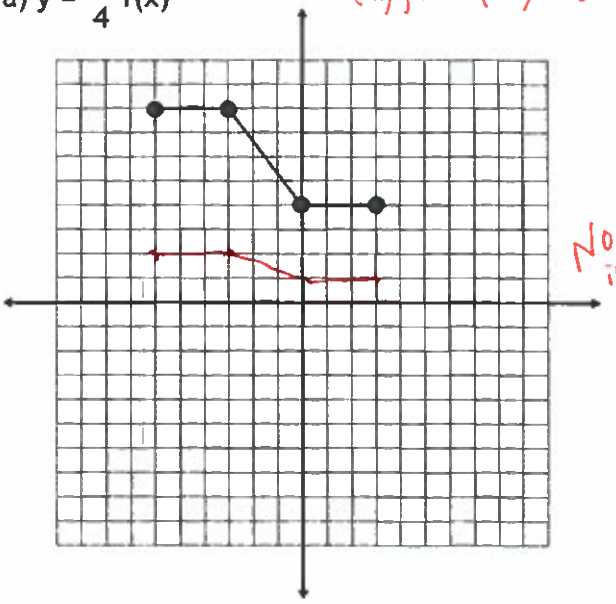


Example 2 Draw the graph resulting from each transformation.

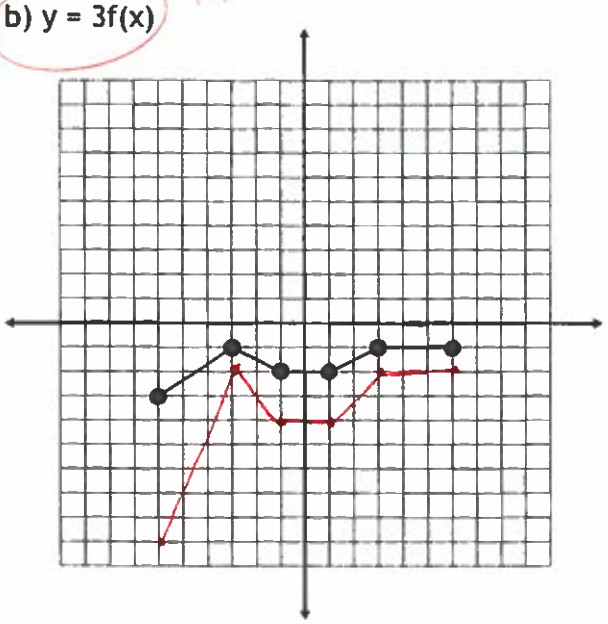
Graphing Stretches

a) $y = \frac{1}{4} f(x)$ $(x, y) \rightarrow (x, \frac{1}{4}y)$

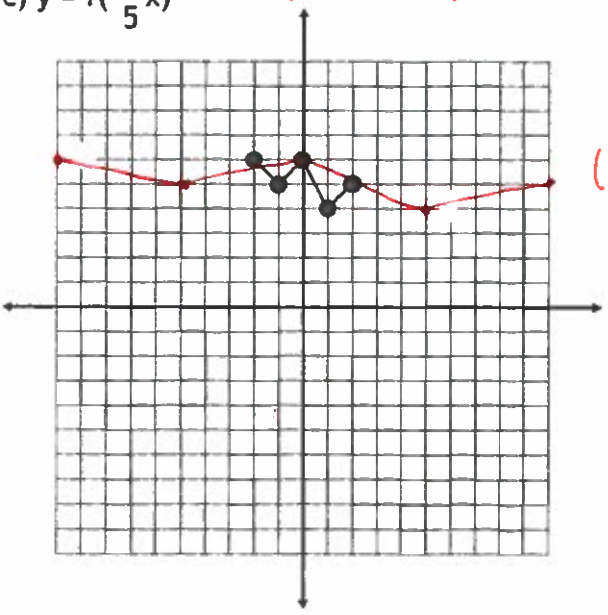


No. invariant

b) $y = 3f(x)$

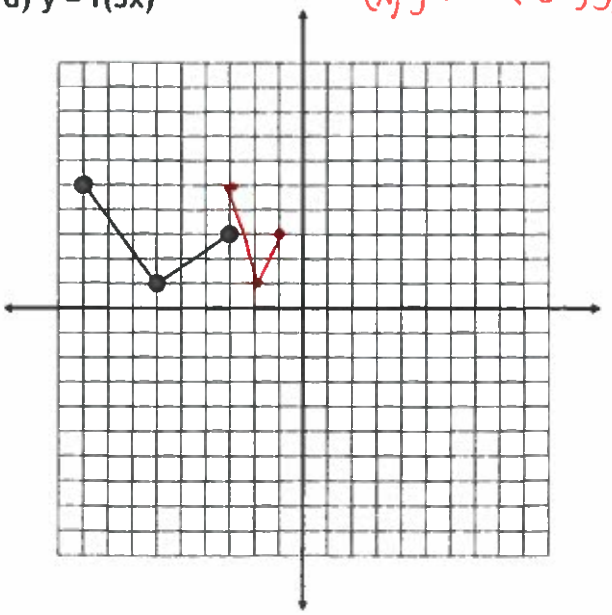


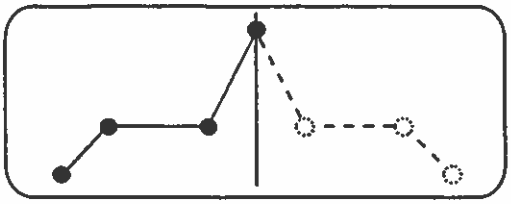
c) $y = f(\frac{1}{5}x)$ $(x, y) \rightarrow (5x, y)$



(0, 6)

d) $y = f(3x)$ $(x, y) \rightarrow (\frac{1}{3}x, y)$





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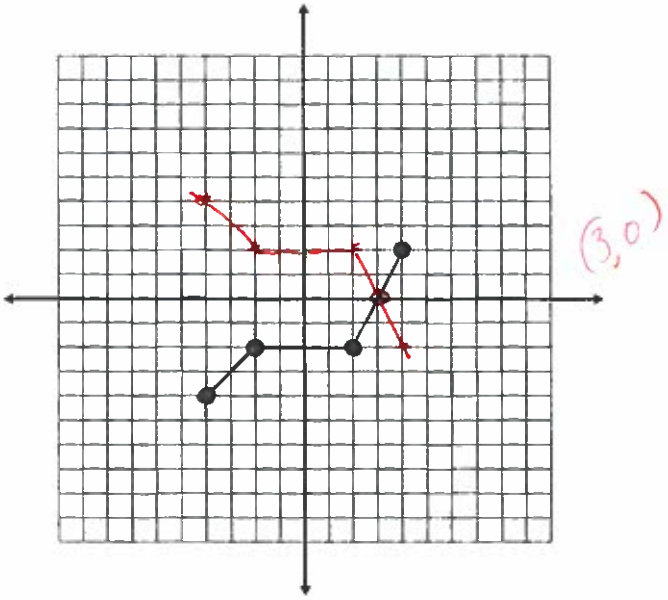
Example 3 Draw the graph resulting from each transformation. Label the invariant points.

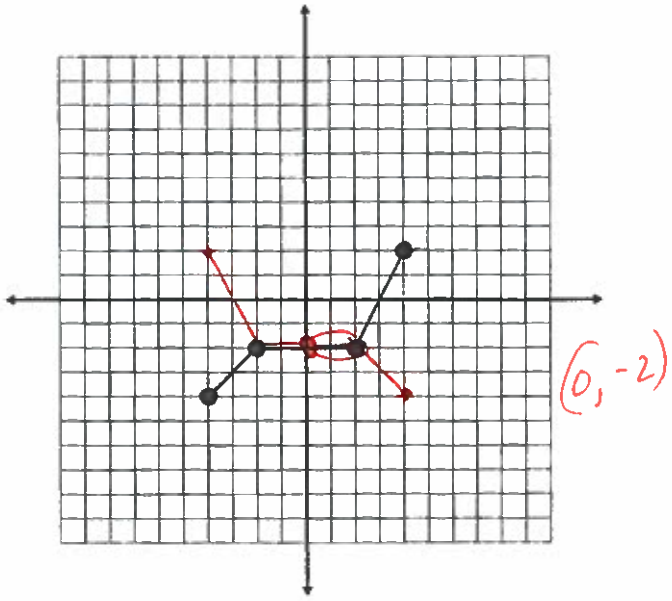
Graphing Reflections

Reflections

a) y = -f(x) $(x,y) \to (x,-y)$

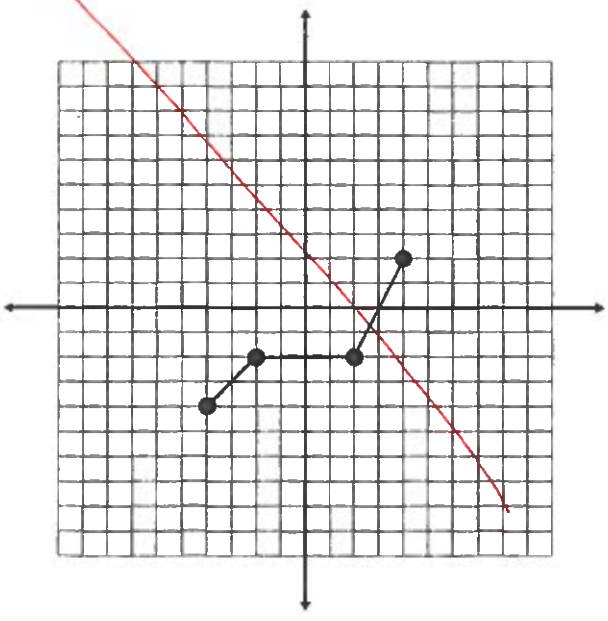


b) y = f(-x) $(x,y) \to (-x,y)$



Inverses

c) x = f(y)



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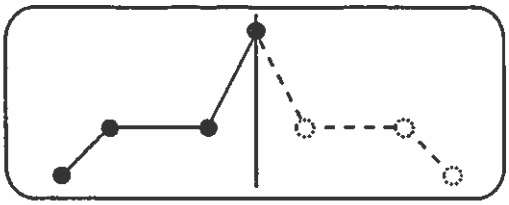
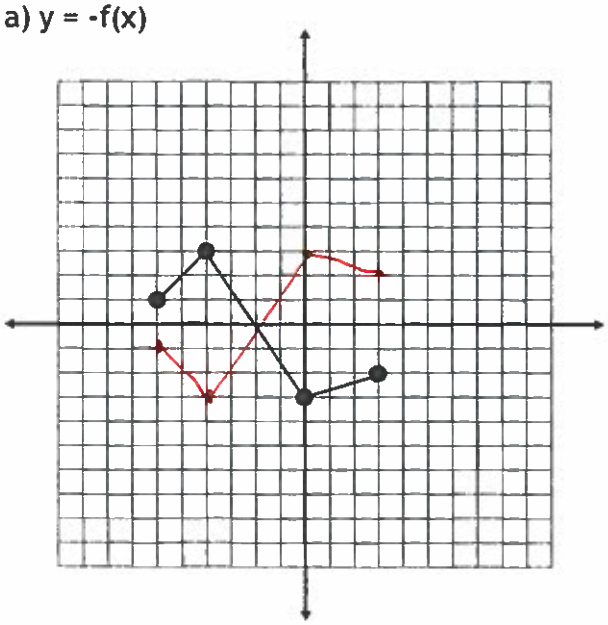


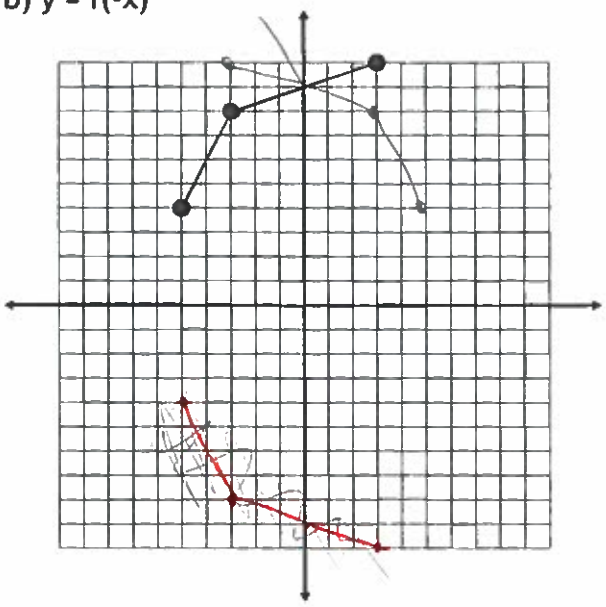
Example 4 Draw the graph resulting from each transformation.

Graphing Reflections

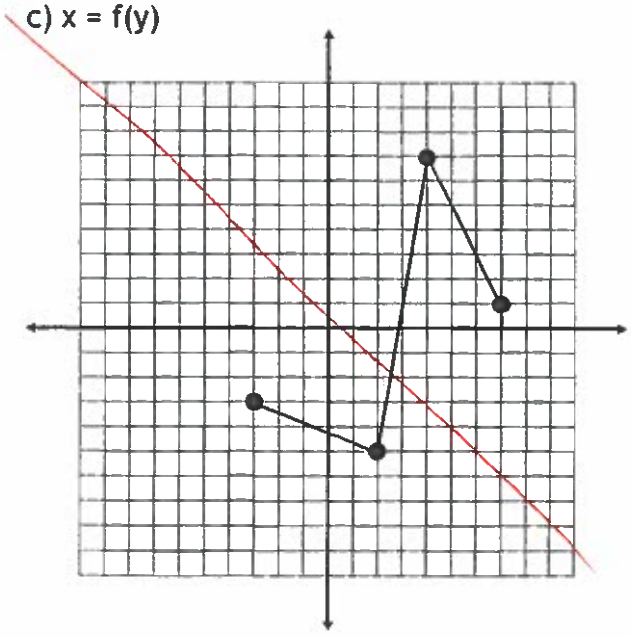
a) y = -f(x)

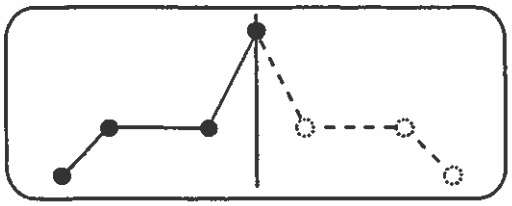


b) y = f(-x)



c) x = f(y)





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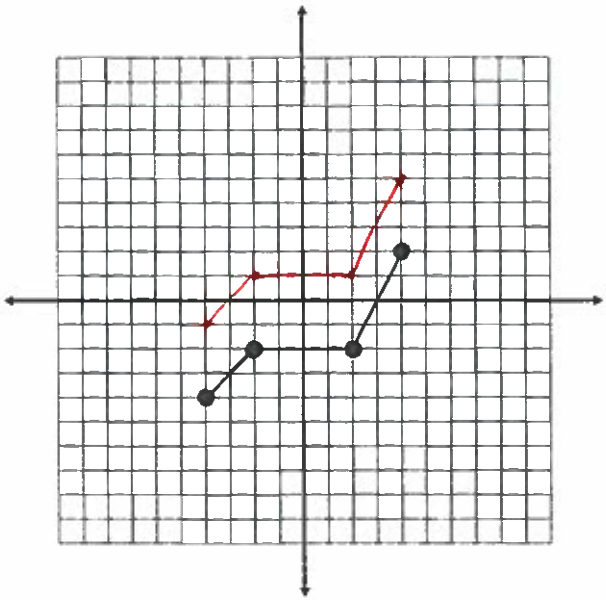
Example 5 Draw the graph resulting from each transformation. Label the invariant points.

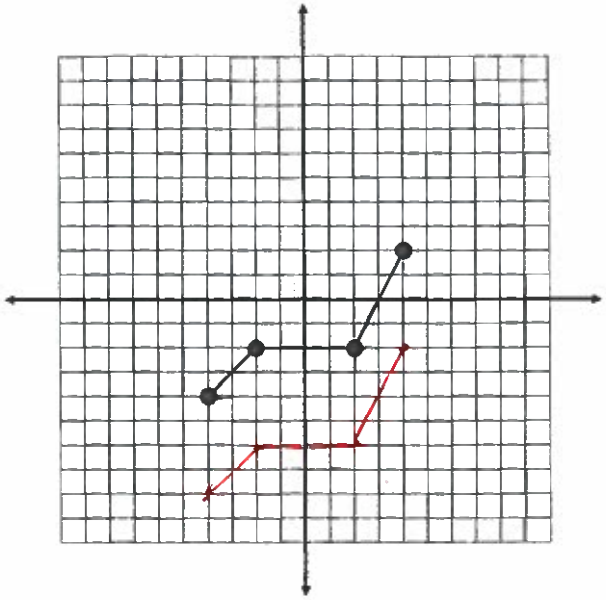
Graphing Translations

Vertical Translations

a) y = f(x) + 3

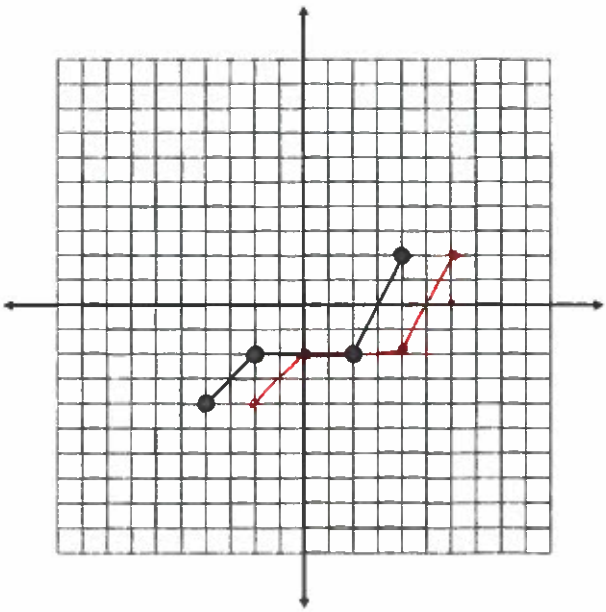


b) y = f(x) - 4

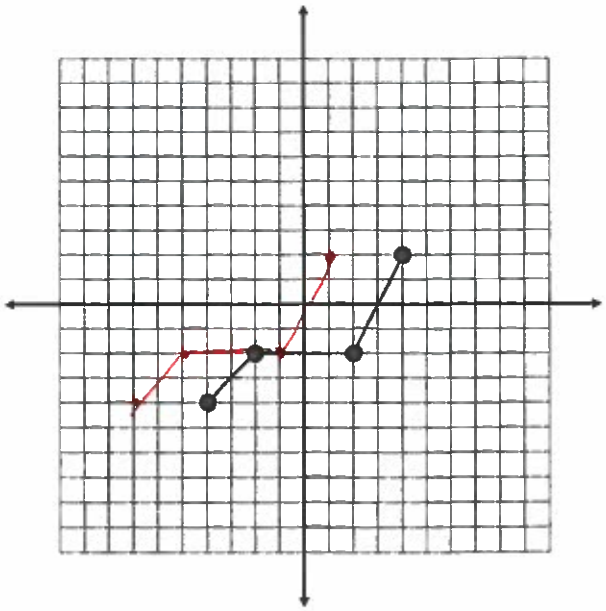


Horizontal Translations

c) y = f(x - 2)



d) y = f(x + 3)



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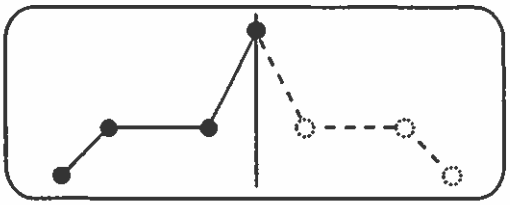
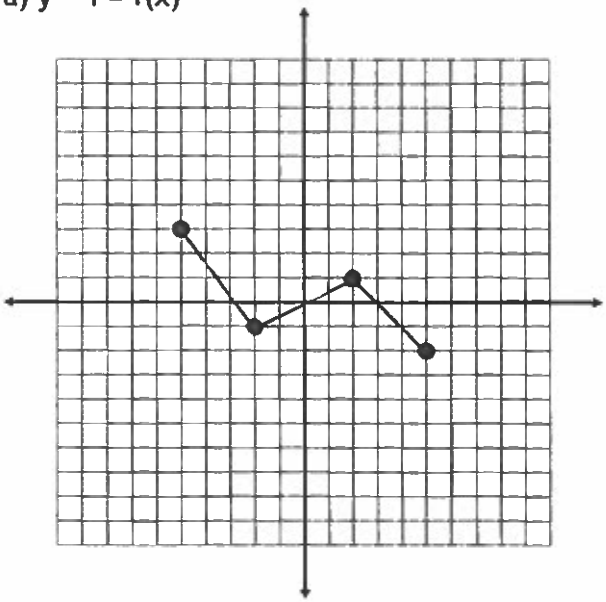


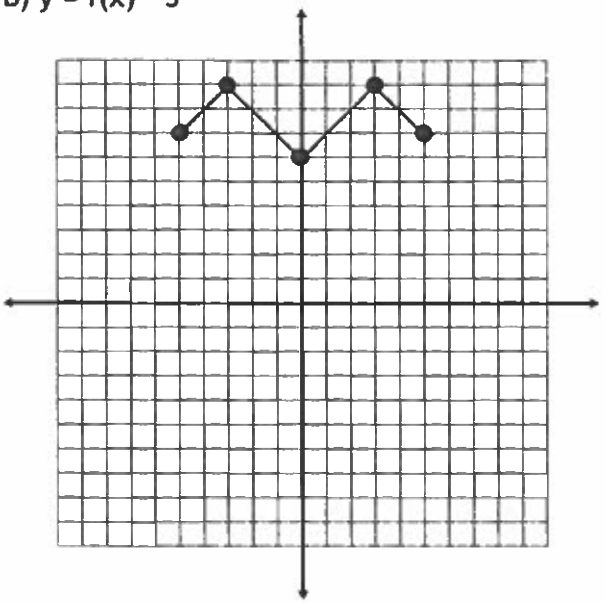
Example 6 Draw the graph resulting from each transformation.

Graphing Translations

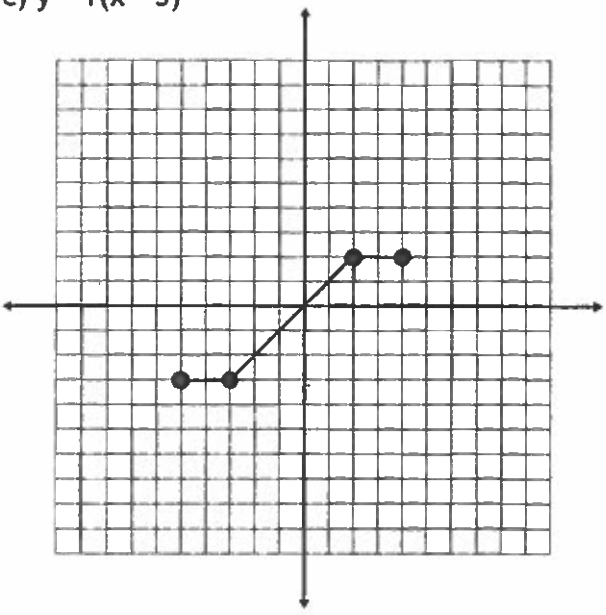
a) $y - 4 = f(x)$



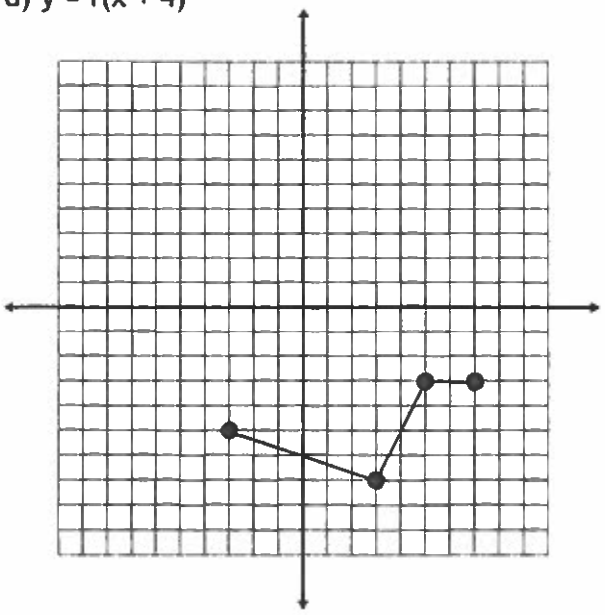
b) $y = f(x) - 3$

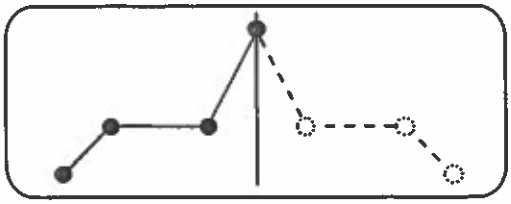


c) $y = f(x - 5)$



d) $y = f(x + 4)$





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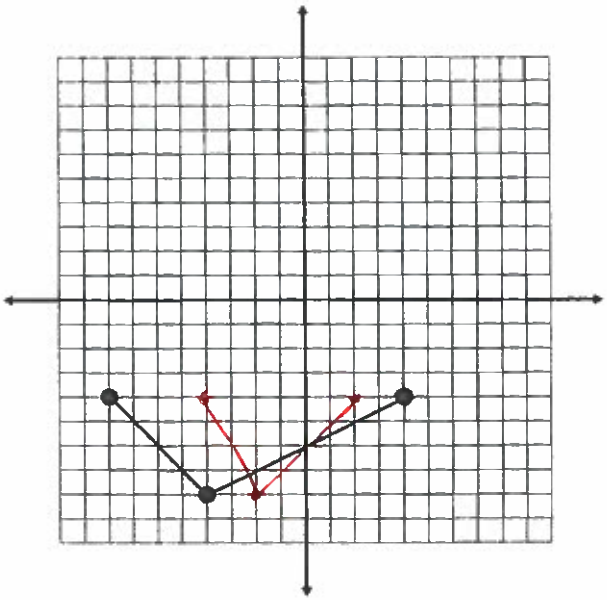
Example 7 Draw the transformed graph. Write the transformation as both an equation and a mapping.

Mappings

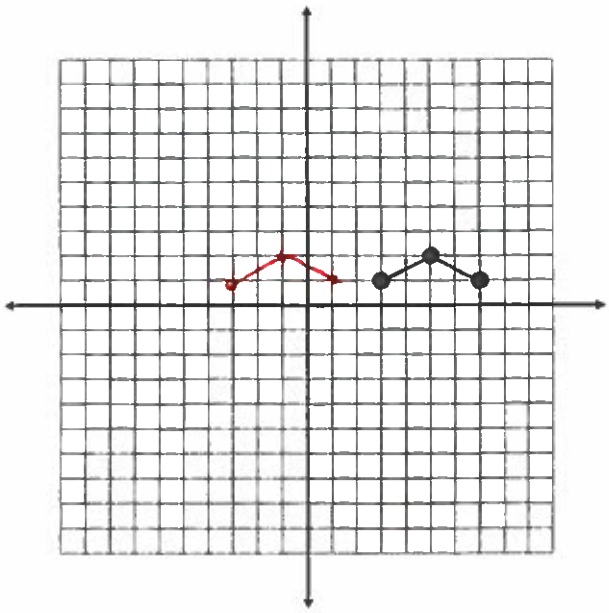
a) The graph of f(x) is horizontally stretched by a factor of $\frac{1}{2}$.



Transformation Equation: $y = f(2x)$

Transformation Mapping: $(x, y) \rightarrow (\frac{1}{2}x, y)$

b) The graph of f(x) is horizontally translated 6 units left.



Transformation Equation: $y = f(x + 6)$

Transformation Mapping: $(x, y) \rightarrow (x - 6, y)$

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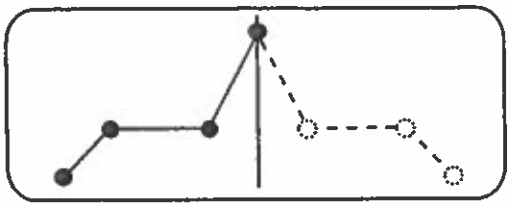
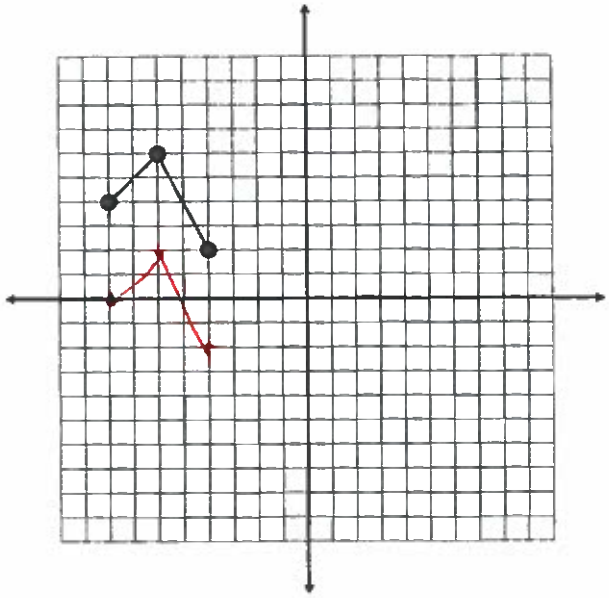


Mappings

c) The graph of f(x) is vertically translated 4 units down.



Transformation Equation:

$y = f(x) - 4$

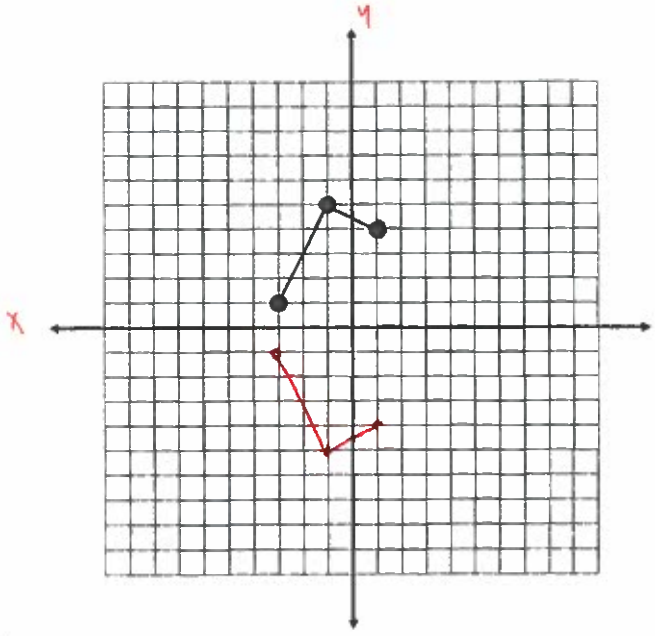
or

$y + 4 = f(x)$

Transformation Mapping:

$(x, y) \rightarrow (x, y - 4)$

d) The graph of f(x) is reflected in the x-axis.

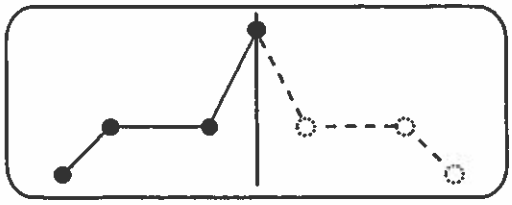


Transformation Equation:

$y = -f(x)$

Transformation Mapping:

$(x, y) \rightarrow (x, -y)$



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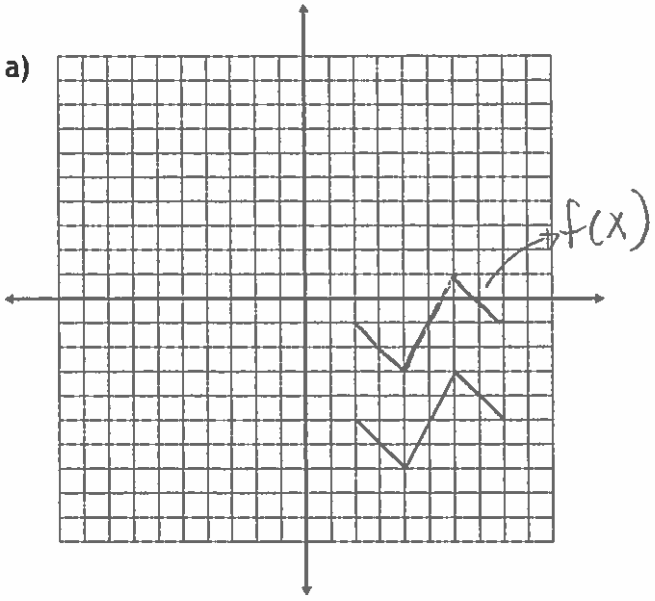
Example 8 Write a sentence describing each transformation, then write the transformation equation.

Describing a Transformation

a)



Original graph: f(x)

Transformed graph: _____

Think of the dashed line as representing where the graph was in the past, and the solid line is where the graph is now.

Transformation Description:

shifted down 4

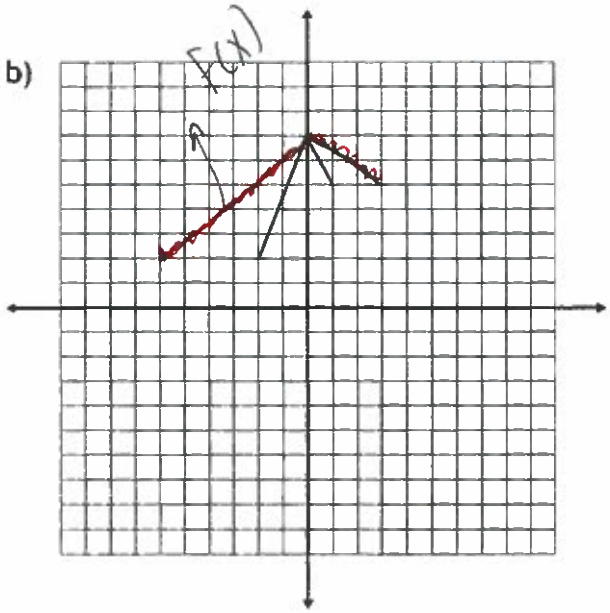
Transformation Equation:

$y+4=f(x)$

or

$y=f(x)-4$

b)



Transformation Description:

Horizontal stretched by a factor of 1/3

Transformation Equation:

$y=f(3x)$