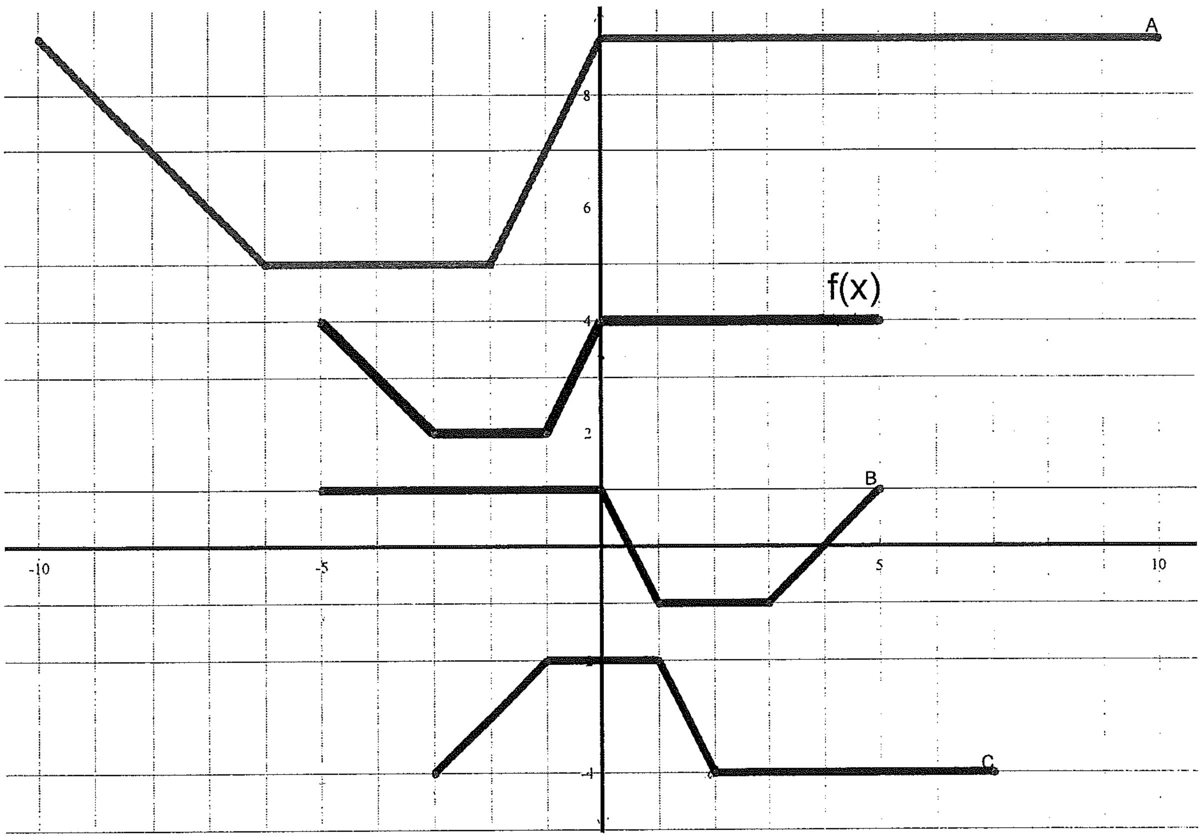
Day8-MCR3U

Name:______________________________

Date:______________________________

FUNCTION TRANSFORMATIONS

1. The graph of f(x) is given. Match each graph with one of the equations provided.



i) $f(x-2)+3$ ii) $-f(x-2)-1$ iii) $-f(x-2)$ iv) $\frac{1}{2}f(2x)+1$ v) $2f\left(\frac{1}{2}x\right)+1$

vi) $-f(x-2)-3$ vii) $f(x-2)-1$ viii) $2f(2x)+1$ ix) $f(-x)-3$ x) $\frac{1}{2}f\left(\frac{1}{2}x\right)+1$

A: $2f\left(\frac{1}{2}x\right)+1$

$(0,4) \rightarrow (0,9)$

$(5,4) \rightarrow (10,9)$

x multiplied by 2
y multiplied by 2
and translated
1 up.

B: $f(-x)-3$

reflected
about
y-axis
then translated
down.

C: $-f(x-2)$

reflected
about x-axis

$(0,4) \rightarrow (2,-4)$

translated 2 right

MCR3U0 date: ______________________

TRANSFORMATION MAPPING NOTATION: TRANSLATIONS

1. Express each in transformation mapping notation. i.e. $T:(x,y)\to(x+p,y+q)$

a) $y=f(x)+5$ b) $y=f(x-4)$ c) $y=f(x+7)$ d) $y=f(x)-1$
e) $y=f(x+2)+13$ f) $y=f(x-8)+2$ g) $y=f(x+10)-6$ h) $y=f(x-19)-3$
i) $y=f(x+12)+18$ j) $y=f(x-9)-25$ k) $y=x^2+8$ l) $y=(x-11)^3$
m) $y=|x-2|$ n) $y=\sqrt{x+8}-12$ o) $f(x)=2^{x+5}+1$ p) $g(x)=\dfrac{1}{x+17}$
q) $h(x)=\sqrt{9-(x-5)^2}-45$ r) $f(x)=\sqrt{x}+23$ s) $y=2^{x+9}$ t) $y=\dfrac{1}{x-1}+3$

2. Express each of the transformations above in words, using the correct language.

3. Express each of the transformations in words, using the correct language.

a) $T:(x,y)\to(x+1,y-8)$ b) $T:(x,y)\to(x-3,y+7)$

ANSWERS:

1.a) $T:(x,y)\to(x,y+5)$ b) $T:(x,y)\to(x+4,y)$ c) $T:(x,y)\to(x-7,y)$
d) $T:(x,y)\to(x,y-1)$ e) $T:(x,y)\to(x-2,y+13)$ f) $T:(x,y)\to(x+8,y+2)$
g) $T:(x,y)\to(x-10,y-6)$ h) $T:(x,y)\to(x+19,y-3)$ i) $T:(x,y)\to(x-12,y+18)$
j) $T:(x,y)\to(x+9,y-25)$ k) $T:(x,y)\to(x,y+8)$ l) $T:(x,y)\to(x+11,y)$
m) $T:(x,y)\to(x+2,y)$ n) $T:(x,y)\to(x-8,y-12)$ o) $T:(x,y)\to(x-5,y+1)$
p) $T:(x,y)\to(x-17,y)$ q) $T:(x,y)\to(x+5,y-45)$ r) $T:(x,y)\to(x,y+23)$
s) $T:(x,y)\to(x-9,y)$ t) $T:(x,y)\to(x+1,y+3)$ 2.a) vertical translation up 5 units
b) horizontal translation right 4 units c) horizontal translation left 7 units
d) vertical translation down 1 unit
e) horizontal translation left 2 units and vertical translation up 13 units
f) horizontal translation right 8 units and vertical translation up 2 units
g) horizontal translation left 10 units and vertical translation down 6 units
h) horizontal translation right 19 units and vertical translation down 3 units
i) horizontal translation left 12 units and vertical translation up 18 units
j) horizontal translation right 9 units and vertical translation down 25 units
k) vertical translation up 8 units l) horizontal translation right 11 units
m) horizontal translation right 2 units
n) horizontal translation left 8 units and vertical translation down 12 units
o) horizontal translation left 5 units and vertical translation up 1 unit
p) horizontal translation left 17 units
q) horizontal translation right 5 units and vertical translation down 45 units
r) vertical translation up 23 units s) horizontal translation left 9 units
t) horizontal translation right 1 unit and vertical translation up 3 units
3.a) horizontal translation right 1 unit and vertical translation down 8 units
b) horizontal translation left 3 units and vertical translation up 7 units

11 Academic | **Date:**

Day 8: Combinations of Transformations | **Unit 1: Intro to Functions**

Practice Transformations Given a Graph

List the transformations.

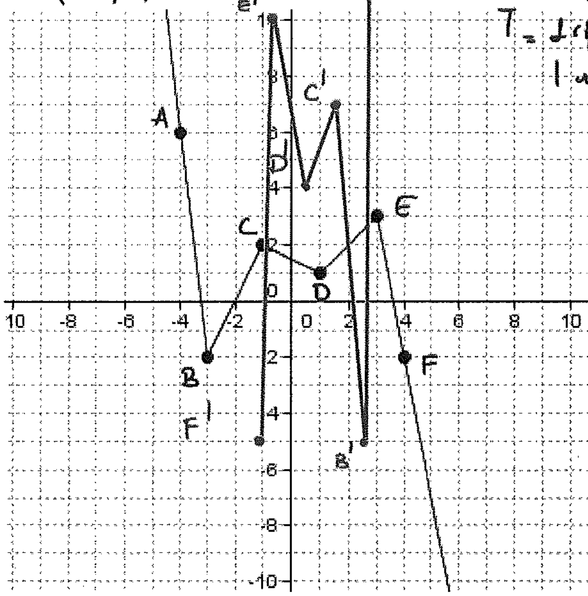
Apply the transformations to key points on the graph.

1) $y = 3g(-2(x-1)) + 1$

$(x,y) \rightarrow \left(\frac{-x}{2}+1,\ 3y+1\right)$

A(-4,6) → A'(3,19)
B(-3,-2) → B'(2.5,-5)
C(-1,2) → C'(1.5,7)
D(1,1) → (0.5,4)
E(3,3) → (-0.5,10)
F(4,-2) → (-1,-5)

vertical ref "x"
R → horizontal refle. ab "y"
S - stretched vertically by 3, com. hor. by 1/2
T = 1 right, 1 up

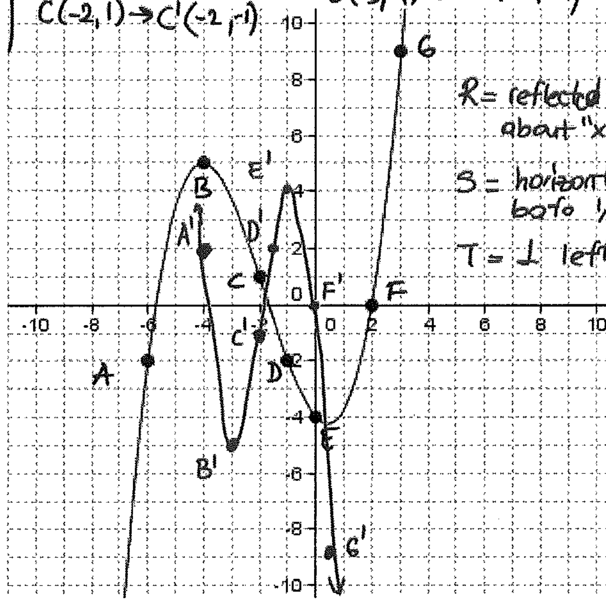


2) $y = -f(2(x+1))$

$(x,y) \rightarrow \left(\frac{x}{2}-1,\ -y\right)$

A(-6,-2) → A'(-4,2)
B(-4,5) → B'(-3,-5)
C(-2,1) → C'(-2,-1)
D(-1,-2) → D'(-1.5,2)
E(0,-4) → E'(-1,4)
F(2,0) → F'(0,0)
G(3,9) → G'(0.5,-9)

R = reflected vertically about "x" axis
S = horizontal compr. bafo 1/2
T = 1 left

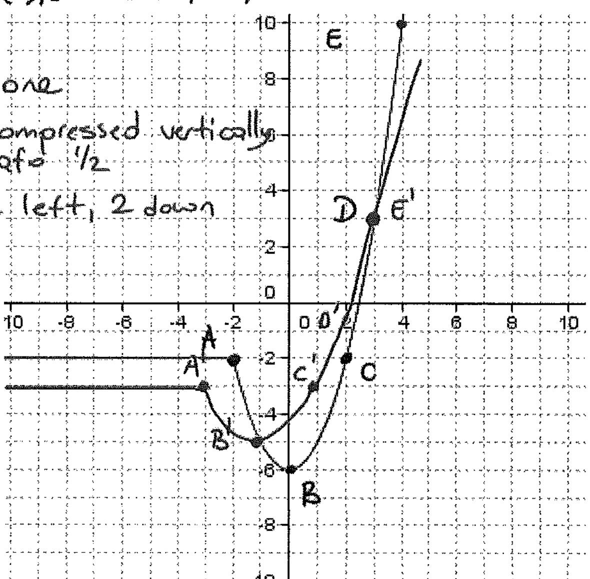


3) $y = \frac{1}{2}h(x+1) - 2$

$(x,y) \rightarrow \left(x-1,\ \frac{y}{2}-2\right)$

A(-2,2) → A'(-3,-3)
B(0,-6) → B'(-1,-5)
C(2,-2) → C'(1,-3)
D(3,3) → D'(2,-0.5)
E(4,10) → E'(3,3)

R = none
S = compressed vertically bafo 1/2
T = 1 left, 2 down

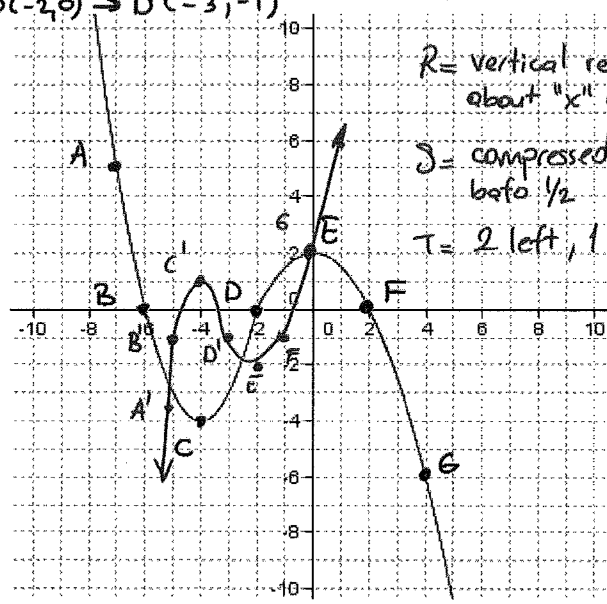


4) $y = -\frac{1}{2}f(2x+4) - 1$ $\quad y = -\frac{1}{2}f[2(x+2)] - 1$

$(x,y) \rightarrow \left(\frac{x}{2}-2,\ \frac{-y}{2}-1\right)$

A(-7,5) → A'(-5.5,-3.5)
B(-6,0) → B'(-5,-1)
C(-4,-4) → C'(-4,1)
D(-2,0) → D'(-3,-1)
E(0,2) → E'(-2,-2)
F(2,0) → F'(-1,-1)
G(4,-6) → G'(0,2)

R = vertical reflection about "x" axis
S = compressed vertically bafo 1/2
T = 2 left, 1 down

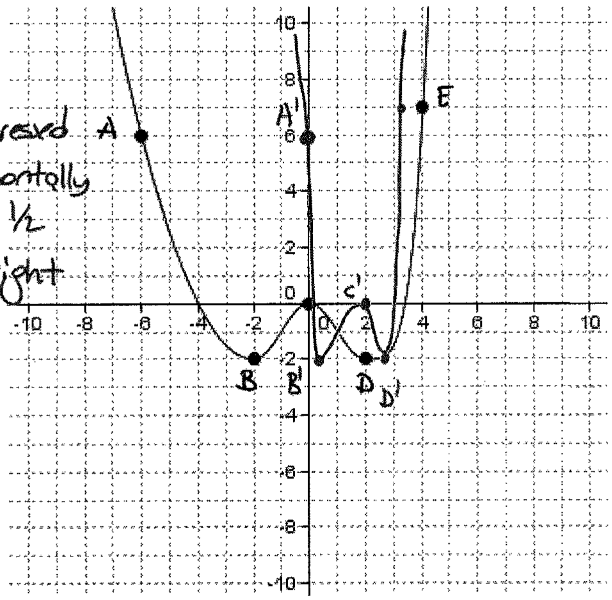


5) $y = f(3x-6)$ $y = f[3(x-2)]$

$(x,y) \rightarrow (\frac{x}{3}+2, y)$

$A(-6,6) \rightarrow A'(0,6)$ $D(2,-2) \rightarrow D'(\frac{8}{3},-2)$
$B(-2,-2) \rightarrow B'(\frac{4}{3},-2)$ $E(4,7) \rightarrow E'(\frac{10}{3},7)$
$C(0,0) \rightarrow C'(2,0)$

R: none
S: compresed horizontally bafo 1/2
T: 2 right

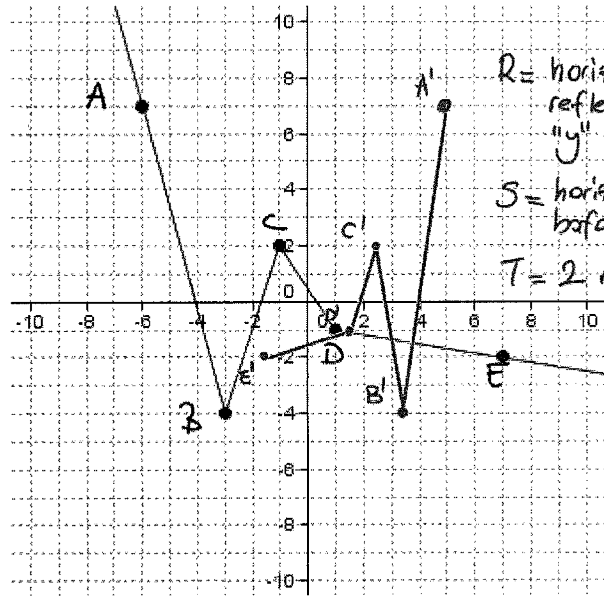


6) $y = f(-2x+4)$ $y = f[-2(x-2)]$

$(x,y) \rightarrow (\frac{-x}{2}+2, y)$

$A(-6,7) \rightarrow A'(5,7)$ $D(1,-1) \rightarrow D'(1.5,-1)$
$B(-3,-4) \rightarrow B'(3.5,-4)$ $E(7,-2) \rightarrow E'(-1.5,-2)$
$C(-1,2) \rightarrow C'(2.5,2)$

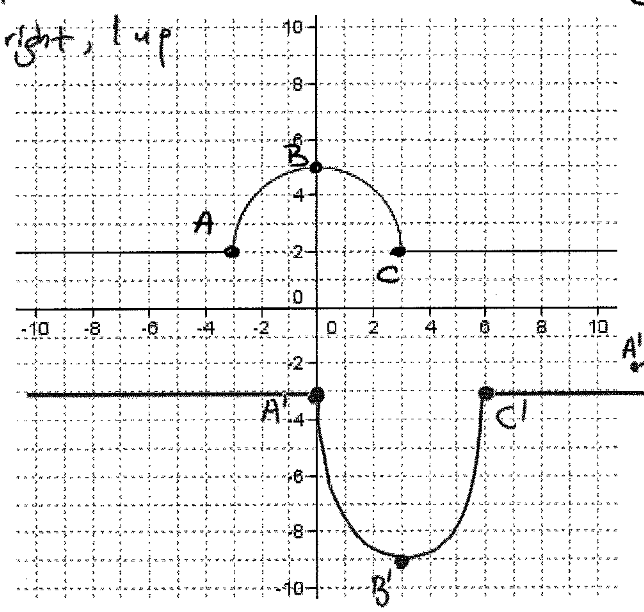
R = horizontal reflection about "y" axis
S = horizontal comp bafo 1/2
T = 2 right



7) $y = -2f(x-3)+1$ $(x,y) \rightarrow (x+3, -2y+1)$

$A(-3,2) \rightarrow A'(0,-3)$
$B(0,5) \rightarrow B'(3,-9)$
$C(3,2) \rightarrow C'(6,-3)$

R = vertical reflection about "x" axis
S = vertical stretch bafo 2
T = 3 right, 1 up

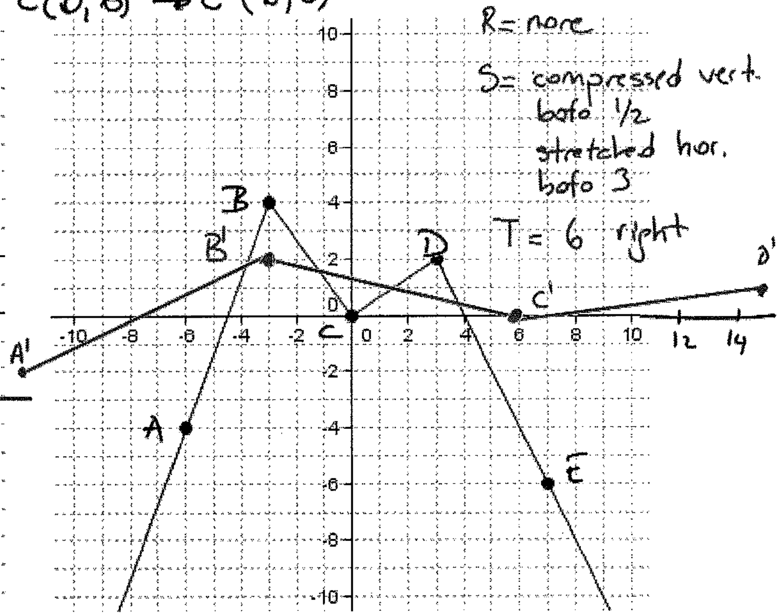


8) $y = \frac{1}{2}f\left(\frac{1}{3}x-2\right)$ $y = \frac{1}{2} f\left[\frac{1}{3}(x-6)\right]$

$(x,y) \rightarrow (3x+6, \frac{y}{2})$

$A(-6,-4) \rightarrow A'(-12,-2)$ $D(3,2) \rightarrow D'(15,1)$
$B(-3,4) \rightarrow B'(-3,2)$ $E(7,-6) \rightarrow E'(27,-3)$
$C(0,0) \rightarrow C'(6,0)$

R = none
S = compressed vert. bafo 1/2
stretched hor. bafo 3
T = 6 right



Transformations Practice

$$y = af[k(x-d)]+c$$

Transformation(s) given in the function notation	Transformation parameter values (a, k, d, c)	What is(are) the transformation(s)?	Parent function	The result of applying the transformation(s) to the parent function
$y=-7f(2(x+1))$	$a=-7$ $k=2$ $d=-1$	· reflect about x-axis · vertically stretch bafo 7. · horizontally comp. bafo $\frac{1}{2}$. 1 left	$f(x)=\frac{1}{x}$	$y=-\dfrac{7}{2(x+1)}$
$y=f(x-1)-1$	$d=1$ $c=-1$	translate 1 unit right and 1 unit down.	$f(x)=\sqrt{x}$	$y=\sqrt{x-1}-1$
$y=f(3(x-2))$	$k=3$ $d=+2$	· horizontally comp bafo 1/3 · translate 2 right	$f(x)=\sqrt{x}$	$y=\sqrt{3x-6}$ $=\sqrt{3(x-2)}$
$y=f(x+1)+3$	$d=-1$ $c=3$	Translate left 1 unit and up 3 units	$f(x)=\sqrt{x}$	$y=\sqrt{x+1}+3$
$y=2f(-2x)$	$a=2$ $k=-2$	· reflect about y-axis · vertical stretch bafo 2 · horizontal comp. bafo 1/2	$f(x)=\sqrt{x}$	$y=2\sqrt{-2x}$
$y=-\frac{1}{2}f(x+3)$	$a=-\frac{1}{2}$ $d=-3$	· reflect about x-axis · vert. comp. by a factor of $\frac{1}{2}$. 3 left	$f(x)=\sqrt{x}$	$y=-\dfrac{1}{2}\sqrt{x+3}$
$y=3f\left[\dfrac{1}{2}(x-1)\right]$	$a=3$ $k=\frac{1}{2}$ $d=1$	· vertically stretched bafo 3. · horizontally stretched bafo 2. 1 right	$f(x)=\sqrt{x}$	$y=3\sqrt{\frac{1}{2}(x-1)}$
$y=2f(3x)-4$	$a=2$ $k=3$ $c=-4$	· vertical stretch bafo 2 · horizontal comp bafo 1/3. 4 down	$f(x)=\lvert x\rvert$	$y=2\sqrt{3x}-4$
$y=2f(x+6)-1$	$a=2$ $d=-6$ $c=-1$	vertically stretched by a factor of 2 translate 6 units left, 1 down	$f(x)=\lvert x\rvert$	$y=2\lvert x+6\rvert-1$

p.70 #5-8, 10-13, 16-18, 21

bafo: by a factor of

Transformations Practice

$$y = af[k(x-d)]+c$$

Transformation(s) given in the function notation	Transformation parameter values (*a*, *k*, *d*, *c*)	What is (are) the transformation(s)?	Parent function	The result of applying the transformation(s) to the parent function
$y=-2f(x)$	$a=-2$	Reflection in the x-axis, vertical stretch by factor of 2	$f(x)=x^2$	$y=-2(x)^2$
$y=f\left(-\frac{1}{3}x\right)$	$k=-\frac{1}{3}$	Reflection about y-axis. horizontally stretched by a factor of 3.	$f(x)=x^2$	$y=\left(-\frac{1}{3}x\right)^2$
$y=2f(x)-5$	$a=2$, $c=-5$	vertically stretched by a factor of 2 translate 5 down.	$f(x)=x^2$	$y=2x^2-5$
$y=f(x-3)-2$	$d=3$ $c=-2$	Translate right 3 units and down 2 units	$f(x)=x^2$	$y=(x-3)^2-2$
$y=-\frac{1}{2}f(x+4)-5$	$a=-\frac{1}{2}$ $d=-4$ $c=-5$	· Reflection about x-axis. vertically compressed by a factor of $\frac{1}{2}$. translate 4 left. 5 down	$f(x)=x^2$	$y=-\frac{1}{2}(x+4)^2-5$
$y=-5f(x)$	$a=-5$	Reflection about y-axis vertically stretched by factor of 5.	$f(x)=\frac{1}{x}$	$y=\frac{-5}{x}$
$y=f(x)-1$	$c=-1$	translate 1 unit down.	$f(x)=\frac{1}{x}$	$y=\frac{1}{x}-1$
$y=f(x-d)+3$	$d=2$ $c=3$	translate 2 units right 3 units up.	$f(x)=\frac{1}{x}$	$y=\frac{1}{x-2}+3$
$y=-f(2x)-5$	$a=-1$ $k=2$ $c=-5$	Reflection in the x-axis, horizontal compression by factor of 1/2, and translate down 5 units	$f(x)=\frac{1}{x}$	$y=\frac{-1}{2(x)}-5$