Day8-MCR3U

Name: PATEL (KEY)

Date:

Transformations

Part 7 – Transformations of $y = af[k(x-d)]+c$

Transformations can be combined so that more than one transformation is performed on a given function. Apply the transformations in the order RST:

1) Reflect: reflect about the x and/or y axis
2) Stretch: stretch vertically and/or horizontally
3) Translate: translate left or right and/or up or down

Recall the following transformation rules:

a: vertical stretch by a factor of a (reflect about the x-axis if a is negative)

k: horizontal stretch by a factor of 1/k (reflect about the y-axis if k is negative)

d: translate right d units (left if d is negative)

c: translate up c units (down if c is negative)

a) What transformations have been performed on $y = x$ to give $y = 4(x-6)$?

vertical stretch by a factor of 4, translate right 6 units.

b) What transformations have been performed on $y = x^2$ to give $y = (-x)^2 + 5$?

reflect about y-axis, translate 5 units up.

c) What transformations have been performed on $y = \sqrt{x}$ to give $y = -\sqrt{\frac{1}{6}x}$?

Reflect about x-axis, horizontally stretched by a factor of 6.

d) What transformations have been performed on $y = \sqrt{x}$ to give $y = 3\sqrt{2x-2} - 4$?
Hint: factor k first! $3\sqrt{2(x-1)} - 4$

vertically stretched by a factor of 3. Horizontally compressed by a factor of $\frac{1}{2}$, translate 1 unit right and 4 down.

e) What transformations have been performed on $y = x^2$ to give $y = -2\left(-\frac{1}{3}x - 3\right)^2 + 7$? Hint: factor k first! $y = -2\left(-\frac{1}{3}(x+9)\right)^2 + 7$

reflect about x-and y-axis. vertically stretched by a factor of 2 and horizontally stretched by a factor of 3. translate 9 left and 7 up.

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Transformations

Part 8 – The Graph of $y = af[k(x-d)]+c$

First determine the parent function y = f(x). This gives you the general shape of the graph.

Determine the values of a, k, d, and c.
Note: use the actual value of k, not 1/k

Determine the key points (and asymptotes, if they exist) for the parent function.

Apply the mapping formula $(x,y) \rightarrow \left(\frac{x}{k}+d, ay+c\right)$ to each ordered pair (x, y)

For the reciprocal function, y = 1/x, there is a vertical asymptote at x = d and a horizontal asymptote at y = c.

Graph using a smooth curve and arrows where appropriate. Don't forget to label the axes and scales.

Ex. 1. Graph $y = -3\sqrt{2(x+1)}+4$

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

Parent function : $y = \sqrt{x}$

a = -3, k = 2, d = -1, c = 4

Key points and mapping:

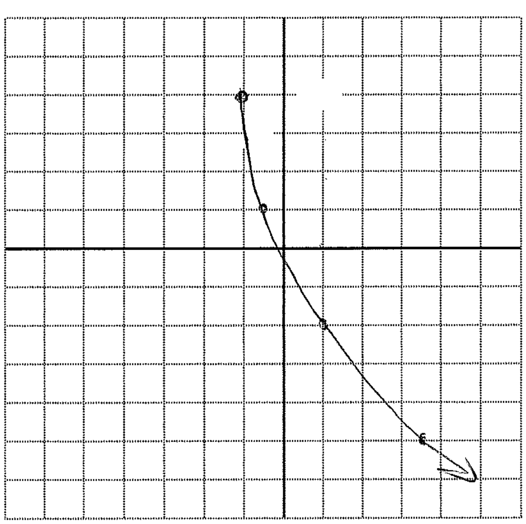
(0, 0) → (0/2 + -1, -3(0) + 4) → (-1, 4)

(1, 1) → (1/2 + -1, -3(1) + 4) → (-0.5, 1)

(4, 2) → (4/2 + -1, -3(2) + 4) → (1, -2)

(9, 3) → (9/2 + -1, -3(3) + 4) → (3.5, -5)

Asymptotes : none



Ex 2. Graph $y = \frac{2}{x-3}$

Parent function : $y = \frac{1}{x}$

a = 2, k = 1, d = 3, c = 0

Key points and mapping:

(1, 1) → (1/1 + 3, 2(1) +0) → (4, 2)

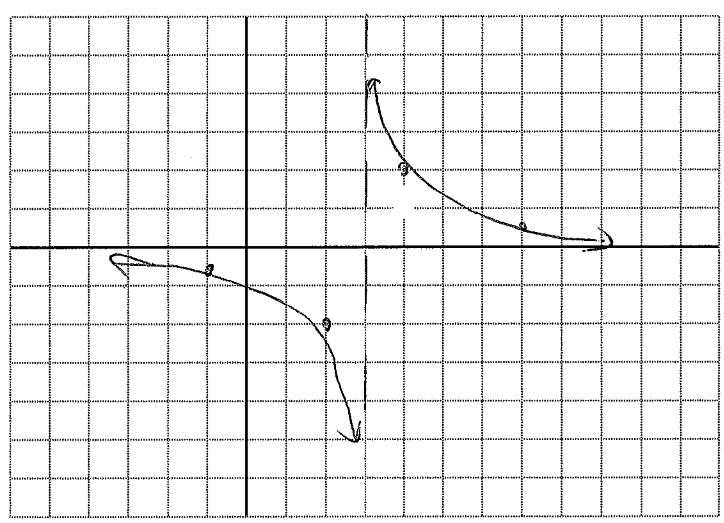
(-1, -1) → (-1/1 + 3, 2(-1) +0) → (2, -2)

Asymptotes : VA: x = 3

HA: y = 0

(4, 0.25) → (7, 0.5)

(-4, -0.25) → (-1, -0.5)



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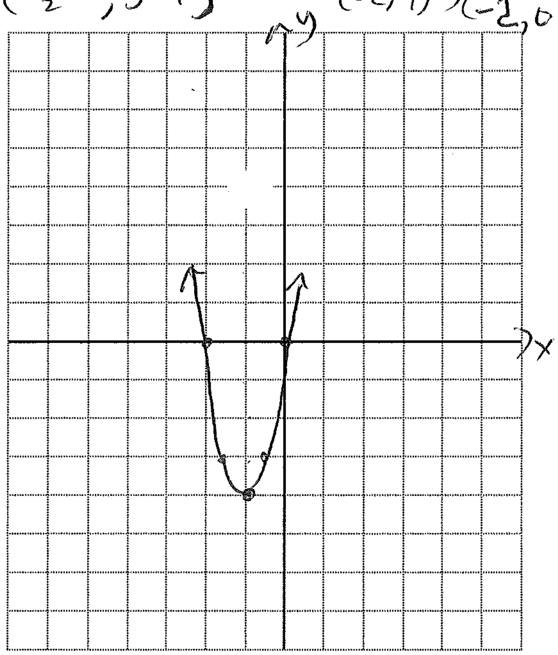
Practice :

a) Graph $y=[2(x+1)]^2-4$

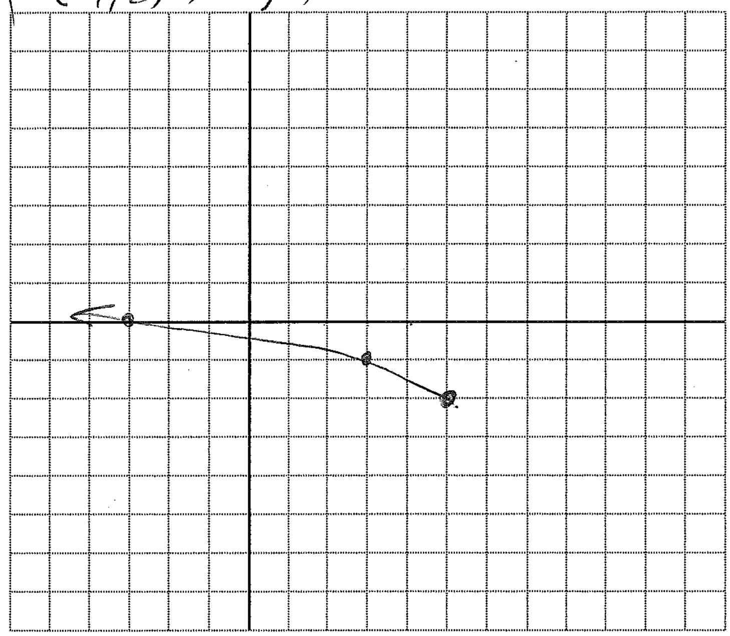
$(0,0)\to(-1,-4)$
$(1,1)\to(-0.5,-3)$
$(2,4)\to(0,0)$
$(-1,1)\to(-1.5,-3)$
$(-2,4)\to(-2,0)$

$(x,y)\to\left(\frac{x}{2}-1,\ y-4\right)$



b) Graph $y=\sqrt{-\frac{1}{2}(x-5)}-2$

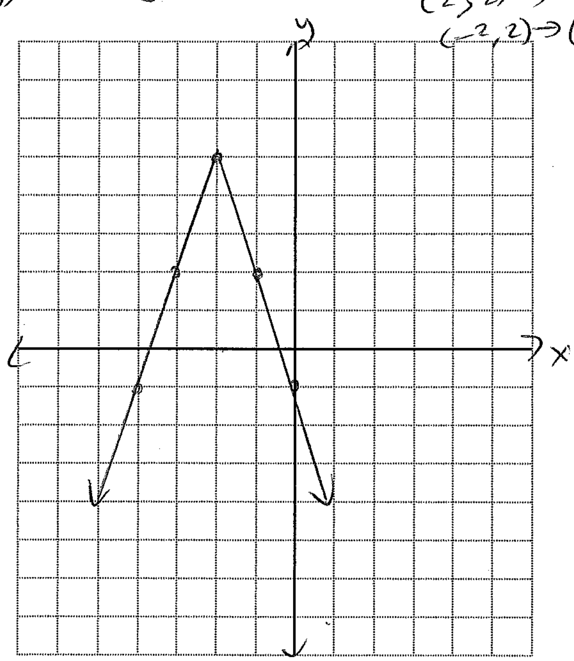
$(x,y)\to(-2x+5,\ y-2)$
$(0,0)\to(5,-2)$
$(1,1)\to(3,-1)$
$(4,2)\to(-3,0)$



c) Graph $y=-3|x+2|+5$

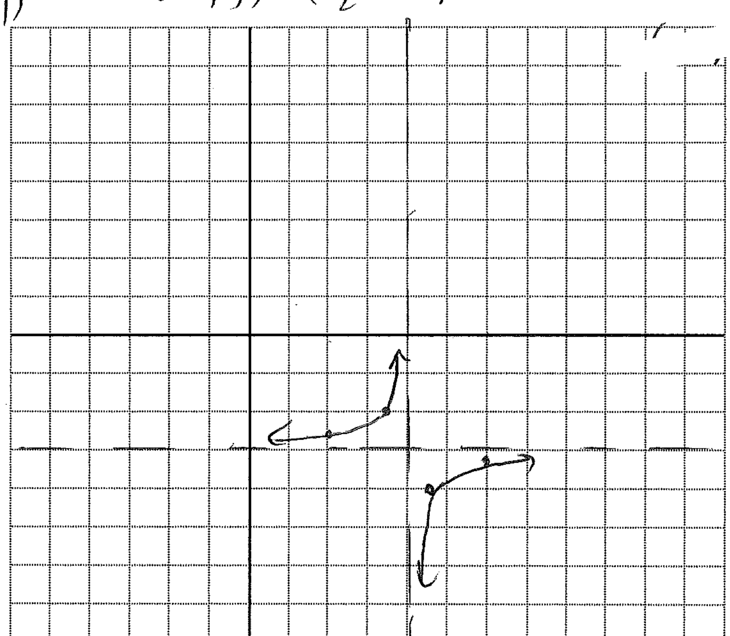
$(0,0)\to(-2,5)$
$(1,1)\to(-1,2)$
$(-1,1)\to(-3,2)$
$(2,2)\to(0,-1)$
$(-2,2)\to(-4,-1)$

$(x,y)\to(x-2,\ -3y+5)$



d) Graph $y=\dfrac{-1}{2(x-4)}-3$

$(x,y)\to\left(\frac{x}{2}+4,\ -y-3\right)$



$(1,1)\to(4.5,-4)$
$(-1,-1)\to(3.5,-2)$
$(4,0.25)\to(6,-3.25)$
$(-4,-0.25)\to(2,-2.75)$

4.5

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Summary: Transforming Relations

Transformation of y = f(x)		Description of Transformation	Mapping
$y = -f(x)$		Reflection about x-axis	$(x, -y)$
$y = f(-x)$		Reflection about x-axis	$(-x, y)$
$y = a f(x)$	$\lvert a\rvert > 1$	vertically stretched by a factor of $\lvert a\rvert$.	(x, ay)
	$0 < \lvert a\rvert < 1$	vertically compressed by a factor of $\lvert a\rvert$.	(x, ay)
$y = f(kx)$	$\lvert k\rvert > 1$	horizontally compressed by a factor of $\frac{1}{\lvert k\rvert}$	$(\frac{x}{k}, y)$
	$0 < \lvert k\rvert < 1$	horizontally stretched by factor of $\lvert\frac{1}{k}\rvert$	$(\frac{x}{k}, y)$
$y = f(x) + c$	$c > 0$	translation 'c' units up	$(x, y+c)$
	$c < 0$	translation $\lvert c\rvert$ units down	$(x, y+c)$
$y = f(x - d)$	$d > 0$	translations right 'd' units.	$(x+d, y)$
	$d < 0$	translate left $\lvert d\rvert$ units.	$(x+d, y)$
$y = a f[k(x - d)] + c$		Reflections Stretches Translations	$(\frac{x}{k}+d, ay+c)$

Homework: p.70 #1-4