section 3.5

for this section concentrate on both Horizontal and Vertical shift. Also vertical stretch.

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2) horizontal stretch: "omit for now"
vertical stretch: it is in form of $y = a\,f(x)$
where $a > 1$ is stretch and $0 < a < 1$ is compress.

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4) "omit for now"

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given $y = f(x - h) + k$

Horizontal shift (H-shift): $h > 0$ to the right
$h < 0$ to the left

Vertical shift (V-shift): $k > 0$ up
$k < 0$ down

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6) $f(x) = \sqrt{x}$ up 1 unit $\rightarrow k = +1$
to the left 2 units $\rightarrow h = -2$

$g(x) = f(x - h) + k$

$g(x) = \sqrt{x - (-2)} + (+1) = \underline{\underline{\sqrt{x+2} + 1}}$

8) $f(x) = \frac{1}{x}$ down 4 units $\rightarrow k = -4$

to the right 3 units $\rightarrow h = +3$

$g(x) = f(x-h) + k$

$g(x) = \frac{1}{x-(+3)} + (-4) = \underline{\underline{\frac{1}{x-3} - 4}}$

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10) $y = f(x-49)$ $h = +49$

to the right 49 units

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12) $y = f(x+3) = f(x-(-3))$ $h = -3$

to the left 3 units

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14) $y = f(x) + 5$ $k = +5$

up 5 units

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16) $y = f(x) - 2 = f(x) + (-2)$ $k = -2$

down 2 units

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18) $y = f(x-2) + 3$

$h = +2 \rightarrow$ to the right 2 units

$k = +3 \rightarrow$ up 3 units

20) $f(x) = 4(x+1)^2 - 5 = 4(x-(-1))^2 + (-5)$ parabola

$h = -1$ $\quad$ $k = -5$ $\quad$ vertex: $(h, k) = (-1, -5)$

like $y = 4x^2$ $\quad$ Increasing: $(-1, \infty)$ $\quad$ decreasing: $(-\infty, -1)$

"opens upward"

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22) $a(x) = \sqrt{-x+4}$ $\quad$ domain: $-x + 4 \geq 0$

$4 \geq x$

$= \sqrt{-(x-4)} + (0)$ $\quad$ $x \leq 4$ $\quad$ $(-\infty, 4]$

$h = +4$ $\quad$ $k = 0$

like $y = \sqrt{-x}$ $\quad$ Increasing: none $\quad$ decreasing: $(-\infty, 4)$

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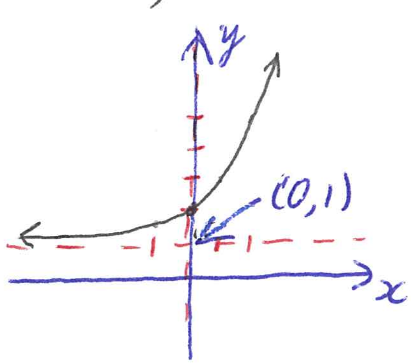
24) $g(x) = 2^x + 1$

$= 2^{(x-0)} + (1)$

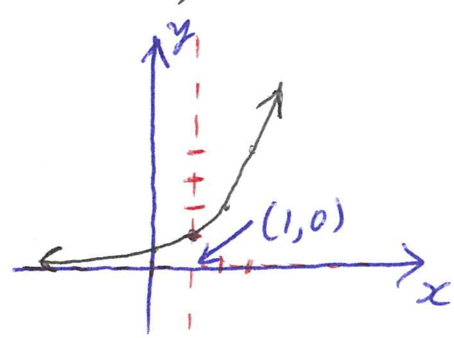
$h = 0$, $k = +1$



26) $w(x) = 2^{x-1}$

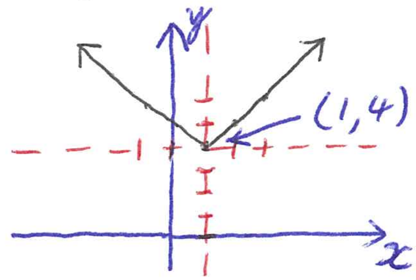
$= 2^{(x-1)} + (0)$

$h = +1$, $k = 0$



28) $h(x) = |x-1| + 4 = |x-(1)| + (4)$

$h = +1$ $\quad k = +4$ $\quad$ like $y = |x|$



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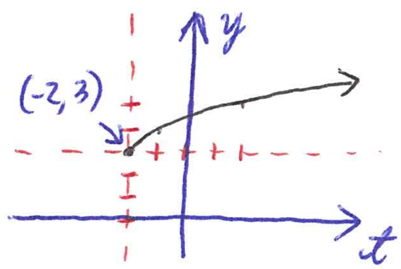
30) $m(t) = 3 + \sqrt{t+2} = \sqrt{t-(-2)} + (3)$

$h = -2$ $\quad k = +3$ $\quad$ like $y = \sqrt{t}$



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32) $f(-2) = -1$ $\quad g(-3) = -1$

the tables have different x values with same y (or $f(x)$ and $g(x)$) values, so it is an Horizontal shift

$g(x) = f(x-h) \rightarrow g(-3) = f((-2)-h)$

$-3 = -2 - h$

$h = -2 + 3$

$h = +1$ $\quad$ so $\underline{g(x) = f(x-1)}$

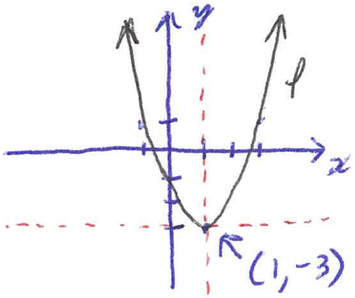
$f(-2) = -1$, $h(-2) = -2$ and $f(-1) = -3$, $h(-1) = -4$

the tables have same x values with different y (or $f(x)$ and $h(x)$) values, so it is a Vertical shift

$h(x) = f(x) + k \rightarrow h(-2) = f(-2) + k \rightarrow (-2) = (-1) + k \rightarrow -1 = k$

so $h(x) = f(x) + k = f(x) + (-1) = \underline{f(x) - 1}$

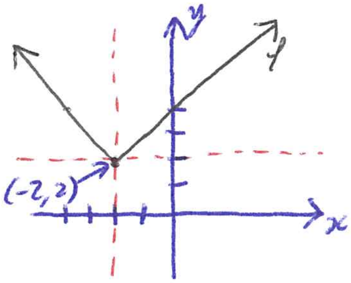
34)



$h = +1 \quad k = -3$ like $y = x^2$

$f(x) = (x-(+1))^2 + (-3) = \underline{\underline{(x-1)^2 - 3}}$

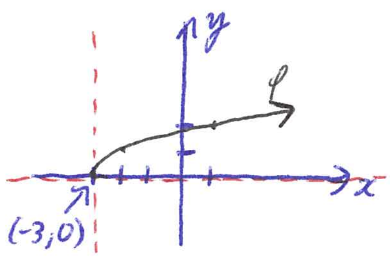
36)



$h = -2 \quad k = +2$ like $y = |x|$

$f(x) = |x-(-2)| + (+2) = \underline{\underline{|x+2| + 2}}$

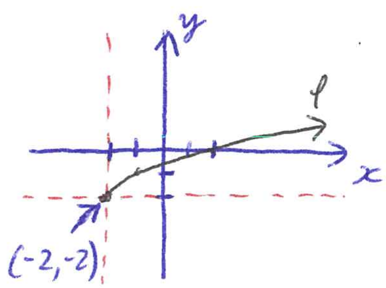
38)



$h = -3 \quad k = 0$ like $y = \sqrt{x}$

$f(x) = \sqrt{x-(-3)} + (0) = \underline{\underline{\sqrt{x+3}}}$

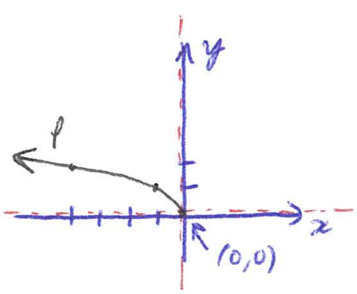
40)



$h = -2 \quad k = -2$ like $y = \sqrt{x}$

$f(x) = \sqrt{x-(-2)} + (-2) = \underline{\underline{\sqrt{x+2} - 2}}$

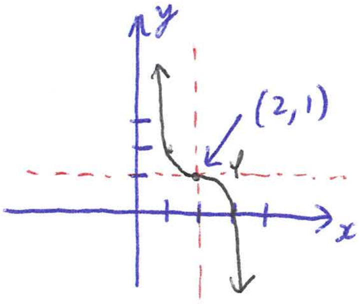
42)



$h = 0, \ k = 0$ like $y = \sqrt{-x}$

$f(x) = \sqrt{-(x-(0))} + (0) = \underline{\underline{\sqrt{-x}}}$

44)



$h=+2 \quad k=+1$ like $y=-x^3$

$f(x) = -(x-(+2))^3 + (+1) = \underline{\underline{-(x-2)^3+1}}$

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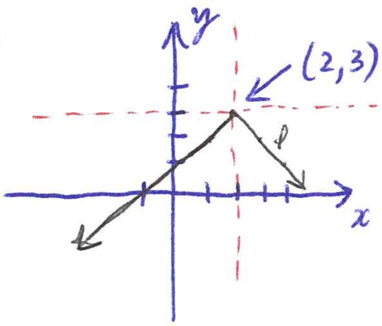
46)



$h=+2 \quad k=+3$ like $y=-|x|$

$f(x) = -|x-(+2)| + (+3) = \underline{\underline{-|x-2|+3}}$

"skip 47-68"

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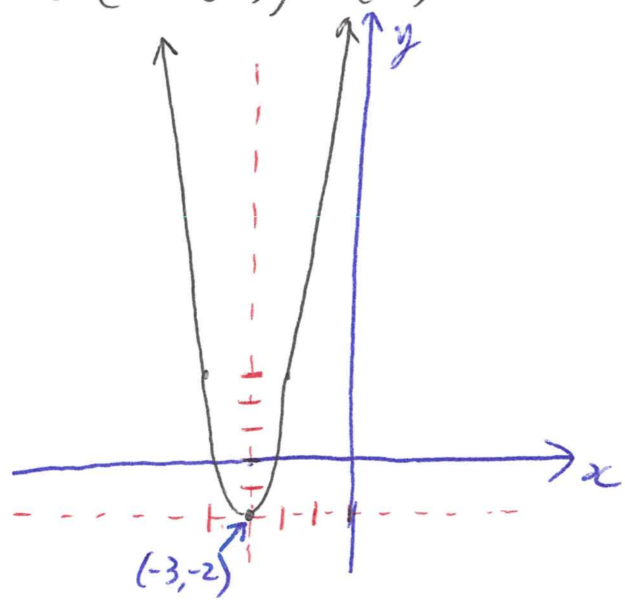
70) $g(x) = 5(x+3)^2 - 2 = 5(x-(-3))^2 + (-2)$

$h=-3 \quad k=-2$

like $y = 5x^2$

x	y
2	20
1	5
0	0
-1	5
-2	20



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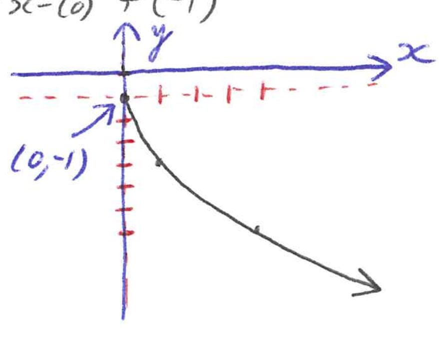
72) $k(x) = -3\sqrt{x} - 1 = -3\sqrt{x-(0)} + (-1)$

$h=0 \quad k=-1$

like $y = -3\sqrt{x}$

x	y
0	0
1	-3

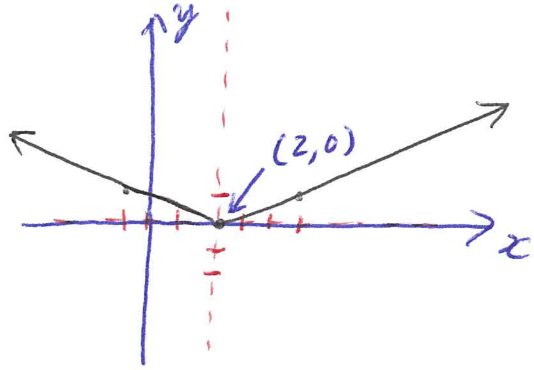


74) $n(x) = \frac{1}{3}|x-2| = \frac{1}{3}|x-(2)|+(0)$

$h = 2$, $k = 0$

like: $y = \frac{1}{3}|x|$

x	y
3	1
0	0
-3	1



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76) $q(x) = \left(\frac{1}{4}x\right)^3 + 1 = \left(\frac{1}{4}(x-(0))\right)^3 + (1)$

$h = 0$, $k = +1$

like $y = \left(\frac{1}{4}x\right)^3$

x	y
4	1
0	0
-4	-1