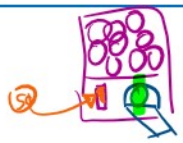
Chapter 3 Notes: Functions

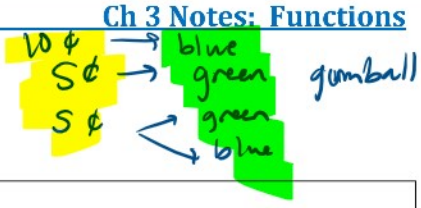
Date	Day	Assignment
10/12/22 **10/13/22**	**Wednesday (A)** **Thursday (B)**	HW: 3.1 Worksheet
10/14/22 **10/17/22**	**Friday (A)** **Monday (B)**	HW: 3.2 Worksheet
10/18/22 **10/19/22**	**Tuesday (A)** **Wednesday (B)**	HW: 3.3 Worksheet
10/20/22 **10/21/22**	**Thursday (A)** **Friday (B)**	HW: 3.4 Worksheet
10/24/22 **10/25/22**	**Monday (A)** **Tuesday (B)**	HW: Ch 3 Review Worksheet
10/26/22 **10/27/22**	**Wednesday (A)** **Thursday (B)**	**Ch 3 Test** No HW 😊

HW Hints:

- Class website: https://www.washoeschools.net/Page/18023
- Check out our class YouTube channel: https://www.youtube.com/channel/UCkqqsceoKE3jFg7YGxTM6Lw
- Show all work for each problem.
- Students who complete every assignment this semester will get a 2% bonus.
- For extra practice, visit www.khanacademy.org
- Check out www.mathguy.us for extra help.

3.1 Notes: Intro to Functions





Key Vocabulary

Domain:	**Range**
set (list) of all inputs xs least to greatest	set (list) of all outputs ys least to greatest

Example 1: Find the domain and range for each set of ordered pairs below.

a)

x	1	2	3	4	5
y	11	12	13	13	13

D: {1, 2, 3, 4, 5}
R: {11, 12, 13}

b)

Input	Output
3	7
8	-2
5	4
5	0

D: {3, 5, 8}
R: {-2, 0, 4, 7}

You try!

c) {(7, −1), (6, 5), (−3, 2), (0, 5)}

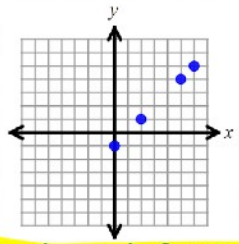
D: {-3, 0, 6, 7}
R: {-1, 2, 5}

d)

input	output
3	Red
7	Blue
-2	Green
5	Green
-4	Green

D: {-4, -2, 3, 5, 7}
R: {Red, Blue, Green}

e)



(0, -1) (2, 1) (5, 4) (6, 5)
D: {0, 2, 5, 6}
R: {-1, 1, 4, 5}

Key Vocabulary

Relation	**Function**
set of ordered pair	* each input has exactly (one) one output 5 ¢ → green ~~25 ¢ → green~~ ~~25 ¢ → blue~~
Vertical Line Test: if a vertical is drawn anywhere on a function, it will only pass through one point	5 ¢ → green 10 ¢ → blue 10 ¢ → blue

Example 2: For each relation, is it a function? yes or no?

a) all diff inputs

x	1	2	3	4	5
y	11	12	13	13	13

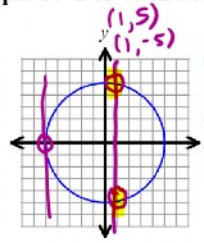
function
Yes

b)

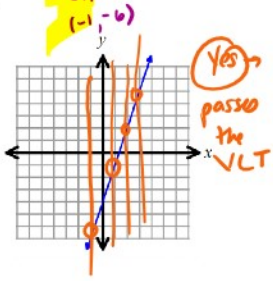
Input	Output
3	7
8	-2
5	4
5	0

No

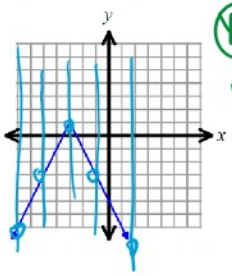
Example 3: For each relation, is it a function?

a) 

No
fails the VLT.
1 → 5, -5

b) 

Yes
passes the VLT

c) 
Yes
passes the VLT

You try!

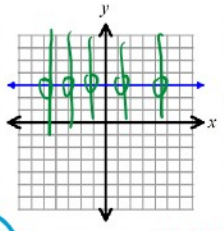
d) $\{(7,-1),(6,5),(-3,2),(0,5)\}$

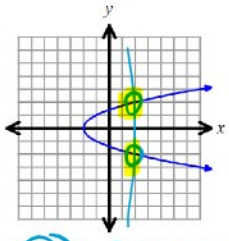
Yes
(inputs are all diff)

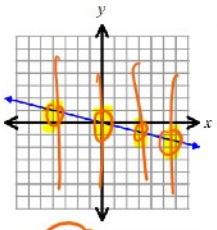
e)

3	Red
7	Blue
-2	Green
5	Green
-4	Green

Yes
(inputs are all diff)

f) 
Yes, passes the VLT

g) 
No fails the VLT

h) 
Yes passes the VLT

Function Notation:

"f of x" — f(x), x is our input

"g of x" — g(x), x is the input

"h of x" — h(x), x is the input

For Examples 4 – 9, given that $f(x) = 3x - 9$ and $g(x) = -4x + 5$.

4) Find $f(-2)$.

use the rule for f, plug in -2 as the input

$= 3(-2) - 9$ (input)

$= -15$

5) Find $g(7)$.

$= -4(7) + 5$ (input)

$= -23$

6) **You try!** Find $f(8)$.

$3(8) - 9$ (input)

$= 15$

7) Find x if $f(x) = 10$.

$3x - 9 = 10$

$+9 \quad +9$

$\frac{3x}{3} = \frac{19}{3}$

$x = \frac{19}{3}$ or $6.\overline{3}$

8) Find x if $g(x) = -5$.

$-4x + 5 = -5$

$-5 \quad -5$

$\frac{-4x}{-4} = \frac{-10}{-4}$ ÷2 ÷2 → $\frac{5}{2}$

$x = \frac{5}{2}$ or 2.5

9) **You try!** Find x if $g(x) = 0$.

$-4x + 5 = 0$

$-5 \quad -5$

$\frac{-4x}{-4} = \frac{-5}{-4}$

$x = \frac{5}{4}$ or 1.25

3.2 Notes: Linear Functions

Key Vocabulary

Linear Function
- line
- passes the VLT → function

★ $y = mx + b$ ← slope-int form (m = slope, b = y-int)
★ $y = m(x-h) + k$ ← (h,k) form
★ $Ax + Bx = C$ ← standard

Rate of Change
slope of a line (m)

Zero Term
y-intercept → starting value when x = 0

Examples 1 – 2: Write a linear function for the data shown in each table.

1)

x	-1	0	1	2
$f(x)$	17	32	47	62

rate of change (slope) → +15, +15, +15 → m = 15
zero term (y-int = 32)
$y = mx + b$
$y = 15x + 32$

2)

0	8
x	$g(x)$
1	5
2	2
3	-1
4	-4

-3, -3, -3, -3
Slope / rate of change → m = -3
y-int / zero-term → b = 8
$y = mx + b$
$y = -3x + 8$

You try! Examples 3 – 6: Write a linear function for the data shown in each table.

3)

x	0	1	2	3
$h(x)$	1	−5	−11	−17

m = -6
b = 1
-6, -6, -6
$y = -6x + 1$

4)

0	3.5
x	$d(x)$
1	6
2	8.5
3	11
4	13.5

+2.5, +2.5, +2.5, +2.5
m = 2.5
b = 3.5
$y = mx + b$
$y = 2.5x + 3.5$

5)

x	y
−2	9
−1	13
0	17
1	21

+4, +4, +4
m = 4
b = 17
$y = 4x + 17$

6)

0	x	1	2	3	4
8	$h(x)$	5	2	−1	−4

-3, -3, -3
m = -3
b = 8
$y = -3x + 8$

Slope-intercept form of a line: $y = mx + b$ (m: slope, b: y-int)

For Examples 7 – 12, write the equation of the described line in slope-intercept form.

7) A line with a slope of $\frac{1}{3}$ and a y-intercept of 10.

m = $\frac{1}{3}$, b = 10

$y = \frac{1}{3}x + 10$

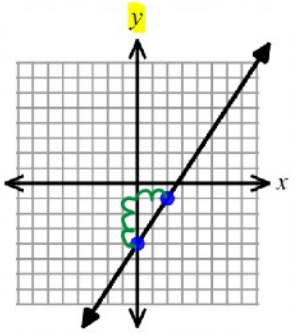
(constant (no variable) = b)

8) A line with a y-intercept of -7 and a slope of 5.

b = -7, m = 5

$y = 5x - 7$

9) The line graphed below.



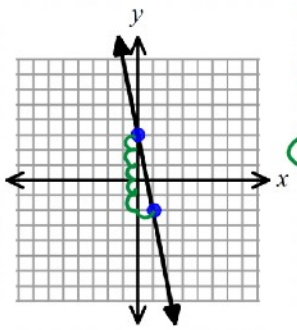
$m = \frac{\text{rise}}{\text{run}} = \frac{3\uparrow}{2\rightarrow} = \frac{3}{2}$

b = -4

$y = \frac{3}{2}x - 4$

$y = \frac{3}{2}x + -4$

10) **You try!** The line graphed below.



$m = \frac{\text{rise}}{\text{run}} = \frac{-5\downarrow}{1\rightarrow} = -5$

b = 3

$y = mx + b$

$y = -5x + 3$

You try #11 – 12:

11) A line with a slope of 1 and a y-intercept of 0.

m = 1, b = 0

$y = 1x + 0$

$y = x$ ✱

$y = 1x$

$y = x + 0$

12) A line with a y-intercept of $-\frac{3}{4}$ and a slope of 8.

$b = -\frac{3}{8}$, $m = 8$

$y = 8x - \frac{3}{8}$

Review: find the slope between the points below. Use the slope formula: $m = \frac{y_2 - y_1}{x_2 - x_1}$

13) $(-14, 30)$ and $(12, 27)$

x_1, y_1 x_2, y_2

$m = \frac{27 - 30}{12 + 14} = \frac{-3}{26}$

14) $(-3, -5)$ and $(9, -2)$

x_1, y_1 x_2, y_2

$m = \frac{-2 + 5}{9 + 3} = \frac{3 \div 3}{12 \div 3} = \frac{1}{4}$

3.3 Notes: Writing Linear Equations in (h, k) Form

(h, k) form of a line: $y = m(x - h) + k$

slope; (h, k) point

Example 1: Write the equation of the line, **in (h, k) form**, that passes through (5, -2) with a slope of -3.

h k m = -3

$y = m(x - h) + k$

$y = -3(x - 5) - 2$

Example 2: Write the equation of the line, **in (h, k) form**, that passes through (-7, 1) with a slope of 5.

h k m = 5

$y = 5(x + 7) + 1$

*h changes signs!

You try! Example 3 – 4: For each line described below, write the equation in **(h, k) form.**

3) through (-3, 1) with a slope of 2 (h k m = 2)

4) through (4, 6) with a slope of $\frac{3}{4}$. (h k m)

(h, k) form	$y = 2(x + 3) + 1$	$y = \frac{3}{4}(x - 4) + 6$

Converting to Slope-intercept form:

- distribute
- combine like terms

$y = mx + b$

Example 5: Write the equation of the line from Example 1 in **slope-intercept form** of a line.

$y = -3(x - 5) - 2$

$y = -3x + 15 - 2$

$y = -3x + 13$

You Try! Example 6: Write the equation of the line from Example 2 in **slope-intercept form** of a line.

$y = 5(x + 7) + 1$

$y = 5x + 35 + 1$

$y = 5x + 36$

Example 7: Write the equation of the line from Example 4 in **slope-intercept form** of a line.

$y = \frac{3}{4}(x - 4) + 6$

$y = \frac{3}{4}x - 3 + 6$

$y = \frac{3}{4}x + 3$

Function Notation for an ordered pair: $(x, f(x))$ — $f(x)$: output, input; $(x, f(x))$: input, output

$f(a) = b$ — input, output; (a, b)

Example 8: Write the equation of the line, in (h, k) form, that contains $f(-11) = -2$ and has a slope of 2.

$m = 2$

$y = m(x-h) + k$

$y = 2(x+11) - 2$

$(-11, -2)$ h k

You try! Example 9: Write the equation of the line, in (h, k) form, that contains $f(14) = -5$ and has a slope of $-\frac{1}{2}$.

$m = -\frac{1}{2}$

$y = -\frac{1}{2}(x-14) - 5$

$(14, -5)$ h K

Writing Equations of Lines from Word Problems in Slope-Intercept Form:

"Starting value" or "one-time fee":

b (y-intercept)

Rate of change (look for "per" or "each"):

m (slope)

Examples 10 – 13: write an equation in slope-intercept form to represent each situation.

10) A plumber charges $40 per hour, plus a one-time service fee of $50. Use c for the total cost and h for the number of hours.

slope $m = 40$

$b = 50$

$y = 40x + 50$

$C = 40h + 50$

output

11) A t-shirt company charges a set-up fee of $30, plus $12 per t-shirt ordered. Use y for the total cost and x for the number of t-shirts ordered.

y-int $b = 30$

slope $= 12$

$y = 12x + 30$

You try!

12) Andrea is keeping track of how many miles she runs. So far, she has run 34 miles, and she plans to run an additional 4 miles each day. Use T for the total number of miles run, and d for the number of days she is going to continue running.

input

slope $= 4 = m$

y-int $b = 34$

$y = mx + b$

$T = 4d + 34$

You try!

13) You are visiting Baltimore, and a tax company charges a flat fee of $8.00 for using the taxi, as well as $2.50 per mile. Use c for the total cost and m for miles.

slope $= m = 2.5$

$b = 8$

$y = mx + b$

$C = 2.5m + 8$

14) For the situation in #13, if you use the taxi for 31 miles, how much would this trip cost?

$C = 2.5(31) + 8$

$C = 77.5 + 8$

$C = \$85.50$

62 + 15.5

3.4 Notes: Writing Linear Equations from Two Points

(h, k) form: $y = m(x - h) + k$ — m: slope; (h, k): point on the line

- What do we need to write the equation of a line in (h, k) form?

  slope & one point

- If we have two ordered pairs (two points), could we get this information?

  yes! slope $= \frac{y_2 - y_1}{x_2 - x_1}$ choose either point to be (h, k)

Using (h, k) form to write the equation of a line that passes through two points:

① Find slope $m = \frac{y_2 - y_1}{x_2 - x_1}$ ② choose one pt to be (h, k) ③ write the equation

Example 1: Write the equation of the line that passes through the points (7, 3) and (5, 9). Write your answer in (h, k) form.

(x_1, y_1) (x_2, y_2) (h, k)

slope: $m = \frac{9 - 3}{5 - 7} = \frac{6}{-2} = -3$ point: $(7, 3)$ (h, k)

$y = -3(x - 7) + 3$ or $y = -3(x - 5) + 9$

Note: Could you write a different answer that is equivalent? If so, how many?

yes 3 equivalent answers

slope-int form: $y = -3x + 21 + 3$

$y = -3x + 15 + 9$

$y = -3x + 24$ ⟷ same ⟷ $y = -3x + 24$ (h, k)

Example 2: Write the equation of the line that passes through the points (6, -2) and (9, -8). Write your answer in (h, k) form.

(x_1, y_1) (x_2, y_2)

slope $= \frac{-8 + 2}{9 - 6} = \frac{-6}{3} = -3$ point: $(6, -2)$ (h, k)

$y = -3(x - 6) - 2$ or $y = -3(x - 9) - 8$

Example 3: convert your answer from #2 to slope-intercept form.

$y = -3(x - 6) - 2$

$y = -3x + 18 - 2$

$y = -3x + 16$

Example 4: Write the equation of the line that passes through the points (-8, 1) and (2, 3). Write your answer in (h, k) form.

slope: $\frac{3-1}{2-(-8)} = \frac{2}{10} = \frac{1}{5}$ { point $(-8, 1)$ (x_1, y_1 x_2, y_2; h k)

$y = \frac{1}{5}(x+8)+1$ or $y = \frac{1}{5}(x-2)+3$ (h k)

Example 5: Write the equation of the line that passes through the points (5, 4) and (10, 6). Write your answer in (h, k) form.

slope $= \frac{6-4}{10-5} = \frac{2}{5}$ { point $(5, 4)$ (x_1, y_1 x_2, y_2; h k)

$y = \frac{2}{5}(x-5)+4$ or $y = \frac{2}{5}(x-10)+6$

Example 6: Consider the line that passes through the points (-2, -3) and (2, 3). Write *as many* correct equations for this line as you can. 😊

slope: $\frac{3-(-3)}{2-(-2)} = \frac{6}{4} = \frac{3}{2}$ { point $(-2, -3)$ (x_1, y_1 x_2, y_2; h k)

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

$y = \frac{3}{2}x+3-3$

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

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

$y = \frac{3}{2}x+0$

Now graph the ~~two~~ 3 lines from Example 6. Verify that your lines are correct by graphing them, and making sure they go through both points above.