Name: Key
Date: _____

CHAPTER 6 PART 2 NOTES – Linear Inequalities

Calendar of Chapter: See the 'Homework' link on the webpage

What You'll Learn:

6.3 – Linear Inequalities: learn what inequalities are and how they are represented
6.4 – Adding & Subtracting Linear Inequalities: learn how to solve linear inequalities that involve adding and subtracting
6.5 – Multiplying Linear Inequalities: learn how to solve linear inequalities that involve multiplying, dividing, adding, and subtracting

6.3 – Linear Inequalities

Focus: Write and graph inequalities.

What do each of the following signs mean?

$>$	$<$	$\geq$	$\leq$
greater than	less than	greater than or equal to	less than or equal to

ex1:
Write an inequality for each situation:

Can you write an inequality for the amount of time, t, you are legally allowed to park according to the sign?

$t \leq 30$ up to and including 30 mins

Let s = speed (km/h)

$s \leq 50$

Let a = age

$a \geq 13$

Let h = height (cm)

$h \geq 120$

Ex2:
Define a variable and write an inequality to describe each situation:
a) Your bank account balance has been above $300 the whole year
b) You must have 9 items or less to use the express checkout
c) Rickie Fowler shot below -1 everyday of the tournament

a) Let m = money
$m > 300$

b) Let i = items
$i \leq 9$

c) Let s = score
$s < -1$

What is different about an inequality compared to an equation?

An equation only has one solution whereas an inequality has a range of solutions.

(ex) $x = 1$ vs. $x \geq 1$

solution(s): 1 vs 1, 1.1, 1.78, 8, 4000, etc.

ex3:
Write the following inequalities how you would say them, then give 2 possible solutions:
a) $x > 2$
b) $x \leq 7$
c) $x < -9$
d) $-3 \geq x$

a) $x > 2$; "x is greater than 2" 3, 10
b) $x \leq 7$; x is less than or equal to 7 7, 6
c) $x < -9$; x is less than -9 $-9.1, -12$
d) $-3 \geq x$; -3 is greater than or equal to x
OR
is $x \leq -3$; x is less than or equal to -3 } $-3, -4$

ex3
Is each number a solution of the inequality $y \geq -3$?
a) -4 b) 4
c) -2.5 d) 0
e) -3

$y \geq -3$

a) -4; NO (b) 4; YES (c) -2.5; YES
d) 0; YES (e) -3; YES

How can you illustrate solutions to an inequality?

What are the guidelines to graphing on a number line?

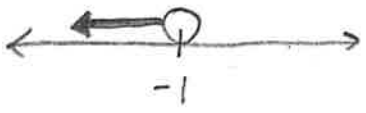
using a number line!

① For $>$ or $<$, use an open dot at the critical point
For $\geq$ or $\leq$, use a coloured dot at the critical point

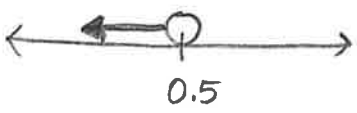
② For $>$ or $\geq$, use a right arrow
For $<$ or $\leq$, use a left arrow

ex4
Graph each inequality on a number line and write two possible solutions:
a) $m < -1$
b) $0.5 > p$
c) $w \leq -3.5$
d) $t \geq 0$

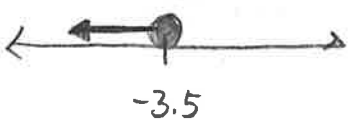
a) $m < -1$



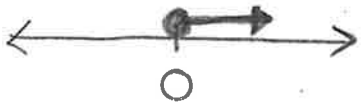
(b) $0.5 > p$ OR $p < 0.5$



(c) $w \leq -3.5$



(d) $t \geq 0$



6.4 – Adding & Subtracting Linear Inequalities

Focus: Use addition and subtraction to solve inequalities

How do we solve Inequalities (how do we isolate the variable)?

Solve inequalities like you solve equations

ex1:
a) $m + 4 = 11$
b) $x + 1 > 5$
c) $y - 9 \leq -1$

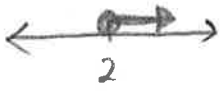
a) $m + 4 = 11$
$-4 \quad -4$
$m = 7$

b) $x + 1 > 5$
$-1 \quad -1$
$x > 4$

c) $y - 9 \leq -1$
$+9 \quad +9$
$y \leq 8$

ex2 – Solve and graph the inequalities:
a) $x + 3 \geq 5$
b) $m - 2.3 < -1.2$
c) $4.1 \leq p - 3.1$
d) $\frac{3}{4} \geq \frac{2}{5} + y$

a) $x + 3 \geq 5$
$-3 \quad -3$
$x \geq 2$



b) $m - 2.3 < -1.2$
$+2.3 \quad +2.3$
$m < 1.1$

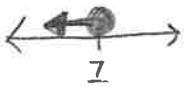
c) $4.1 \leq p - 3.1$
$p - 3.1 \geq 4.1$
$+3.1 \quad +3.1$
$p \geq 7.2$

d) $\frac{3}{4} \geq \frac{2}{5} + y$

$y + \frac{2}{5} \leq \frac{3}{4} \quad -\frac{2}{5} \quad -\frac{2}{5}$

$y \leq \frac{3(5)}{4(5)} - \frac{2(4)}{5(4)}$

$y \leq \frac{7}{20}$



ex3 – Do checks for ex2a & 2b

2a check
try $x = 3$
$x + 3 \geq 5$
$3 + 3 \geq 5$
$6 \geq 5$ ✓

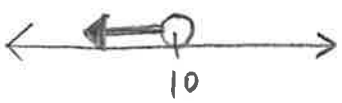
2b check
try $m = 0$
$m - 2.3 < -1.2$
$0 - 2.3 < -1.2$
$-2.3 < -1.2$ ✓

Why aren't checks perfect for inequalities?

You can only check one number at a time but inequalities have a range of solutions, so you can't check all possible solutions

ex4 – Solve and graph the inequalities:
a) $5x - 3 < 4x + 7$
b) $-9y + 1 > -10y + 1$

(a) $5x - 3 < 4x + 7$
$-4x \quad -4x$
$x - 3 < 7$
$+3 \quad +3$
$x < 10$



(b) $-9y + 1 > -10y + 1$
$+10y \quad +10y$
$y + 1 > 1$
$-1 \quad -1$
$y > 0$

ex5 – Jake plans to board his dog while he is away on vacation. Boarding house A charges $90 plus $5 per day. Boarding house B charges $100 plus $4 per day. For how many days can Jake board his dog so that boarding house A is less expensive than boarding house B?
a) Choose a variable and write an inequality
b) Solve the problem
c) Graph the solution

a) Let x = number of days

$$5x + 90 < 4x + 100$$

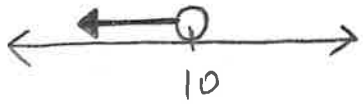
b) $5x + 90 < 4x + 100$
$-4x \quad -4x$

$x + 90 < 100$
$-90 \quad -90$

$\therefore x < 10$

If Jake boards his dog for less than 10 days, Boarding House A will be cheaper than Boarding House B.

c)



Day	A	B
1	95	104
2	100	108
3	105	112
4	110	116
5	115	120
6	120	124
7	125	128
8	130	132
9	135	136
10	140	140
11	145	144
12	150	148
13	155	152
14	160	156

6.5 – Multiplying (and Dividing) Linear Inequalities

Focus: Use multiplication and division to solve inequalities.

How do we solve inequalities?

The same way we solve equations, except...

add to both sides	subtract	multiply pos	divide pos
$4 > 3$	$4 > 3$	$4 > 3$	$4 > 2$
$+2 \quad +2$	$-2 \quad -2$	$\times 2 \quad \times 2$	$\div 2 \quad \div 2$
$6 > 5$ ✓	$2 > 1$ ✓	$8 > 6$ ✓	$2 > 1$ ✓

What is the one exception to watch for?

multiply neg	divide neg
$4 > 3$	$4 > 2$
$\times(-2) \quad \times(-2)$	$\div(-2) \quad \div(-2)$
$-8 > -6$	$-2 > -1$
✗	✗
actually $-8 < -6$	actually $-2 < -1$

Why?

Negative numbers are mirror image to positive numbers.

We solve inequalities just like we solve equations, EXCEPT if you multiply OR divide both sides by a negative number, FLIP the sign!!

ex1 – Solve & graph

a) $3x \geq 18$

b) $-y < 4$

c) $\frac{t}{-5} \leq -1$

d) $\frac{w}{6} > 0$

e) $-\frac{3}{4}x \leq 9$

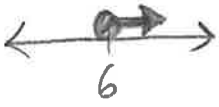
f) $2x + 5 > -4$

g) $-4w - 1 \leq -9$

a) $3x \geq 18$

$\frac{3x}{3} \geq \frac{18}{3}$

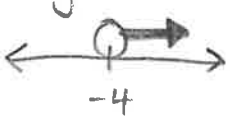
$x \geq 6$



b) $-y < 4$

$\frac{-1y}{-1} < \frac{4}{-1}$ FLIP

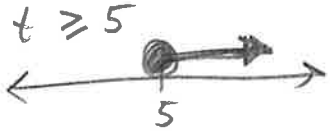
$y > -4$



c) $\frac{t}{-5} \leq -1$

$\frac{(-5)t}{-5} \leq -1(-5)$ flip

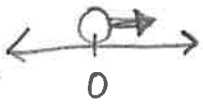
$t \geq 5$



d) $\frac{w}{6} > 0$

$\frac{w}{6} > 0(6)$

$w > 0$

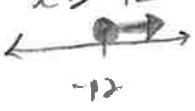


e) $\frac{-3}{4}x \leq 9$

$-\frac{3}{4}x \leq 9(4)$

$\frac{-3x}{-3} \leq \frac{36}{-3}$ flip

$x \geq -12$



f) $2x + 5 > -4$

$-5 \quad -5$

$\frac{2x}{2} > \frac{-9}{2}$

$x > -\frac{9}{2}$

g) $-4w - 1 \leq -9$

$+1 \quad +1$

$\frac{-4w}{-4} \leq \frac{-8}{-4}$ flip

$w \geq 2$

ex2 – Solve & graph

a) $15 + 4x \geq 10x - 15$

b) $-2.6a + 14.6 < -5.2 + 1.8a$

c) $-3(x + 7) - 5x > 4x - 9$

ex3 – A superslide charges $1.25 to rent a mat and $0.75 per ride. Haru has $10.25. How many rides can he go on?

a) Choose a variable and write an inequality

b) Solve the problem

c) Graph the solution

a) $15 + 4x \geq 10x - 15$
$-10x \quad -10x$

$15 - 6x \geq -15$
$-15 \quad -15$

$\frac{-6x}{-6} \geq \frac{-30}{-6}$ flip

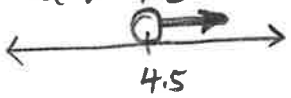
$x \leq 5$

b) $-2.6a + 14.6 < -5.2 + 1.8a$
$-1.8a \quad -1.8a$

$-4.4a + 14.6 < -5.2$
$-14.6 \quad -14.6$

$\frac{-4.4a}{-4.4} < \frac{-19.8}{-4.4}$ flip

$a > 4.5$



c) $-3(x+7) - 5x > 4x - 9$

$-3x - 21 - 5x > 4x - 9$

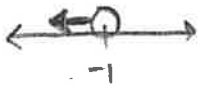
$-8x - 21 > 4x - 9$
$+8x \quad +8x$

$-21 > 12x - 9$
$+9 \quad +9$

$\frac{-12}{12} > \frac{12x}{12}$

$-1 > x$

$x < -1$



a) Let x = # of rides

$0.75x + 1.25 \leq 10.25$
$-1.25 \quad -1.25$

b)

$\frac{0.75x}{0.75} \leq \frac{9.00}{0.75}$

$x \leq 12$

Harn can go on up to 12 rides.

c)