Notes Math 111, 9/20/2023:
Make sure your class notes are part of your PDF. If you miss class, they must be copied from my PDF and loaded together with your homework PDF.

In the PDF, please be sure to draw a divider line between your class notes and homework so it's clear which is which.

Section 1.7:

>= over time became ≥ (greater than or equal to)
<= over time became ≤ (less than or equal to)
< (less than)
> (greater than)

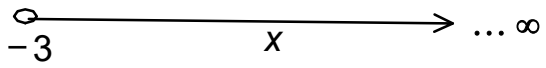
read from left to right!
3<4 or 4>3
$5 \le 5$...why is this true? < or =?
equal to part =
$3 \ge 2$ (this is true b/c >)

example 1 in book:
(-3,5] ⇐ interval notation , -3 is not included, 5 is included
inequality form: $-3 < x \le 5$ (*becomes* < ,] becomes ≤
x is present..(-3,5] ...infinite number of values ..so x stands for one of these values

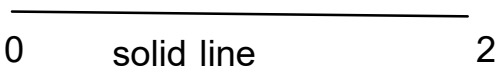
$(-3, \infty)$ ← interval form

(-3 becomes -3<, x stands for any number from -3 to infinity

$-3 < x$ or we can write x>-3 too $2 < 3$ or 3>2



$[0, 2]$ ⇐ interval from, [0 becomes $0 \le$, 2] becomes ≤ 2
$[0, 2]$ is an interval,

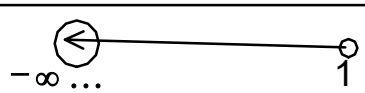


solid line
so infinite number of values from 0 to 2!

$1.5 \in [0, 2]$
$1.9999 \in [0, 2]$
$0.00001 \in [0, 2]$ ∈ is read as "belongs to" or "is an element of"

Only three example but there are infinitely many b/c the line is solid.

$x + 3 < 4$



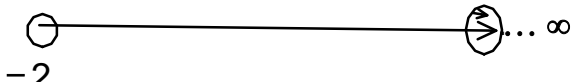
$x + 3 - 3 < 4 - 3$

$x < 1$
inequalty form

picture is useful for interval forms:
from left to right:
$(-\infty, 1)$ (interval form)

level 2: $2x - 4 > -8$
$2x - 4 + 4 > -8 + 4$
$2x > -4$
$\frac{2x}{2} > -\frac{4}{2}$

$x > -2$



works when x is on the left!

interval form left to right: $(-2, \infty)$

never:
∞] *this* means we have reached infinity!

example 3 in book:

$1-\frac{3}{2}x \geq x-4$

gather terms with x on LHS and constants on the other(same as for equations)
multiply by 2:

$2\cdot 1-2\cdot\frac{3}{2}x \geq 2\cdot x-2\cdot 4$ (b/c fractions are terrible)

$2-3x \geq 2x-8$ (cancel off 2)

$2-2-3x \geq 2x-8-2$

$-3x \geq 2x-10$

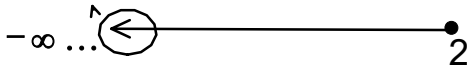
$-3x-2x \geq 2x-2x-10$

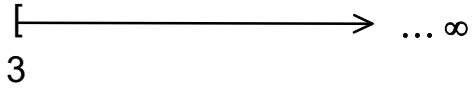
$-5x \geq -10$

$x \leq 2$ ⇐ flip inequality here!

$-2x > 4$

divide by -2 but don't flip:
$x > -2$
say x=0>-2
-2 · 0>4
0>4 false..sad face!





[is the same as •

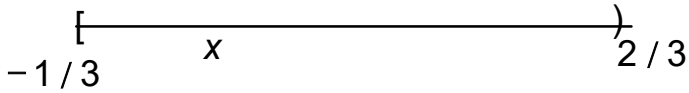
left to right along picture:
$(-\infty, 2]$

Example 4(a) preliminary:
2<4<8 true
divide by 2: $1<2<4$ still true

divide by -1: $-1>-2>-4$ (flip signs ..still true)

example 4 in book: $-3 \leq 6x-1<3$
let's add 1: $-3+1 \leq 6x-1+1<3+1$
simplify: $-2 \leq 6x<4$
divide by 6: $-\frac{2}{6} \leq \frac{6x}{6}<\frac{4}{6}$
simplify $\frac{-1}{3} \leq x<\frac{2}{3}$ ⇐ inequality form

$[-1/3, 2/3)$
≤ turns into bracket [, < turns into)



absolute value inequalities:
$|x|<a \Rightarrow -a<x<a$

$|x|<1$ $x=1/2: |1/2|<1$ *true*
$x=-1/2: |-1/2|<1$ still true b/c 1/2<1
$-1<x<1$ (must have the -1<)

$|x| > a$ means $x < -a$ or $x > a$

$|x| > 1$ $x = 2b/c$ $|2| > 1 \rightarrow 2 > 1$ is true

$x = -2$ b/c $|-2| > 1 \rightarrow 2 > 1$ is true!

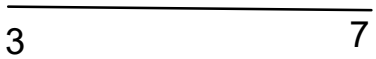
example 5 in book:

$|x-5| < 2$

$-2 < x-5 < 2$ (drop bars and attach -2< on LHS)

add 5: $-2+5 < x-5+5 < 2+5$

finalize the additions: $3 < x < 7 \leftarrow$ inequality form...interval form? $(3,7)$ (this not a point!)



$4 \in (3, 7)$

$6.999999 \in (3, 7)$

$3.00001 \in (3, 7)$

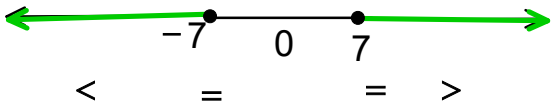
$7 \in (3, 7)$ False b/c 7 is not included as part of our interval.

$3 \notin (3, 7)$ true or false? true ...y?

3 is not an element of (3,7) b/c of the (next to the 3!!

$|x| \geq 7$

$x \geq 7$ *or* $x \leq -7$ compound or inequality



solid dots b/c of the = part of each inequality!

example 6:(in book)

Two phone plans..

Plan A: 49.99 per month for 500 minutes plus $.4 for each additional minute.

Plan B: 45.99 per month for 500 minutes plus $.45 for each additional minute.

How many additional minutes must you use in one month for plan B to cost more than plan A?

Plan A Cost: $49.99 + 0.4m$ (montly cost+cost per minute · number of minutes m)

Plan B Cost: $45.99 + 0.45m$ (ditto...)

"cost more than" means use >

$45.99 + 0.45m > 49.99 + 0.4m$

B A

$0.45m - 0.4m > 49.99 - 45.99$

$0.05m > 4$

$m > 80$ minutes! Plan B costs more if you use more than 80 additional minutes in one month!

Example 7: You go to a store to buy chocolates that cost $9.89 per pound. The scale used in the store has a state seal of approval that indicates

the scale is accurate to within half an ounce. (or 1/32 of a pound)

$16\,oz = 1$ lb

divide by 16: 1 oz= $\frac{1}{16}$ lb

divide by another 2: $\frac{1}{2}\,oz = \frac{1}{32}$ lb

$2.54\,cm = 1\,inch$

1cm= $\frac{1}{2.54}\,in$

$\div 3$

$\frac{1}{3}\,cm = \frac{1}{2.54 \cdot 3}\,in$

According to the scale, your purchase weighs
one-half pound and costs 4.95$. How much might you have been undercharged or overcharged as a result of an inaccuracy in the scale?
Let x=true weight of the candy(imagine a scale that can weigh perfectly)
B/c the scale is accurate to within 1/2 ounce (1/32 of a pound), the difference between the true weight and the scale weight is less than or equal to 1/32 of a pound.

inequality form: $|x - 1/2| \le 1/32$

drop bars: $-\frac{1}{32} \le x - \frac{1}{2} \le \frac{1}{32}$

add 1/2: $-\frac{1}{32} + \frac{1}{2} \le x \le \frac{1}{32} + \frac{1}{2}$

add the fractions: $-\frac{1}{32} + \frac{16}{32} \le x \le \frac{1}{32} + \frac{16}{32}$

finalize the addition: $\frac{15}{32} \le x \le \frac{17}{32}$

approximate: $0.46875 \le x \le 0.53125$

So our one-half pound of candy might have weighed as little as .46875 or as much as .53125.

if it weighed as little as .46875, then the cost is $9.89 \cdot 0.46875 = 4.64$
if it weighted as much as .53125, then the cost is $0.53125 \cdot 9.89 = 5.25$
exactly half a pount would be : $0.5 \cdot 9.89 = 4.95$

B / c sclae is not perfect, we might pay over: $5.25 - 4.95 = 0.30$