

Representing Inequalities

- used to represent a situation where there is more than one solution
- graphically, this is a region (shaded). i.e. $x \geq 5$

Symbols & Words:

- less than $<$
- greater than $>$
- maximum of \leq
- minimum of \geq
- at most \leq
- at least \geq
- no more than \leq

- Basics
 - be sure to always define variables
 - write expression
 - determine the sign

ex. There are at least 12 apples & oranges in the fruit basket.

$$x + y \geq 12$$

↑ ↑
apples oranges

* ex. There are at least twice as many girls as boys.

$x = \text{girls}$ $y = \text{boys}$

$x \geq 2y$

$20 = 2(10)$
 \downarrow \downarrow
 x y

$x \geq 2y$

ex. Your chem mark was a minimum of 12 marks higher than your math mark.

$$\text{Chem} = x$$

$$\text{Math} = y$$

ex. $x \geq y + 12$

Graphing Inequalities

Steps: ① identify variables; write the equations

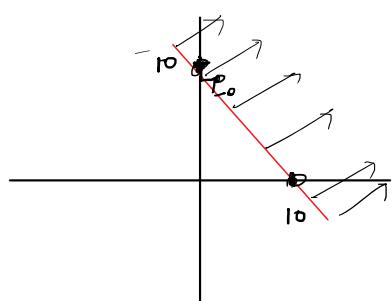
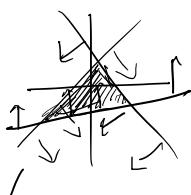
② Graph your inequality \rightarrow $<$ or $>$ \rightarrow dotted line
 \leq or \geq \rightarrow solid line

③ Shade the solution set; check with test point if required

$>$, \geq \rightarrow shade above / upwards

$<$, \leq \rightarrow shade downwards

ex. There are at least 10 electricians & painters fixing the school.



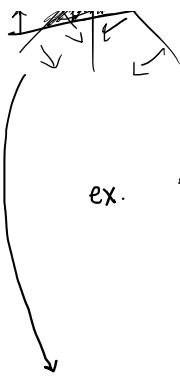
Electricians = x
Painters = y

$$x + y \geq 10$$

$$\rightarrow y = -x + 10$$

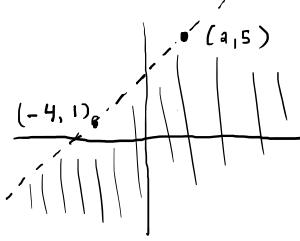
$$-\frac{1}{1} \text{ rise run}$$

$y = ax + b$



ex. Find the rule

10 ✓



$$\frac{-1}{1} \frac{\text{rise}}{\text{run}}$$

$$a = \frac{2}{3}$$

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

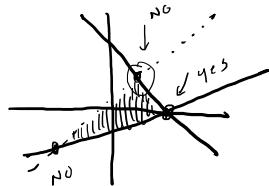
$$5 = \frac{2}{3}(2) + b$$

$$b = \frac{11}{3}$$

$$y < \frac{2}{3}x + \frac{11}{3}$$

Systems of Inequalities

- this is where shaded regions overlap
- points of intersection occur where two solid lines intersect (these are the only real solutions)



ex. Graph & solve for points of intersection:

a) $y \geq 2x$
 $y \leq -x + 3$

b) $2x + y < 4$
 $x \geq 1$

c) $x + y \geq 5$
 $x + 1 \leq y$

TRY THESE!

Target Objectives:

- target is a goal of the optimization
- an objective function "or" "function rule" or "Z rule" is an expression that calculates the goal

Steps:

- graph all inequalities to make a polygon of constraints
- determine the vertices (points of intersection)
- plug your vertices into the objective rule
- determine which coordinates optimize the rule

ex. James loves his stuffed animals. He has stuffed teddy bears and stuffed dinosaurs. He estimates that he has a minimum of 10 stuffed animals but a maximum of 20. He has less than or equal to 6 Teddy Bears. [He has at least 5 more stuffed dinos than teddys. He estimates each teddy is worth \$25 and each dino is worth \$15. What is the maximum value of his collection?] $x = \text{TB}, y = \text{dinos}$

Target Objective $\rightarrow Z = 25x + 15y$

✓ ① $x + y \geq 10$

✓ ② $x + y \leq 20$

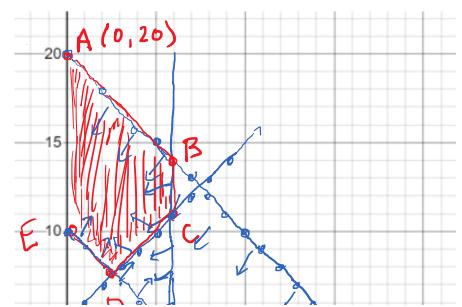
✓ ③ $x \geq 1$

A: $(0, 20)$

B: $(6, 14)$

C: $(6, 11)$

D: $(2.5, 7.5) \rightarrow (2, 8)$



$$\checkmark \textcircled{2} \quad x + y \leq 20$$

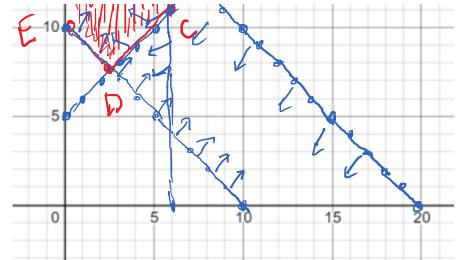
$$\checkmark \textcircled{3} \quad x \leq 6$$

$$\checkmark \textcircled{4} \quad y \geq 1x + 5 -$$

$$C: (6, 11)$$

$$D: (2.5, 7.5) \rightarrow (2, 8)$$

$$E: (0, 10)$$



Max value of James' collection:

$$z = 25x + 15y$$

$$A: 25(0) + 15(20) = 300$$

$$B: 25(6) + 15(14) = 360$$

$$C: 25(6) + 15(11) = 315$$

$$D: 25(2) + 15(8) = 170$$

$$E: 25(0) + 15(10) = 150$$

\$360 is the max value of

James' collection

if he has 6 teddy & 14 dino.