5 TOPICS COVERED THIS YEAR

1- OPTIMIZATION
2- GRAPH THEORY
3- SCALING (rotations, reflections, translations, etc.)
4- PROBABILITY
5- EQUIVALENCY (vol., area)

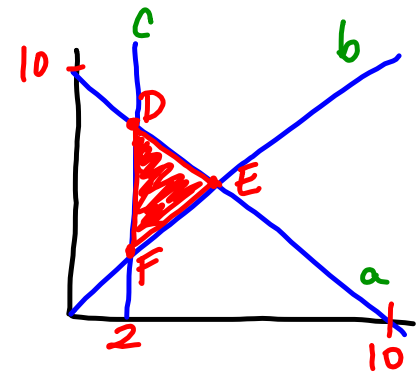
TOPIC 1:

OPTIMIZATION

1- OPTIMIZATION

- graphing lines
- polygon of constraints
- calculating profit/revenue

ex: $P = 12x + 15y$



a: $x + y \leq 10$

b: $x \leq y$

c: $x \geq 2$

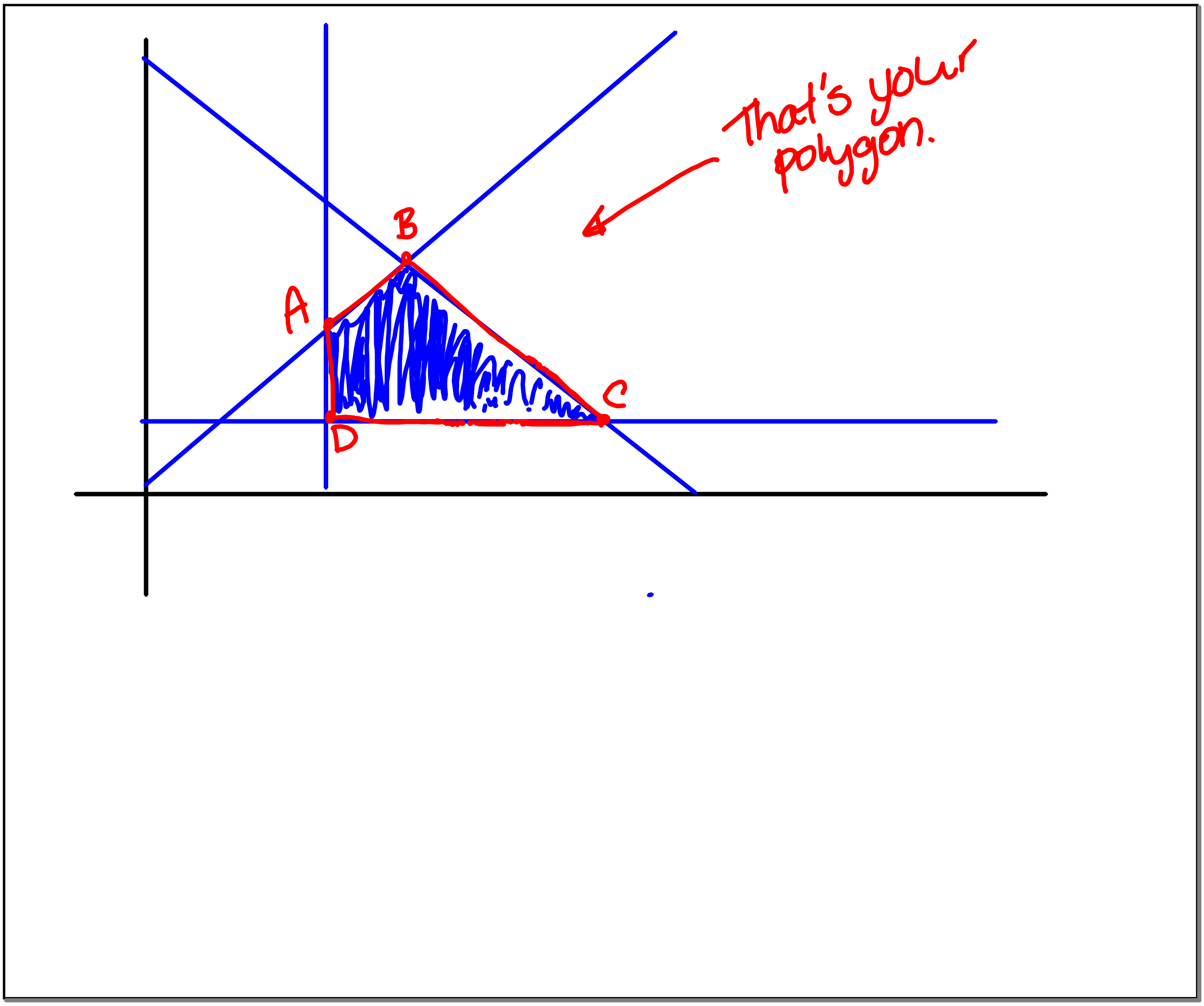
Points	$P = 12x + 15y$	
D( )		
E( )		
F( )		

MEMORY AID

OPTIMIZATION : looking for the min. or max. in a given situation.

→ Your optimizing function is the "P" or "R" rule that you're going to plug your coordinates into.

- Polygon of constraints = the shape you get after you graph all your inequalities.


B
A
C
D
That's your polygon.

* Rules for shading:

- Look at your y.

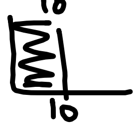
  $y \geq x+5$ shade <u>above</u> the line.

  $y \leq x+5$ shade <u>below</u> the line.

- When there is no y, you do the same with the x.

  $x \geq 10$

  $x \leq 10$



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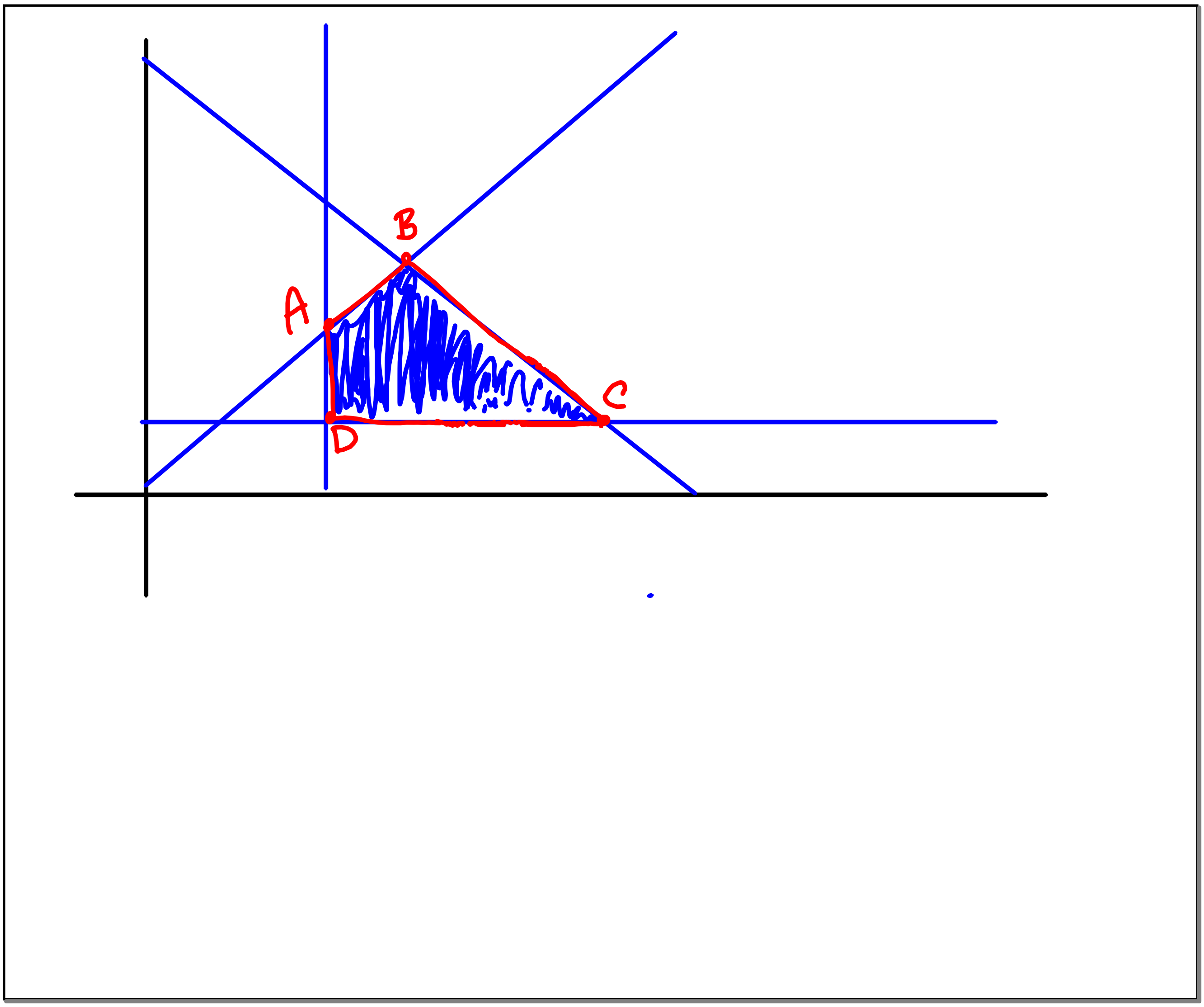
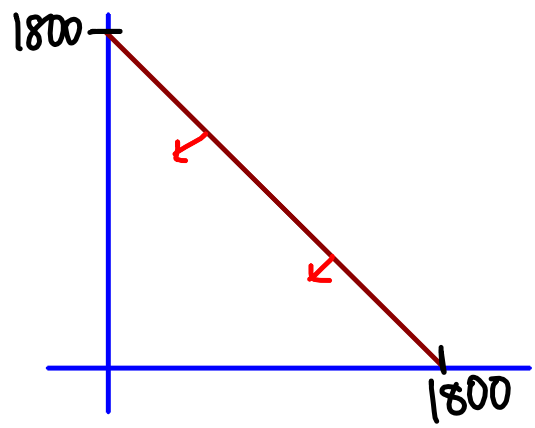


Rules for graphing:

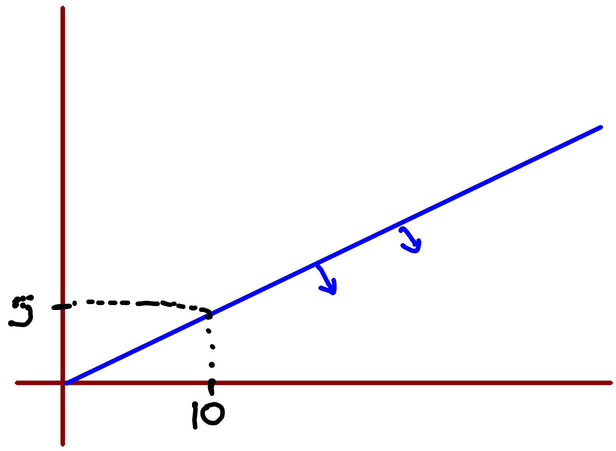
- "He can make a total of 1800 in a day"

$$x + y \leq 1800$$

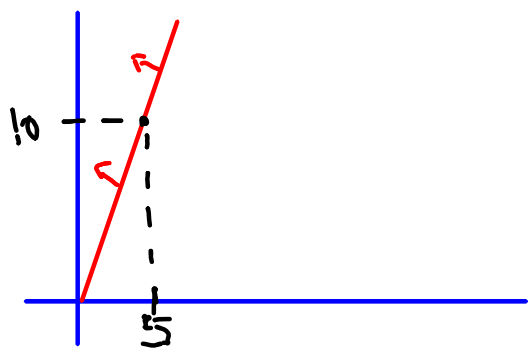


• He has at least twice as many ______ as ______
x y

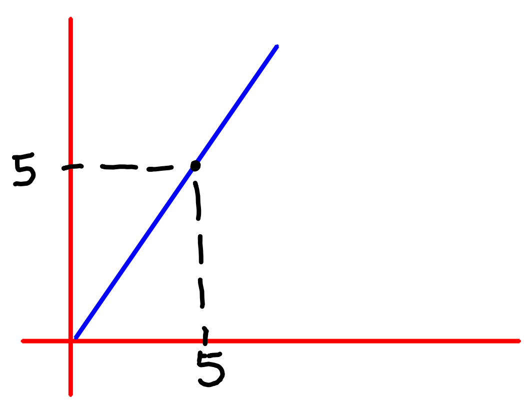
$x \geq 2y$



Note: $y \geq 2x$ would look similar but it is the steeper one:

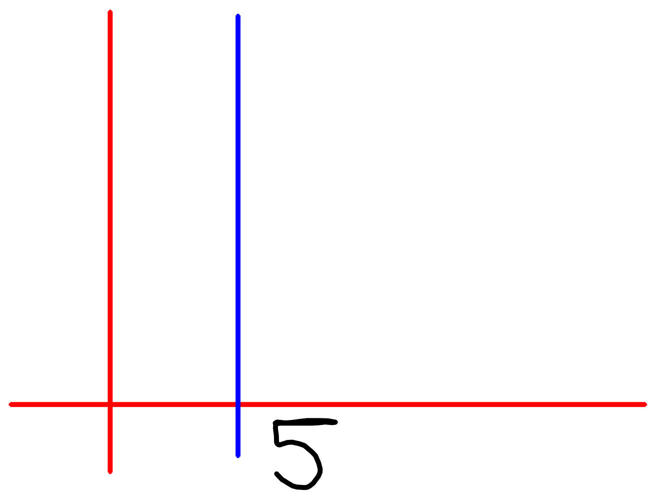


$x \geq y$ would be straight up the middle:

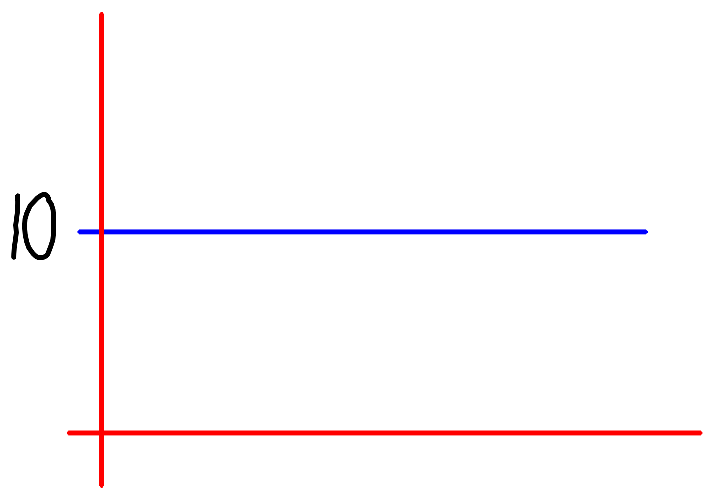


- When you get one that has just one variable, you just have a straight line:

$x = 5$



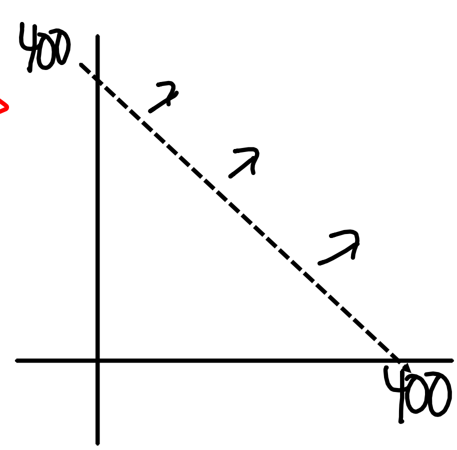
$y = 10$



Multiple Choice/Short Ans Tricks for Optimization:

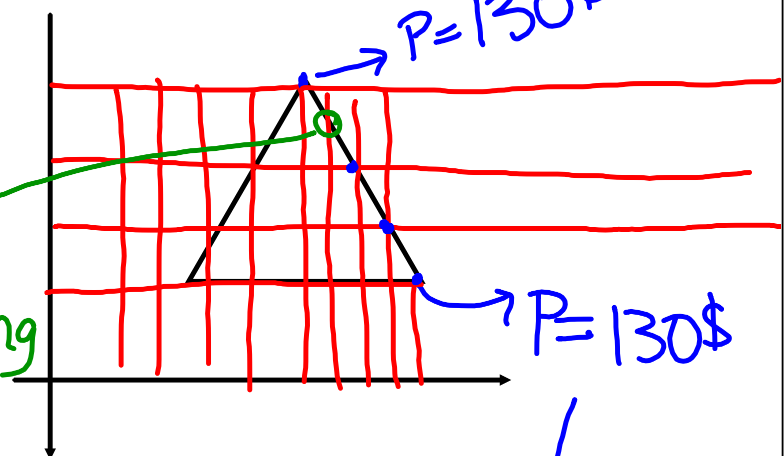
- Make sure the figures they give you are inside the polygon of constraints.
  - A dotted line means that those points are excluded:
    "there are more than 400 people here"
    gives you $x+y > 400$

Notice how there is no line underneath, that means it's more than 400, so 400 is excluded.



When you have more than one min or max from your question, you need to count all the real points on that line.

P=130$



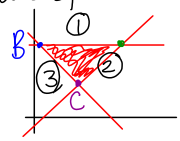
P=130$

Don't count this one because it's not touching 2 grid lines.
(You can't have 1.5 adults and 2.5 kids...)

All real points on that same line will give you P=130$

So there's 4 solutions.

Solving for where 2 points are equal:



① $y=10$

② $y=x-2$

③ $3x+5y=60$

A: Make lines ① and ② equal and solve:

$$10=x-2$$
$$+2 \quad +2$$
$$12=x$$

B: Make lines ① and ③ equal.

Options:

1 → do the same as above but you need to isolate y in line ③:

$$3x+5y=60$$
$$-3x \quad -3x$$
$$\frac{5y}{5}=\frac{-3x+60}{5}$$
$$y=\frac{-3}{5}x+12$$

→ OR to make the math easier / fraction free, you can substitute your y:

① $y=10$

③ $3x+5y=60$

$$3x+5(10)=60$$
$$3x+50=60$$
$$-50 \quad -50$$
$$\frac{3x}{3}=\frac{10}{3}$$
$$x=3.33$$

$$3(3.33)+5y=60$$
$$10+5y=60$$
$$-10 \quad -10$$
$$\frac{5y}{5}=\frac{50}{5}$$
$$y=10$$

C: same as above but with ② and ③

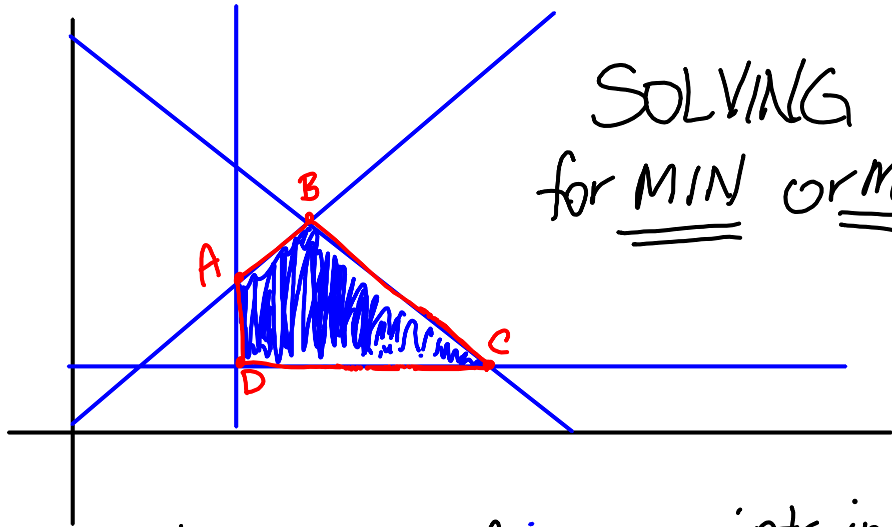
$y=x-2$

and

$3x+5y=60$

$$3x+5(x-2)=60$$
$$3x+5x-10=60$$
$$8x-10=60$$
$$+10 \quad +10$$
$$\frac{8x}{8}=\frac{70}{8}$$
$$x=8.75$$

$$y=x-2$$
$$y=8.75-2$$
$$y=6.75$$



SOLVING
for MIN or MAX

→ Plug each of your points into your optimizing function.

↳ Usually about profit or rev.

EX: \$6.00 for t-shirts (x)
\$9.00 for sweat shirts (y)

$$P = 6.00x + 9.00y$$

		P
A(10,10)	6.00(10) + 9.00(10) =	150
B(30,30)	6.00(30) + 9.00(30) =	450
C(6,54)	6.00(6) + 9.00(54) =	522
D(6,10)	6.00(6) + 9.00(10) =	126

* The max is at point C and the min is at D.

- Most long ans. questions for optimization will add a new constraint and make you re-evaluate your max or compare options like in the practice exam and review package. Use examples you need

TOPIC 2:

GRAPH THEORY

TOPIC 2: GRAPH THEORY

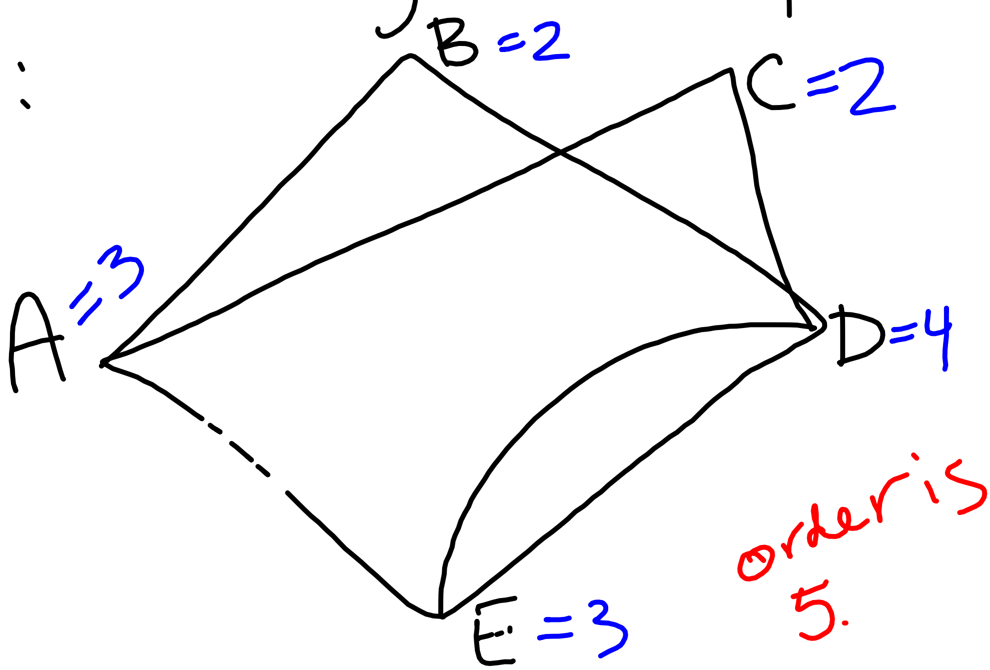
edges: the lines/relationships

vertices: points

order: number of points in the whole graph.

degree: number of lines coming out of a point

EX:



EULER

each edge once

- path = 2 odd degree
- circuit = all even

HAMILTON

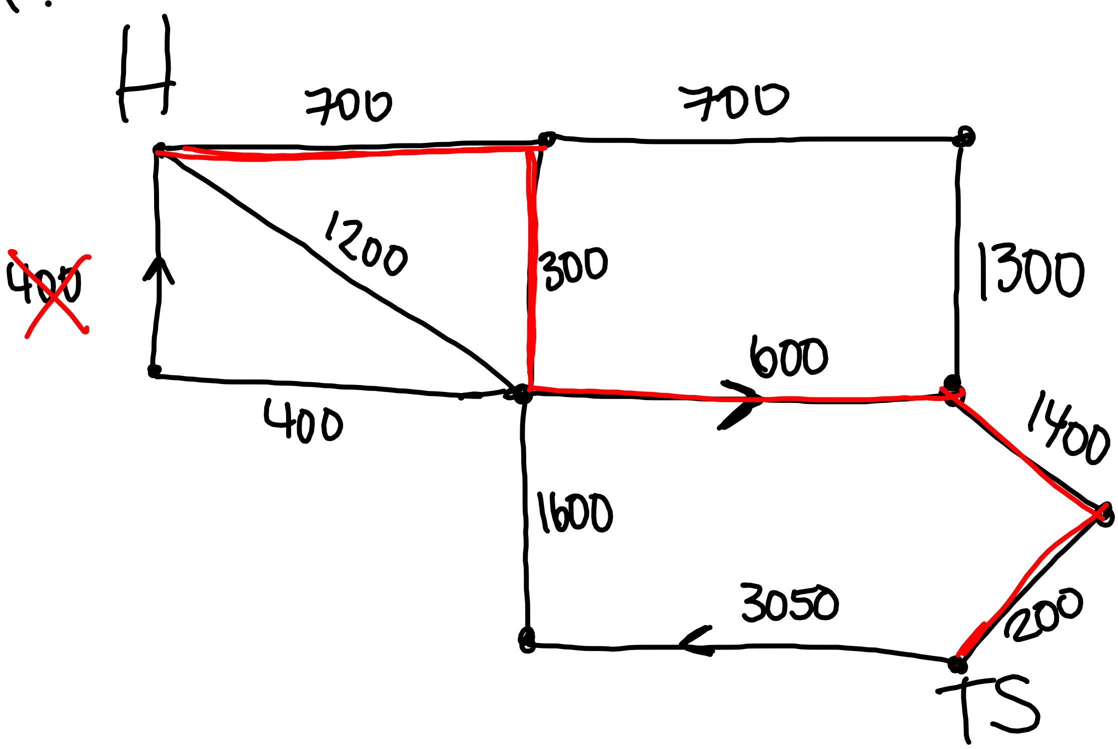
each point once

NO RULES :(

DIRECTED GRAPHS:

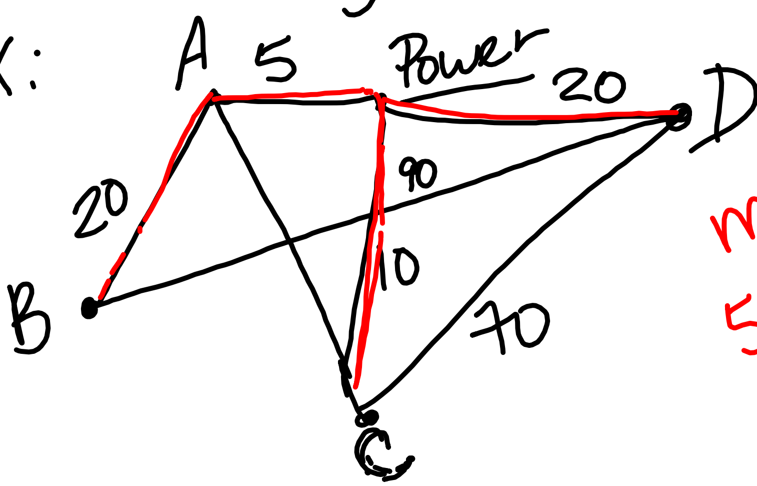
- Sometimes you have arrows in your graph. This is like a one-way street... you have to obey the arrows, even if the path is shorter

EX:



- Questions involving plumbing/electricity/something like that you just need to find a tree connecting them so that they're all touching

EX:



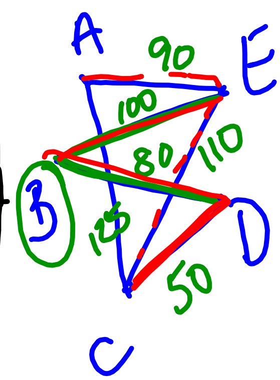
min cost:
$5+10+20+20$
$=55$

• When the question involves travelling, you need to follow an actual path and if you go over the same line twice you need to count it again. #9 from your practice exam is a good example for this.

SAMPLE TRAVEL QUESTION

Boat	Cost
AE	100
BD	80
BE	140
CD	50
CE	110

Plane	Cost
AC	125
AE	90
BE	100

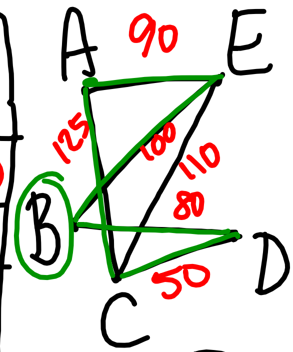


*Begin and end at B.

$100+80+50+125+90$ Min cost?

Boat	Cost
AE	100
BD	80
BE	140
CD	50
CE	110

Plane	Cost
AC	125
AE	90
BE	100



*Begin and end at B.

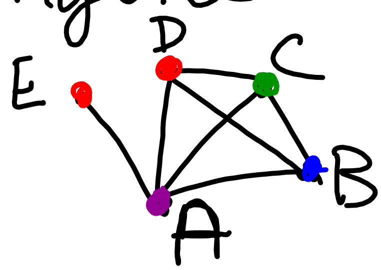
Min cost?

BEACDB

445

Recap: Chromatic Number is the minimum number of colours needed for something like a map.

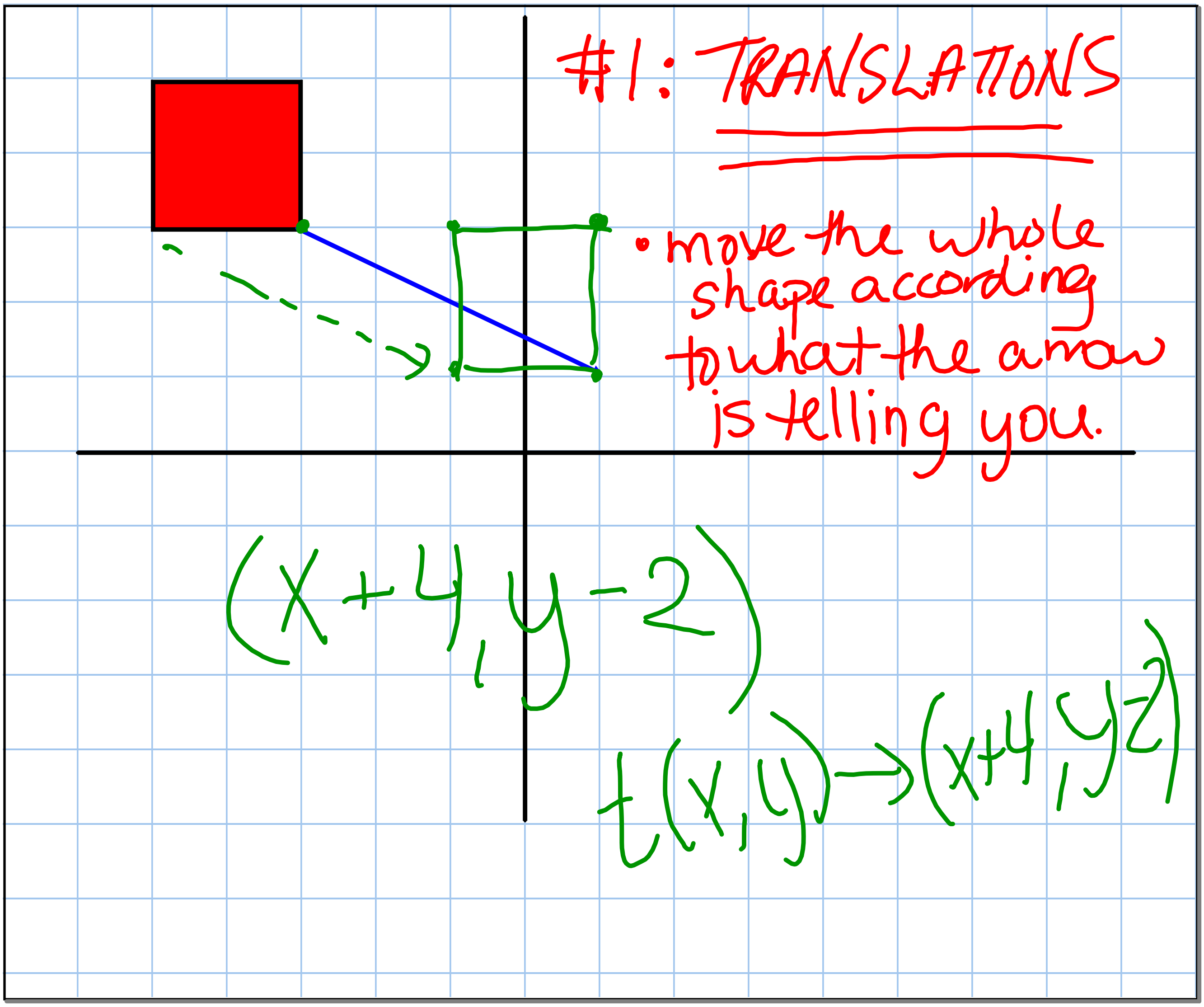
EX:



Chromatic Number = 4

TOPIC 3:

TRANSFORMATIONS


#1: TRANSLATIONS
• move the whole shape according to what the arrow is telling you.
(x+4, y-2)
t(x,y) → (x+4, y-2)

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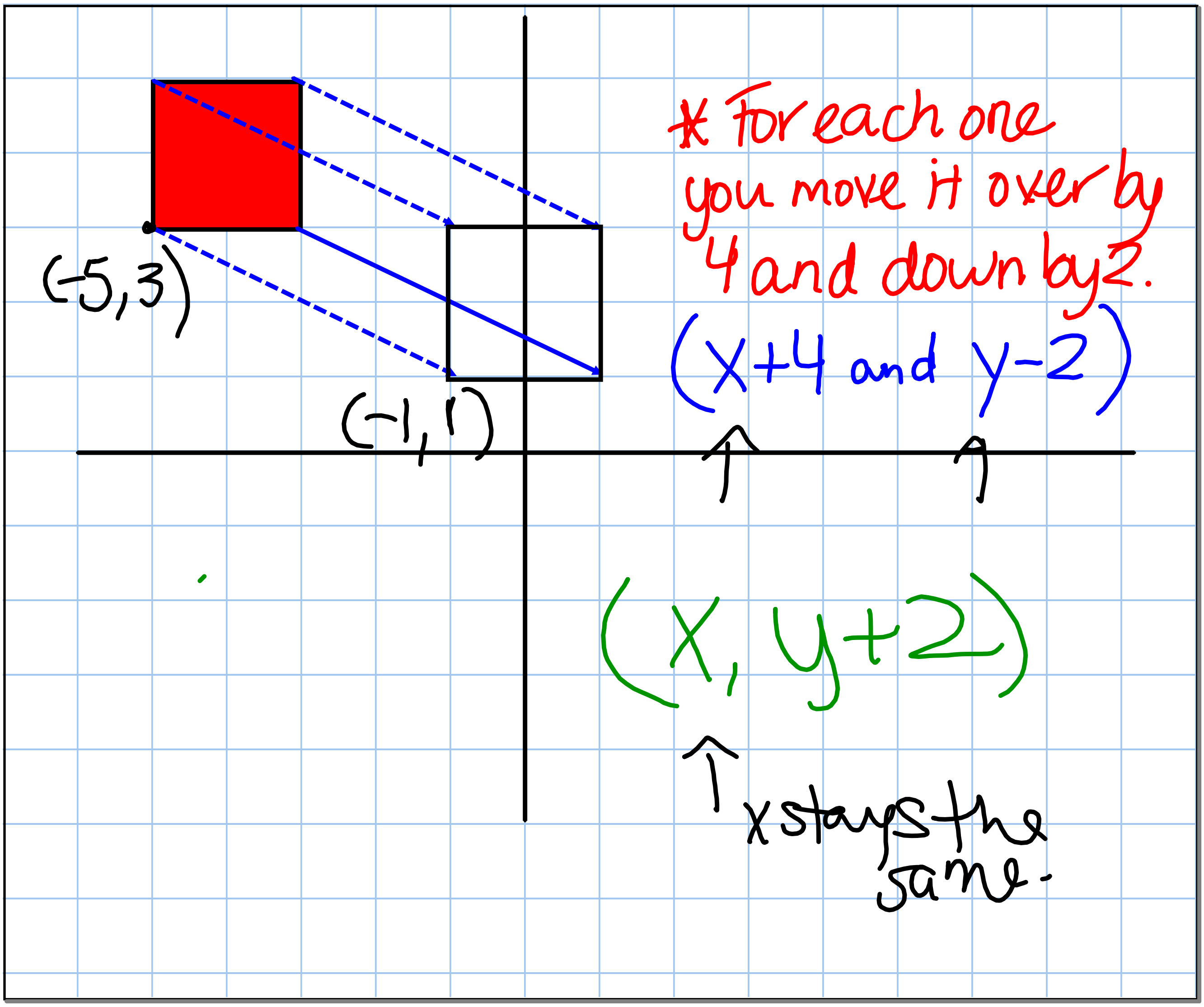
(-5,3)
(-1,1)
* For each one you move it over by 4 and down by 2.
(X+4 and Y-2)
(X, Y+2)
X stays the same.

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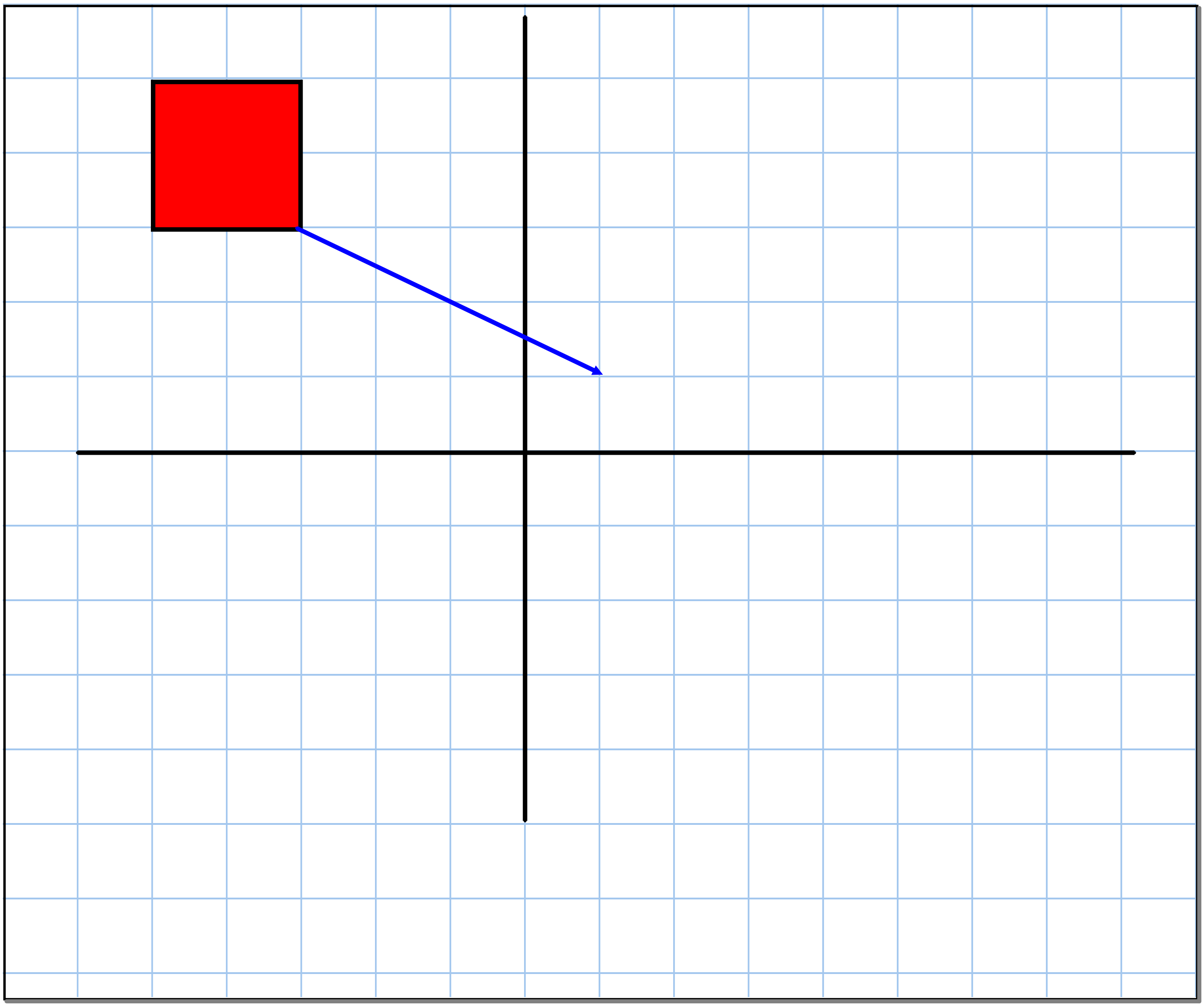
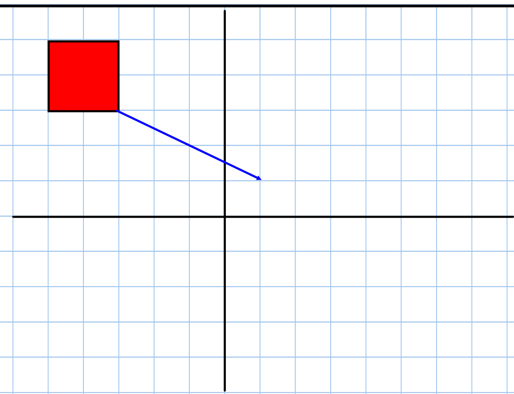
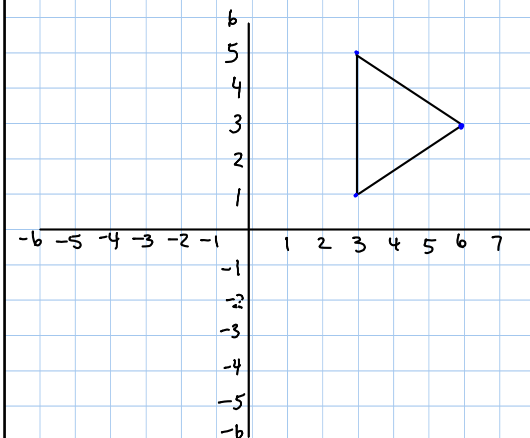




ROTATIONS: Turning your shape (either by 90° or 180°)



How do we do this??

RULES FOR ROTATIONS

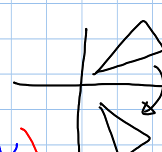
1. 90° rotation:

$(x, y) \rightarrow (-y, x)$

2. 180° rotation:

$(x, y) \rightarrow (-x, -y)$

3. 270° rotation: (or −90°)



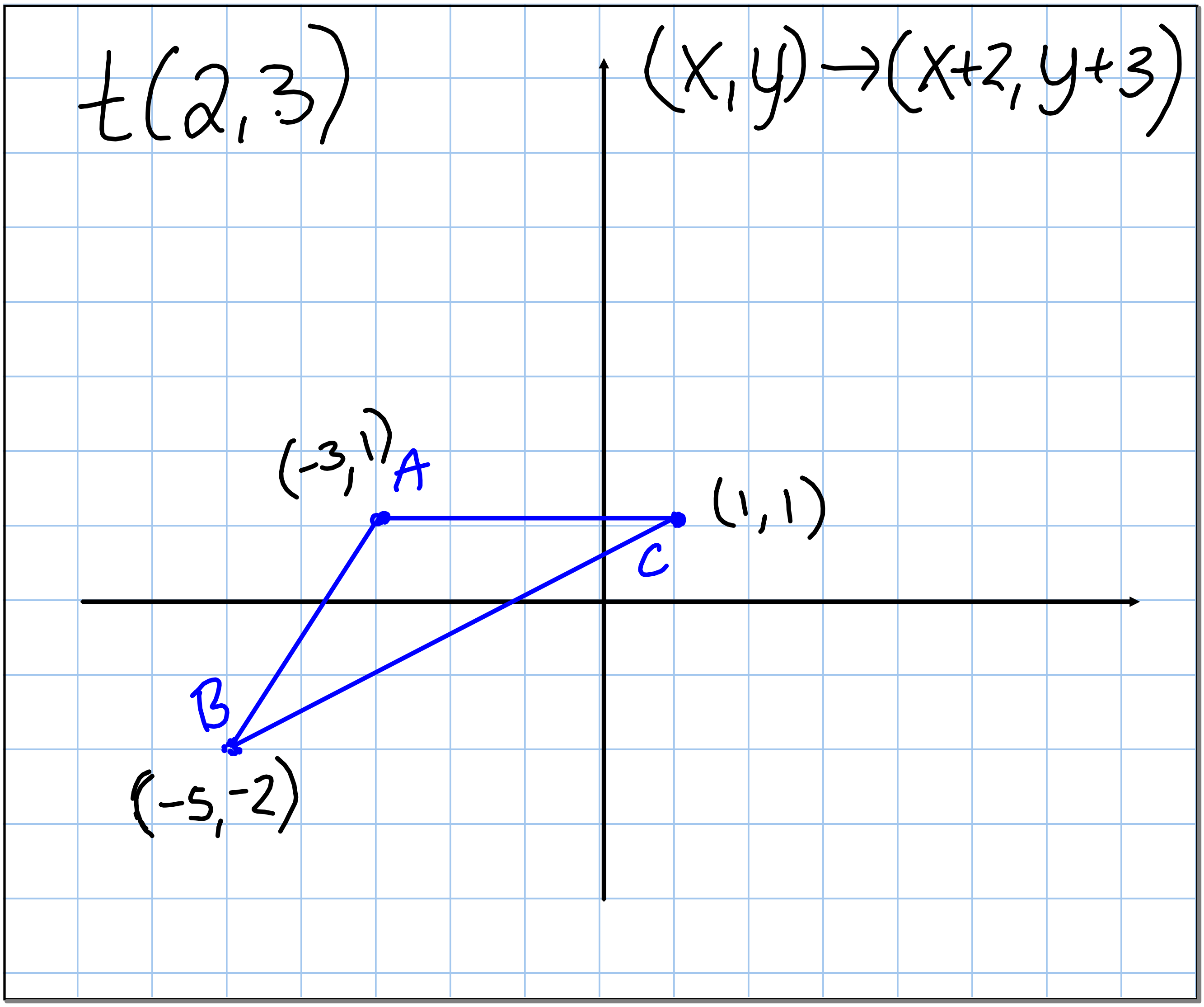
$(x, y) \rightarrow (y, -x)$

REVIEW

1. Translations (FLIP)

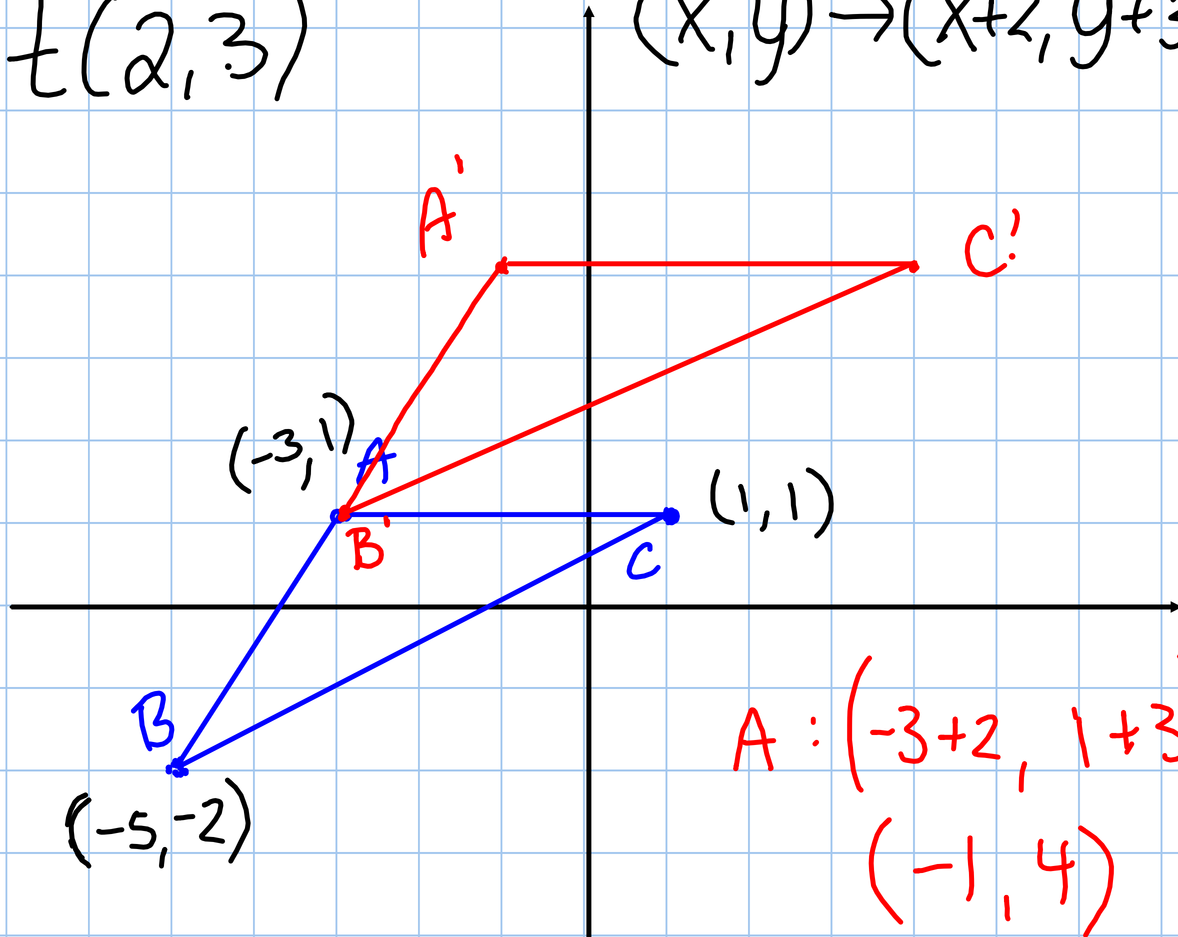
Ex: $t(2,3) \longrightarrow (x+2, y+3)$

→ you take the coordinates of each of your points and add 2 to the x-value and 3 to the y-value


t(2,3)
(x,y) → (x+2, y+3)
(-3,1) A
(1,1) C
B (-5,-2)

$t(2,3)$

$(x,y) \rightarrow (x+2, y+3)$



A: $(-3+2, 1+3)$

$(-1, 4)$

B: $(-5+2, -2+3)$

$(-3, 1)$

C: $(1+2, 1+3)$

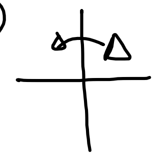
$(3, 4)$

② Rotations (TURNS)

RULES

You just need to follow these every time and you're set!

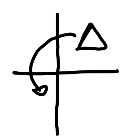
$r\,90°$: You are going one quadrant C.C.W. (counter-clockwise)



$(x, y) \rightarrow (-y, x)$

EX: $(2, -3) \rightarrow (3, 2)$

$r\,180°$: You are going 2 quadrants (or directly across



$(x, y) \longrightarrow (-x, -y)$

EX: $(5, -12) \rightarrow (-5, 12)$

$r\,{-90°}$ (A.K.A. $+270°$) : You are moving one quadrant C.W. (clockwise)

$(x, y) \rightarrow (y, -x)$

ex: $(6, 2) \rightarrow (2, -6)$

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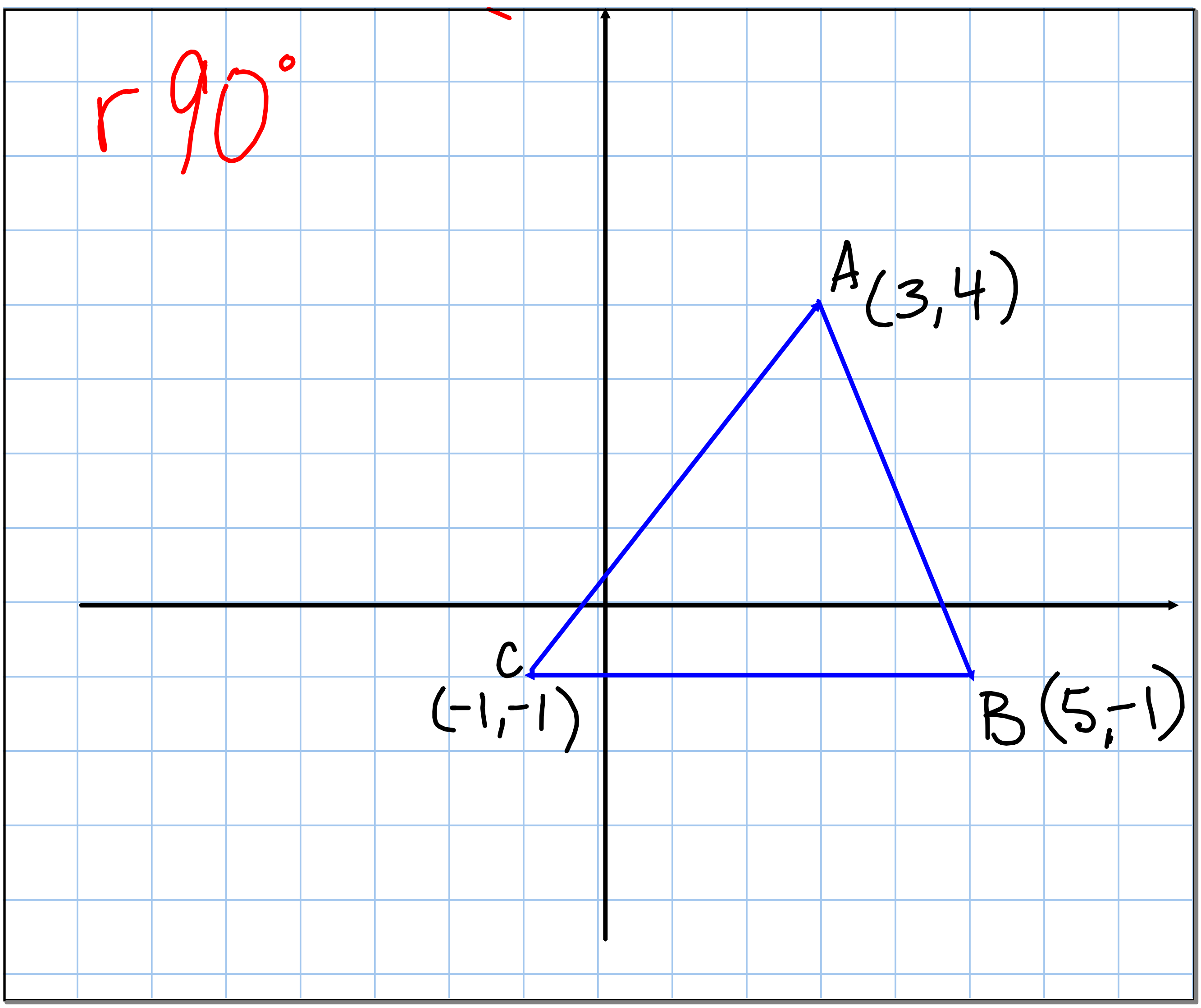
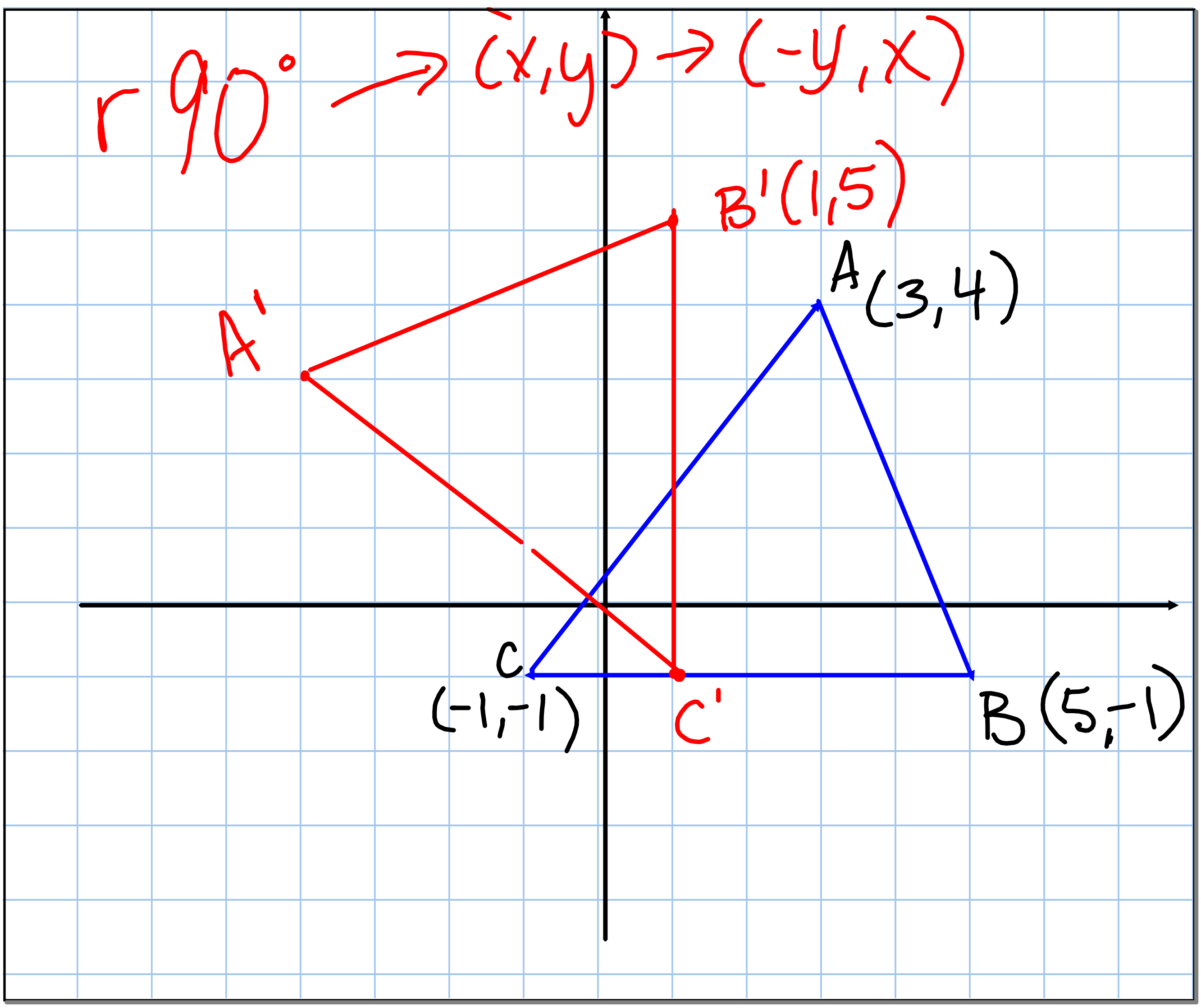



r 90° → (x,y) → (-y,x)
B'(1,5)
A'
A (3,4)
C
(-1,-1)
C'
B (5,-1)

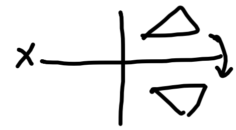
NEW :

Reflections (FLIP)

RULES

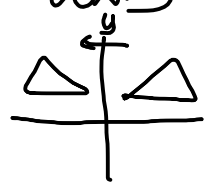
Δ_x : flip over the x-axis

$(x,y) \rightarrow (x,-y)$



Δ_y : flip over the y-axis

$(x,y) \rightarrow (-x,y)$

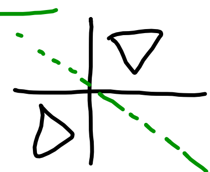


Δ ⧄ flip over fist quadrant bisector

$(x,y) \rightarrow (y,x)$

Δ ⧅ : flip over 2nd quadrant bisector

$(x,y) \rightarrow (-y,-x)$



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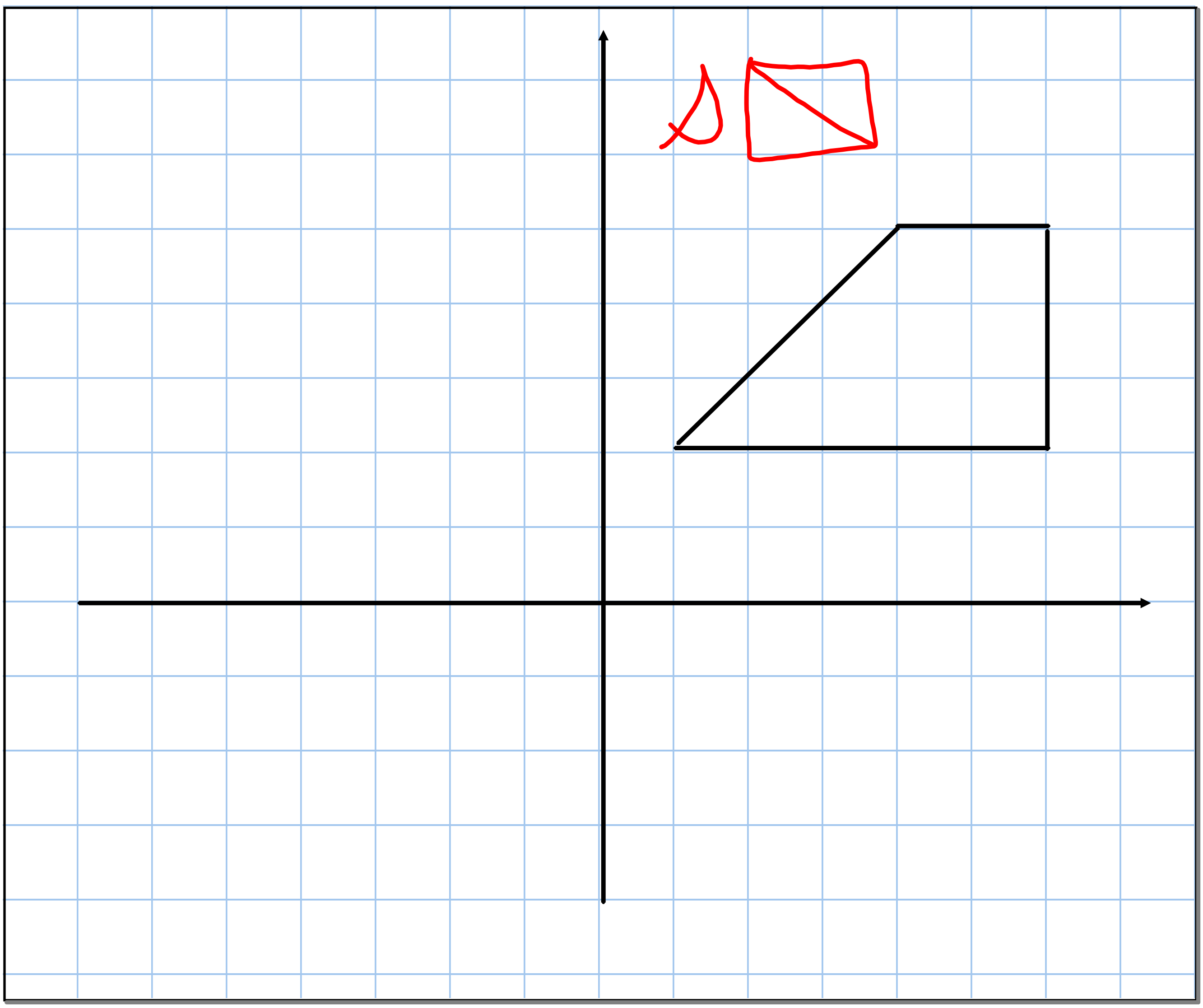

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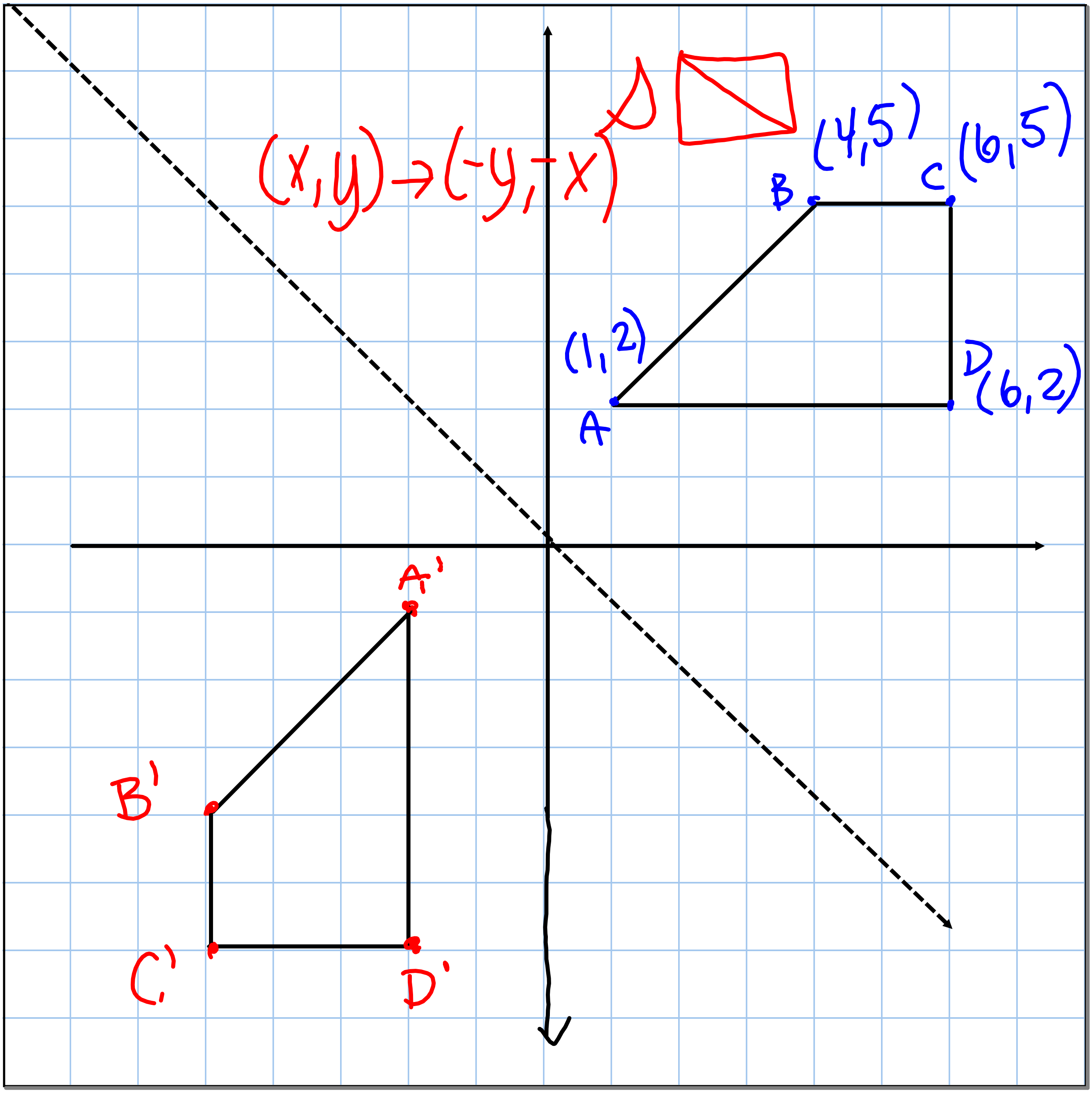


REVIEW

So far for transformations, we have covered:
- **translations** (sliding a figure)
- **rotations** (turning a figure)
- **reflections** (flipping a figure)

NEW

We have 2 more types of transformations to cover:
- **scaling**
- **homothety (dilation)**

You are increasing or decreasing the SIZE of the shape for these kinds of transformations

2 types of SCALING:

A. Horizontal (you are multiplying the x value by a number, and the y is staying the same)

written as: $(x, y) \rightarrow (kx, y)$

example:

(x , y) ——> (2x, y)

A(3,4) ——> (6,4)

In this case your shape will be twice as wide. Since you are making it bigger, it is called a **stretch**. If the number you are multiplying by is between 0 and 1 (making it smaller) it is called a **compression**.

B. Vertical (you are multiplying the y value by a number, and the x is staying the same)

In this case your shape will be twice as tall. Since you are making it bigger, it is called a **stretch**. If the number you are multiplying by is between 0 and 1 (making it shorter) it is called a **compression**.

written as: $(x, y) \rightarrow (x, ky)$

example:

(x , y) ——> (x, 2y)

A(3,4) ——> (3 , 8)

HOMOTHETY(Dilation):

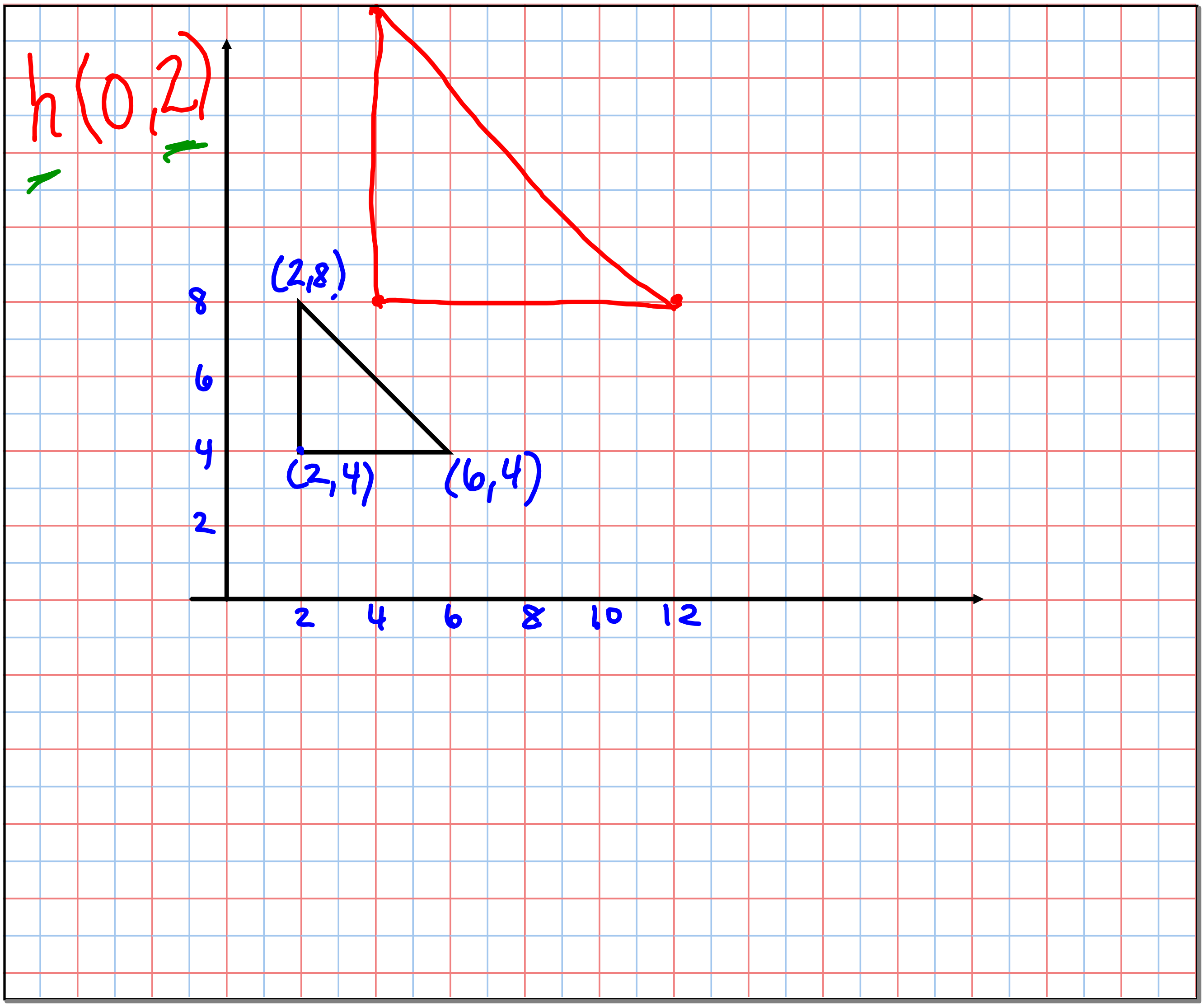
In this case you are changing the whole thing (horizontal and vertical) and making your whole shape bigger or smaller.

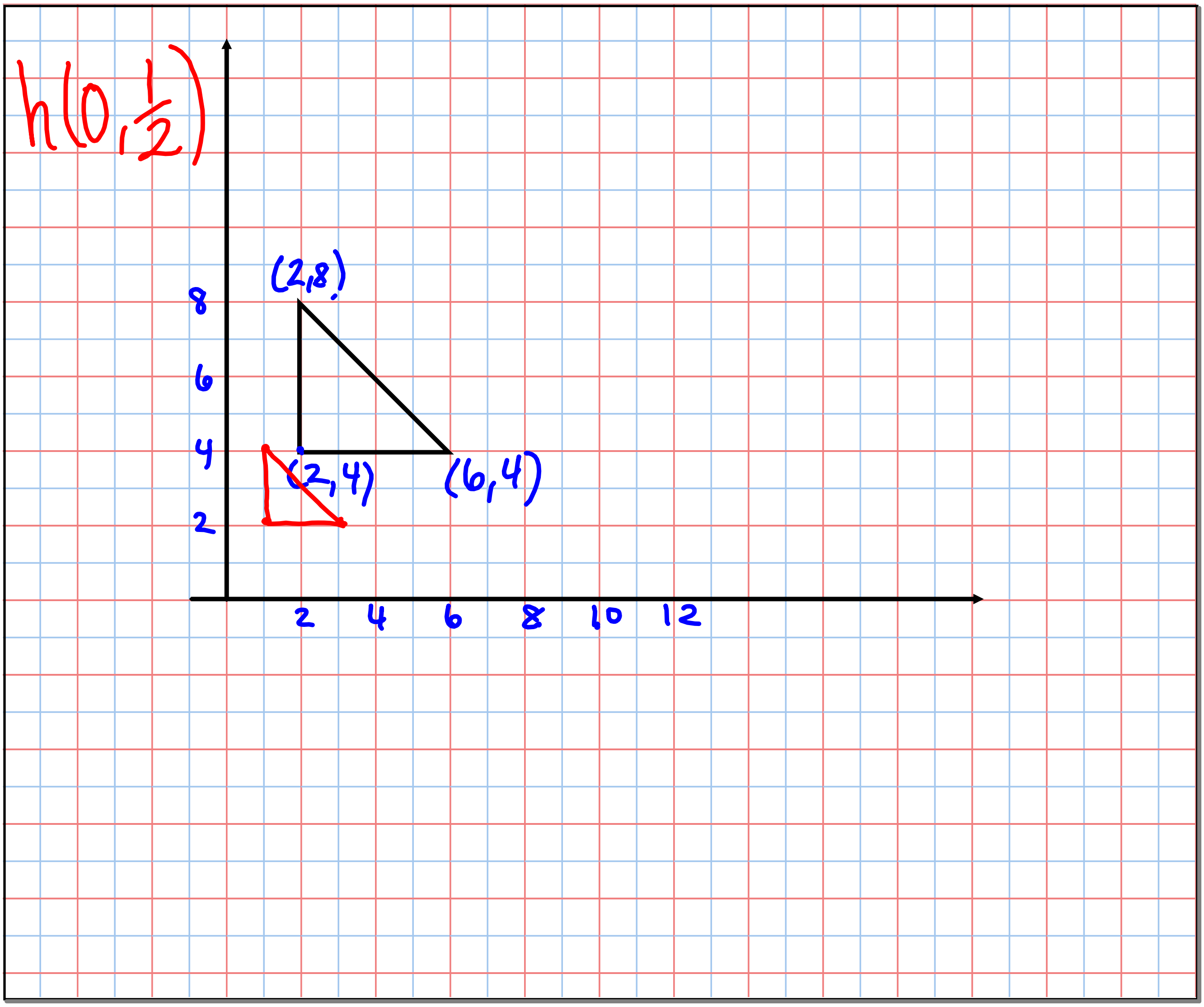
written as: $h(0,k): (x, y) \rightarrow (kx, ky)$

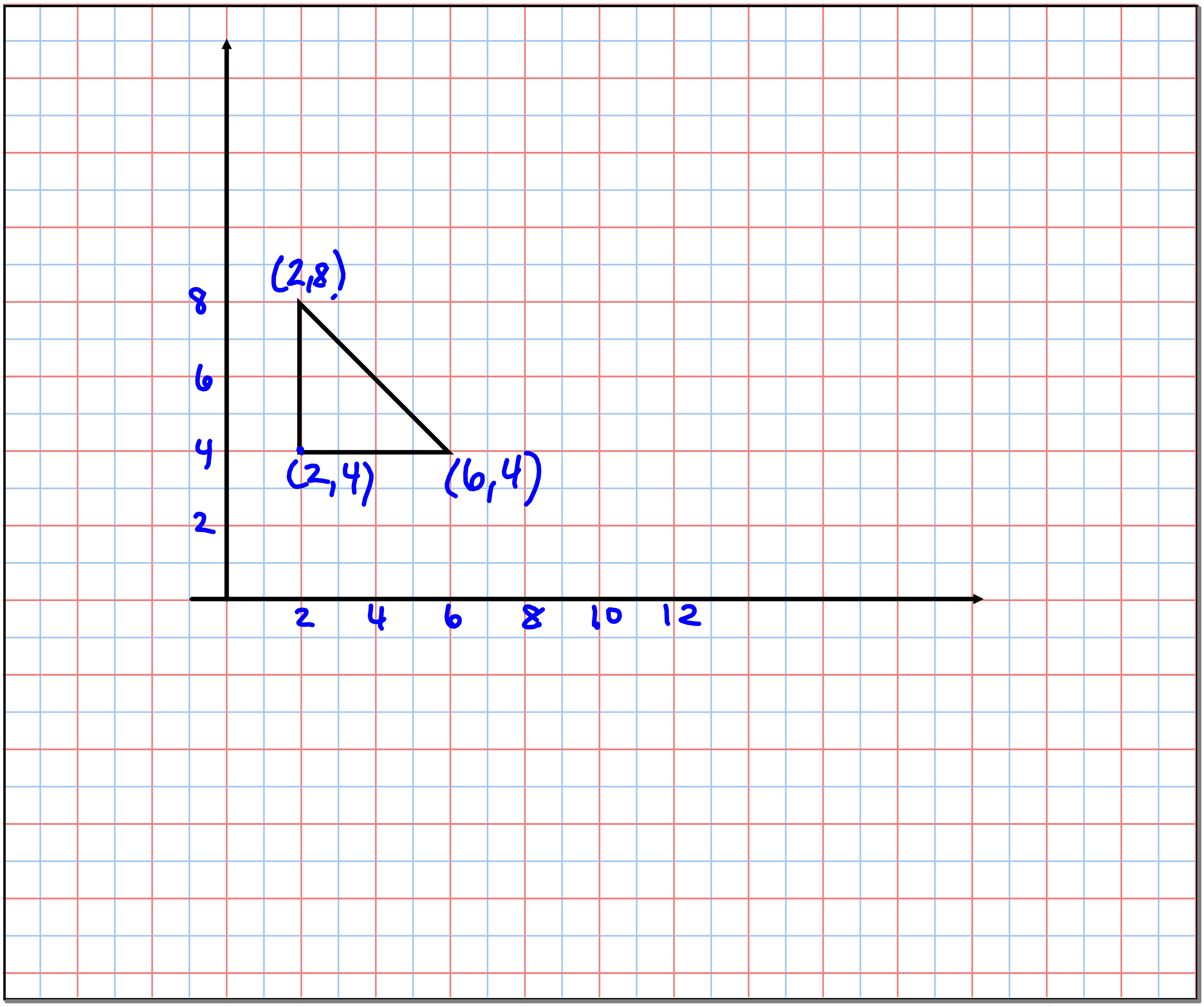
example:

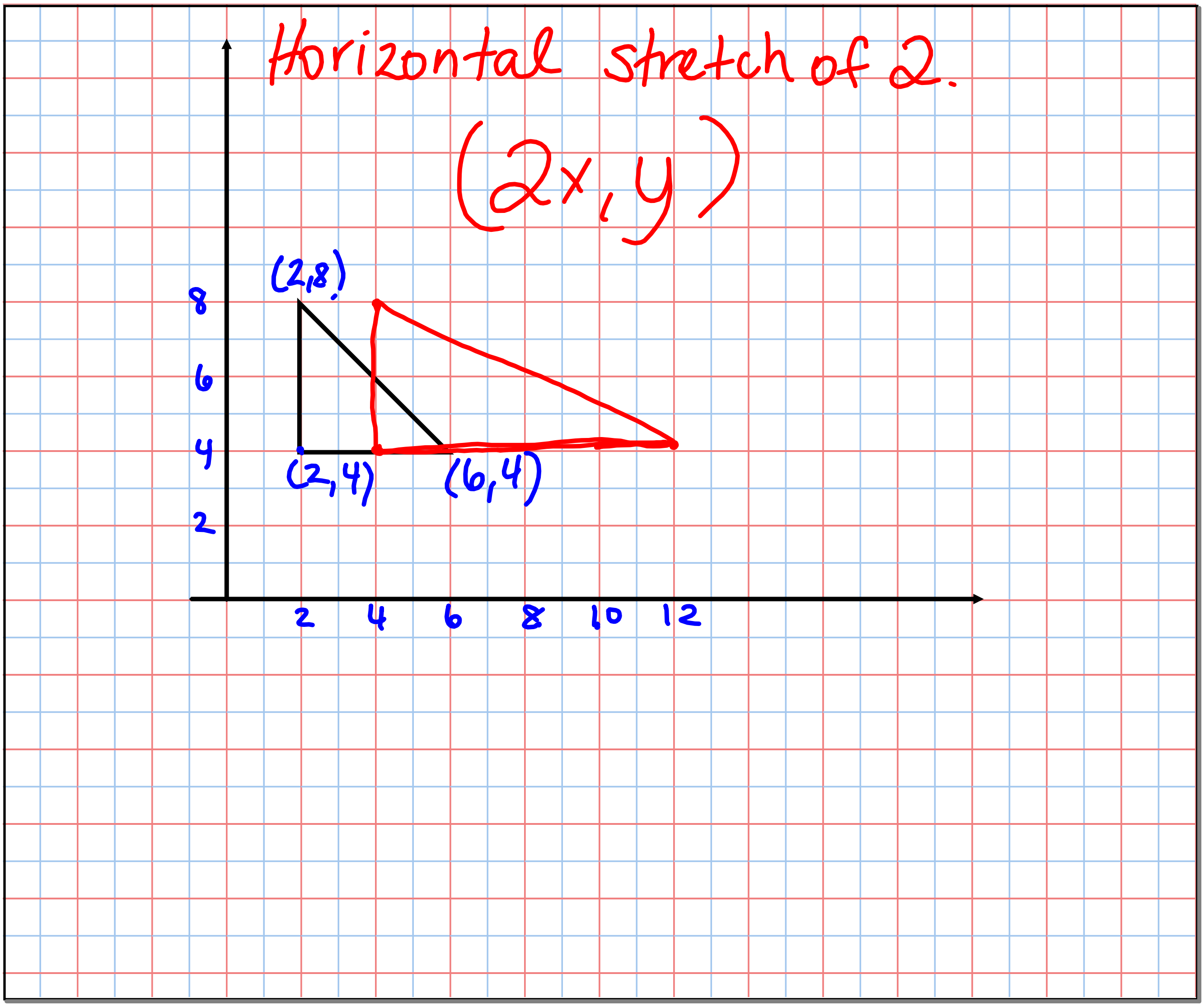
h (0,3)

A(3, 4) ——> (9,12)


h(0,2)
(2,8)
(2,4)
(6,4)
8
6
4
2
2
4
6
8
10
12

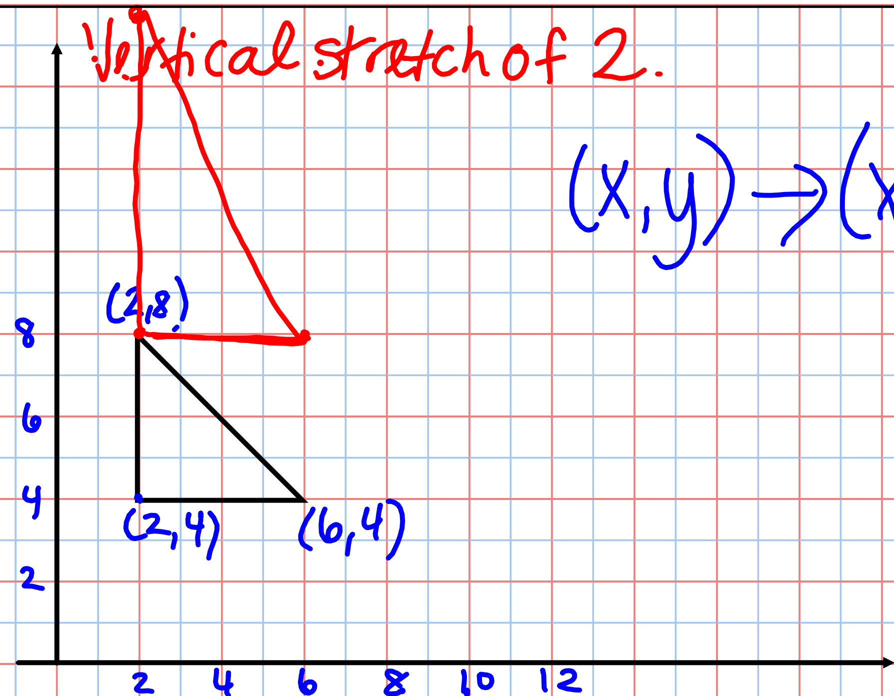

h(0, 1/2)
(2,8)
(2,4)
(6,4)
8
6
4
2
2
4
6
8
10
12


(2,8)
8
6
4
2
(2,4)
(6,4)
2
4
6
8
10
12


Horizontal stretch of 2.
(2x, y)
(2,8)
(2,4)
(6,4)
8
6
4
2
2
4
6
8
10
12

Vertical stretch of 2.

$(x, y) \rightarrow (x, 2y)$



TOPIC 4:

PROBABILITY

- prob.
- voting

TOPIC 4: PROBABILITY

"What are the chances??"

PROBABILITY vs. ODDS

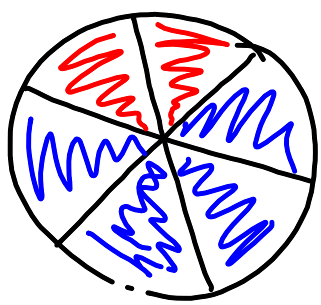
If someone asks you what the probability of something happening, you are going to have a fraction of a whole.

If someone asks you for the odds of something happening, you will have a ratio

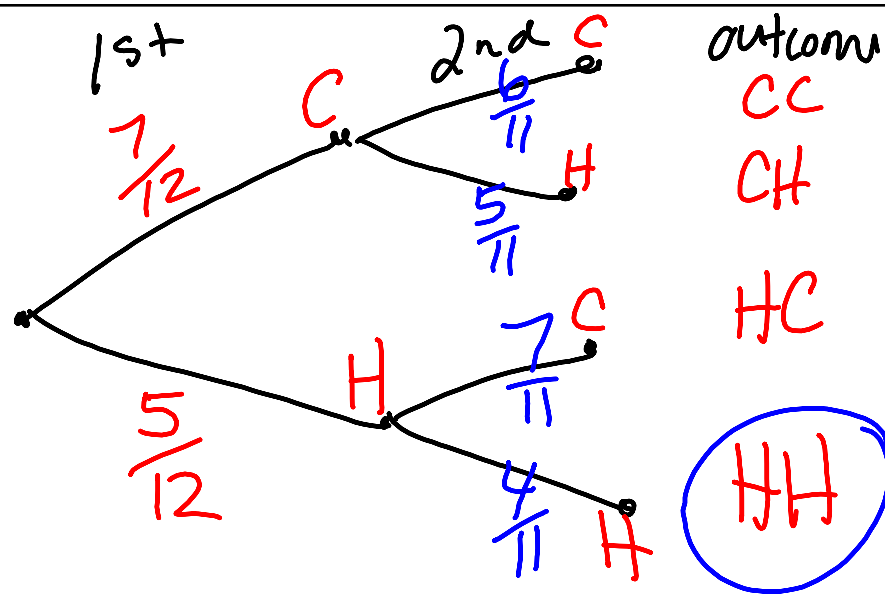
Example:

The probability of getting a red piece is

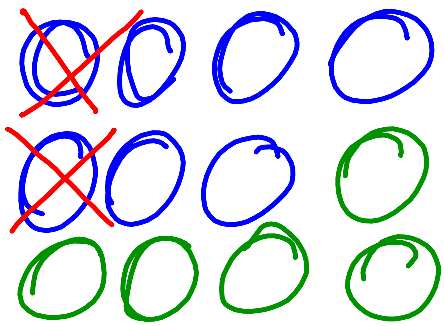
$$\frac{2}{6}$$



The odds of getting a red piece is 2:4



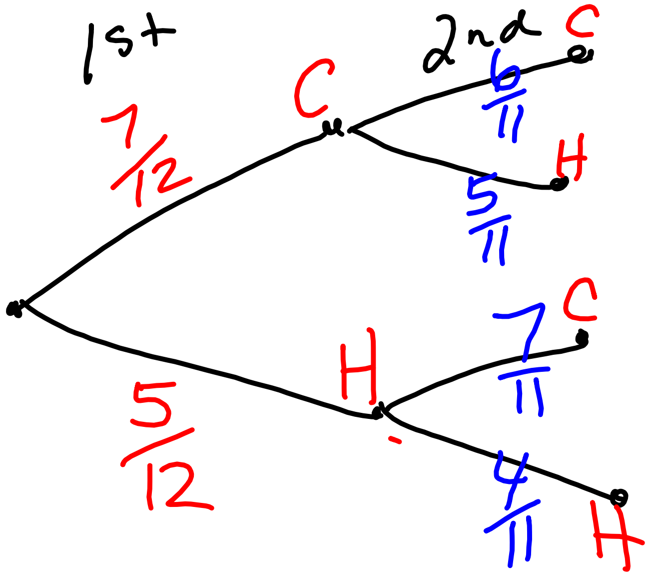
$$\frac{5}{12} \times \frac{4}{11} = \frac{20}{132}$$



$\frac{7}{12}$ or $\frac{5}{12}$

$\frac{6}{11}$ $\frac{5}{11}$

$\frac{5}{10}$ $\frac{5}{10}$



outcome

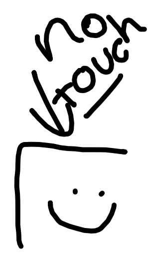
CC	$\frac{42}{132}$
CH	$\frac{35}{132}$
HC	$\frac{35}{132}$
HH	$\frac{5}{12} \times \frac{4}{11} = \frac{20}{132}$

Ex: You have 3 shirts, 4 pairs of pants and 2 pairs of shoes. How many different outfits can you make?

$3 \times 4 \times 2 = 24$

Permutations

When you have a bunch of things and you want to know how many possible ways you can "order" them, you have to use FACTORIAL:

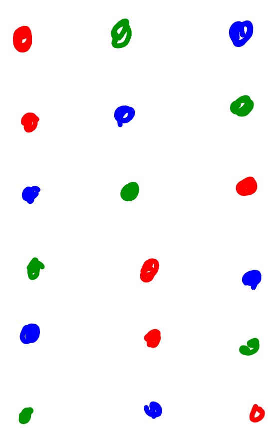


Ex: a b c d e

abcde
acbde

$5!$

$5 \times 4 \times 3 \times 2 \times 1 = 120$



$3! = 3 \times 2 \times 1$
$= 6$

Questions from yesterday

1. $3 \times 4 \times 2 = 24$

2. 16 teams

Gold $\times$ Silver $\times$ Bronze

16 $\times$ 15 $\times$ 14

$= 3360$

3. License Plate

AAA 123

$26 \times 26 \times 26$

$26^3 \times 10^3 =$

17 576 000

(6) 4 couples, 8 chairs

a) if the couples want to sit together? $4! \times 2! = 48$

couples   within couples

b) no restriction? $8! = 40{,}320$

Factorial

$8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1$

7 4 boys, 2 girls, 6 chairs

a) boys want to sit together and girls want to sit together.

$$2! \times 4! \times 2 = 96$$

b) boys want to sit together.

$$4! \times 2! \times 3 = 144$$

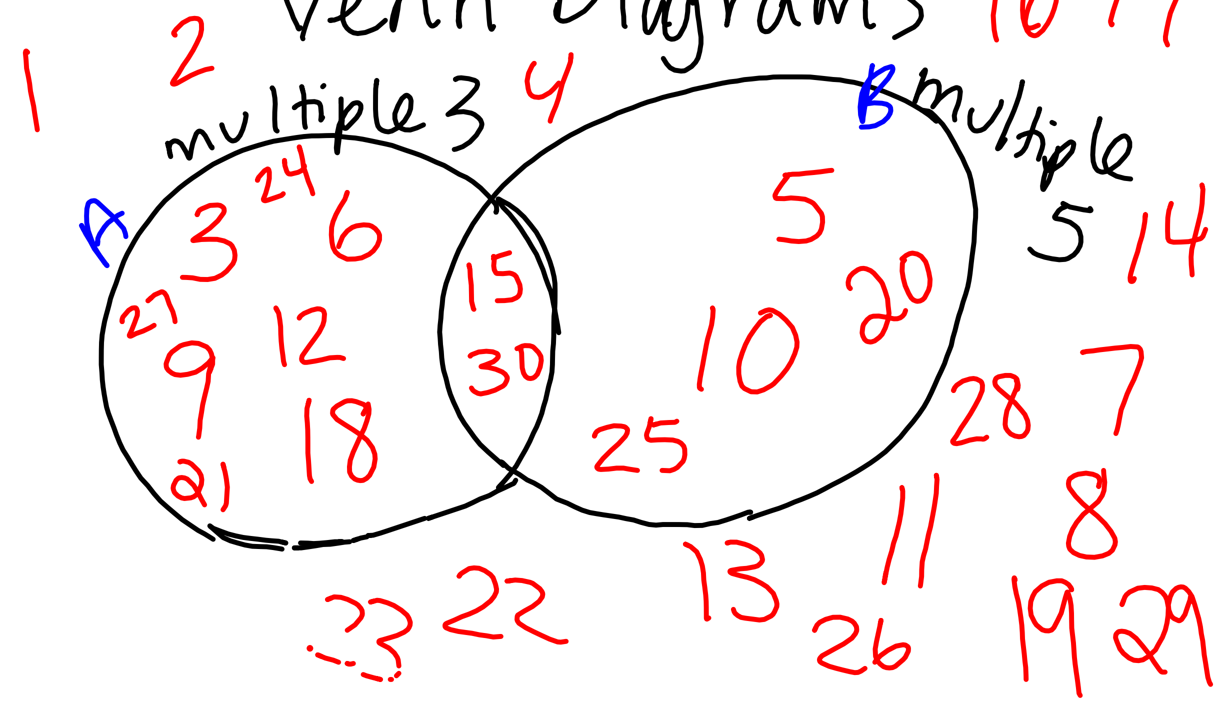
c) girls want to sit together.

$$4! \times 2! \times 5 = 240$$

d) no restriction

$$6! = 720$$

Venn Diagrams



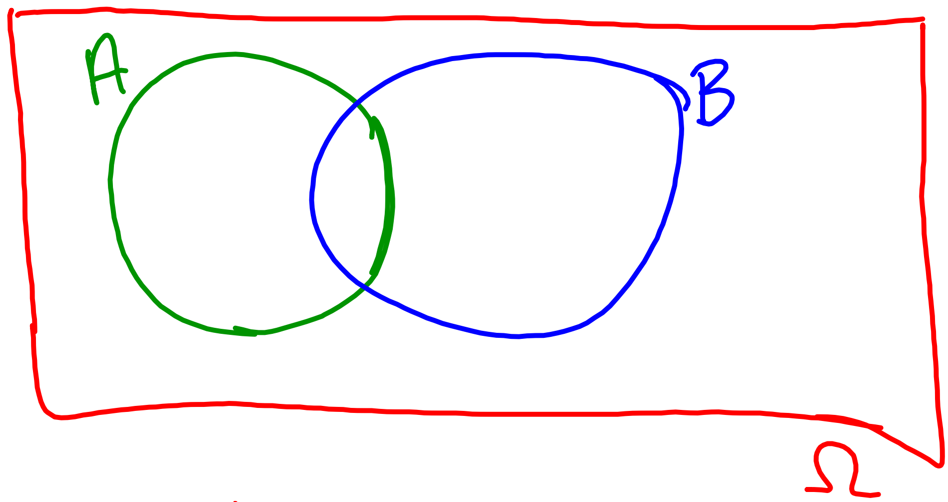
Prob of multiple of 3

is $\frac{10}{30}$

5: $\frac{6}{30}$

$A \cap B$

VENN DIAGRAMS



Ω : all the numbers in the set

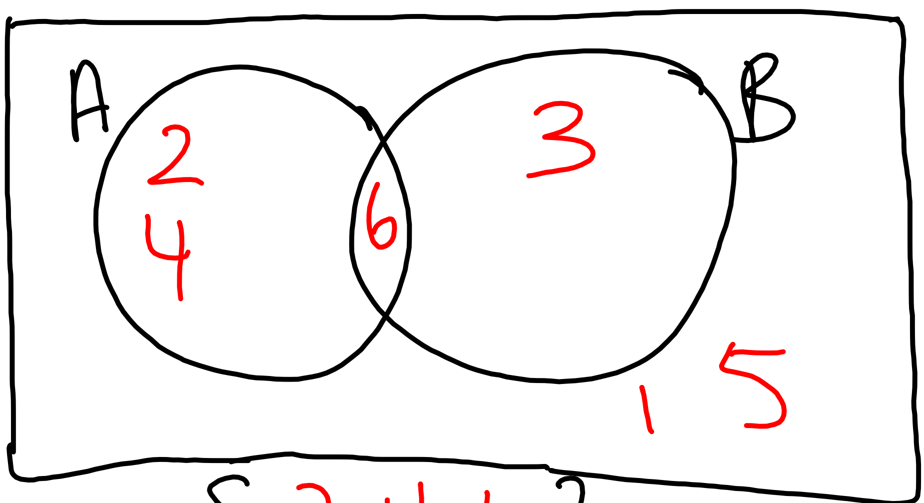
A : numbers that satisfy event "A"

B : numbers that satisfy event "B"

Ex: Numbers on dice.

Event A: even numbers

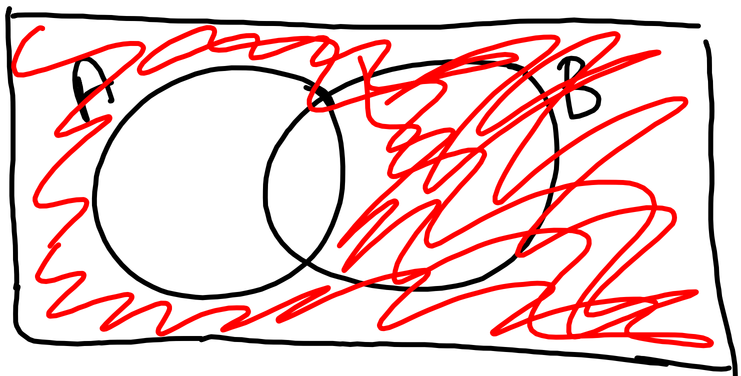
Event B: multiples of 3.



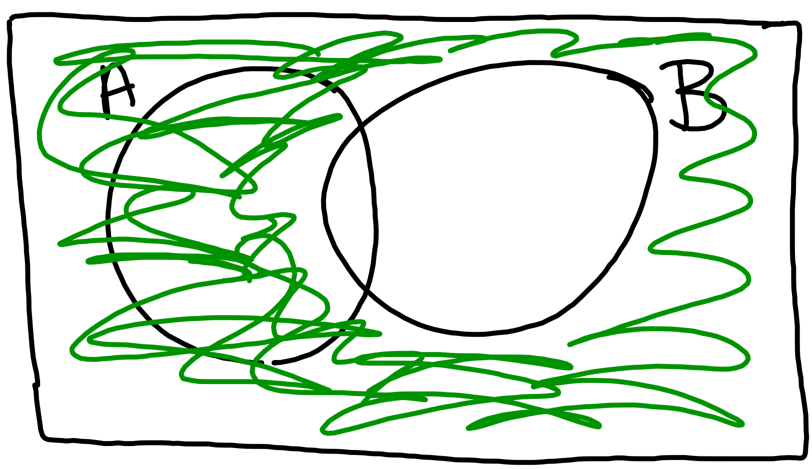
A: {2, 4, 6}

B: {3, 6}

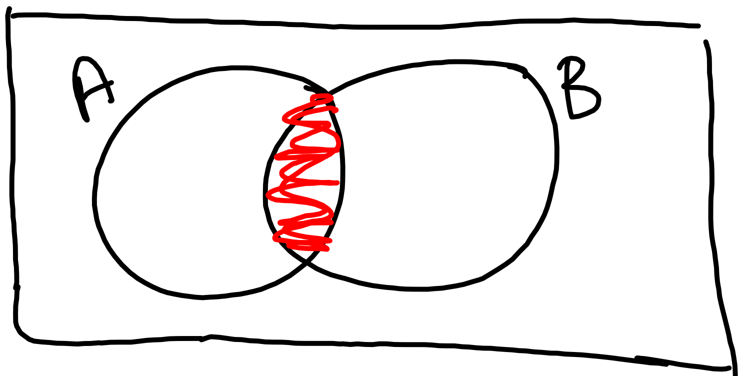
$\bar{A}$: "the opposite of A"

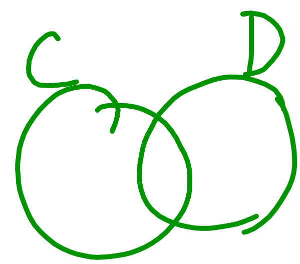


$\bar{B}$: "the opposite of B"



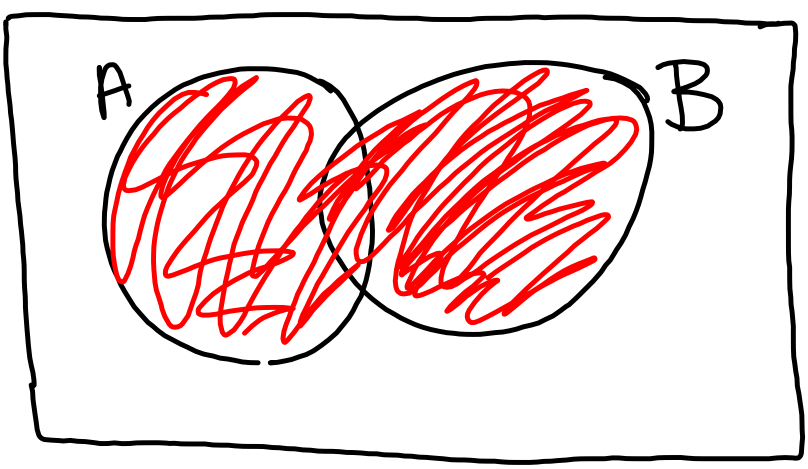
$A \cap B$: A and B → "intersection"



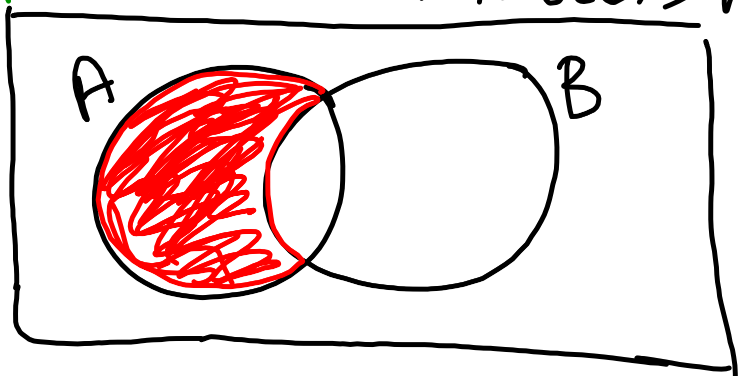


$C \cap D$

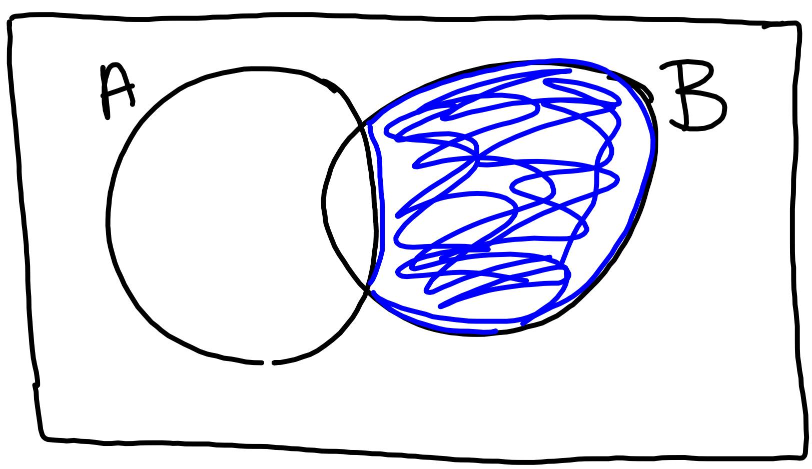
$A \cup B$: A or B → "union"



$A \setminus B$: Everything in A <u>except</u> when it intersects with B.

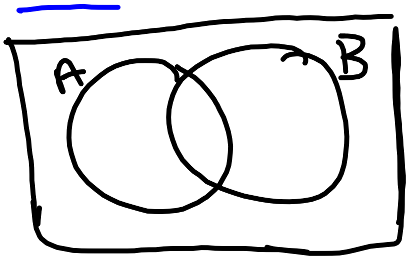


$B \setminus A$: Everything in B <u>except</u> when it intercepts with A.

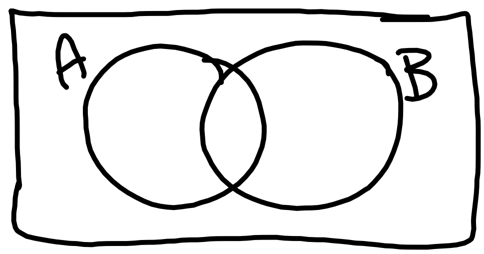


$$\bar{A} \cap \bar{B} = \overline{A \cup B}$$

"outside of A and outside of B."



"outside of 'A or B'"

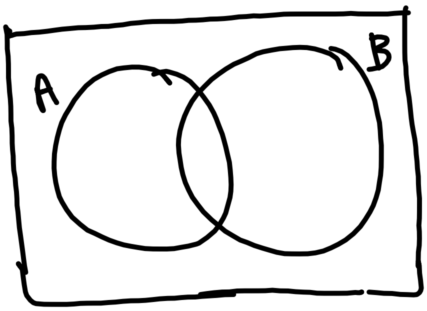


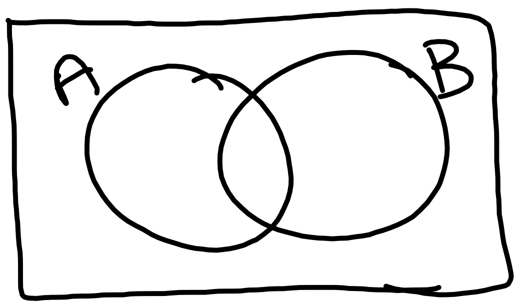
↳ Gives you the same thing.

$$\bar{A} \cup \bar{B} = \overline{A \cap B}$$

"outside of A **or** outside of B"

"outside of 'A and B'"





↳ Gives you the same thing.

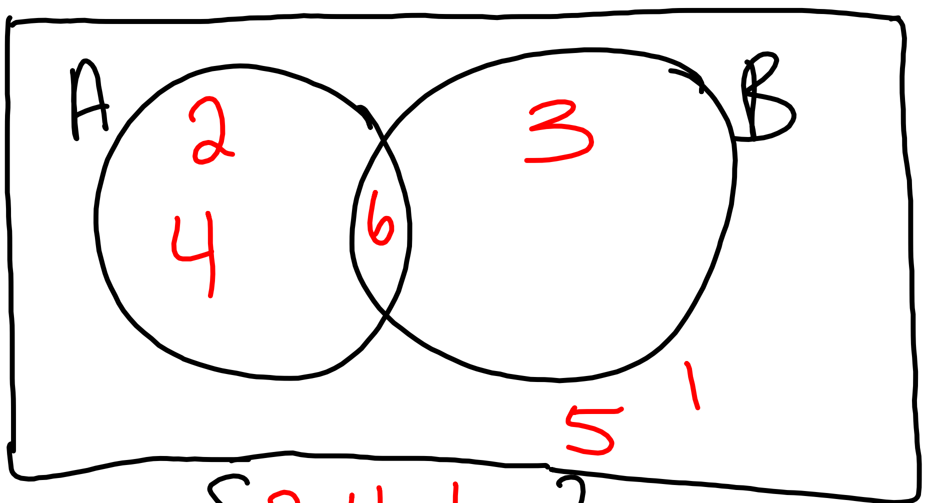
NOTE: When calculating the probability of these events, you should be getting a number between 0 and 1.

$$P = \frac{\text{Number in that event}}{\text{total in the set}}$$

Ex: Numbers on dice.

Event A: even numbers

Event B: multiples of 3.



A: $\{2, 4, 6\}$

B: $\{3, 6\}$

$$P(A) = \frac{3}{6} = 0.50$$

$$P(B) = \frac{2}{6} = 0.\overline{33}$$

$$P(A \cap B) = \frac{1}{6} = 0.1\overline{6}$$

VOTING PROCEDURES

Majority ballot: winning person has more than half the votes (50% + 1)

Plurality ballot: winning candidate is the one with the most votes.

EX:

Votes	16	14	10
1st choice	A	C	B
2nd choice	B	A	A
3rd choice	C	B	C

Total 40

Majority? No.

Plurality? A. with 16 votes

→ BORDA'S METHOD

Different strategy for deciding who wins. First place = 2 points
2nd play = 1 point
3rd place = 0 points
Add these up and compare.

EX:

Votes	16	14	10	
1st choice	A	C	B	2pts
2nd choice	B	A	A	1pt
3rd choice	C	B	C	0pt

A: $2 \times \underline{16} + 1 \times \underline{24} + 0 \times \underline{0}$ =56

B: $2 \times \underline{10} + 1 \times \underline{16} + 0 \times \underline{14}$ =36

C: $2 \times \underline{14} + 1 \times \underline{0} + 0 \times \underline{\quad}$ =28

Winner: Ann

Because they earned the most points overall.

→ CONDORCET'S CRITERION

System where the winner is someone who is always "prefered" when you compare them to one other candidate.

EX:

Votes	16	14	10
1st choice	A	~~C~~	B
2nd choice	B	A	A
3rd choice	~~C~~	B	~~C~~
	16+14		10

A vs. B: A

A vs C: A 26 times

B vs C: B

Winner: Ann

Because they always win in a direct confrontation.

→ ELIMINATION BALLOT

① Check 1st place votes. Get rid of person with the lowest.

② Give the votes of the person you're cutting to whoever the 2nd choice is (box below)

EX:

Votes	16	14	10
1st choice	A	C	~~B~~
2nd choice	B	A	A
3rd choice	C	B	C

A=26
C=14

Plu

→ ELIMINATION BALLOT

1. Check 1^{st} place votes. Get rid of person with the lowest.
2. Give the votes of the person you're cutting to whoever the 2^{nd} choice is (box below)

Votes	4	3	2	3	5	3
1^{st} choice	A	A	~~B~~	~~B~~	C	C
2^{nd} choice	B	C	A	C	A	B
3^{rd} choice	C	B	C	A	B	A

$$A = 7 + 2 = 9$$

$$B = 5$$

$$C = 8 + 3 = 11$$

Winner is C.

TOPIC 5:

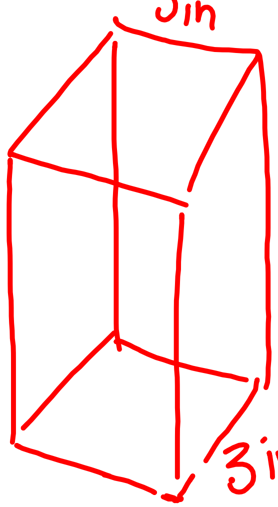
EQUIVALENCY

• vol
+ comparison

Volume and Surface Area

→PRISM $V = l \times w \times h$

$SA = 2(l \times w) + 2(h \times w) + 2(l \times h)$



$V = 3 \times 3 \times 6 = 54$ inches^3

$S.A. = 2(3 \times 3) + 2(3 \times 6) + 2(3 \times 6)$

$= 2(9 + 18 + 18)$

$= 90 \text{ in}^2$

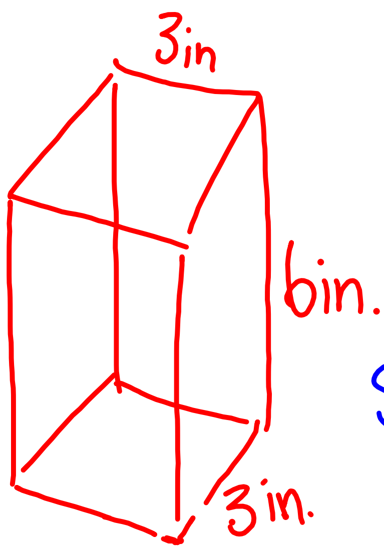
Answer is ______ in^2

Volume and Surface Area

$\boxed{\rightarrow \text{PRISM}}$

$V = l \times w \times h$

$SA = 2(l \times w) + 2(h \times w) + 2(l \times h)$



$V = 3 \times 3 \times 6 = 54 \text{ in}^3$

$S.A. = 2(3 \times 3) + 2(3 \times 6) + 2(3 \times 6)$

$= 2(9) + 2(18) + 2(18)$

$= 90 \text{ in}^2$

Volume and Surface Area

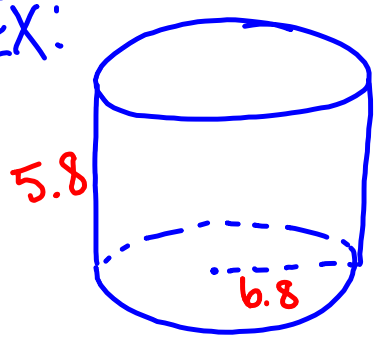
→ CYLINDER

$V = B \times h$ $\quad B =$ Area of base circle

$V = \pi r^2 \cdot h$ $\quad B = \pi r^2$

$S.A. = 2(\pi r^2) \times h$

EX:



Volume and Surface Area

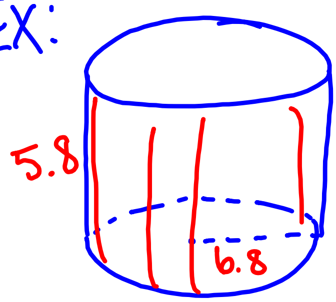
→ CYLINDER

$V = B \times h$ $\quad B =$ Area of base circle

$V = \pi r^2 \cdot h$ $\quad B = \pi r^2$

$S.A. = 2(\pi r^2) + C \times h$ $\quad C = 2\pi r$

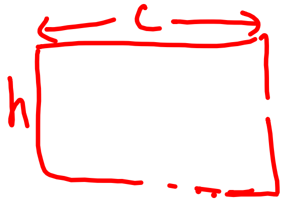
EX:



$V = 3.14 \times 6.8^2 \times 5.8$

$V = 145.19 \times 5.8$

$V = 842.12$



$S.A. = 2(3.14 \times 6.8^2) + ((\overset{C}{2 \times 3.14 \times 6.8}) \times 5.8)$

$= 290.38 + 247.68$

$= 538.06$

$A○ = \pi r^2$

$C○ = 2\pi r$

Volume and Surface Area

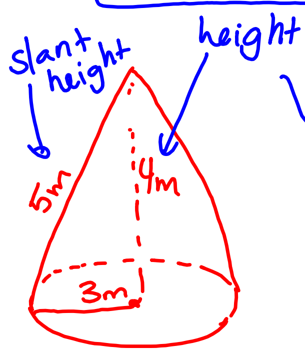
→ CONE

$V = \frac{1}{3} \times \text{area of base} \times h$

$$\boxed{V = \frac{1}{3} \times \pi r^2 \times h}$$

$S.A. = \text{area of base} + \frac{1}{2} C \times \text{slant height}$

$$\boxed{S.A. = \pi r^2 + \frac{1}{2}(2\pi r) \times \text{slant}}$$



$V = \frac{1}{3} \cdot \pi r^2 \cdot h$

$= \frac{1}{3} \cdot 3.14 \cdot 3^2 \cdot h$

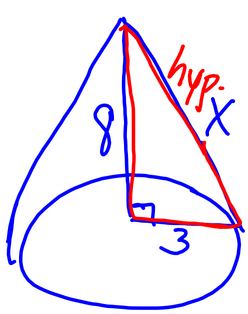
$= 37.70 m^3$

$S.A = \pi r^2 + \frac{1}{2} C \cdot s\ell$

$= 3.14 \times 3^2 + \frac{1}{2}(2 \cdot \pi \cdot r) \times 5$

$= 28.27 + 47.12$

$= 75.39 m^2$



PYTH:

$a^2 + b^2 = c^2 \rightarrow \text{hyp.}$

$8^2 + 3^2 = 73$

$\sqrt{73} = 8.54$

Volume and Surface Area

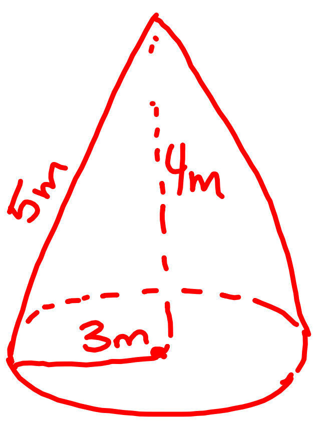
→ CONE

$V = \frac{1}{3} \times \text{area of base} \times h$

$$\boxed{V = \frac{1}{3} \times \pi r^2 \times h}$$

$S.A. = \text{area of base} + \frac{1}{2} C \times \text{slant height}$

$$\boxed{S.A. = \pi r^2 + \frac{1}{2}(2\pi r) \times \text{slant}}$$



$V = \frac{1}{3}(3.14 \times 3^2)(4)$

$= 37.68 m^3$

$S.A. = (3.14 \times 3^2) + \frac{1}{2}(2$

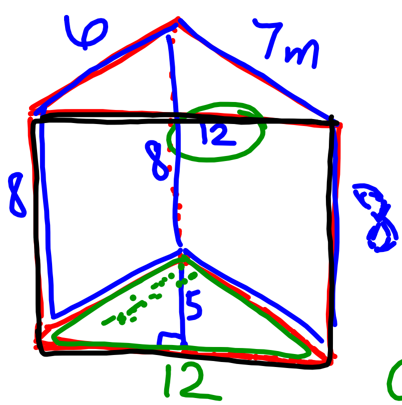
Volume and Surface Area

→ TRIANGULAR PRISM

$V = \text{area of base} \times h$

$V = \left(\frac{b \cdot h}{2}\right) \times h$

that part is talking about the height of the triangle.



$S.A. = 2 \times \text{area of triangle} + \text{area of the 3 other rectangles}$

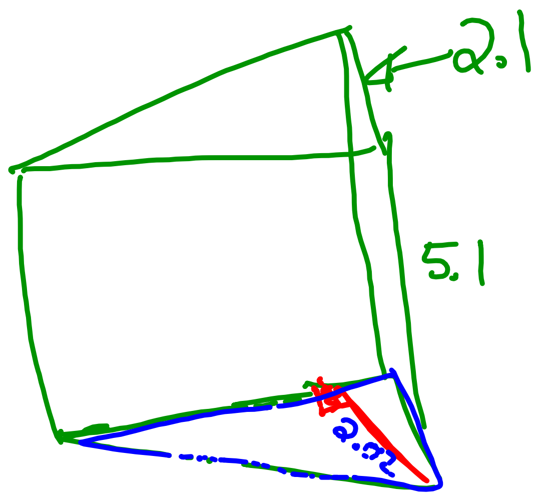
$= 2\times30 + 6\times8 + 7\times8 + 12\times8$

$= 60 + 48 + 56 + 96$

$= 260\ m^2$

area of base triangle $= \frac{5\times12}{2} = 30$

$30 \times 8 = 240\ m^3$



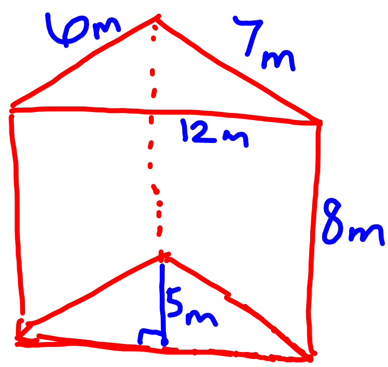
Volume and Surface Area

→ TRIANGULAR PRISM

$V =$ area of base $\times h$

$V = \left(\frac{b \cdot h}{2}\right) \times h$

that part is talking about the height of the triangle.



S.A. $= 2 \times$ area of triangle $+$ area of the 3 other rectangles

$$\text{Vol} = \frac{12 \times 5}{2} \cdot 8$$
$$= 30 \cdot 8$$
$$= 240\,m^3$$

$$S.A. = 2\left(\frac{12 \times 5}{2}\right) + (8 \times 12) + (8 \times 6) + (8 \times 7)$$
$$= 60 + 96 + 48 + 56$$
$$= 260\,m^2$$

Volume and Surface Area

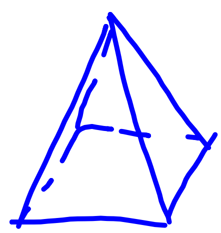
→PYRAMID

$V = \frac{1}{3} \cdot \text{area of base} \cdot h$

square pyramids → $S.A = \text{area of base} + \frac{P \cdot sl}{2}$

perimeter of base

slant height



Volume and Surface Area

→PYRAMID

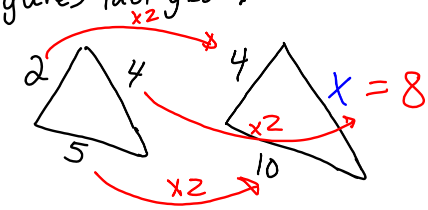
$$V = \frac{1}{3} \cdot \underset{\text{of base}}{\text{area}} \cdot h$$

square pyramids → $$S.A = \underset{\text{of base}}{\text{area}} + \frac{P \cdot sl}{2}$$

P → perimeter of base

sl → slant height

Do you remember doing similar figures last year?



How did we know the X was 8?

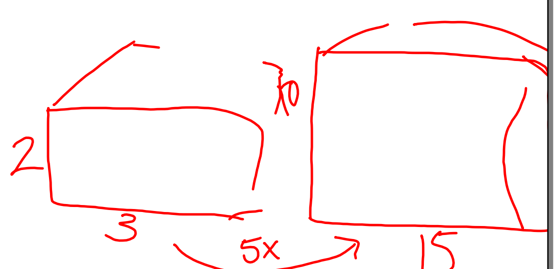
↳ Because everything was multiplied by 2.

So 2 is your <u>scale factor</u>

$k=2$

Now, we are still doing the same thing except that we are comparing AREA (k^2) and VOLUME (k^3) as well.

As you saw with your practice questions yesterday, the area and volume increase much faster than the dimensions.



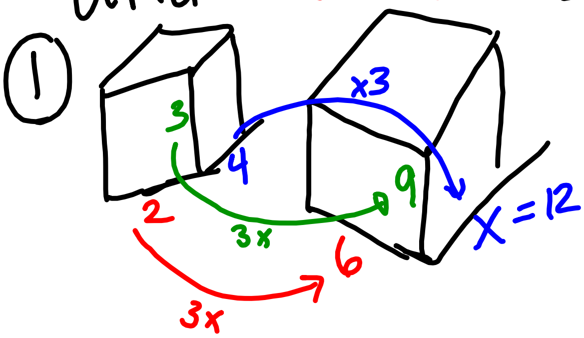
$k=5$

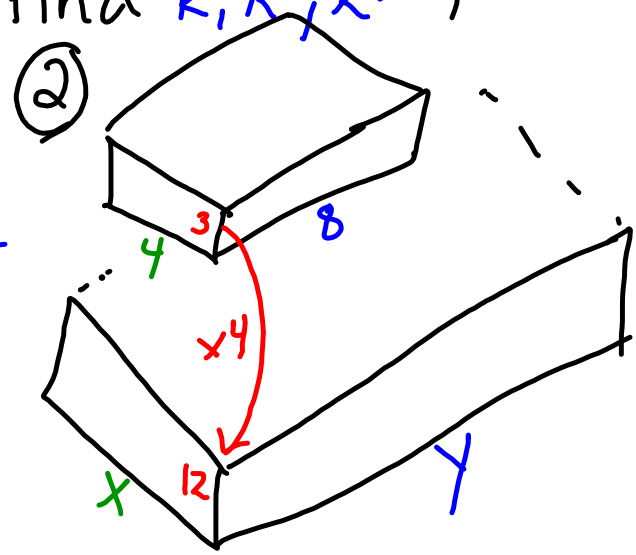
Volume → k^3

area
5^2 times bigger
25

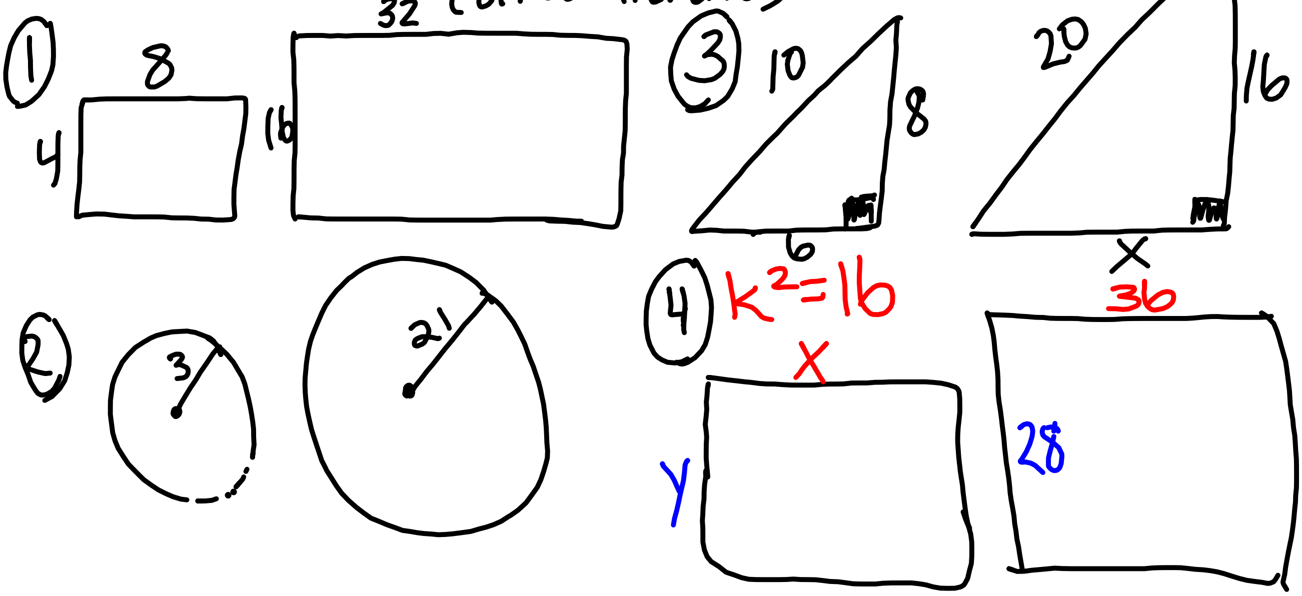
5^3 times bigger
125

Compare dimensions, surface area, and Volume. (Find k, k^2, k^3)





Compare perimters and areas.
(circumference)



EQUIVALENT SOLIDS

- When they say 2 3-D shapes are equivalent it means they have the SAME VOLUME.

EX: CANDLE MAKING QUESTION FROM REVIEW PACKAGE OR BONUS QUESTION FROM QUIZ.

1) Find volume on the one you have all the dimensions for.

2) Use that volume in the formula of the 2nd shape to work backwards and find missing value.

*3) They might ask you to then find surface area.

* MAKE SURE ALL VOLUME & SURFACE AREA FORMULAS ARE ON MEMORY AID!!! *

June 01, 2015

Good

Luck!