Unit 1

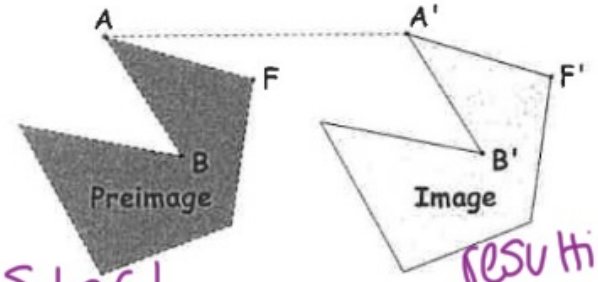
Lesson 1

Translations

Lesson 1 – Introduction to Transformations and Translations

Introduction to Transformations and Translations

- **Congruent figures:** Figures with same size and shape.
  - ✓ When two figures are congruent, you can move one figure on top of the other figure with no overlap, fit over each other perfectly.
- **Transformation** of a geometric figure: change in its size, location or orientation
- **Preimage** – Starting figure
  - ✓ Notation: AFB
- **Image** – new or resulting figure
  - ✓ Notation: A'F'B' "Prime"



Start

resulting

- **Isometry** – transformation in which preimage and image are the same size and shape (also called: rigid motion)

Examples:

translation

slide

reflection

mirror

flip

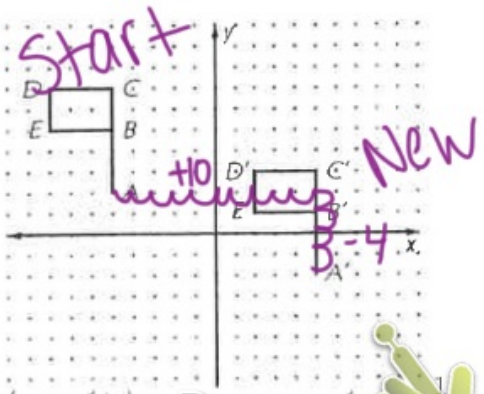
rotation

turn

➢ **Translation** – an isometry that maps all points the same distance and the same direction.

❖ **Three ways to describe a translation** (using example shown right):

✓ Always **be specific** when completing **any** type of description!!



1) **Words:** Translation to the right 10 units and down 4 units.

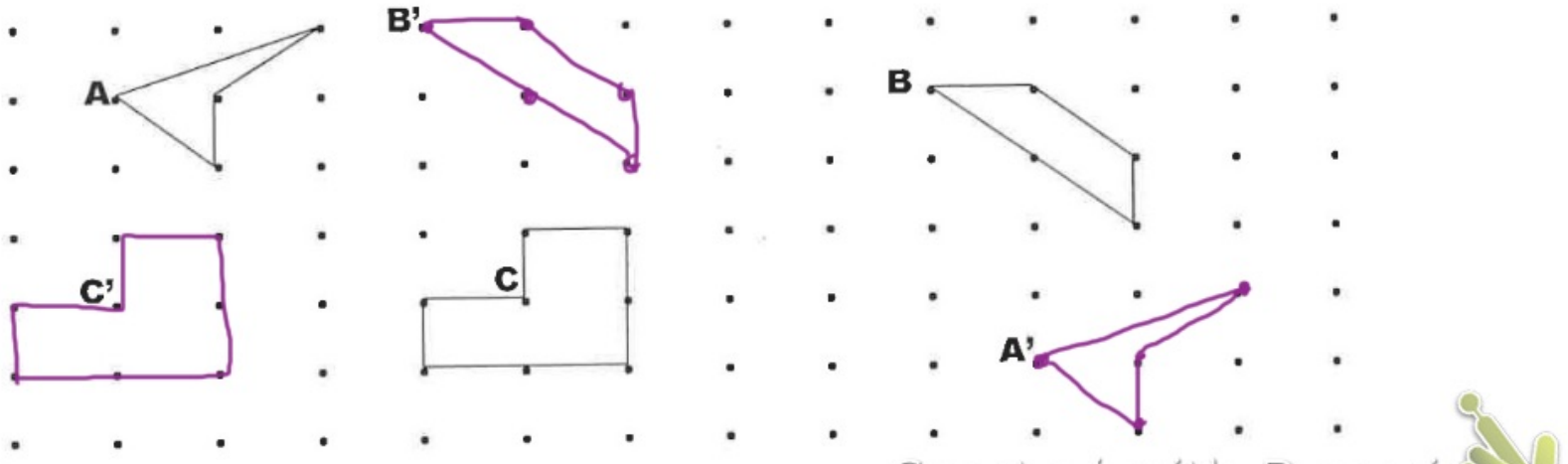
2) **Algebraic rule** (motion rule): $T: (x, y) \rightarrow (x + 10, y - 4)$

3) **Vector:** $< 10, -4 >$

+right +up

-left -down

1) Use the dots to help you draw the image of the first figure so that A maps to A′.
2) Use the dots to help you draw the image of the second figure so that B maps to B′.
3) Use the dots to help you draw the image of the third figure so that C maps to C′.
4) Complete each of the following translation rules using your mappings from 1 – 3 above.
   a) For A, the translation rule is: $T: (x, y) \rightarrow (\underline{x+9}, \underline{y-4})$ or $\langle \underline{+9}, \underline{-4} \rangle$
   b) For B, the translation rule is: $T: (x, y) \rightarrow (\underline{x-5}, \underline{y+1})$ or $\langle \underline{-5}, \underline{+1} \rangle$
   c) For C, the translation rule is: $T: (x, y) \rightarrow (\underline{x-4}, \underline{y+0})$ or $\langle \underline{-4}, \underline{0} \rangle$



❖ **Example:** ΔGEO has coordinates G(−2, 5), E(−4, 1) O(0, −2). A **translation** maps G to G′ (3, 1).

1. Find the coordinates of: a) E′ (1 , -3) b) O′ (5 , -6)
2. Describe the transformation in words: right 5, down 4
3. The translation rule is T: $(x, y) \rightarrow$ (x+5 , y-4)
4. The vector is < +5 , -4 >

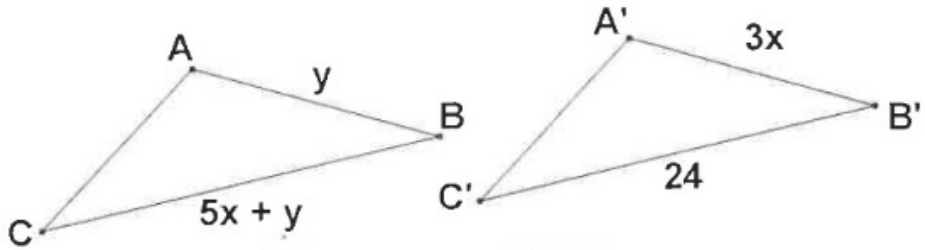
(x+5, y-4)

❖ **Example:** Given the translation from ΔABC to ΔA′B′C′, find the specified values for x and y.

~~Hint: ΔABC ≅ ΔA′B′C′~~

$x =$ 3

$y =$ 9



5x+y=24

y=3x

$5x+y=24$

$y=3x$

$5x+3x=24$

$\frac{8x}{8}=\frac{24}{8}$

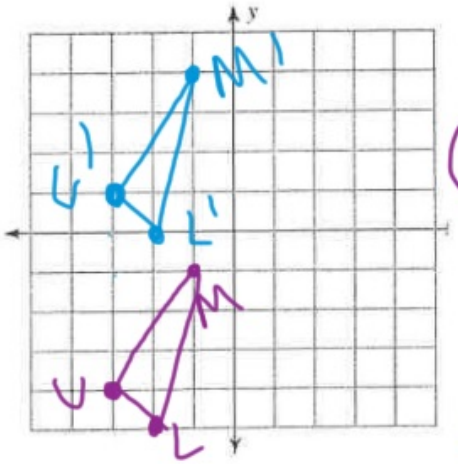
$x=3$

$y=3(3)$

$y=9$

$(3,9)$

5) translation: 5 units up
$U(-3, -4)$, $M(-1, -1)$, $L(-2, -5)$

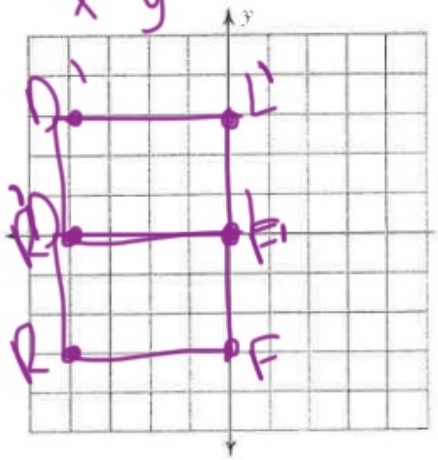


Algebraic Rule: $(x, y+5)$

Vector: $\langle 0, 5 \rangle$

6) translation: $< 0, 3 >$
$R(-4, -3)$, $D(-4, 0)$, $L(0, 0)$, $F(0, -3)$

x y



Algebraic Rule: $(x, y+3)$

Description: 3 units up
up 3

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5 : 3, 4, 5, 6

10) Translation: 3 units right and 4 units up

$P(-4,-3), L(-2,-2), T(-2,-4)$

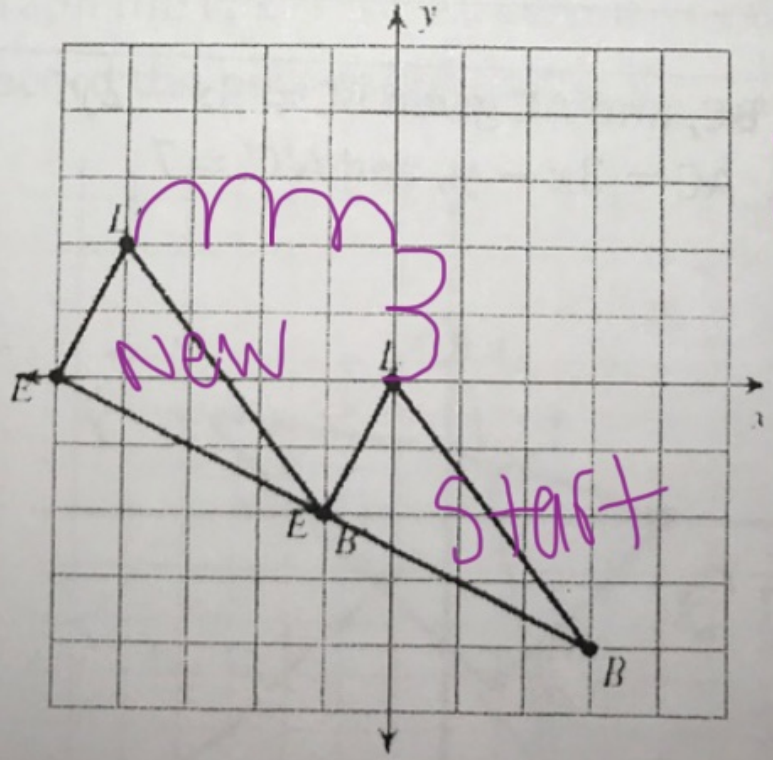
+3 +4 +3 +4 +3 +4

Vertices: P'(-1,1) L'(1,2) T'(1,0)

Algebraic Rule: (x+3, y+4)

Vector Notation: ⟨3,4⟩

13)



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Description:

Left 4, up 2

Algebraic Rule:

$(x-4, y+2)$

Vector Notation:

$\langle -4, +2 \rangle$

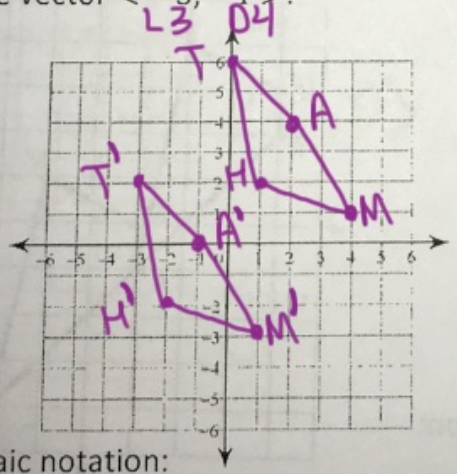
3. Graph and label quadrilateral MATH with vertices $M(4,1), A(2,4), T(0,6), and\ H(1,2)$. Graph and label the image of quad. MATH when the quadrilateral is shifted according to the vector $< -3, -4 >$.

M′ (1, -3)

A′ (-1, 0)

T′ (-3, 2)

H′ (-2, -2)



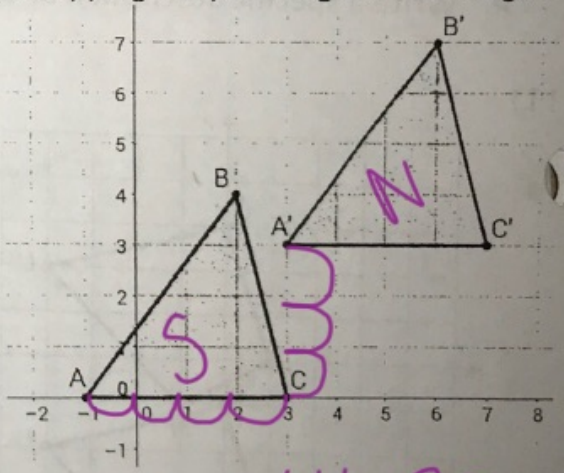
Write the rule in algebraic notation:

T: (x-3, y-4)

Describe in words the shift:

L3, D4

4. Write the rule mapping the pre-image to the image.



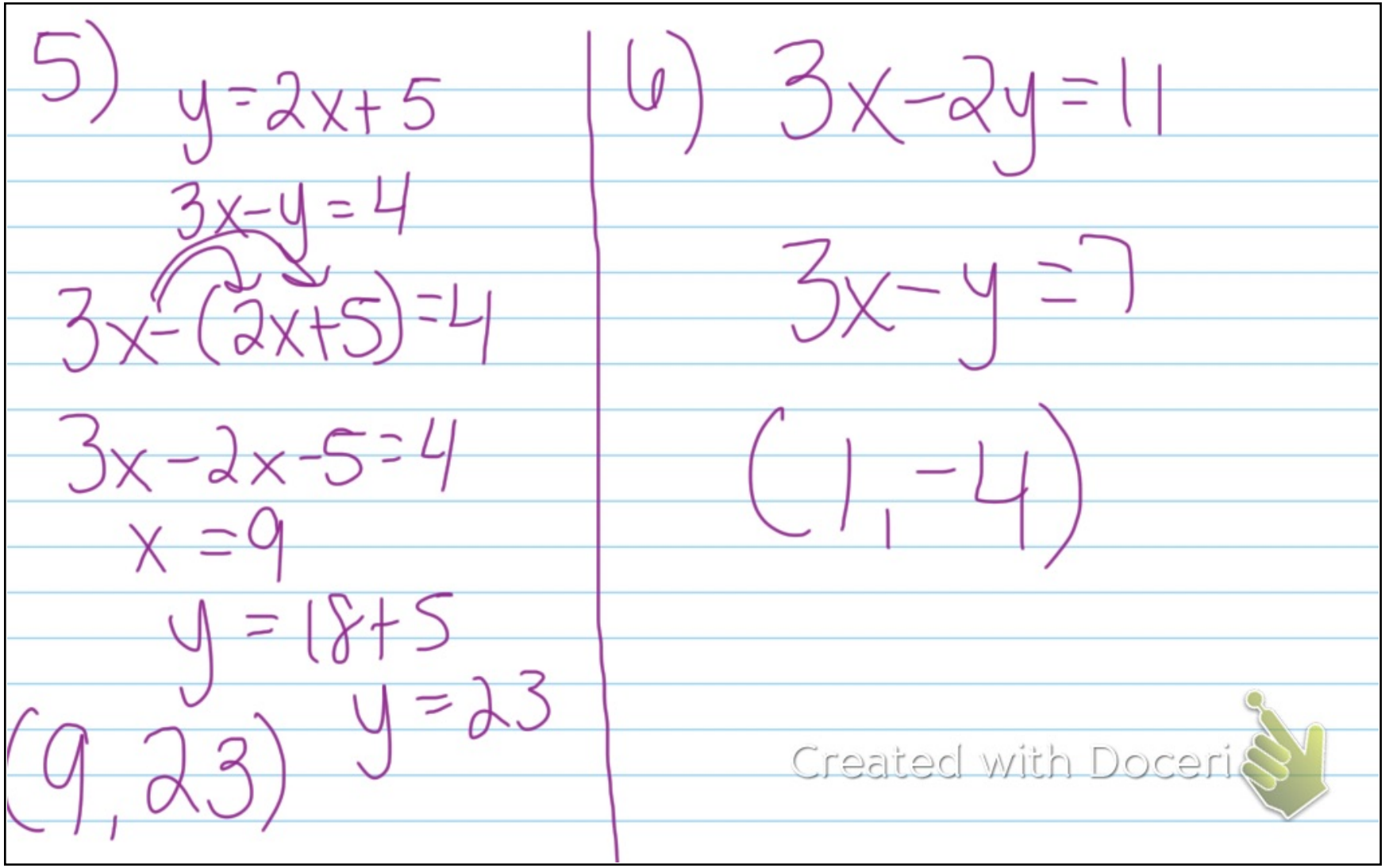
Write the rule in vector notation: <4, 3>

Write the rule in algebraic notation:

T: (x+4, y+3)

Describe in words the shift:

R4, U3


5) y = 2x + 5
3x − y = 4
3x − (2x + 5) = 4
3x − 2x − 5 = 4
x = 9
y = 18 + 5
y = 23
(9, 23)
6) 3x − 2y = 11
3x − y = 7
(1, −4)
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