

Name _____

Date _____

14.3 Translation — worked answers

Translate points and shapes by a vector, describe a translation from an object and its image, and identify corresponding points without a grid. · 51 questions

A · Fluency — Apply a vector, and read one off.

- 1 Translate the point (2, 3) by (4, 1). Where does it land?

Answer: (6, 4)

Add the vector to the coordinates: $2 + 4 = 6$ across and $3 + 1 = 4$ up, giving (6, 4).

- 2 Translate the point (−1, 5) by (3, −2). Where does it land?

Answer: (2, 3)

Add the vector to the coordinates: $-1 + 3 = 2$ across and $5 + -2 = 3$ up, giving (2, 3).

- 3 Translate the point (0, 0) by (−5, 4). Where does it land?

Answer: (−5, 4)

Add the vector to the coordinates: $0 + -5 = -5$ across and $0 + 4 = 4$ up, giving (−5, 4).

- 4 Translate the point (4, −2) by (−3, −3). Where does it land?

Answer: (1, −5)

Add the vector to the coordinates: $4 + -3 = 1$ across and $-2 + -3 = -5$ up, giving (1, −5).

- 5 Translate the point (−4, −1) by (6, 2). Where does it land?

Answer: (2, 1)

Add the vector to the coordinates: $-4 + 6 = 2$ across and $-1 + 2 = 1$ up, giving (2, 1).

- 6 Translate the point (3, 6) by (−7, −5). Where does it land?

Answer: (−4, 1)

Add the vector to the coordinates: $3 + -7 = -4$ across and $6 + -5 = 1$ up, giving (−4, 1).

- 7 Translate the point (−2, 2) by (5, −6). Where does it land?

Answer: (3, −4)

Add the vector to the coordinates: $-2 + 5 = 3$ across and $2 + -6 = -4$ up, giving (3, −4).

- 8 Translate the point (1, −4) by (−4, 7). Where does it land?

Answer: (−3, 3)

Add the vector to the coordinates: $1 + -4 = -3$ across and $-4 + 7 = 3$ up, giving (−3, 3).

- 9 Translate the point (5, 1) by (−2, −4). Where does it land?

Answer: (3, −3)

Add the vector to the coordinates: $5 + -2 = 3$ across and $1 + -4 = -3$ up, giving (3, −3).

- 10 Translate the point (−3, −5) by (4, 8). Where does it land?

Answer: (1, 3)

Add the vector to the coordinates: $-3 + 4 = 1$ across and $-5 + 8 = 3$ up, giving (1, 3).

- 11** Translate the point (6, 0) by (−6, 3). Where does it land?

Answer: (0, 3)

Add the vector to the coordinates: $6 + -6 = 0$ across and $0 + 3 = 3$ up, giving (0, 3).

- 12** Translate the point (−5, 4) by (2, −9). Where does it land?

Answer: (−3, −5)

Add the vector to the coordinates: $-5 + 2 = -3$ across and $4 + -9 = -5$ up, giving (−3, −5).

- 13** A point moves from (2, 3) to (6, 4). Write the translation as a vector, in the form (across, up).

Answer: (4, 1)

Subtract the object from the image: $6 - 2 = 4$ across and $4 - 3 = 1$ up.

- 14** A point moves from (−1, 5) to (2, 3). Write the translation as a vector, in the form (across, up).

Answer: (3, −2)

Subtract the object from the image: $2 - -1 = 3$ across and $3 - 5 = -2$ up.

- 15** A point moves from (0, 0) to (−5, 4). Write the translation as a vector, in the form (across, up).

Answer: (−5, 4)

Subtract the object from the image: $-5 - 0 = -5$ across and $4 - 0 = 4$ up.

- 16** A point moves from (4, −2) to (1, −5). Write the translation as a vector, in the form (across, up).

Answer: (−3, −3)

Subtract the object from the image: $1 - 4 = -3$ across and $-5 - -2 = -3$ up.

- 17** A point moves from (−4, −1) to (2, 1). Write the translation as a vector, in the form (across, up).

Answer: (6, 2)

Subtract the object from the image: $2 - -4 = 6$ across and $1 - -1 = 2$ up.

- 18** A point moves from (3, 6) to (−4, 1). Write the translation as a vector, in the form (across, up).

Answer: (−7, −5)

Subtract the object from the image: $-4 - 3 = -7$ across and $1 - 6 = -5$ up.

- 19** A point moves from (−2, 2) to (3, −4). Write the translation as a vector, in the form (across, up).

Answer: (5, −6)

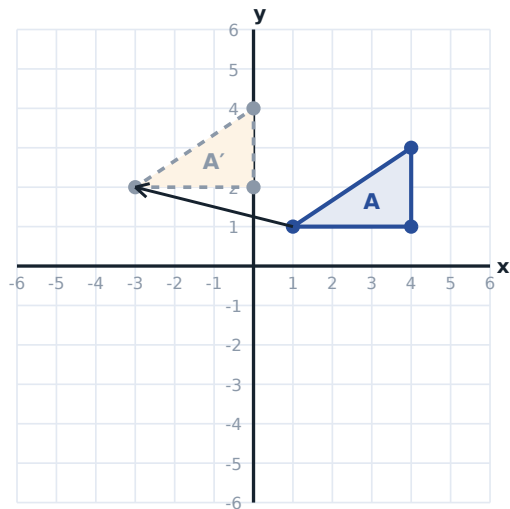
Subtract the object from the image: $3 - -2 = 5$ across and $-4 - 2 = -6$ up.

- 20** A point moves from (1, −4) to (−3, 3). Write the translation as a vector, in the form (across, up).

Answer: (−4, 7)

Subtract the object from the image: $-3 - 1 = -4$ across and $3 - -4 = 7$ up.

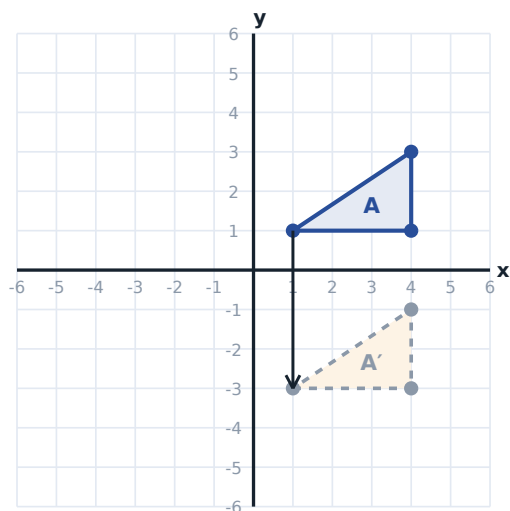
- 21** Triangle A has vertices $(1, 1)$, $(4, 1)$ and $(4, 3)$. It is translated by $(-4, 1)$. Where does the vertex $(1, 1)$ go?



Answer: $(-3, 2)$

Every vertex moves the same way: $(1, 1) + (-4, 1) = (-3, 2)$. The other two land on $(0, 2)$ and $(0, 4)$.

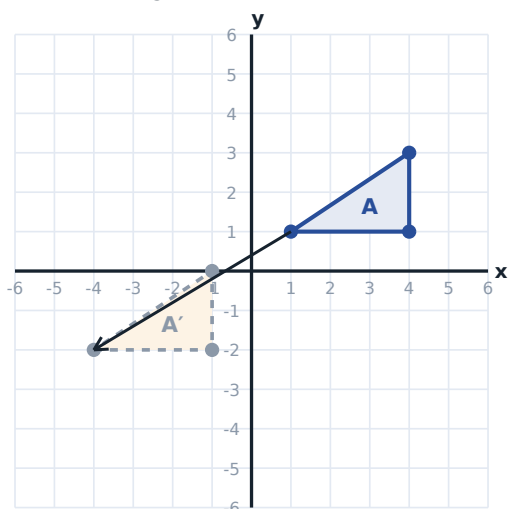
- 22** Triangle A has vertices $(1, 1)$, $(4, 1)$ and $(4, 3)$. It is translated by $(0, -4)$. Where does the vertex $(1, 1)$ go?



Answer: $(1, -3)$

Every vertex moves the same way: $(1, 1) + (0, -4) = (1, -3)$. The other two land on $(4, -3)$ and $(4, -1)$.

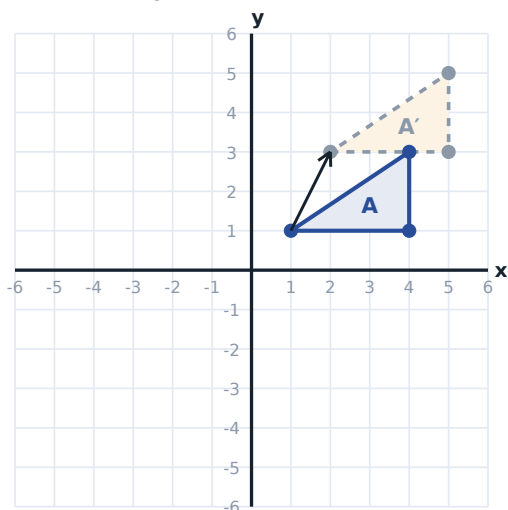
- 23** Triangle A has vertices $(1, 1)$, $(4, 1)$ and $(4, 3)$. It is translated by $(-5, -3)$. Where does the vertex $(1, 1)$ go?



Answer: $(-4, -2)$

Every vertex moves the same way: $(1, 1) + (-5, -3) = (-4, -2)$. The other two land on $(-1, -2)$ and $(-1, 1)$.

- 24** Triangle A has vertices $(1, 1)$, $(4, 1)$ and $(4, 3)$. It is translated by $(1, 2)$. Where does the vertex $(1, 1)$ go?



Answer: $(2, 3)$

Every vertex moves the same way: $(1, 1) + (1, 2) = (2, 3)$. The other two land on $(5, 3)$ and $(5, 5)$.

B · Reasoning — What a slide does and does not change.

- 25** What does a translation do to a shape?

- ☐ Turns it
- ☐ Flips it
- ☐ Slides it without turning or flipping
- ☐ Makes it bigger

Answer: Slides it without turning or flipping

Every point moves the same distance in the same direction.

26 After a translation, the image is ...

- ☐ larger than the object
- ☐ congruent to the object
- ☐ a mirror image
- ☐ similar but not congruent

Answer: congruent to the object

Same shape, same size, same way round. Only the position changes.

27 In the vector $(-3, 5)$, what does the -3 mean?

- ☐ 3 right
- ☐ 3 left
- ☐ 3 down
- ☐ 3 up

Answer: 3 left

The first number is the movement across; negative means left.

28 In the vector $(2, -6)$, what does the -6 mean?

- ☐ 6 left
- ☐ 6 right
- ☐ 6 up
- ☐ 6 down

Answer: 6 down

The second number is the movement up; negative means down.

29 How do you find the vector that takes A to B?

- ☐ $B + A$
- ☐ $A - B$
- ☐ $B - A$
- ☐ $A \times B$

Answer: $B - A$

Image minus object, coordinate by coordinate.

30 A shape is translated by $(4, -2)$, then by $(-4, 2)$. Where is it?

- ☐ Back where it started
- ☐ Translated by $(8, -4)$
- ☐ Translated by $(0, 4)$
- ☐ It cannot be done

Answer: Back where it started

The second vector undoes the first, because the two add to $(0, 0)$.

31 Does a translation change the size of the angles in a shape?

- ☐ Yes
- ☐ No

Answer: No

It changes nothing except position.

32 Do you need a grid to translate a point?

- ☐ Yes
- ☐ No

Answer: No

Adding the vector to the coordinates does the whole job — which is exactly what objective 7Gp.03 asks for.

33 The vector $(0, 0)$ translates a shape ...

- ☐ off the grid
- ☐ nowhere at all
- ☐ to the origin
- ☐ upside down

Answer: nowhere at all

It is the translation that does nothing.

34 A shape is translated by $(5, 3)$. What single vector takes the image back to the object?

- ☐ $(5, 3)$
- ☐ $(-5, -3)$
- ☐ $(3, 5)$
- ☐ $(-3, -5)$

Answer: $(-5, -3)$

Reverse both parts. Every transformation in this unit can be undone.

C · Challenge — Chains of translations, and working backwards.

35 The point $(2, 3)$ is translated by $(4, -1)$ and then by $(3, 5)$. Where does it end up?

Answer: $(9, 7)$

Do them one at a time: $(2, 3) \rightarrow (6, 2) \rightarrow (9, 7)$. Or add the vectors first: $(4, -1) + (3, 5) = (7, 4)$, then apply that once.

36 The point $(-1, -2)$ is translated by $(-3, 6)$ and then by $(2, -4)$. Where does it end up?

Answer: $(-2, 0)$

Do them one at a time: $(-1, -2) \rightarrow (-4, 4) \rightarrow (-2, 0)$. Or add the vectors first: $(-3, 6) + (2, -4) = (-1, 2)$, then apply that once.

37 The point $(0, 4)$ is translated by $(5, 5)$ and then by $(-6, -2)$. Where does it end up?

Answer: $(-1, 7)$

Do them one at a time: $(0, 4) \rightarrow (5, 9) \rightarrow (-1, 7)$. Or add the vectors first: $(5, 5) + (-6, -2) = (-1, 3)$, then apply that once.

38 The point $(3, -3)$ is translated by $(-2, -7)$ and then by $(4, 3)$. Where does it end up?

Answer: $(5, -7)$

Do them one at a time: $(3, -3) \rightarrow (1, -10) \rightarrow (5, -7)$. Or add the vectors first: $(-2, -7) + (4, 3) = (2, -4)$, then apply that once.

39 Two translations $(4, -1)$ and $(3, 5)$ are done one after the other. Write the single vector that does the same job.

Answer: $(7, 4)$

Add the vectors: $4 + 3 = 7$ across and $-1 + 5 = 4$ up.

40 Two translations $(-3, 6)$ and $(2, -4)$ are done one after the other. Write the single vector that does the same job.

Answer: $(-1, 2)$

Add the vectors: $-3 + 2 = -1$ across and $6 + -4 = 2$ up.

41 A translation takes $(3, -2)$ to $(-1, 5)$. Where does it take $(0, 0)$?

Answer: $(-4, 7)$

The vector is $(-1 - 3, 5 - (-2)) = (-4, 7)$. Applying it to the origin gives $(-4, 7)$.

- 42** A translation takes $(-5, 1)$ to $(2, 4)$. Where does it take $(6, -3)$?

Answer: (13, 0)

The vector is $(2 - (-5), 4 - 1) = (7, 3)$. Then $(6, -3) + (7, 3) = (13, 0)$.

- 43** A square of side 4 is translated by $(6, 2)$. What is the area of the image?

Answer: 16

A translation does not change size, so the area is still $4 \times 4 = 16$.

D · Word problems — Chess, ships, robots and drones.

- 44** A chess piece stands at $(3, 2)$. It moves 4 squares right and 1 square up. Where is it now?

Answer: (7, 3)

That is the translation $(4, 1)$: $(3, 2) \rightarrow (7, 3)$.

- 45** A ship at $(-2, 5)$ sails 6 units east and 3 units south. Give its new position.

Answer: (4, 2)

East is +6 across and south is -3 up, so the vector is $(6, -3)$: $(-2, 5) \rightarrow (4, 2)$.

- 46** A robot moves from $(1, 1)$ to $(-4, 6)$ in one straight slide. Write the translation as (across, up).

Answer: (-5, 5)

$-4 - 1 = -5$ across and $6 - 1 = 5$ up.

- 47** A counter at $(4, -1)$ is translated by $(-9, 3)$. Where does it land?

Answer: (-5, 2)

$4 + (-9) = -5$ and $-1 + 3 = 2$, so it lands on $(-5, 2)$.

- 48** A window on a plan has a corner at $(2, 7)$. The whole window is moved 3 units left and 5 units down. Where is that corner now?

Answer: (-1, 2)

The vector is $(-3, -5)$: $(2, 7) \rightarrow (-1, 2)$.

- 49** A drone at $(0, 0)$ flies by $(7, -4)$, then by $(-2, 9)$. Where does it finish?

Answer: (5, 5)

$(0, 0) \rightarrow (7, -4) \rightarrow (5, 5)$. Adding the vectors first gives $(5, 5)$ as well.

- 50** A tile at $(-6, -6)$ is slid to $(-6, 2)$. Where would the same slide take a tile at $(1, 1)$?

Answer: (1, 9)

The vector is $(0, 8)$ — straight up. So $(1, 1) \rightarrow (1, 9)$.

- 51** A rectangle 5 by 3 is translated three times. What is the area of the final image?

Answer: 15

Translations never change size, however many you do: the area is $5 \times 3 = 15$ throughout.