VECTORS

SCALAR QUANTITIES: Have only magnitudes

VECTOR QUANTITIES: Have magnitudes & directions

EXAMPLES:

SCALAR QUANTITIES	VECTOR QUANTITIES

SCALARS : HAVE ONLY MAGNITUDE

VECTORS : HAVE MAGNITUDES & DIRECTIONS

EXAMPLES

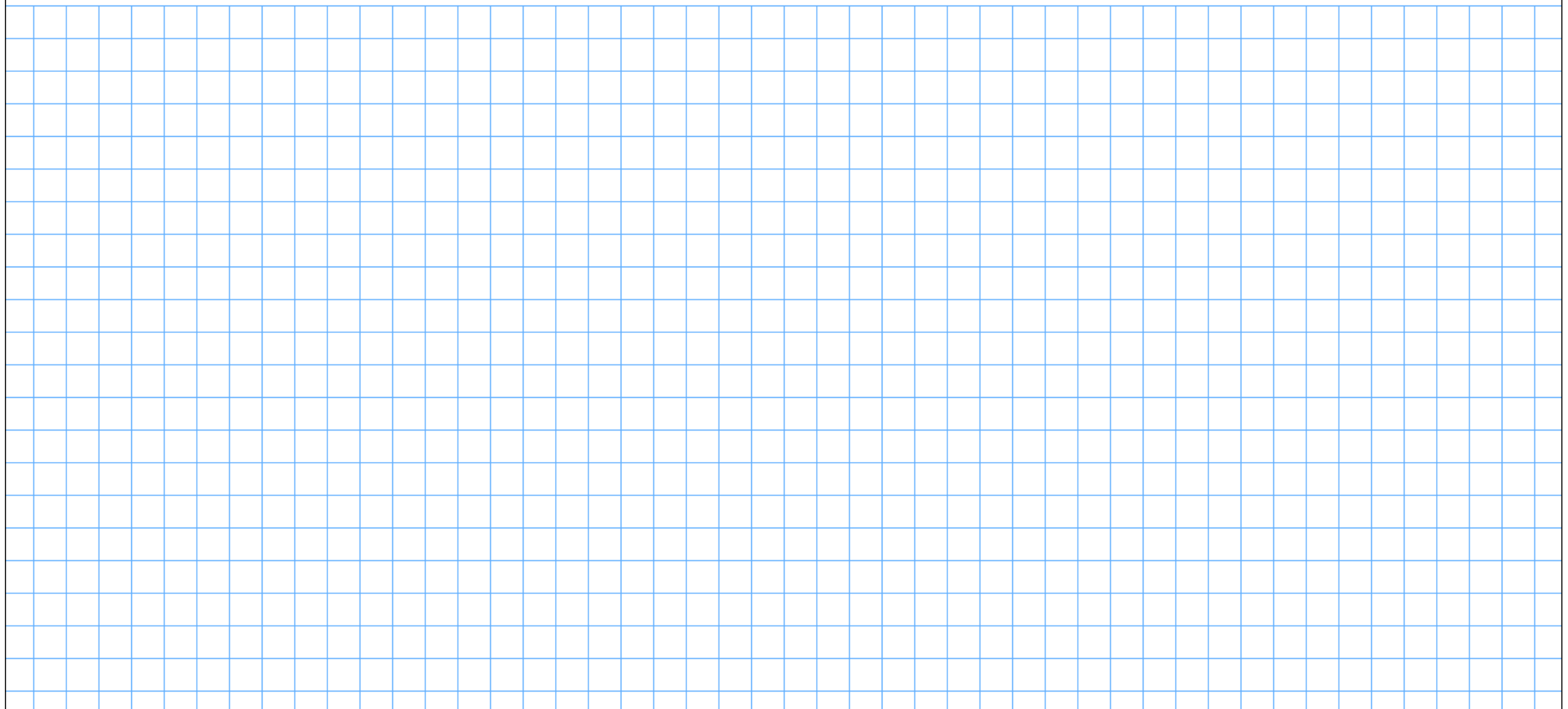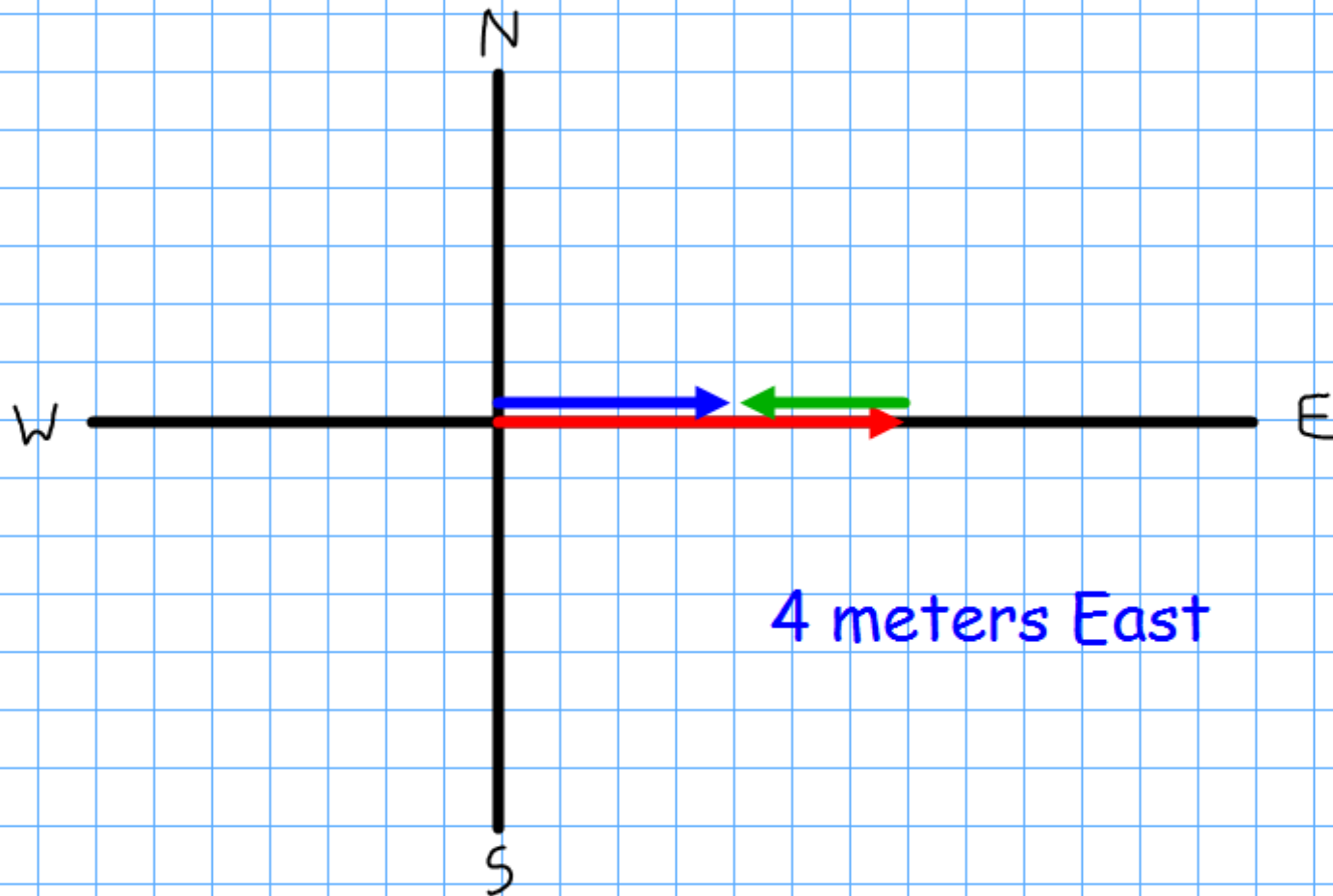| VECTORS	SCALARS
velocity	mass
accelaration	speed
Force	energy
current	volume
Gravity	Length
Momentum	width
INERTIA	TIME
ELECTRIC FIELDS	DENSITY
	DISTANCE

EXAMPLE 1: If I walk 7 meters East, then 3 meters
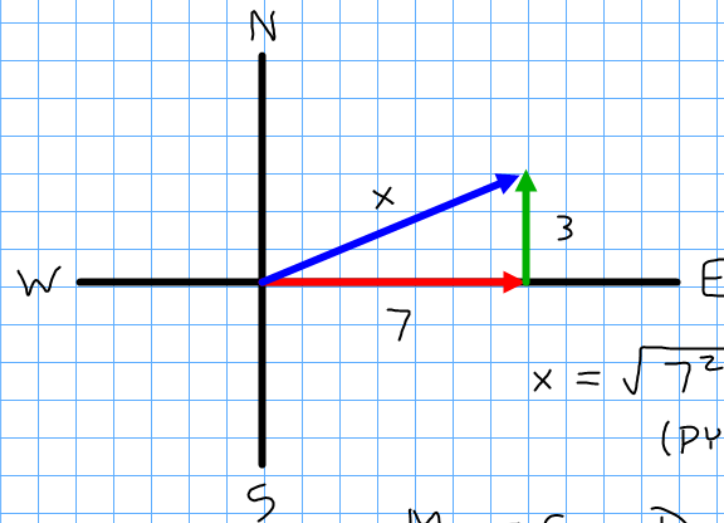West, what is my displacement?

EXAMPLE 1: If I walk 7 meters East, then 3 meters West, what is my displacement?

4 meters East

EXAMPLE 2: What is my displacement if I walk 7 meters East and then 3 meters North?
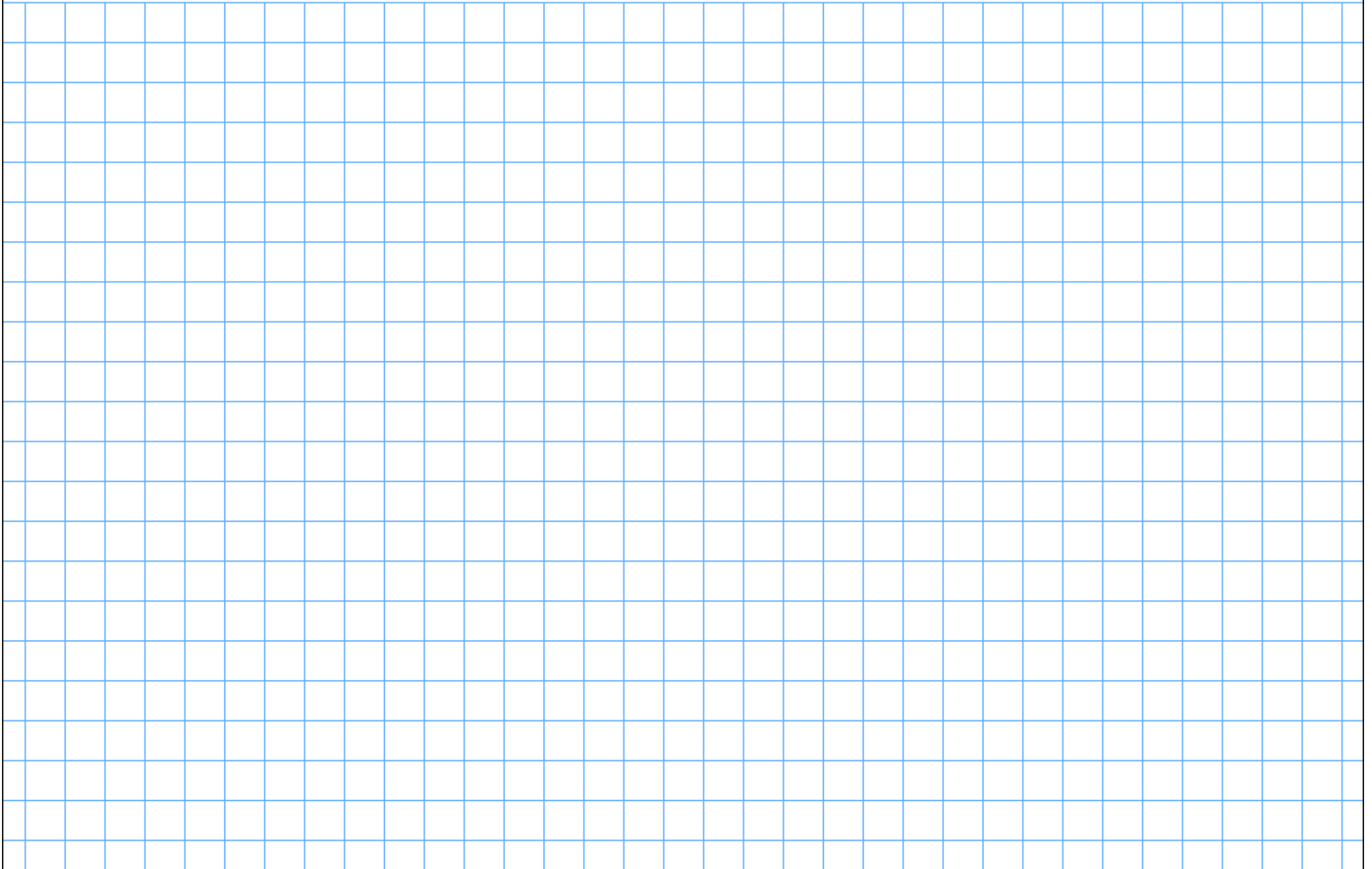
EXAMPLE 2: What is my displacement if I walk 7 meters East and then 3 meters North?

N

W ——————————— E

7

3

x

$$x = \sqrt{7^2 + 3^2} = \boxed{7.6\,m}$$

(PYTHAGOREAN THEOREM)

S

MUST GIVE DIRECTION AS WELL
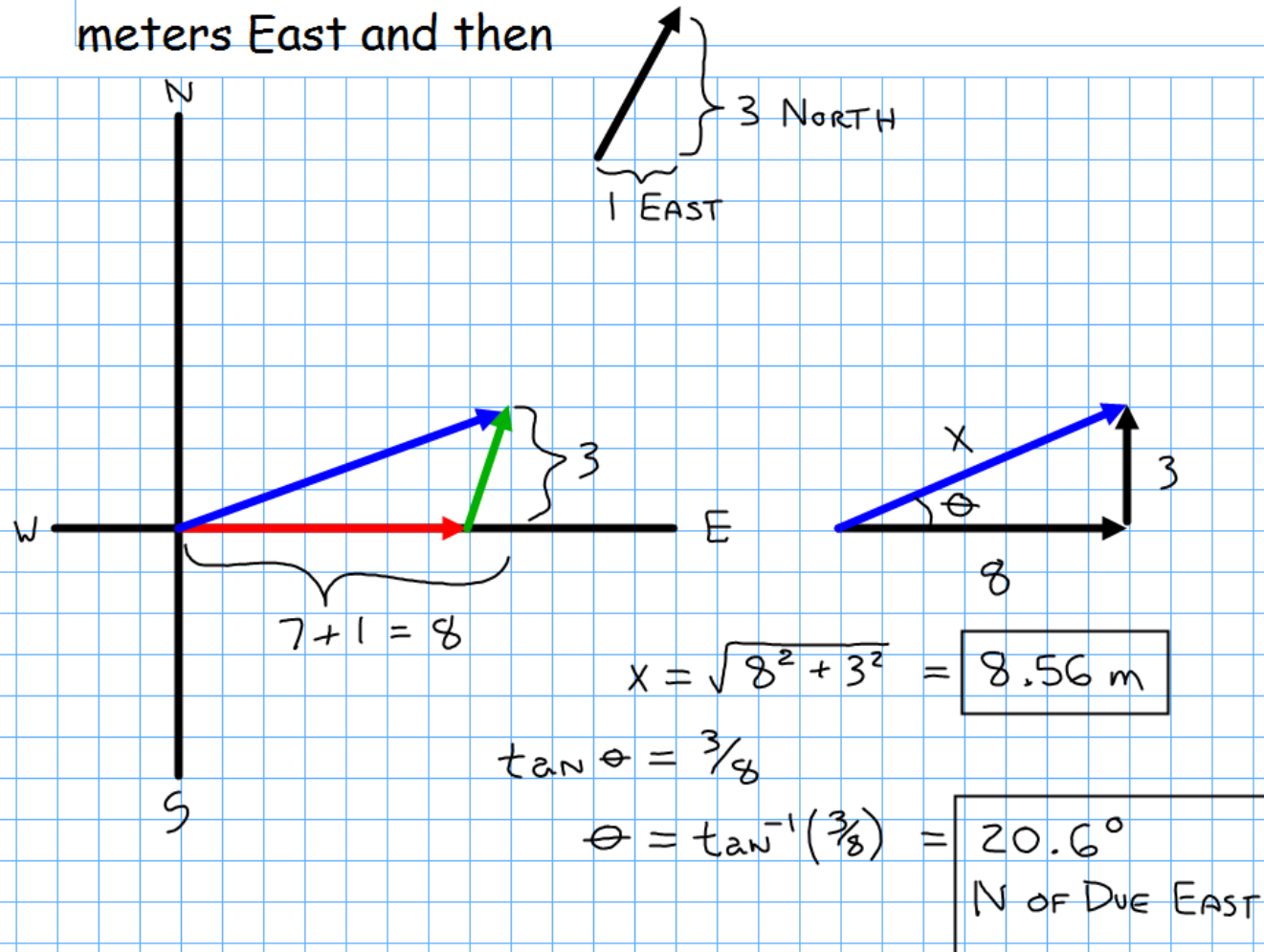
FIND θ

$$\tan \theta = \tfrac{3}{7}$$

$$\theta = \tan^{-1}\left(\tfrac{3}{7}\right) = \boxed{\begin{array}{c} 23.2° \\ N \text{ OF DUE EAST} \end{array}}$$

EXAMPLE 3: What is my displacement if I walk 7 meters East and then

3 NORTH

I EAST

EXAMPLE 3: What is my displacement if I walk 7 meters East and then

3 NORTH

1 EAST

N

W — E

S

7 + 1 = 8

3

X

θ

3

8

$$X = \sqrt{8^2 + 3^2} = \boxed{8.56 \text{ m}}$$

$$\tan\theta = \frac{3}{8}$$

$$\theta = \tan^{-1}\left(\frac{3}{8}\right) = \boxed{20.6° \text{ N OF DUE EAST}}$$
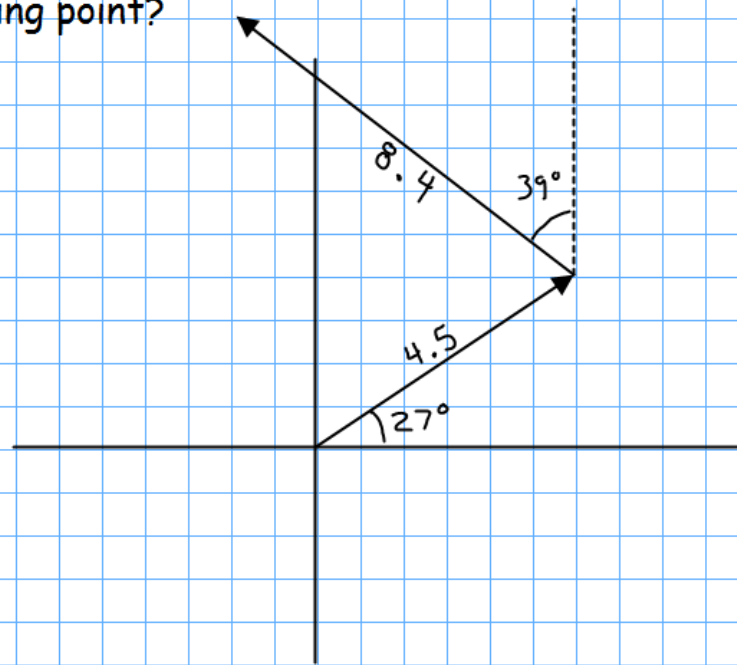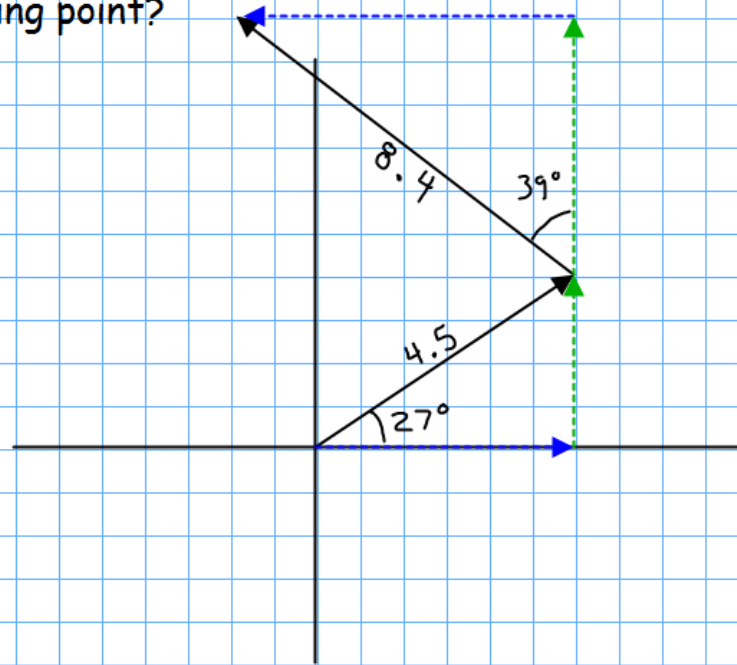
STEPS FOR ADDING VECTORS TOGETHER:

1. Identify the vectors.
2. Check units (must be consistent).
3. Select a reference frame (origin, directions).
4. Resolve all vectors into x and y components.
5. Add all x components up (= the x component of your resultant).
6. Add all y components up (= the y component of your resultant).
7. Plot #5 and #6 on a new set of coordinate axes.
8. Evaluate the hypotenuse (the magnitude of the resultant)
9. Evaluate the angle (for direction of the resultant vector)

EXAMPLE 4: A person walks 4.5 km at 27 Degrees North of due
East, then turns and walks 8.4 km in a direction of 39 degrees West
of due North. What is the person's net displacement from their
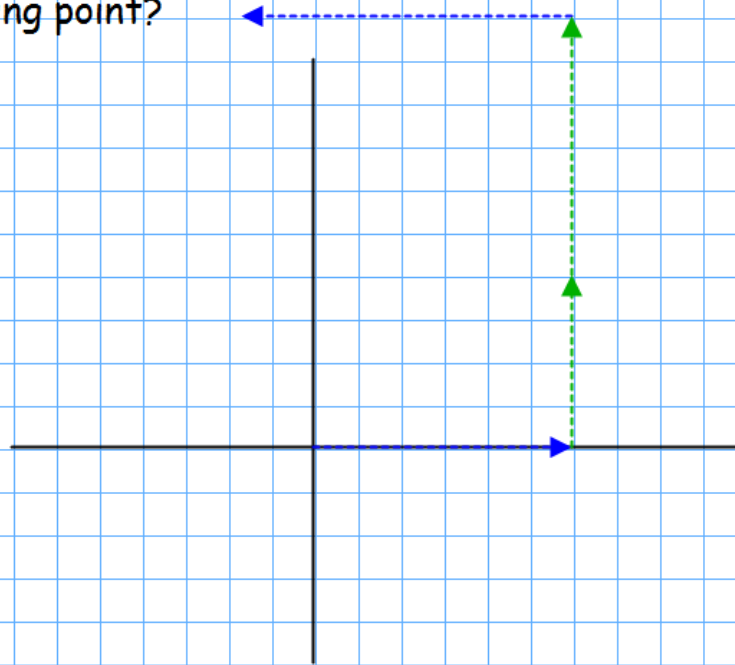starting point?

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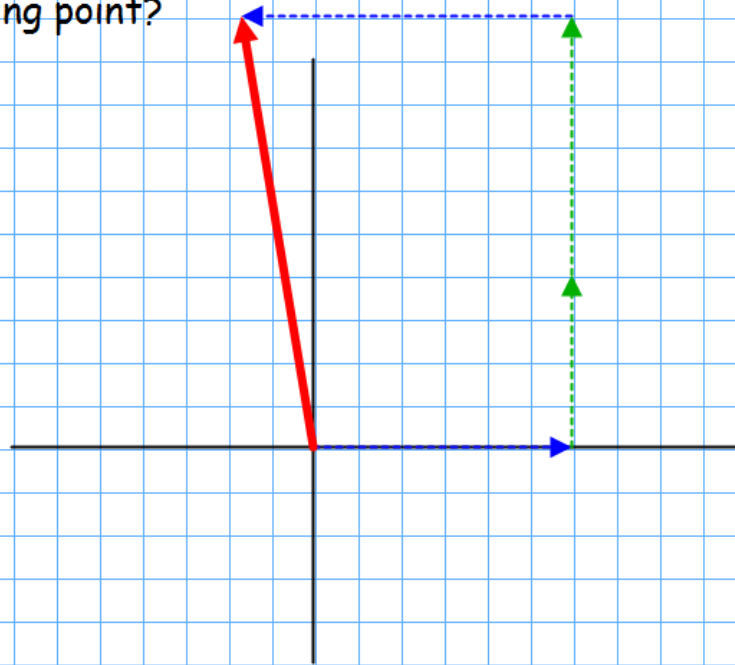
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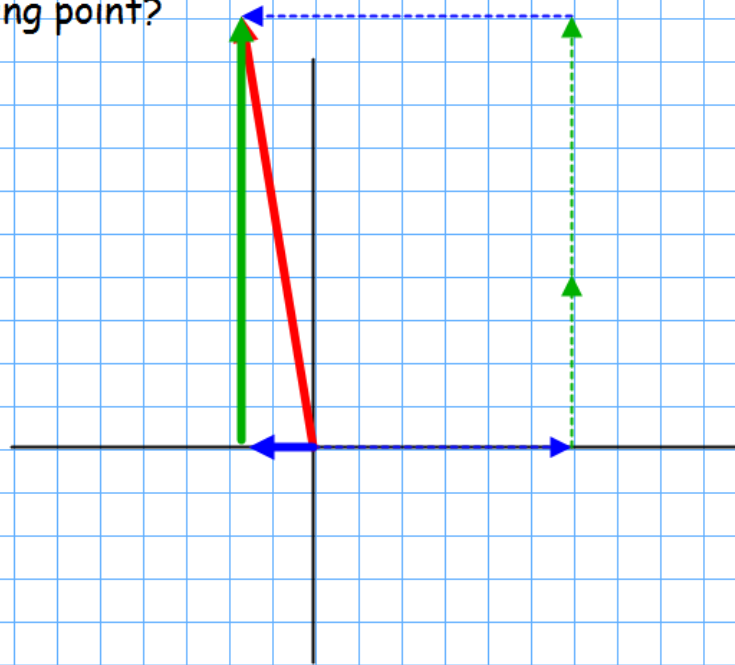
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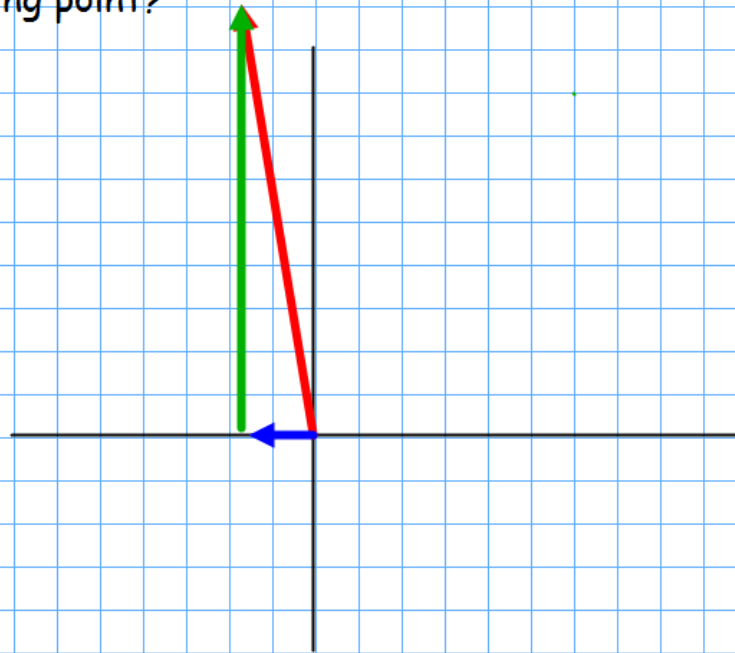
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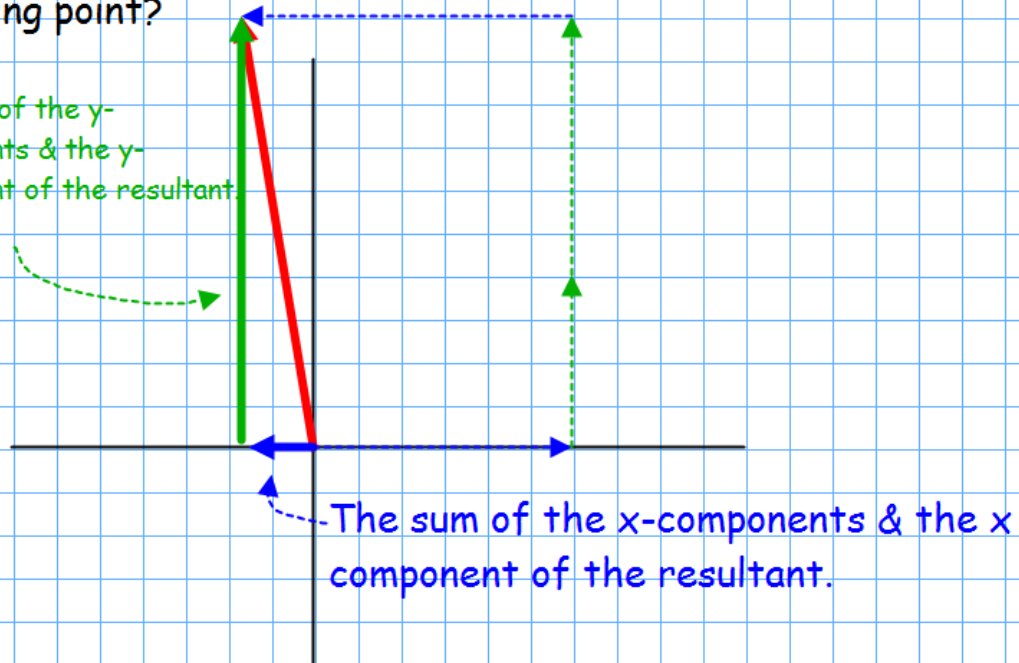
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The sum of the y-components & the y-component of the resultant.

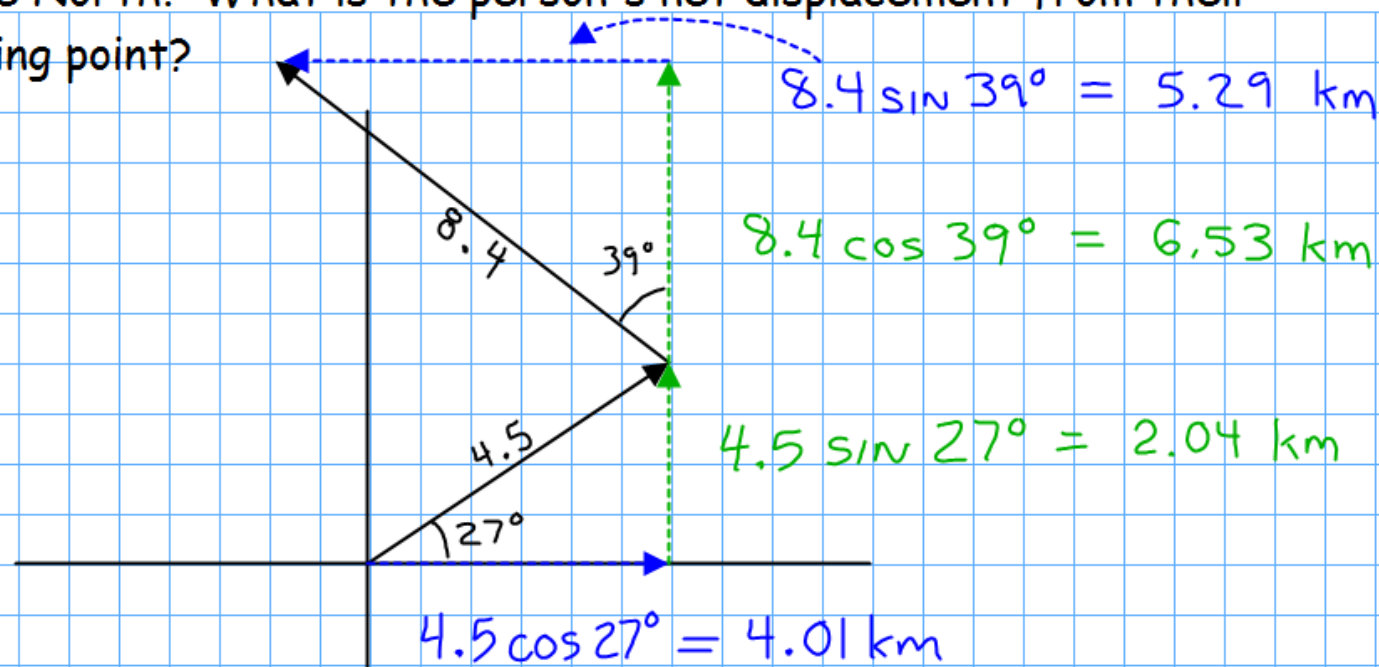The sum of the x-components & the x component of the resultant.

EXAMPLE 4: A person walks 4.5 km at 27 Degrees North of due East, then turns and walks 8.4 km in a direction of 39 degrees West of due North. What is the person's net displacement from their starting point?

$8.4 \sin 39° = 5.29$ km

$8.4 \cos 39° = 6.53$ km

$4.5 \sin 27° = 2.04$ km

$4.5 \cos 27° = 4.01$ km

$\Sigma x's = 4.01 - 5.29 = -1.28$ km

$\Sigma y's = 2.04 + 6.53 = 8.57$ km

These are the x & y components of the resultant. Now replot them.

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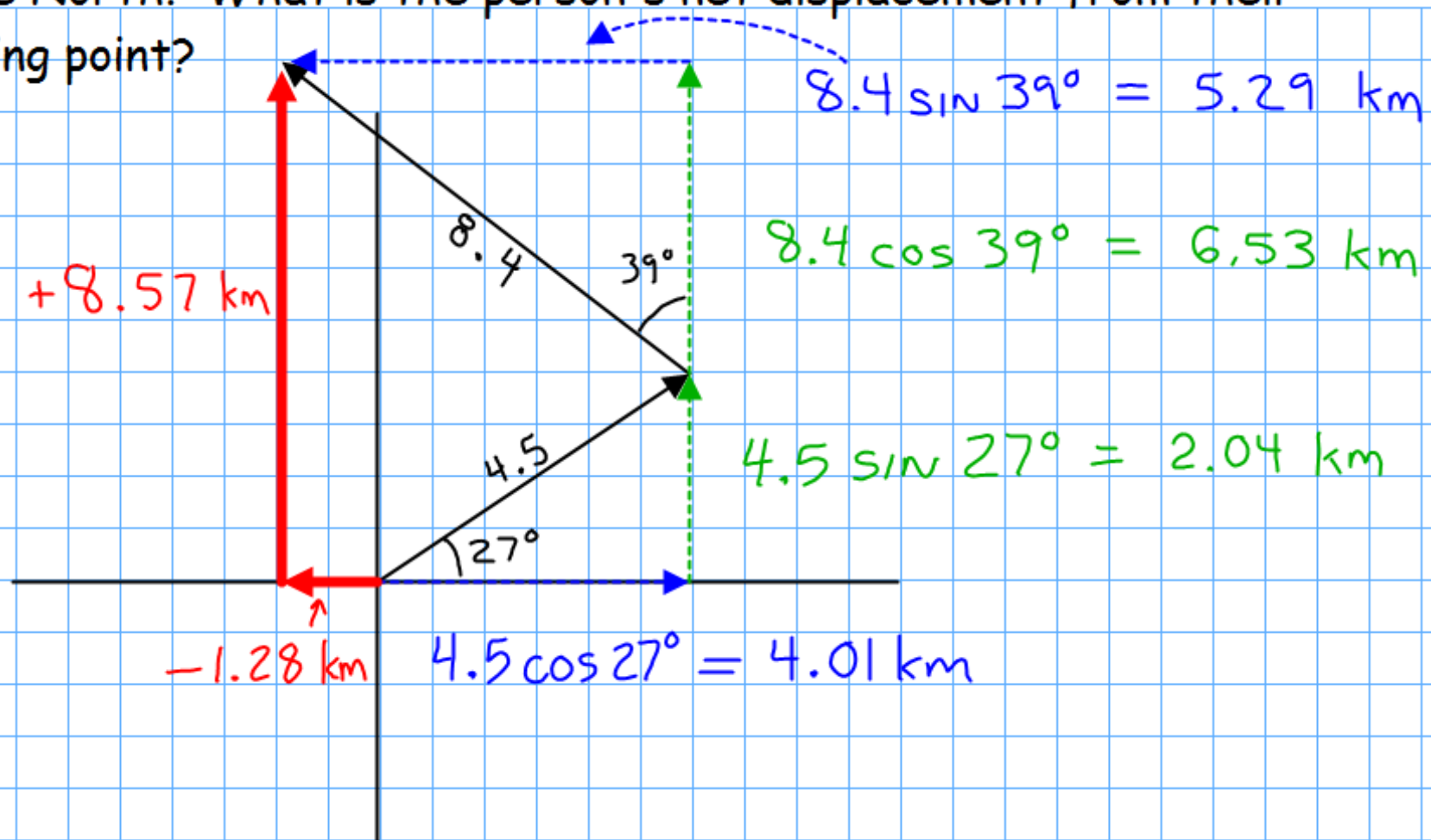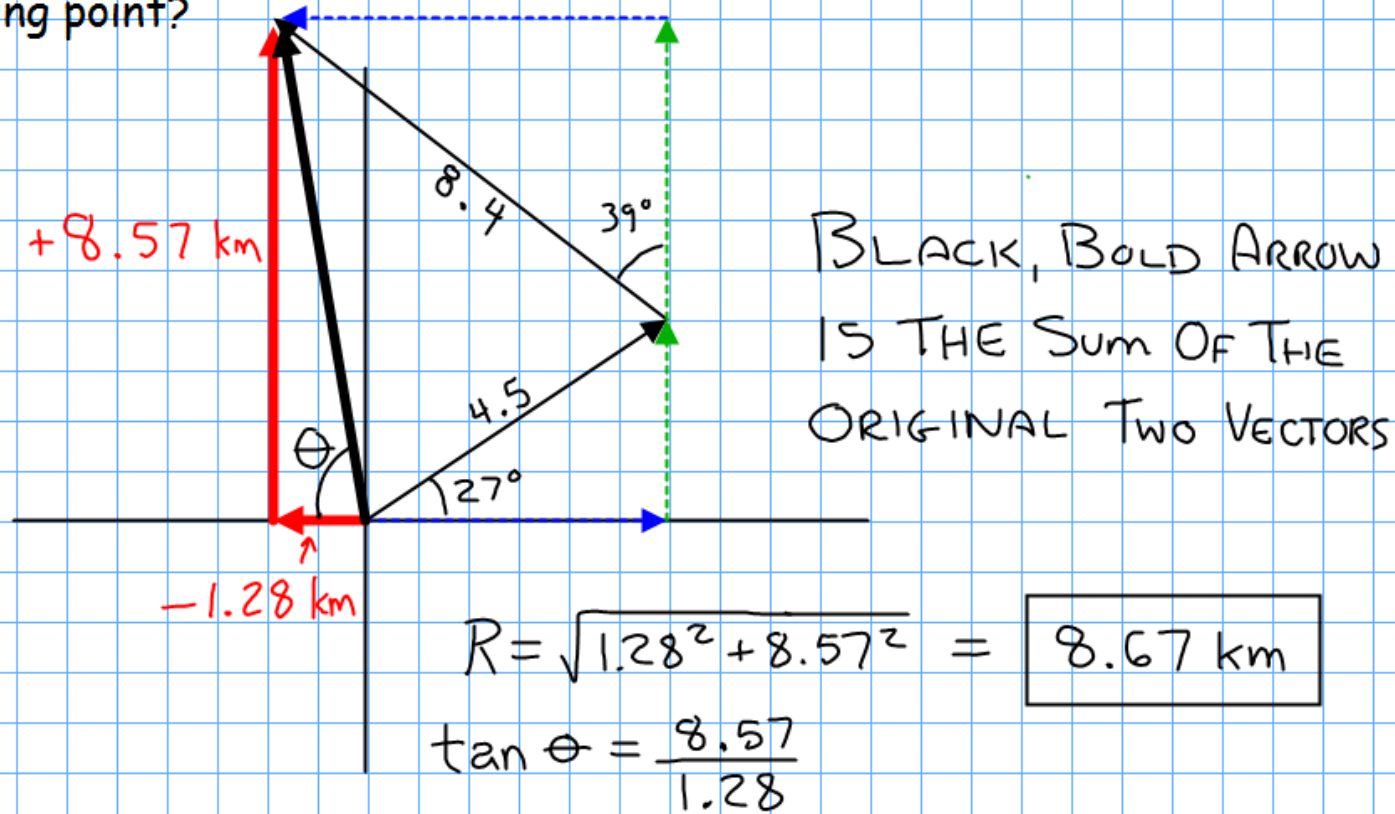
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$4.5 \sin 27° = 2.04$ km

$4.5 \cos 27° = 4.01$ km

$+8.57$ km

-1.28 km

8.4

4.5

39°

27°

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of due North. What is the person's net displacement from their
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+8.57 km

8.4

39°

4.5

27°

θ

−1.28 km

BLACK, BOLD ARROW
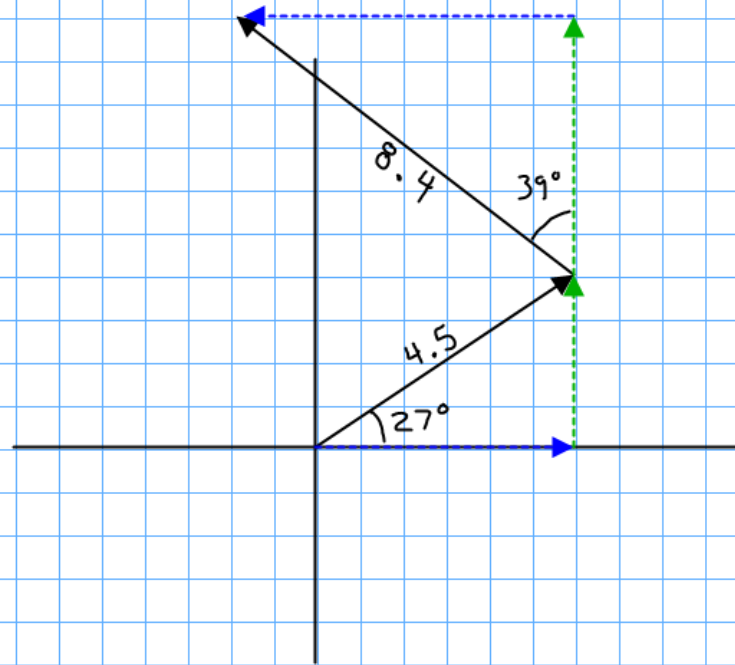IS THE SUM OF THE
ORIGINAL TWO VECTORS

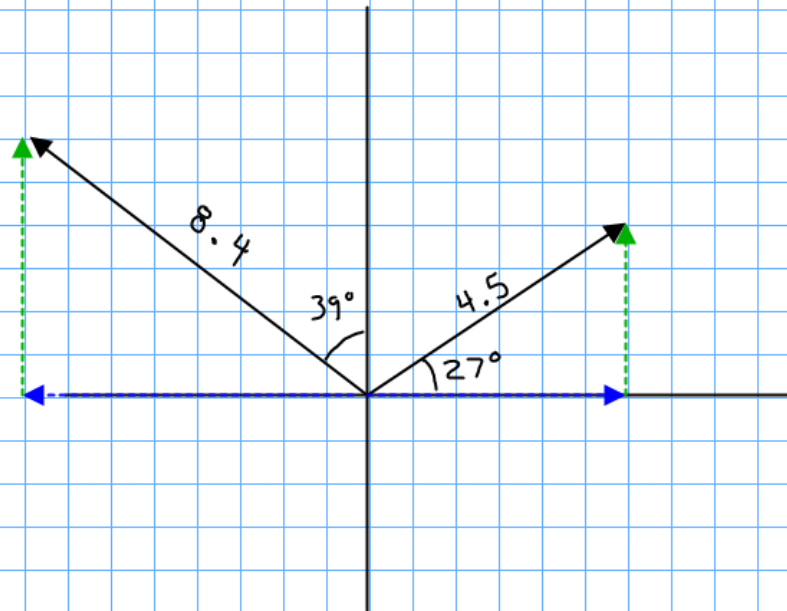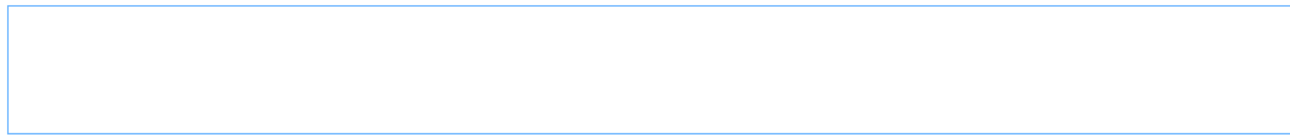$$R = \sqrt{1.28^2 + 8.57^2} = \boxed{8.67 \text{ km}}$$

$$\tan \theta = \frac{8.57}{1.28}$$

$$\theta = \tan^{-1}\left(\frac{8.57}{1.28}\right) = \boxed{81.51 \text{ N OF DUE W}}$$
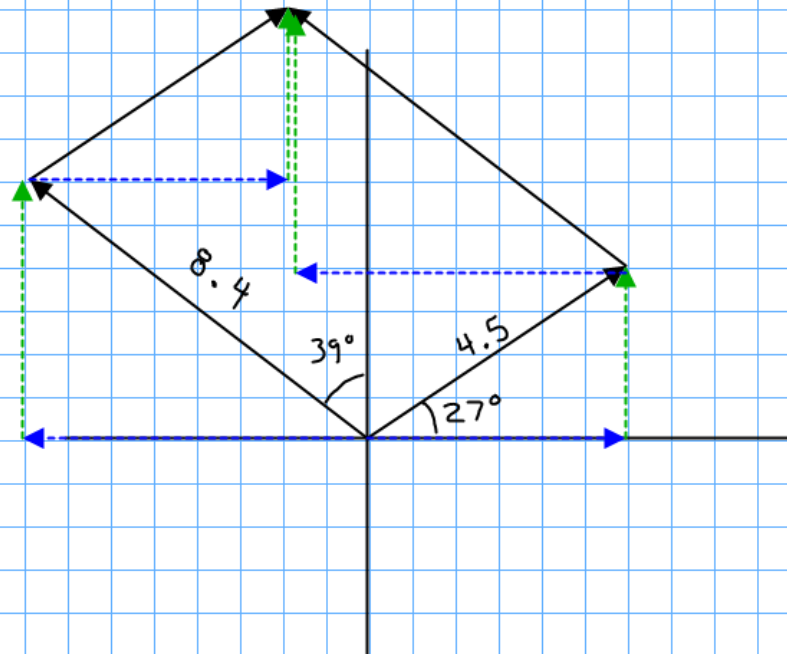
Since we are just adding components, we can draw all of the vectors we are adding up as starting at the origin.
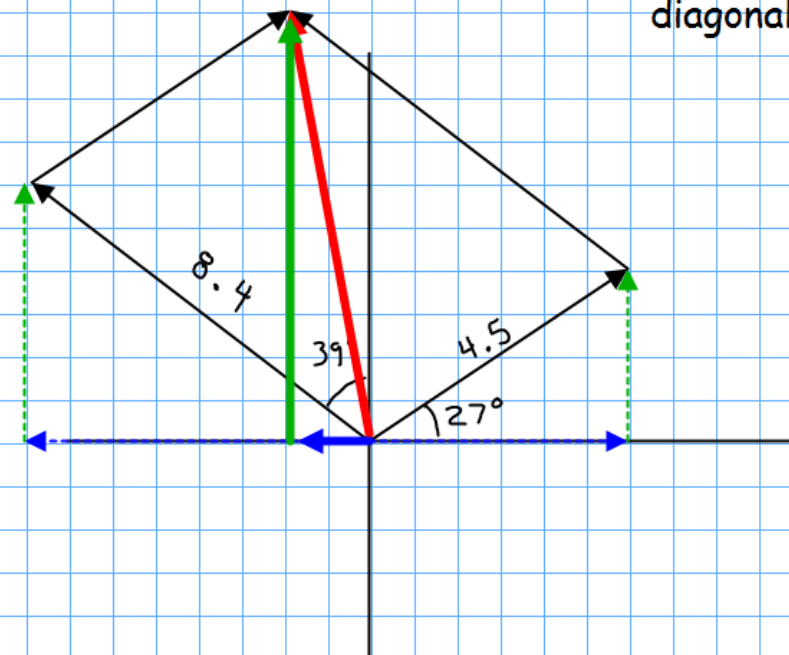
This . . . becomes . . .

8.4

39°

4.5

27°

THIS!!!

8.4

39°

4.5

27°

Make a parallelogram of the two vectors.

8.4

39°

4.5

27°

The resultant is the
diagonal.

The resultant is still
found by summing the x
and y-components of all
vectors being added
together.

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