

Vector Difference Detectives

Subtract vectors by reversing, then adding.

HIGH SCHOOL • HSN-VM.B.4c

CCSS.Math.Content.HSN-VM.B.4c "Understand vector subtraction $v - w$ as $v + (-w)$, where $-w$ is the additive inverse of w , with the same magnitude as w and pointing in the opposite direction..."

NAME _____

DATE _____

SUBTRACT BY ADDING THE OPPOSITE

To subtract w from v , add the opposite of w : $v - w = v + (-w)$.
The vector $-w$ has the same length as w but points in the opposite direction. If v and w start at the same point on a graph, $v - w$ is the arrow from the tip of w to the tip of v .

WORKED EXAMPLE

Find $v - w$ if $v = \langle 5, -3 \rangle$ and $w = \langle -2, 4 \rangle$.

- $v - w = \langle 5, -3 \rangle - \langle -2, 4 \rangle$
- Subtract matching components: $\langle 5 - (-2), -3 - 4 \rangle$
- Simplify: $\langle 7, -7 \rangle$

Answer: $\langle 7, -7 \rangle$

PRACTICE 6 problems

1 Compute $\langle 1, -7 \rangle - \langle -6, 8 \rangle$.

ANSWER _____

2 Compute $\langle -9, 6 \rangle - \langle 7, -1 \rangle$.

ANSWER _____

3 Compute $\langle 0, 11 \rangle - \langle -8, -9 \rangle$.

ANSWER _____

4 Compute $\langle 12, -10 \rangle - \langle -11, 13 \rangle$.

ANSWER _____

5 Let $p = \langle 14, 0 \rangle$ and $q = \langle -13, 9 \rangle$. Find $q - p$.

ANSWER _____

6 Vectors r and s both start at the origin. The tip of r is at $(16, -12)$, and the tip of s is at $(-14, 15)$. What vector does the arrow from the tip of s to the tip of r represent? Compute it.

ANSWER _____

APPLY IT Show your work

- 1** In a game design project, an avatar's position vector from the spawn point is $\langle 19, -8 \rangle$. A target's position vector from the same spawn point is $\langle -7, 16 \rangle$. What displacement vector points from the target to the avatar?

WORK SPACE

ANSWER _____

- 2** At a school film festival, an equipment cart is located at $\langle -18, 22 \rangle$ relative to the entrance. The editing station is located at $\langle 17, -11 \rangle$ relative to the entrance. What displacement vector points from the cart to the editing station?

WORK SPACE

ANSWER _____

CHALLENGE One step up

CHALLENGE

Let $a = \langle 31, -18 \rangle$ and $b = \langle -12, 17 \rangle$. A student says that $a - b = \langle 19, -1 \rangle$. Is the student correct? Explain the error and give the correct result.

PART 1 • PRACTICE

#	PROBLEM	ANSWER
1	Compute $\langle 1, -7 \rangle - \langle -6, 8 \rangle$.	$\langle 7, -15 \rangle$
2	Compute $\langle -9, 6 \rangle - \langle 7, -1 \rangle$.	$\langle -16, 7 \rangle$
3	Compute $\langle 0, 11 \rangle - \langle -8, -9 \rangle$.	$\langle 8, 20 \rangle$
4	Compute $\langle 12, -10 \rangle - \langle -11, 13 \rangle$.	$\langle 23, -23 \rangle$
5	Let $p = \langle 14, 0 \rangle$ and $q = \langle -13, 9 \rangle$. Find $q - p$.	$\langle -27, 9 \rangle$
6	Vectors r and s both start at the origin. The tip of r is at $(16, -12)$, and the tip of s is at $(-14, 15)$. What vector does the arrow from the tip of s to the tip of r represent? Compute it.	$r - s = \langle 30, -27 \rangle$

PART 2 • APPLY IT

1. **$\langle 26, -24 \rangle$** Subtract the target's vector from the avatar's vector. Compute $\langle 19 - (-7), -8 - 16 \rangle$.
2. **$\langle 35, -33 \rangle$** Subtract the cart's position vector from the editing station's position vector. Compute $\langle 17 - (-18), -11 - 22 \rangle$.

CHALLENGE

No. $\langle 19, -1 \rangle$ is $a + b$, so the student added b instead of adding its opposite. $a - b = \langle 31 - (-12), -18 - 17 \rangle = \langle 43, -35 \rangle$.

Accept component vectors written with angle brackets, parentheses, or as vertical columns if the component order and signs are correct. For graphical subtraction, accept $r - s$ identified as the arrow from the tip of s to the tip of r .