MATHEMATICS · GRADES 10-12

Vector addition and subtraction

Difficulty level: Advanced

Mathematics: Grades 10-12

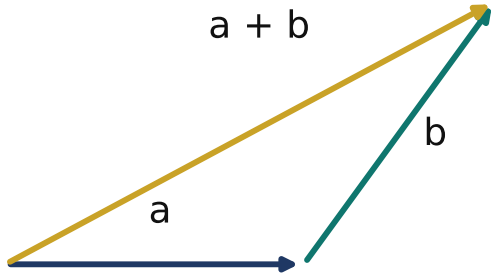
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Overview of the concept

This is how you combine two movements into one total movement, like walking to school and then to the park, or a boat crossing a river while the current pushes it sideways. Each movement has a size and a direction, and adding them gives the overall journey, from where you started to where you ended. Subtracting a movement does the reverse, taking one journey away from another. That is how you work out where you end up after two trips, or how a boat is pushed off course by a current.



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Rule

Vector addition and subtraction: to add or subtract vectors, add or subtract the matching components.

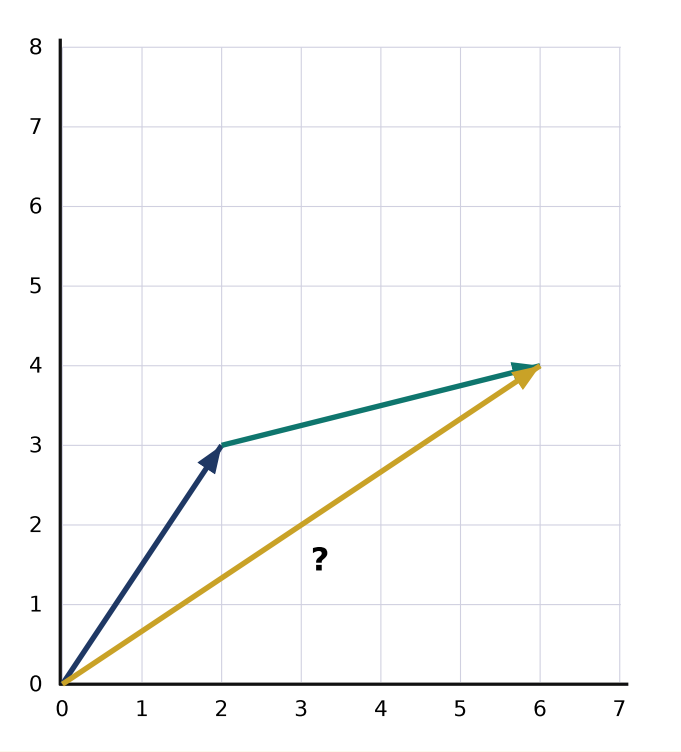
Add the x components together and the y components together, and do the same for subtraction.

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Worked examples

EXAMPLE 1

Q Add (2, 3) and (4, 1).



SOLUTION

Add the x components: 2 + 4 = 6

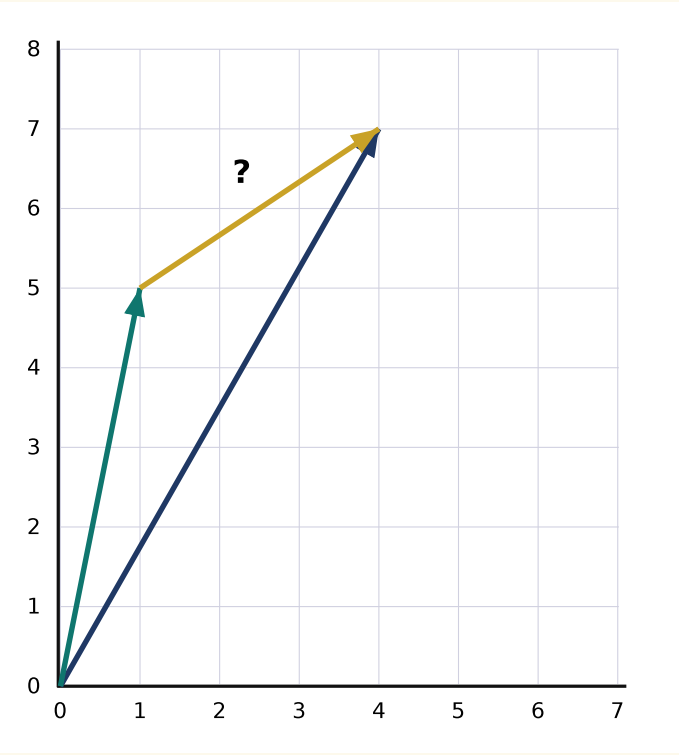
Add the y components: 3 + 1 = 4

Sum: (6, 4)

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EXAMPLE 2

Q Subtract (1, 5) from (4, 7).



SOLUTION

Subtract the x components: 4 - 1 = 3

Subtract the y components: 7 - 5 = 2

Difference: (3, 2)

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Practice questions

1 A walk goes (1, 2) then (3, 4). Add the vectors.

- **A** (4, 6)
- **B** (4, 5)
- **C** (3, 6)
- **D** (2, 6)

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2 A boat moves (5, 0) then (0, 5). What is the total movement?

- **A** (5, 0)
- **B** (5, 5)
- **C** (0, 5)
- **D** (10, 5)

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3 Find (6, 5) - (2, 1).

- A (4, 4)
- B (8, 6)
- C (6, 4)
- D (4, 6)

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4 A bird flies (-1, 3) then (4, -2). What is the total movement?

- A (5, 1)
- B (3, 5)
- C (3, 1)
- D (-5, 5)

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5

Add (2, 3) and the zero vector (0, 0).

A (2, 3)

B (0, 0)

C (3, 2)

D (2, 0)

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6

Find (3, 3) - (3, 3).

A (3, 3)

B (6, 6)

C (0, 3)

D (0, 0)

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7 Three trips are (2, 2), (1, 1), and (3, 0). Add them all.

- **A** (6, 2)
- **B** (5, 3)
- **C** (6, 3)
- **D** (6, 6)

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8 Describe in words what adding vectors means geometrically.

- **A** Placing them head to tail and joining the start to the end
- **B** Adding their lengths and ignoring direction
- **C** Placing them tail to tail and joining the ends
- **D** Multiplying their matching components

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9 Find (5, 9) - (0, 4).

- A (5, 5)
- B (5, 13)
- C (9, 5)
- D (5, 4)

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10 A boat is pushed (10, -3) by its engine and (-4, 3) by the current. What is the total movement?

- A (14, 0)
- B (6, -6)
- C (10, 3)
- D (6, 0)

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ANSWER KEY

1. (4, 6)

2. (5, 5)

3. (4, 4)

4. (3, 1)

5. (2, 3)

6. (0, 0)

7. (6, 3)

8. Placing them head to tail and joining the start to the end

9. (5, 5)

10. (6, 0)

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