

February, Week 3

Today: Chapter 1, Vectors

Homework Assignment #3 - Due Today

Mastering Physics: 6 problems from chapter 2.

Written Question: 2.88

Homework Assignment #4 - Due February 8

Mastering Physics: 8 problems from chapters 1 and 3.

Written Question: 3.65

Box numbers can be found on webpage

Example III

$$y = y_0 + (v_{0y})t + \frac{1}{2}a_y t^2$$

$$v_y = v_{0y} + a_y t$$

$$v_y^2 = v_{0y}^2 + 2a_y (x - x_0)$$

Example: A person at the top of a building 30 *m* high, throws an egg upwards at 15 *m/s*. If air resistance is ignored:

- How fast will it be going after 3 *s*?
- How high, from where it was thrown, does the egg go before coming back down?

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- How fast will it be going after 3 *s*?
- How high, from where it was thrown, does the egg go before coming back down?
- How long does it take the egg to hit the ground?

Free-Fall Exercise II

Which of the following statements about the egg hitting the ground is *False*?

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- (e) Both (c) and (d) are false.

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Example: A man is in a hot-air balloon which takes off and rises with a constant 2.5 m/s speed. Just after take off, the man notices that he forgot his camera. A "friend" throws the camera up to him with a speed of 15 m/s . If the man is 2 m above the camera when it is thrown, how high will he be when he catches his camera?

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$$\vec{v} = 5 \text{ m/s at } 37^\circ$$

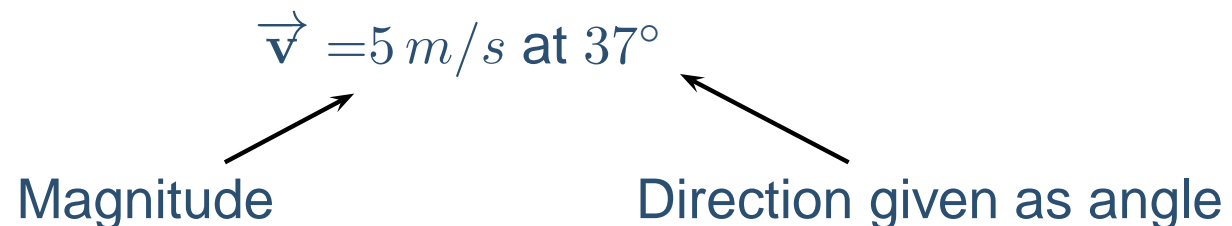
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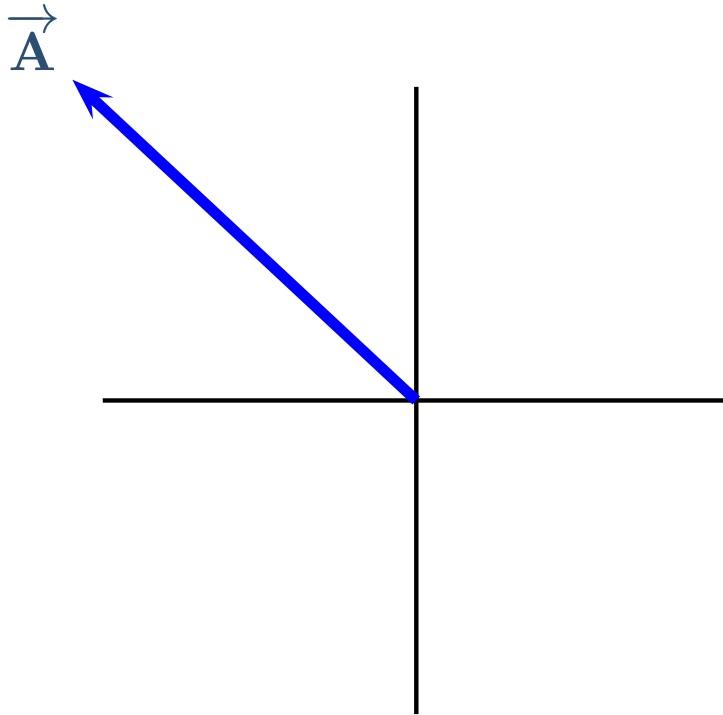


Drawing Vectors

To represent a vector, we use an arrow whose length is proportional to the magnitude.

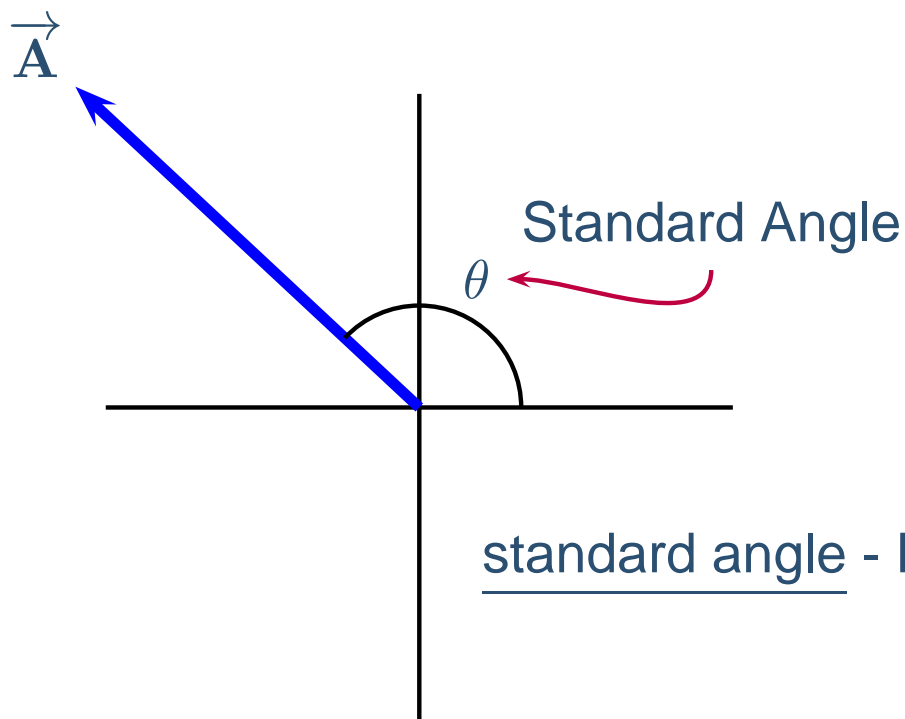
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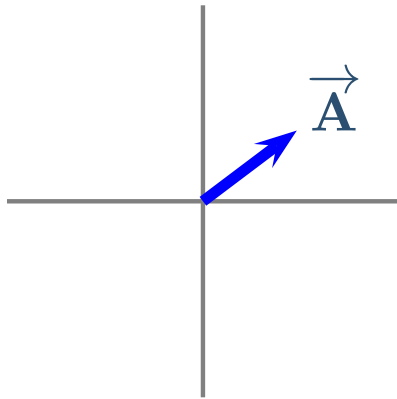
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standard angle - From the positive x -axis

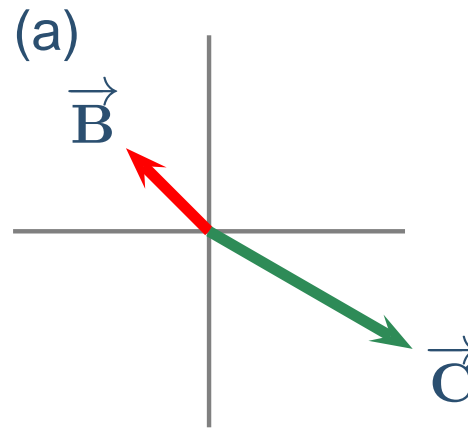
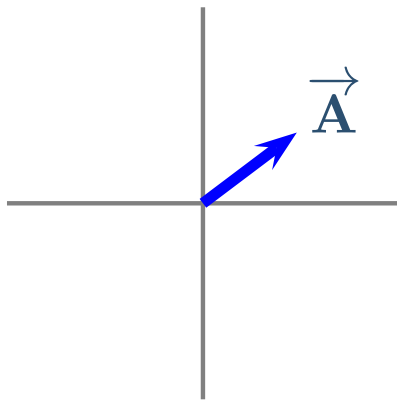
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If $\vec{A} = 5 \text{ m/s}$ at 37° , which of the following drawing correctly shows $\vec{B} = 5 \text{ m/s}$ at 135° and $\vec{C} = 10 \text{ m/s}$ at 330° ?



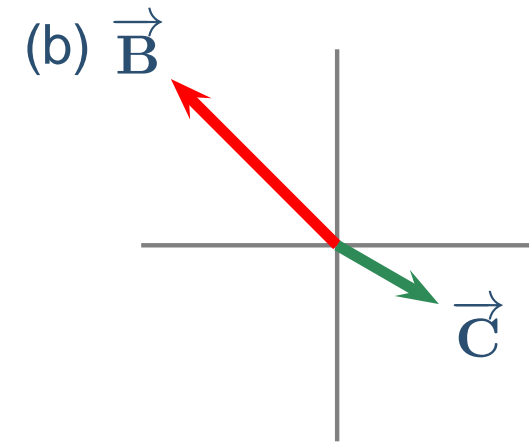
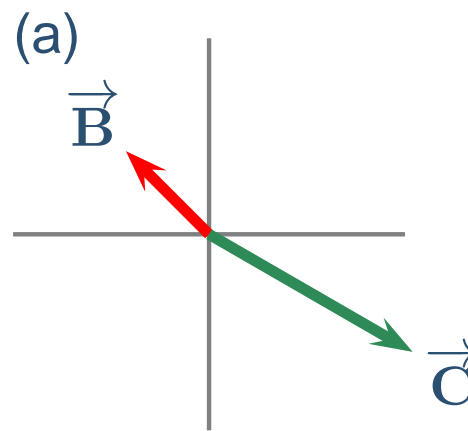
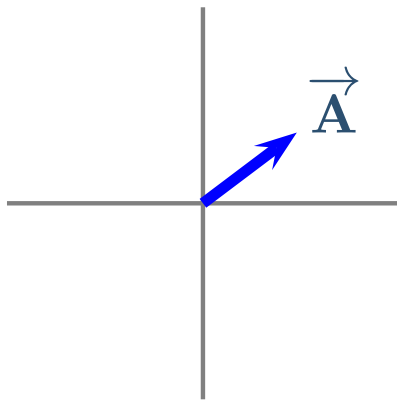
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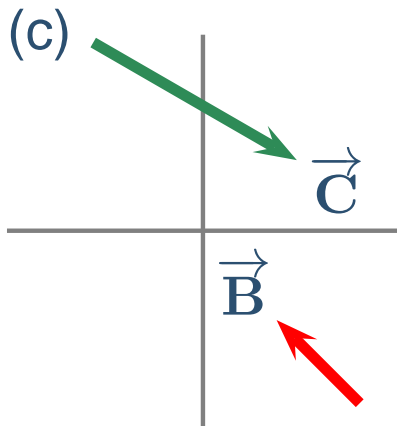
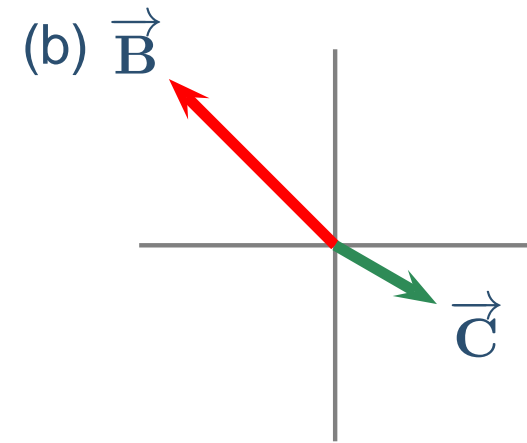
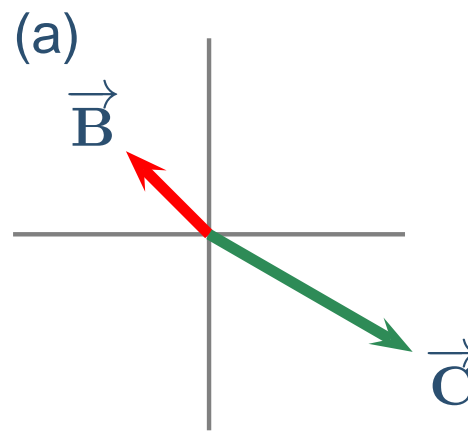
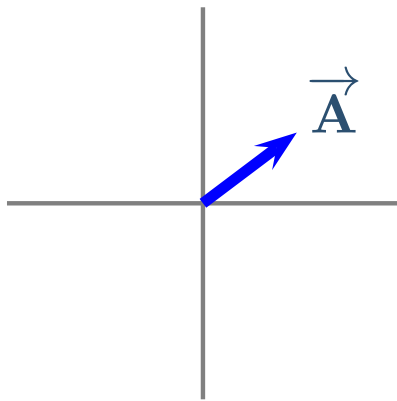
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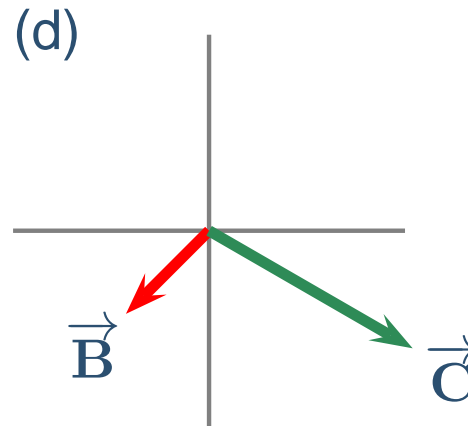
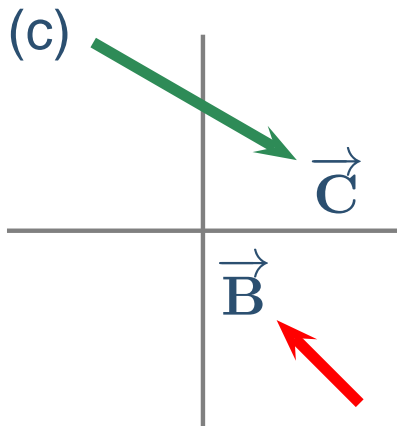
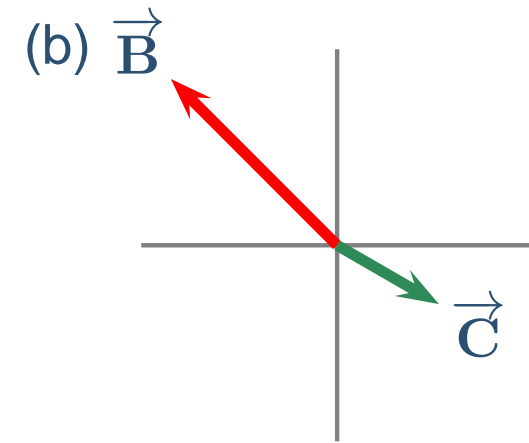
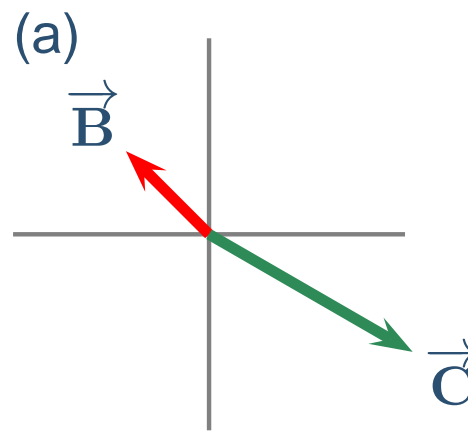
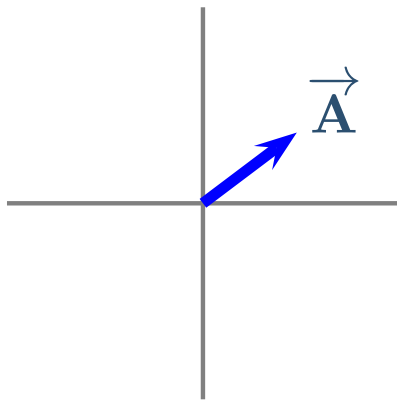
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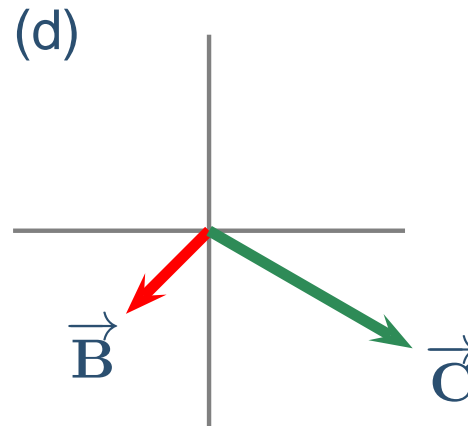
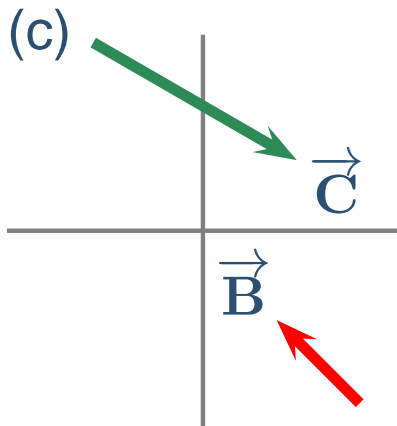
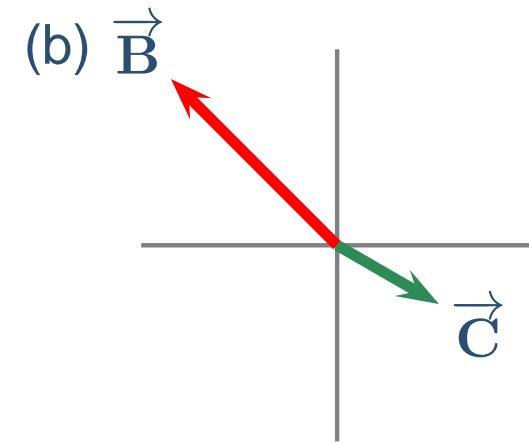
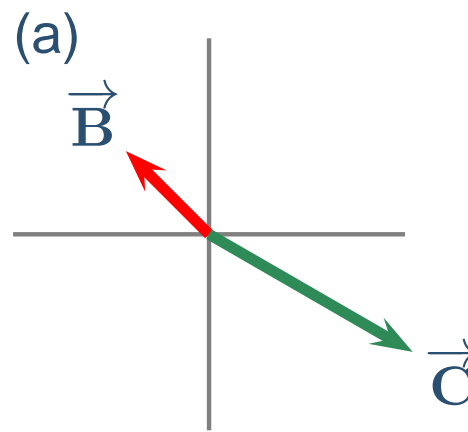
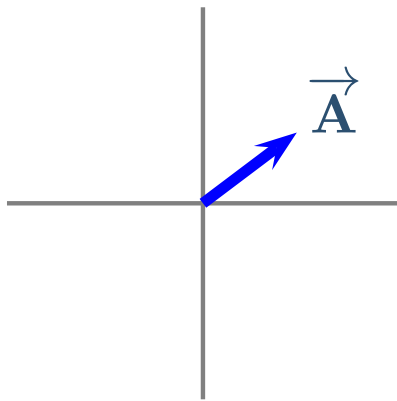
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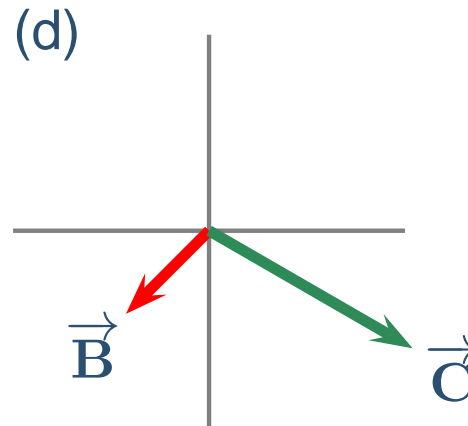
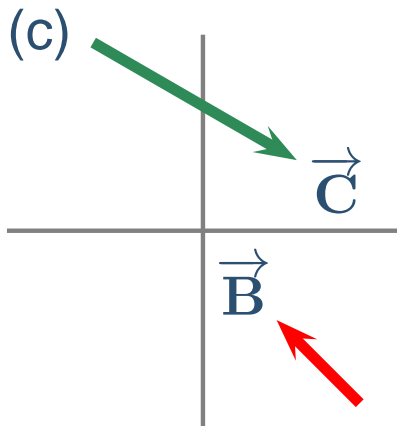
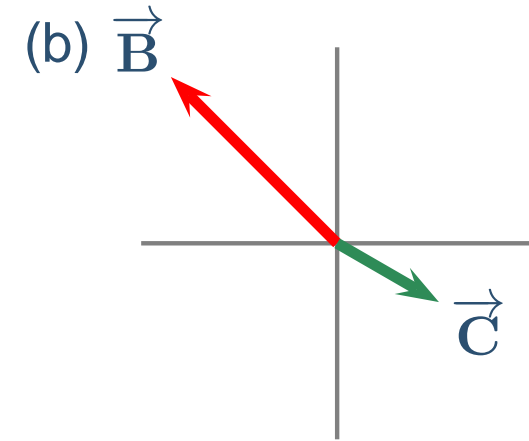
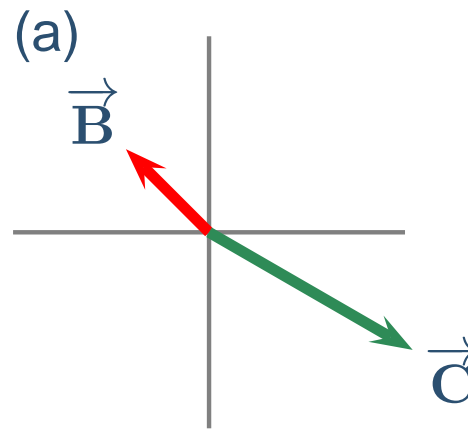
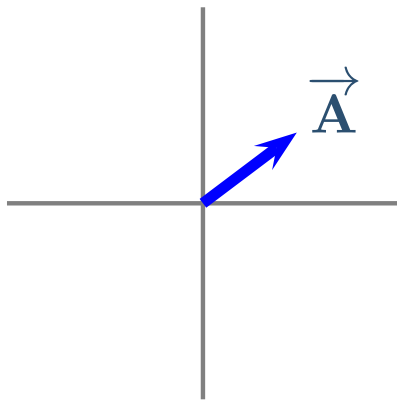
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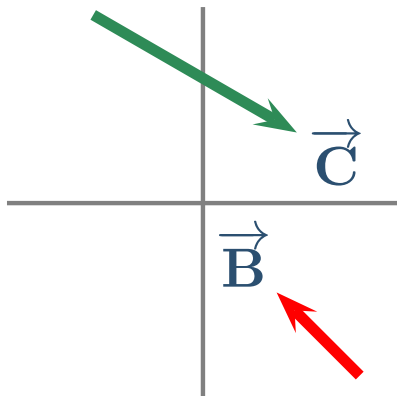
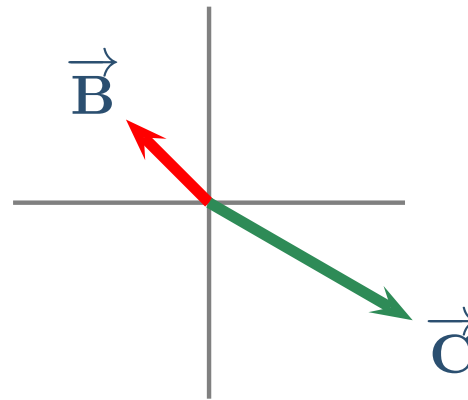
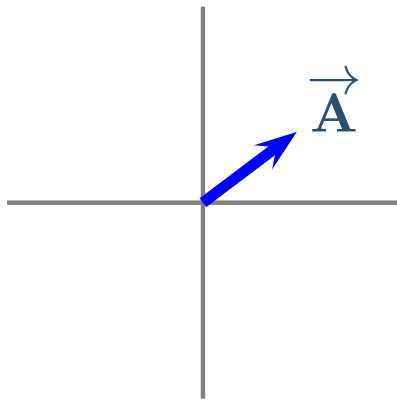
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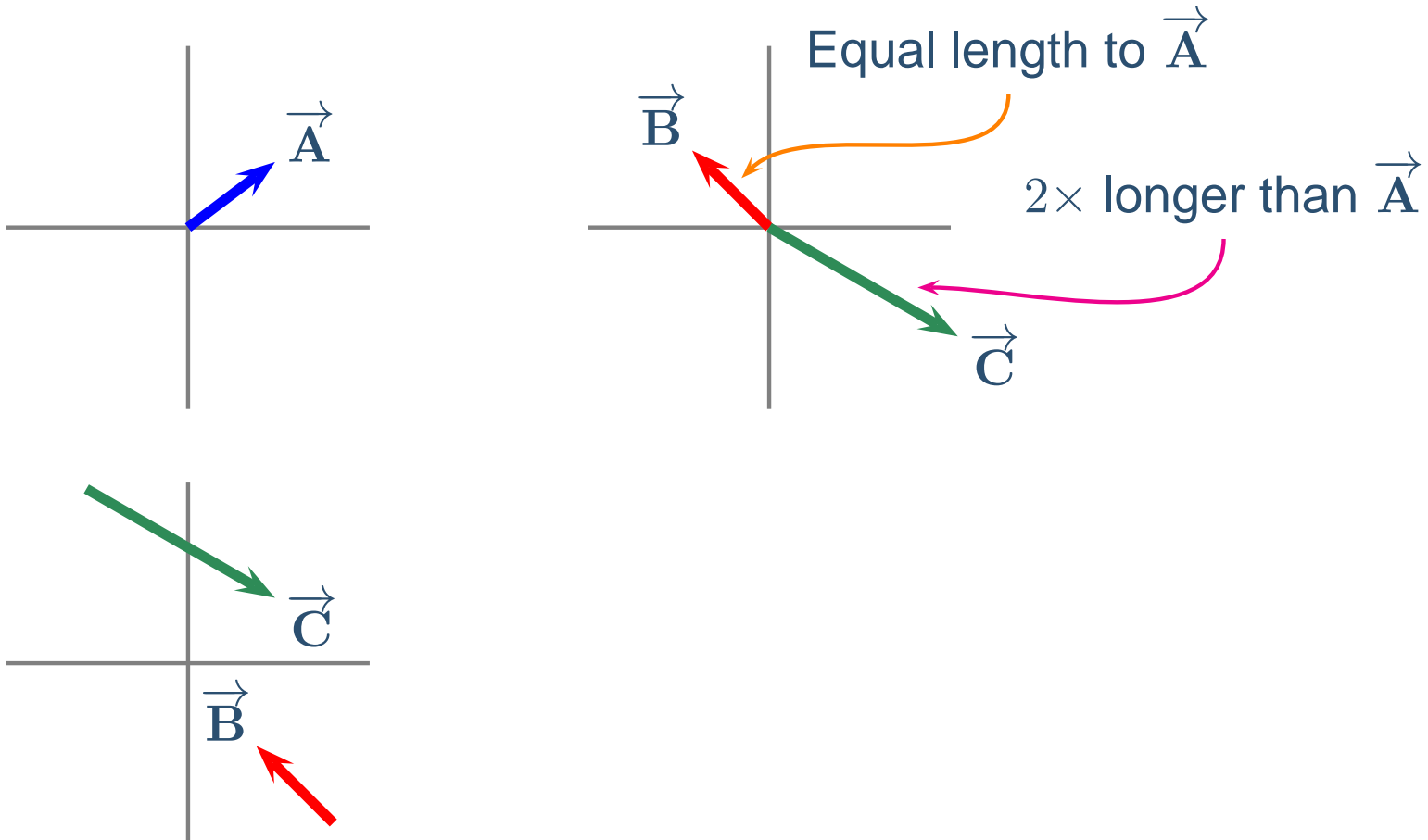
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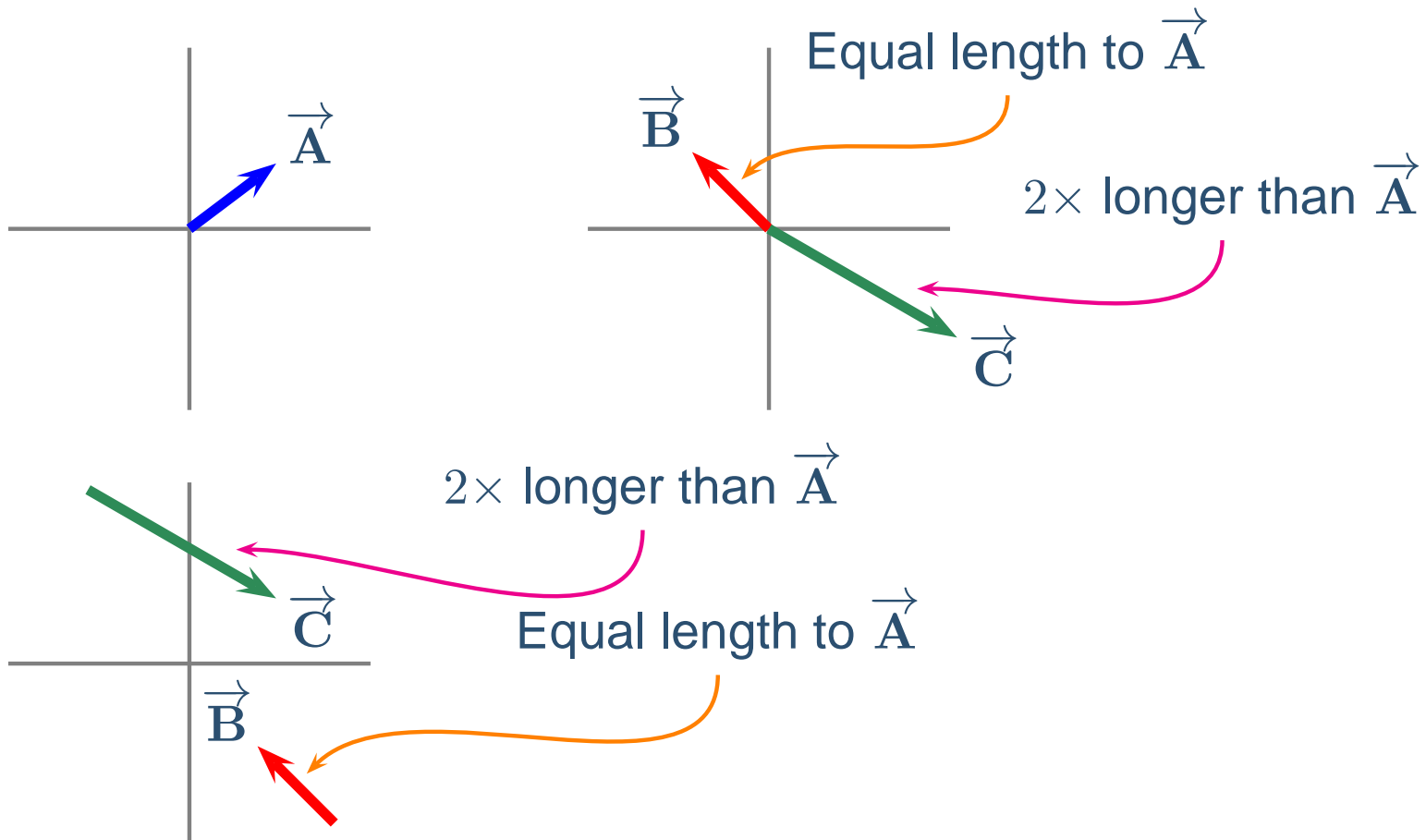
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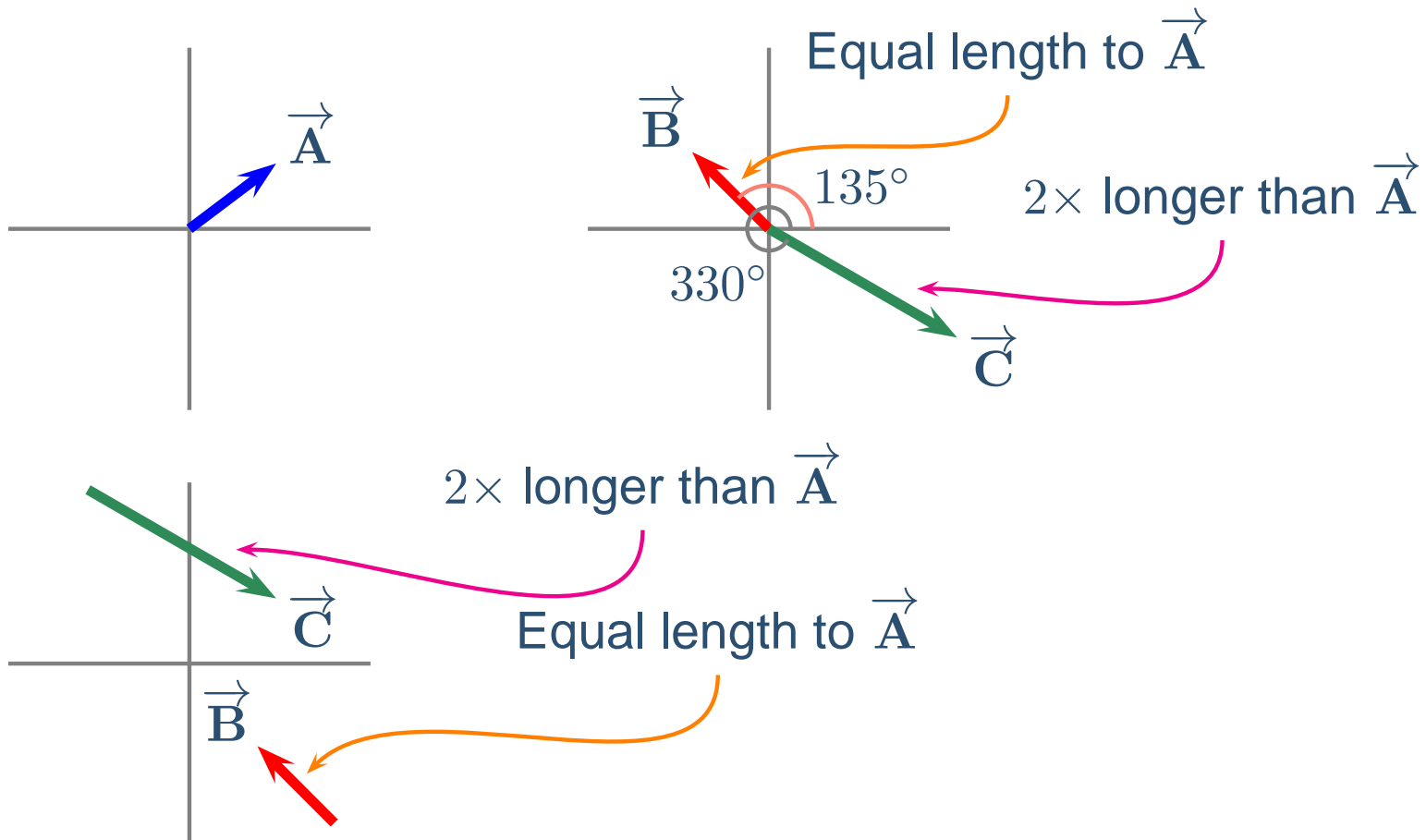
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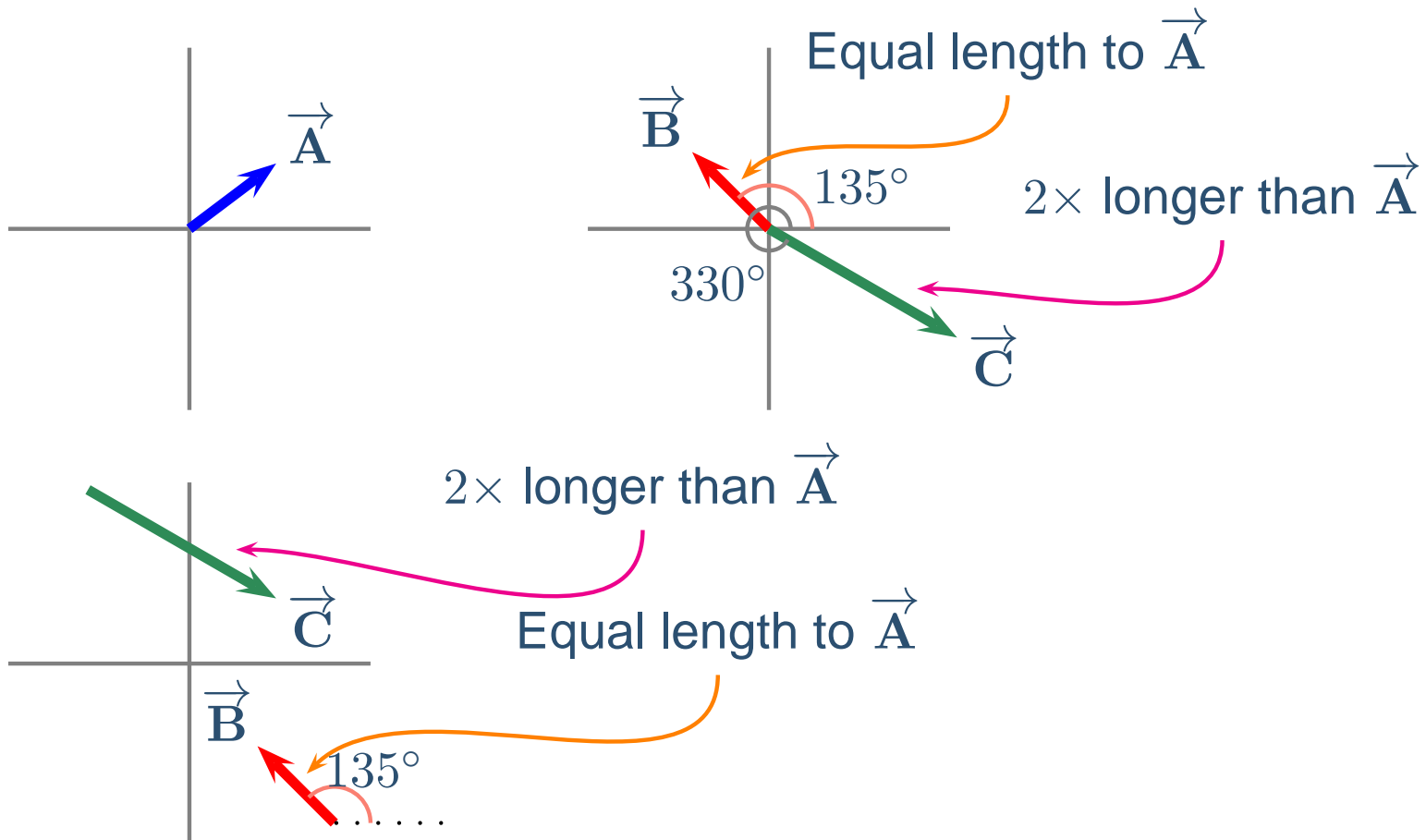
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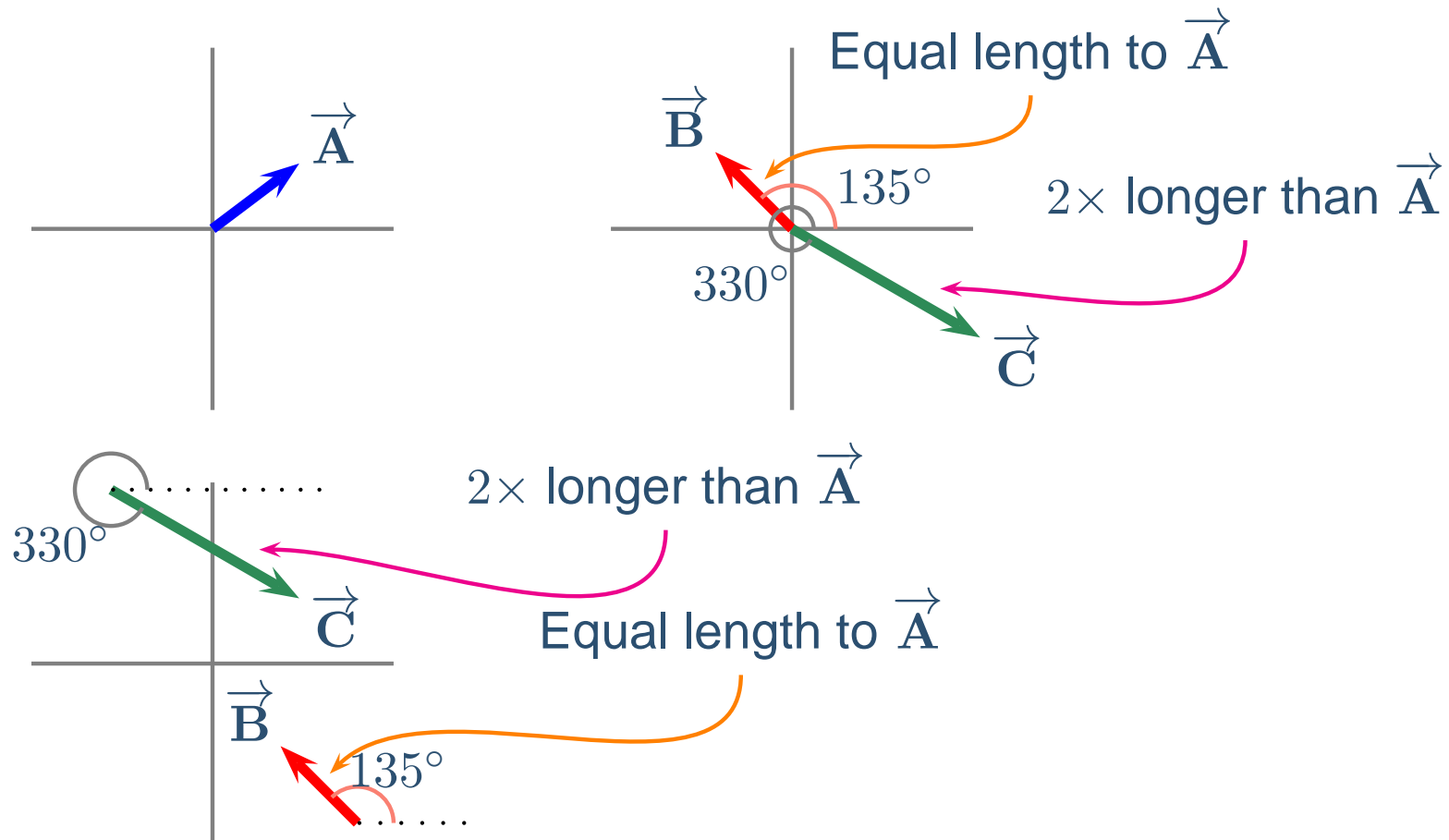
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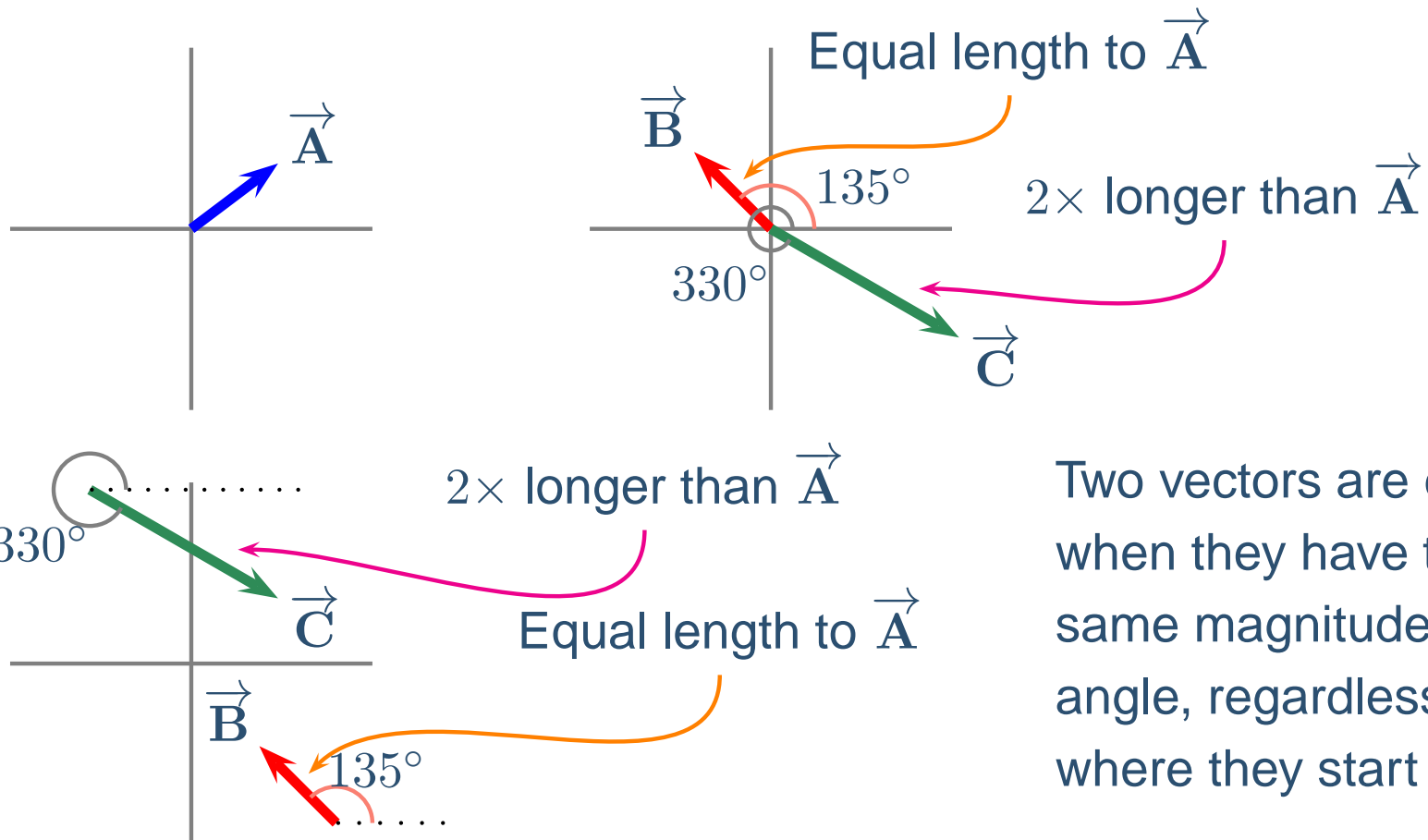
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Two vectors are equal when they have the same magnitude and angle, regardless of where they start

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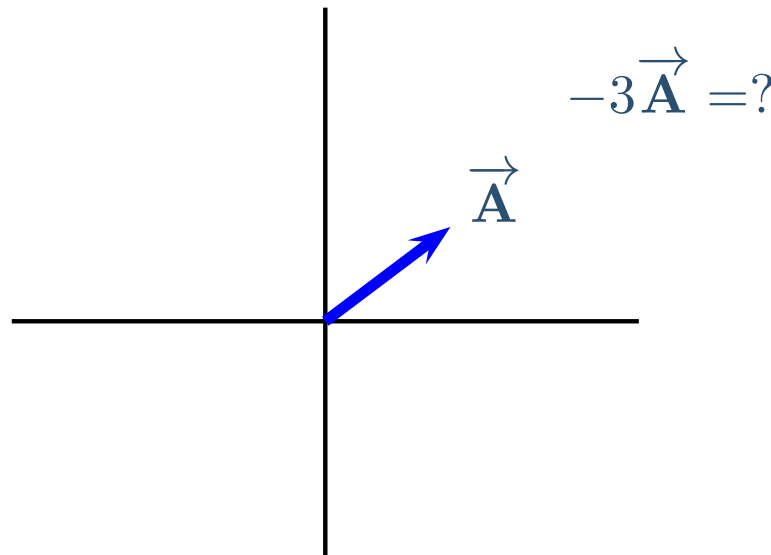
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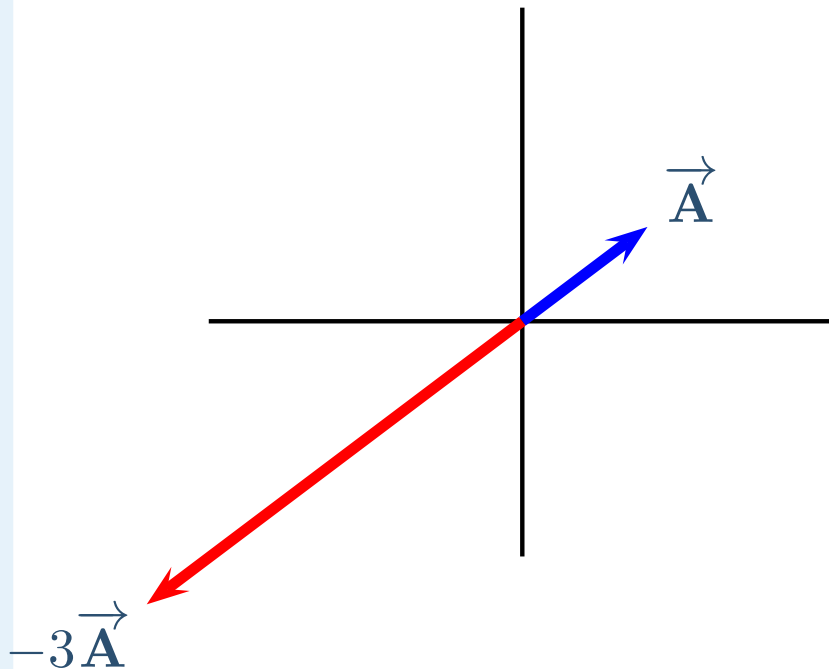


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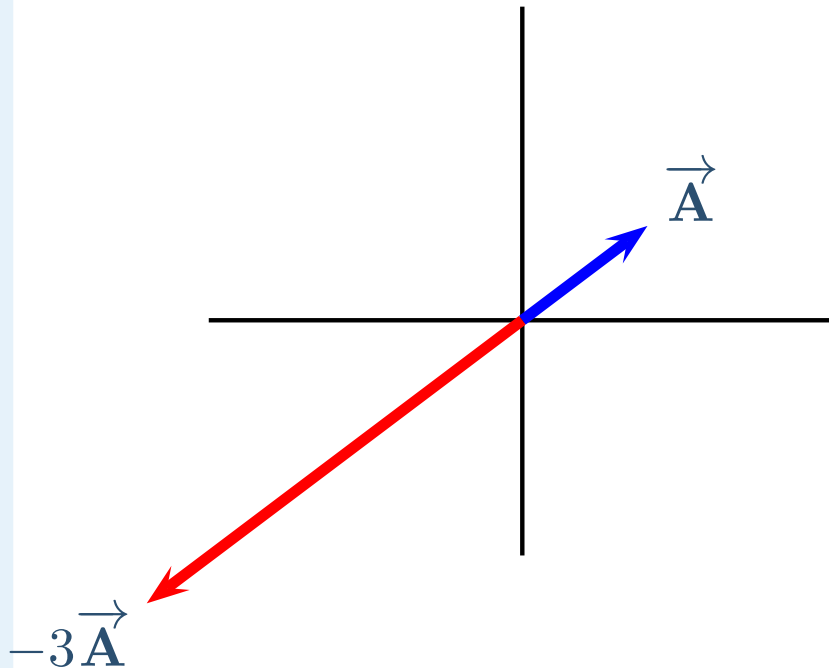


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Of particular interest:

$$\vec{A} = -\vec{B}$$

\Rightarrow equal magnitude
but opposite direction
- equal but opposite

Vector Addition

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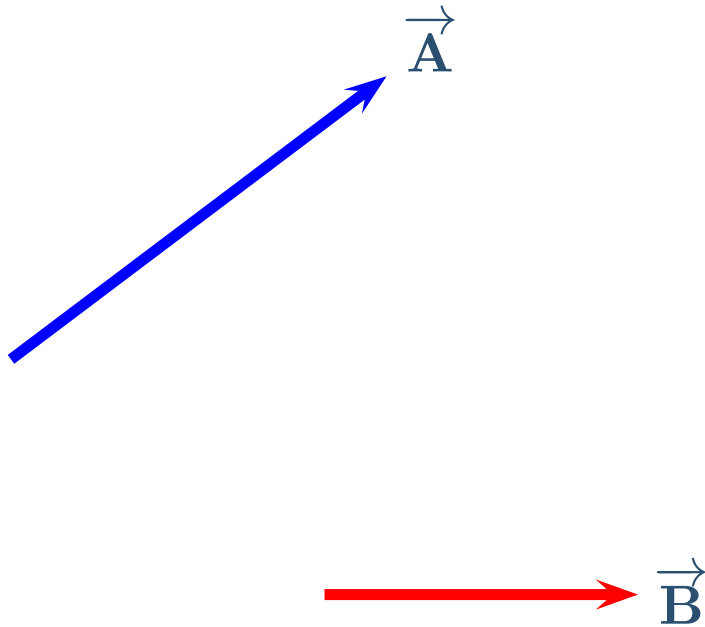
Graphical Addition - Drawing pictures and placing the vectors, "tip-to-tail" in order to determine the vector sum.

Example II

Add the following vectors.

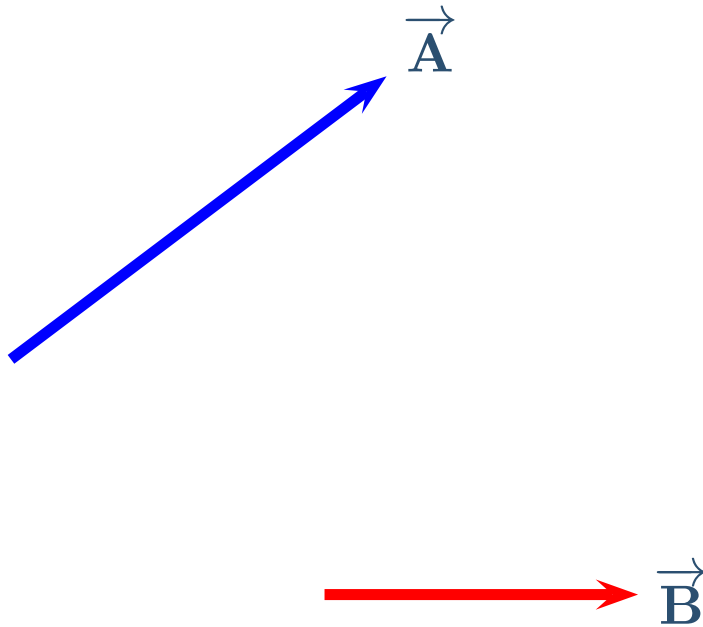
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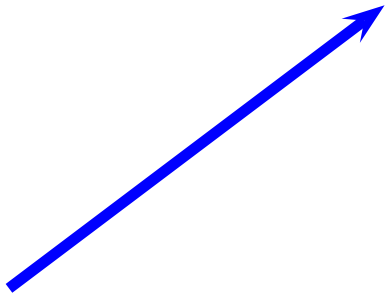
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Vectors can be drawn at any point. As long as the magnitude and direction don't change.

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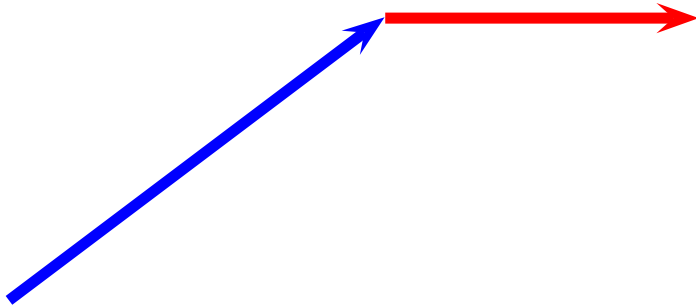
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First draw \vec{A} .

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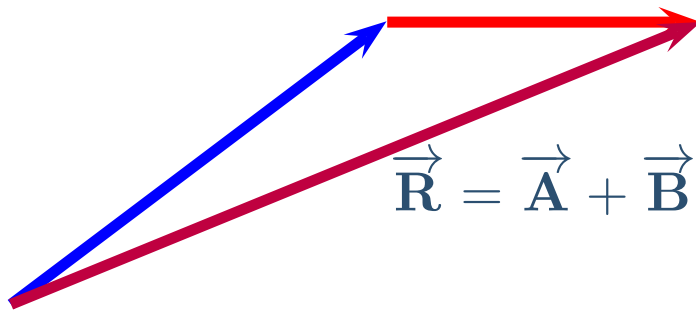
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Then draw \vec{B}
at the front of \vec{A} .

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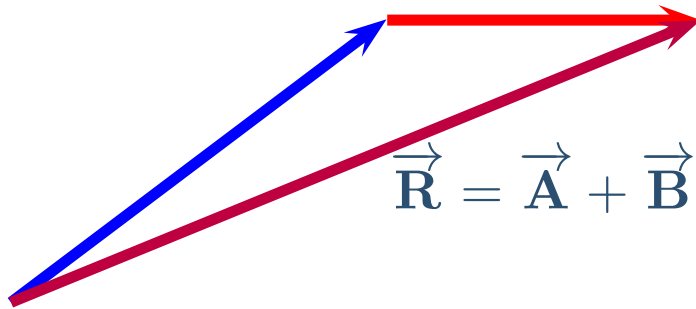
Add the following vectors.



The vector sum or resultant, \vec{R} goes from the remaining tail to tip.

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A carefully drawn picture can give magnitude and direction of \vec{R} . Simply use a ruler and protractor.

Vector Addition is commutative

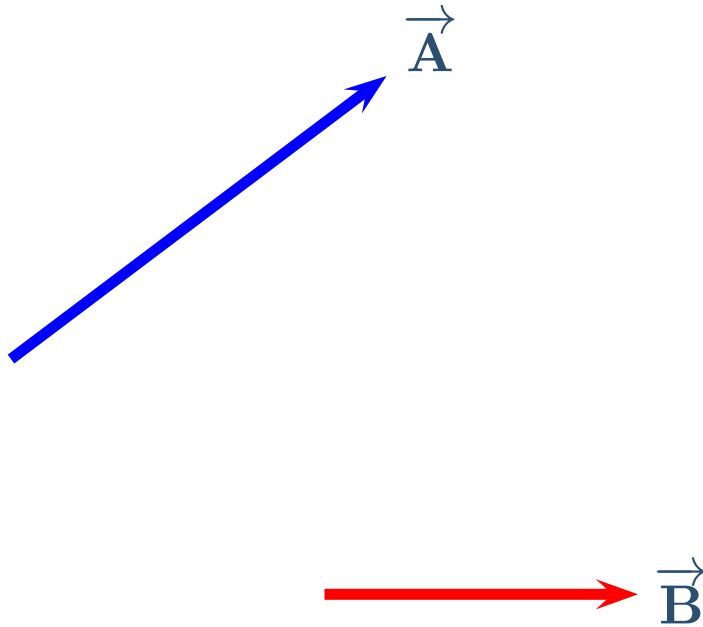
You can add vectors in either order and the answer is the same!

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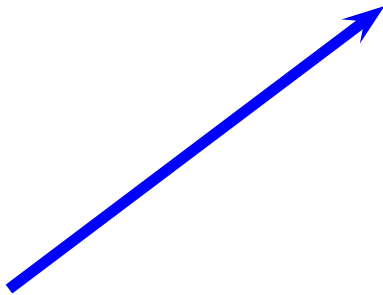
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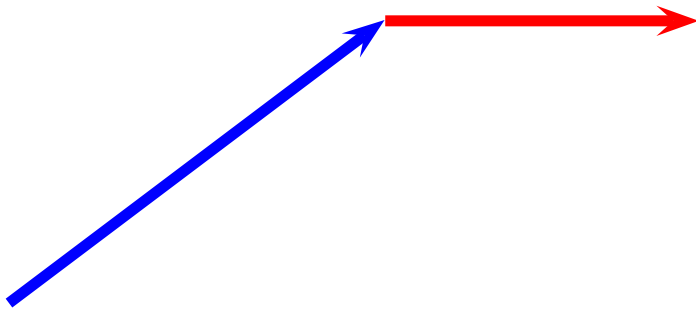


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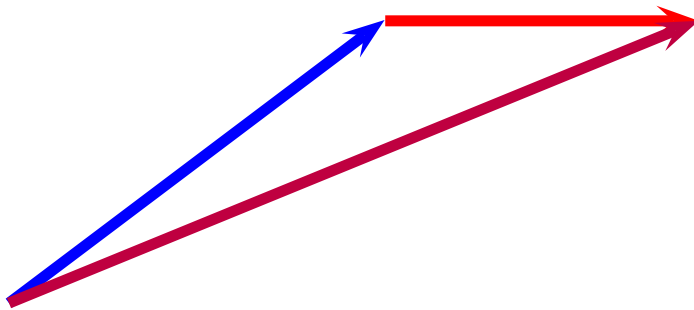


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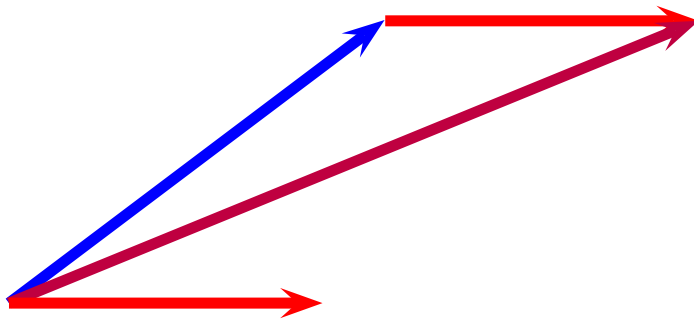


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$$\vec{R} = \vec{A} + \vec{B} = \vec{B} + \vec{A}$$

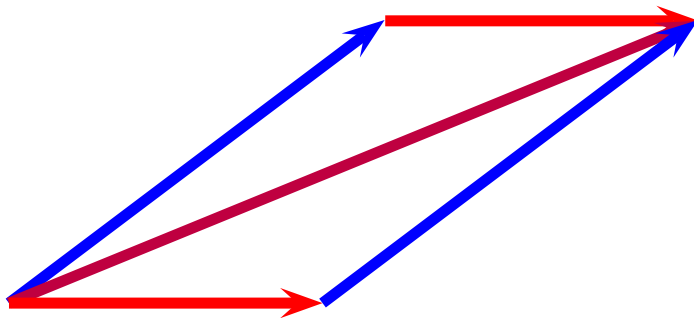


Now do $\vec{B} + \vec{A}$.

Vector Addition is commutative

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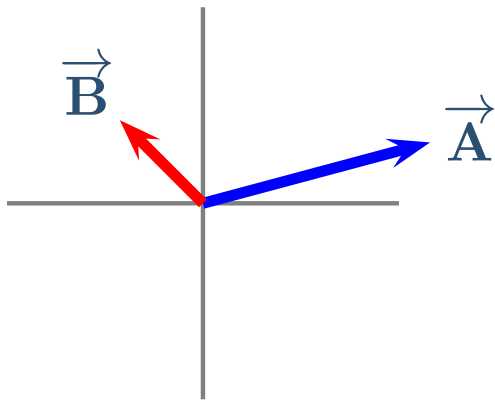
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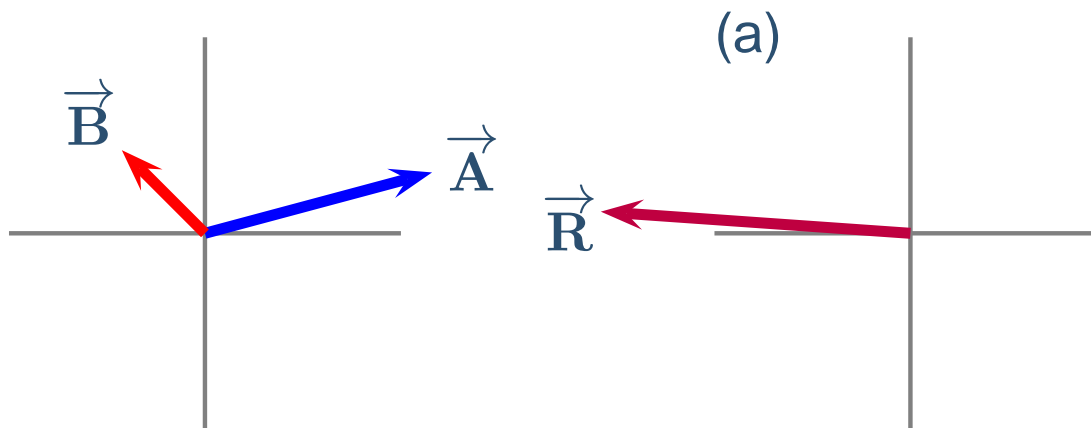
Vector Addition Exercise

For the vectors \vec{A} and \vec{B} , which of the following correctly shows \vec{R} , where $\vec{R} = \vec{A} + \vec{B}$?



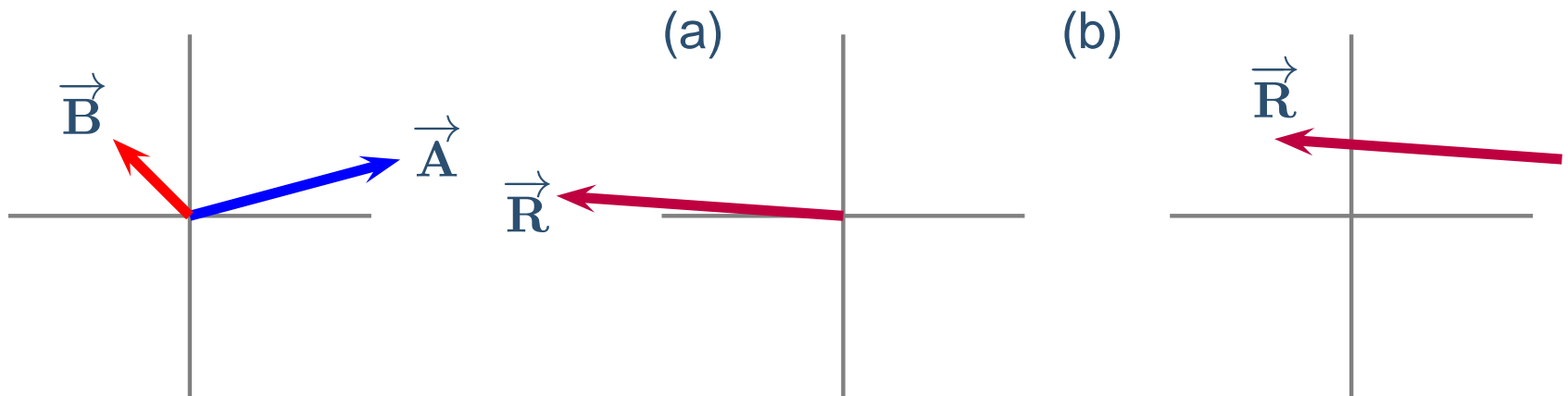
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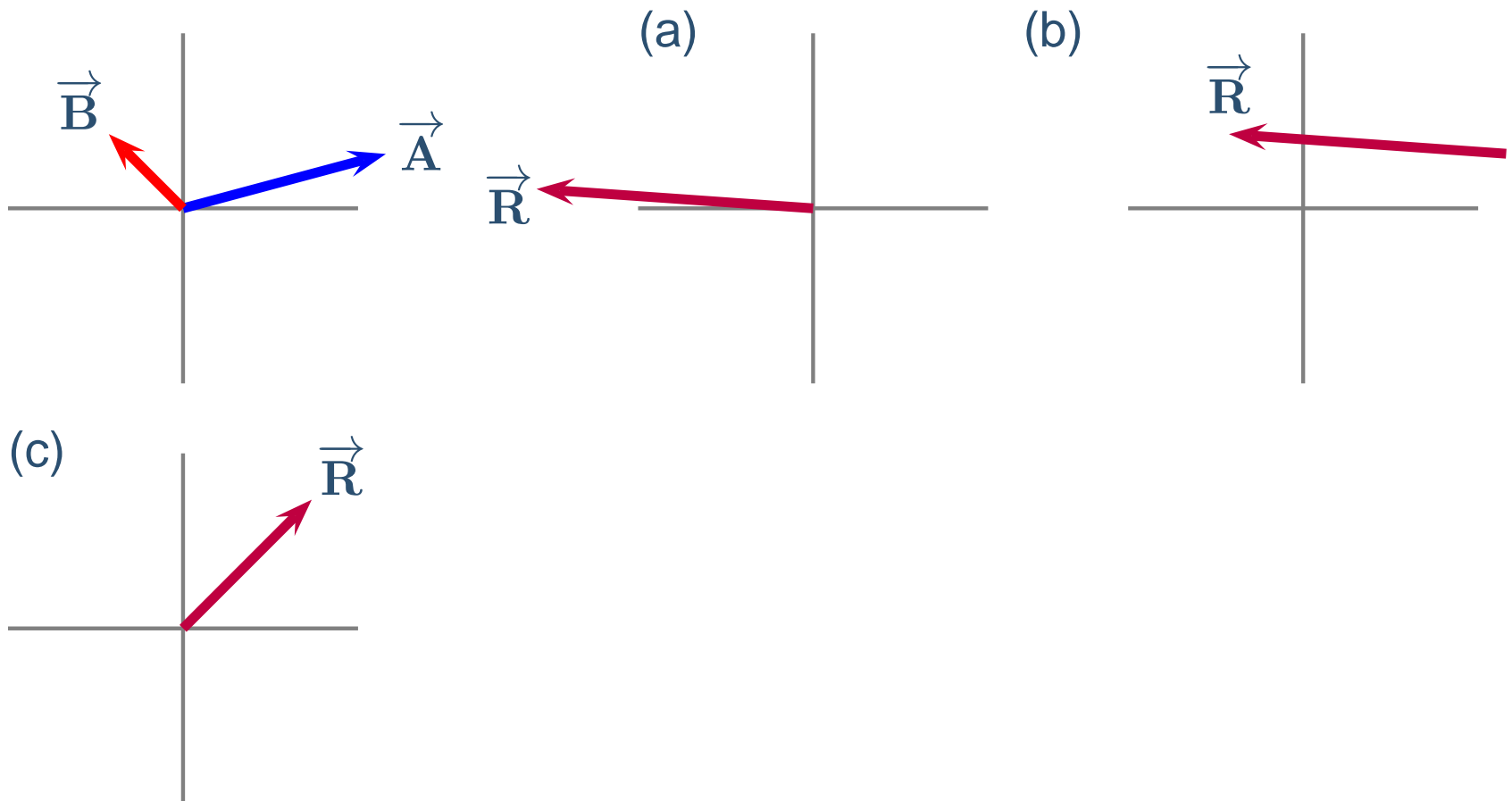
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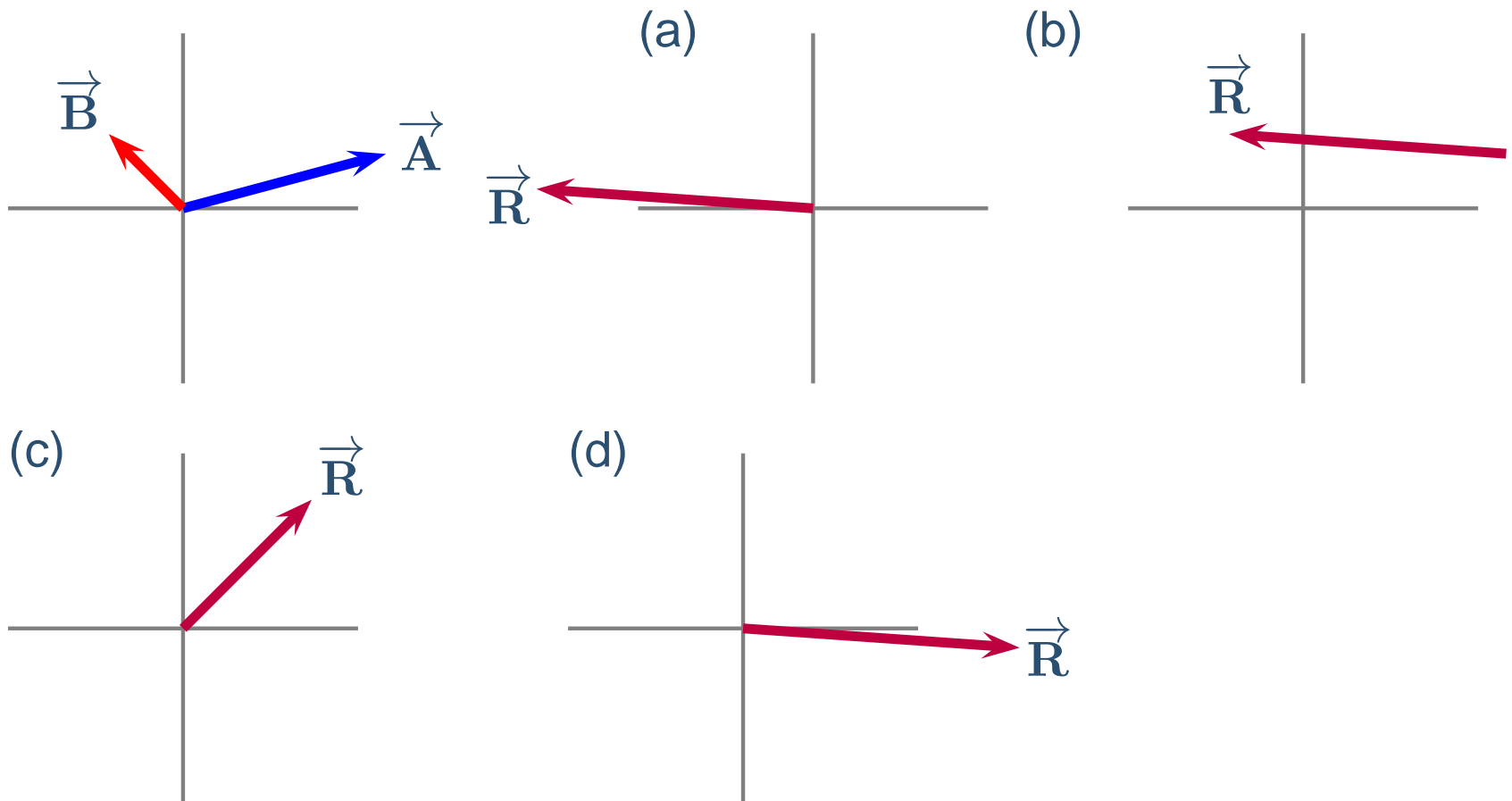
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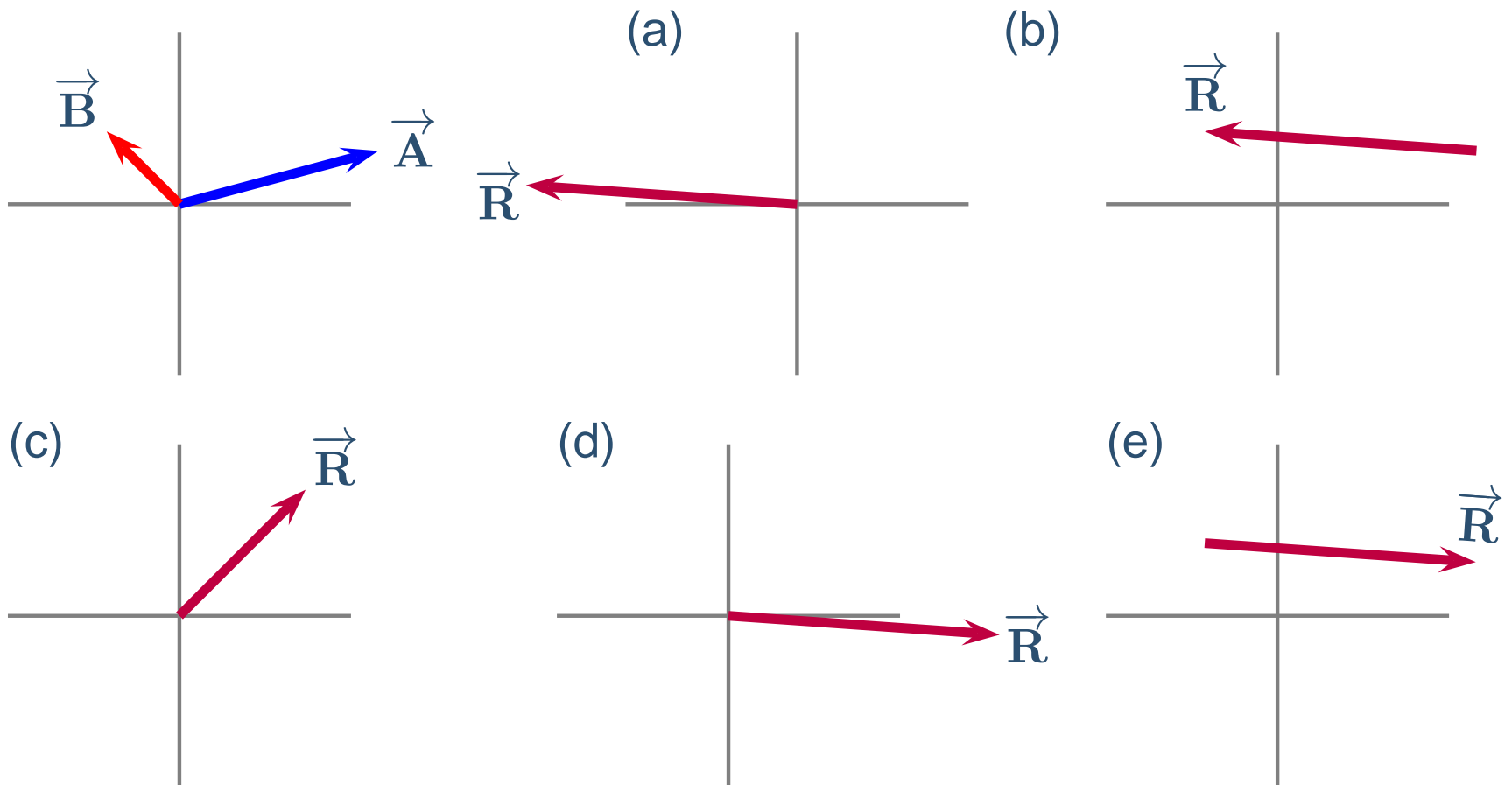
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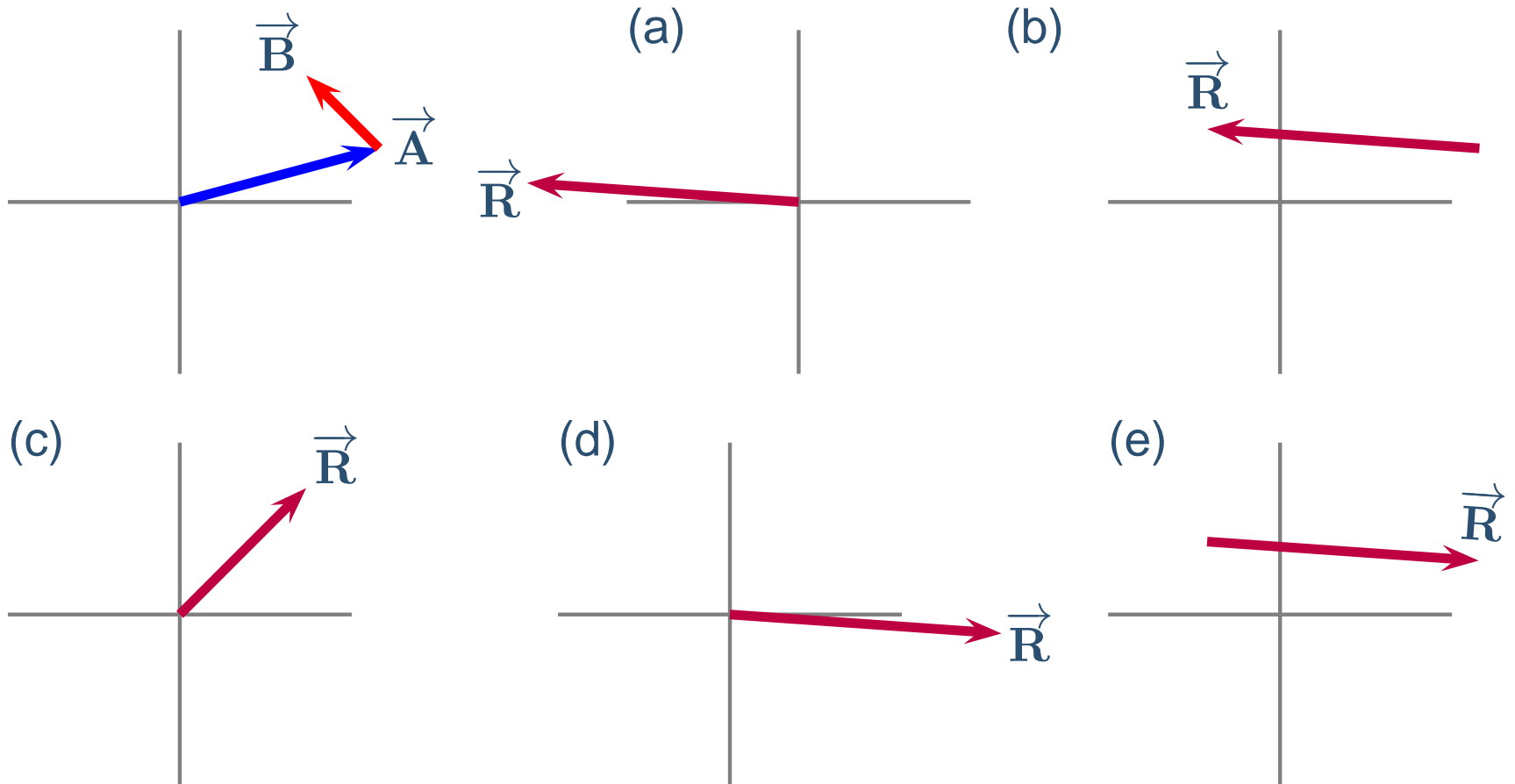
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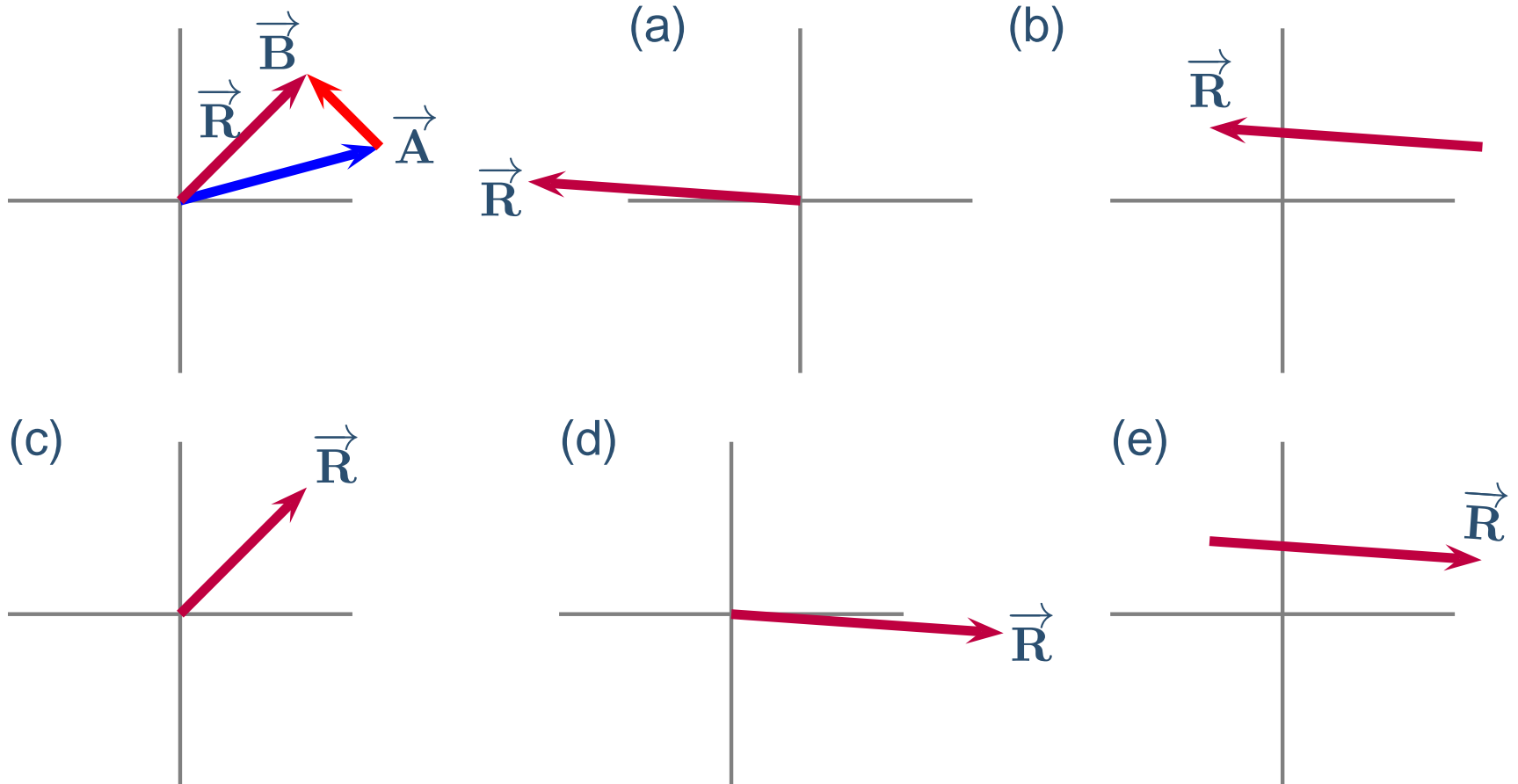
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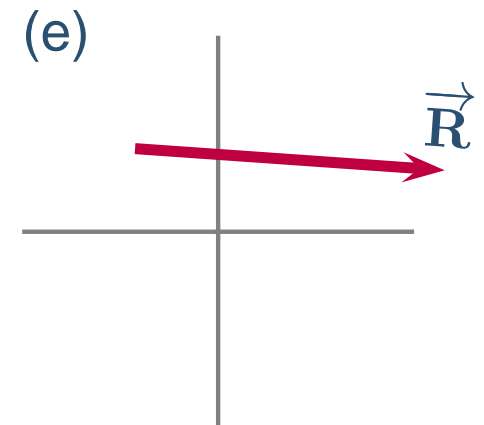
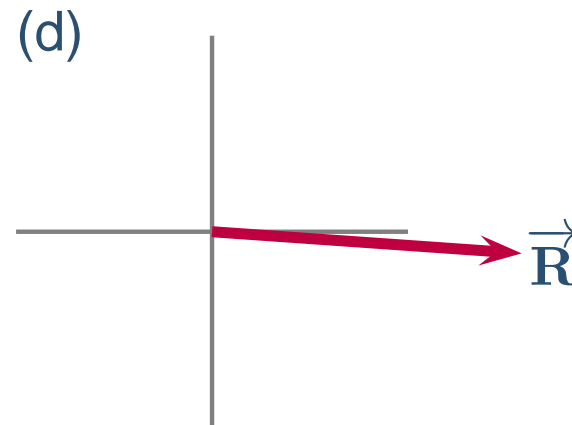
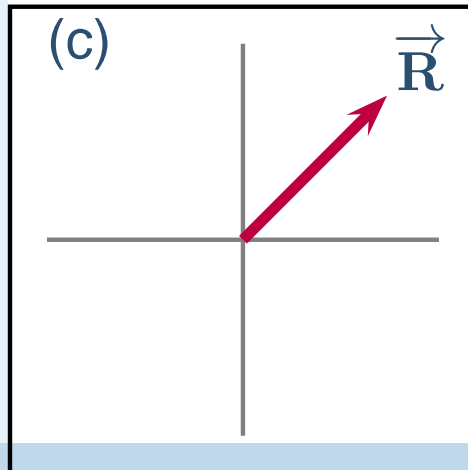
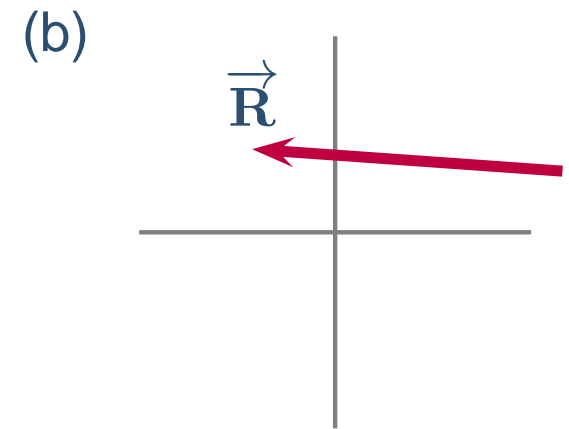
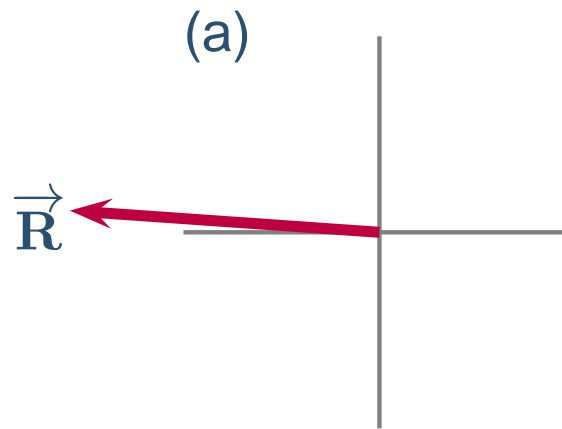
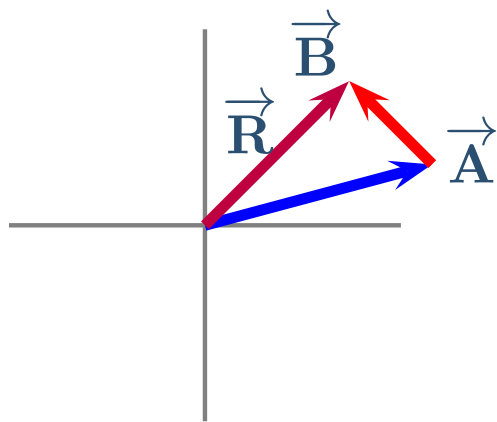
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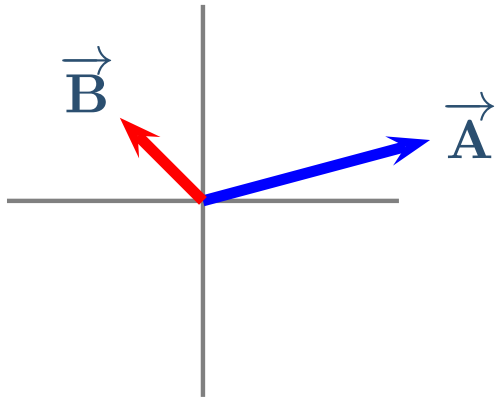
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Vector Subtraction

The previous example contained two vector subtractions.



Vector Subtraction

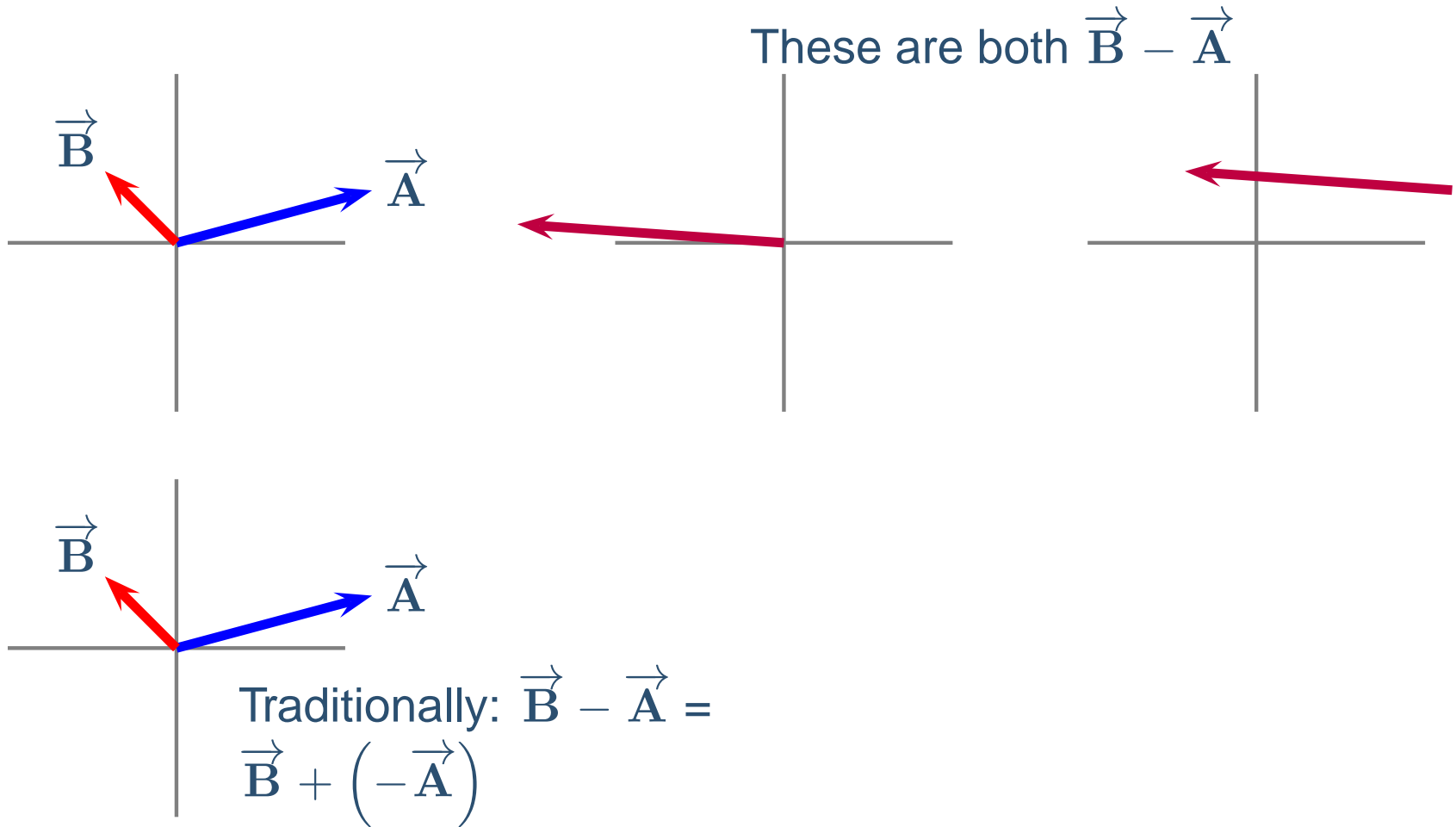
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These are both $\vec{B} - \vec{A}$



Vector Subtraction

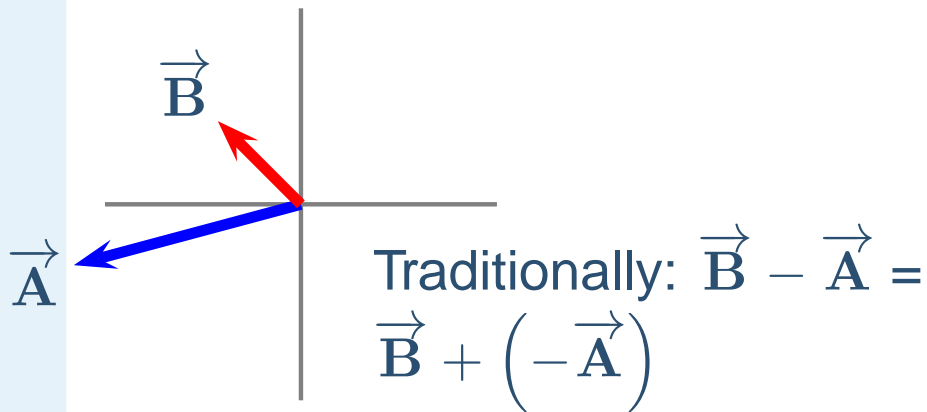
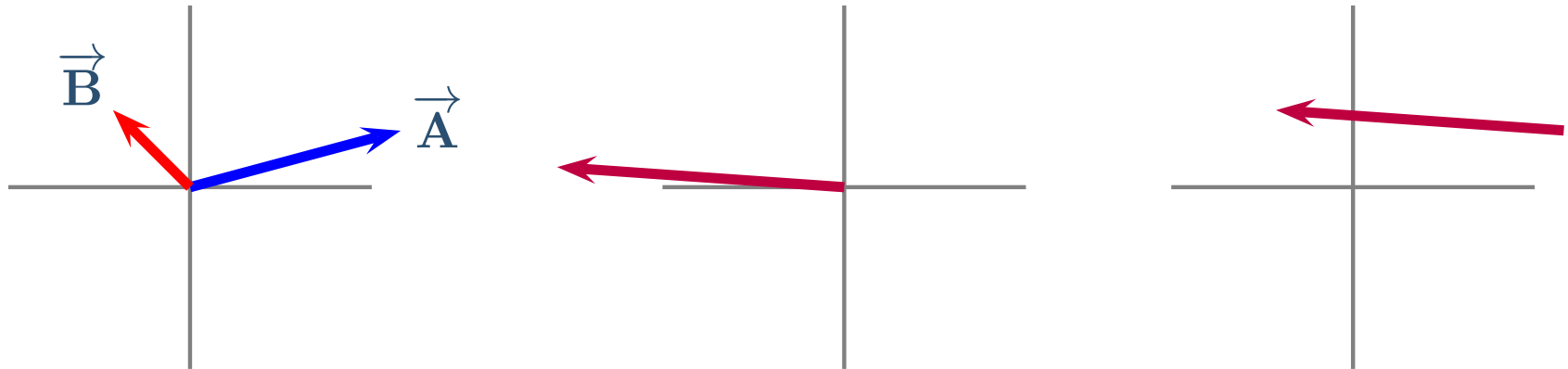
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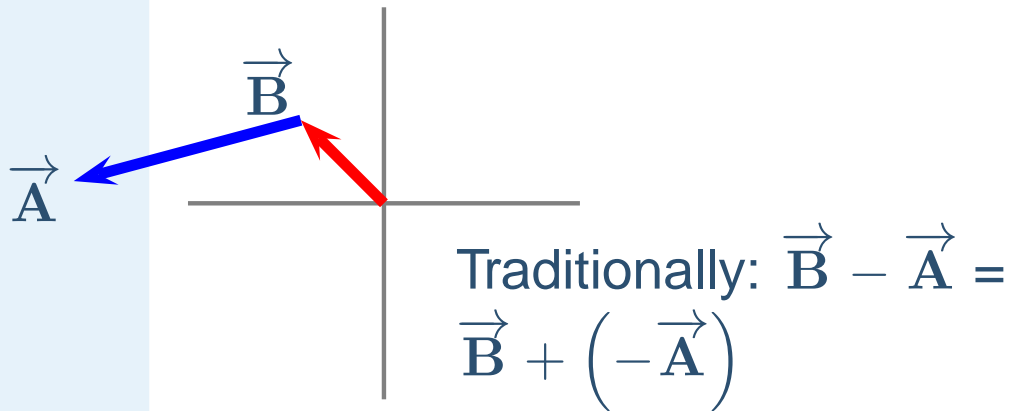
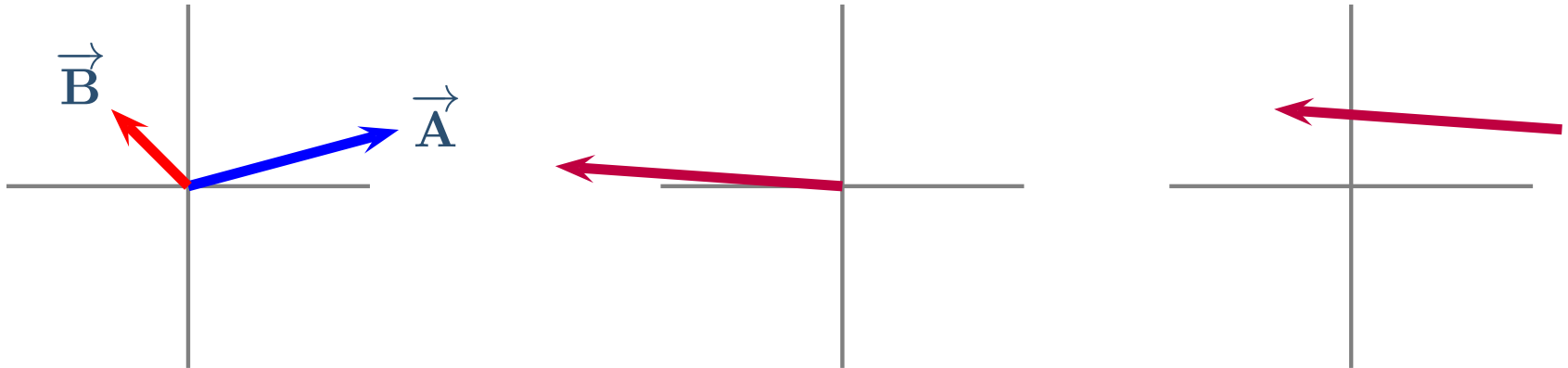
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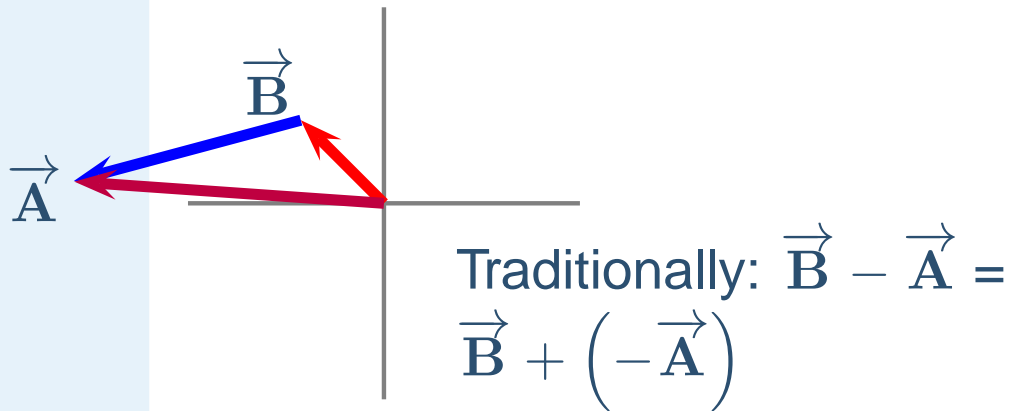
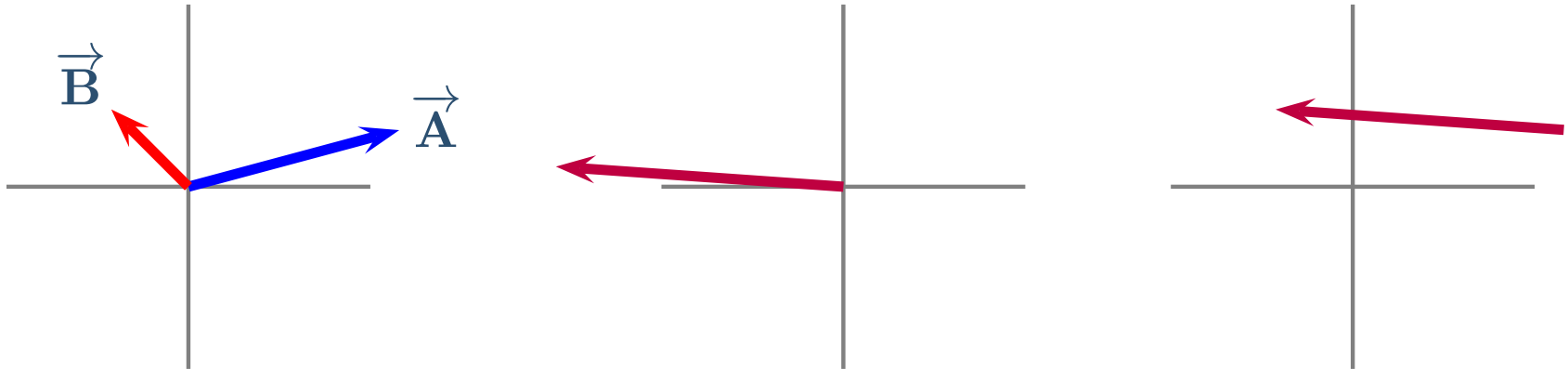
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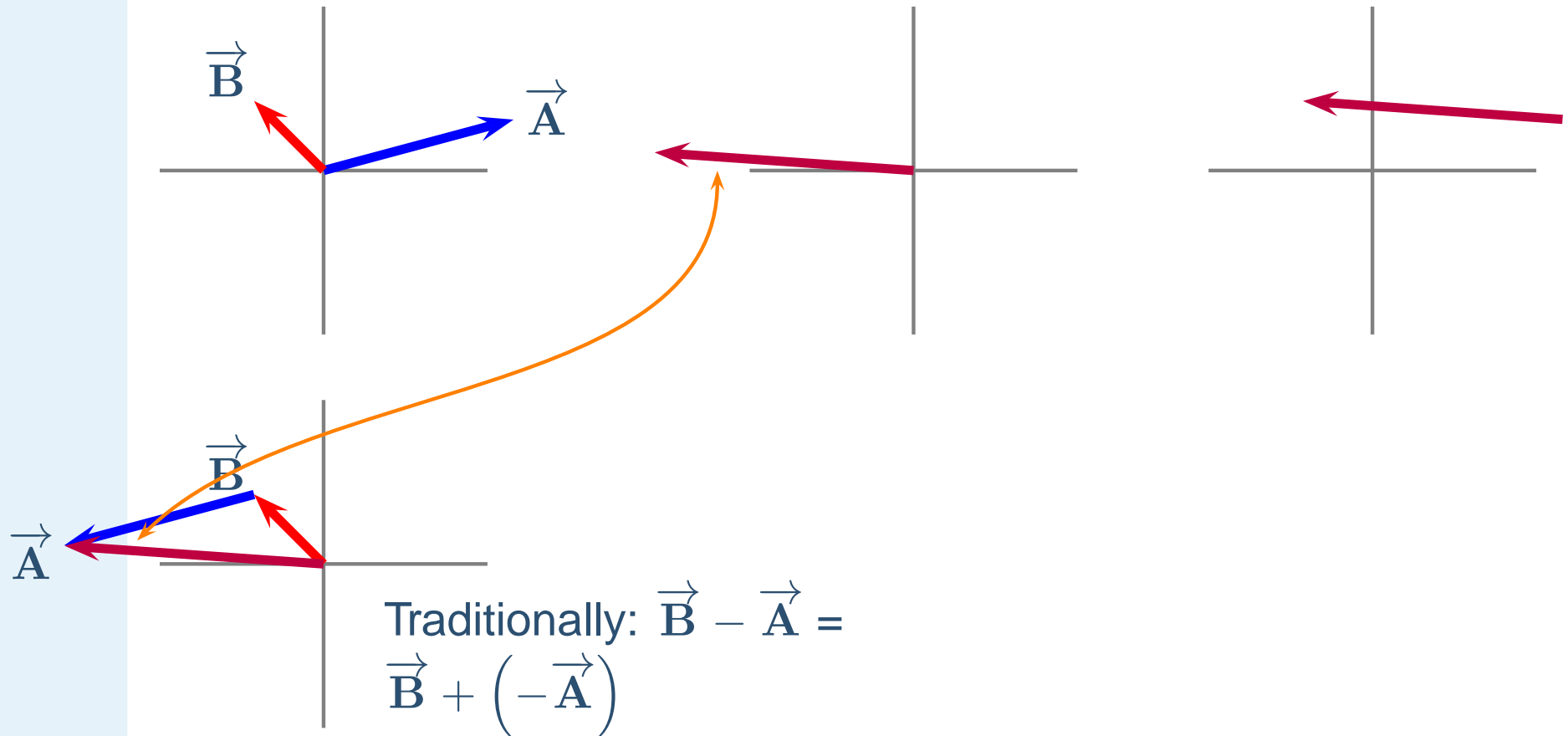


Traditionally: $\vec{B} - \vec{A} = \vec{B} + (-\vec{A})$

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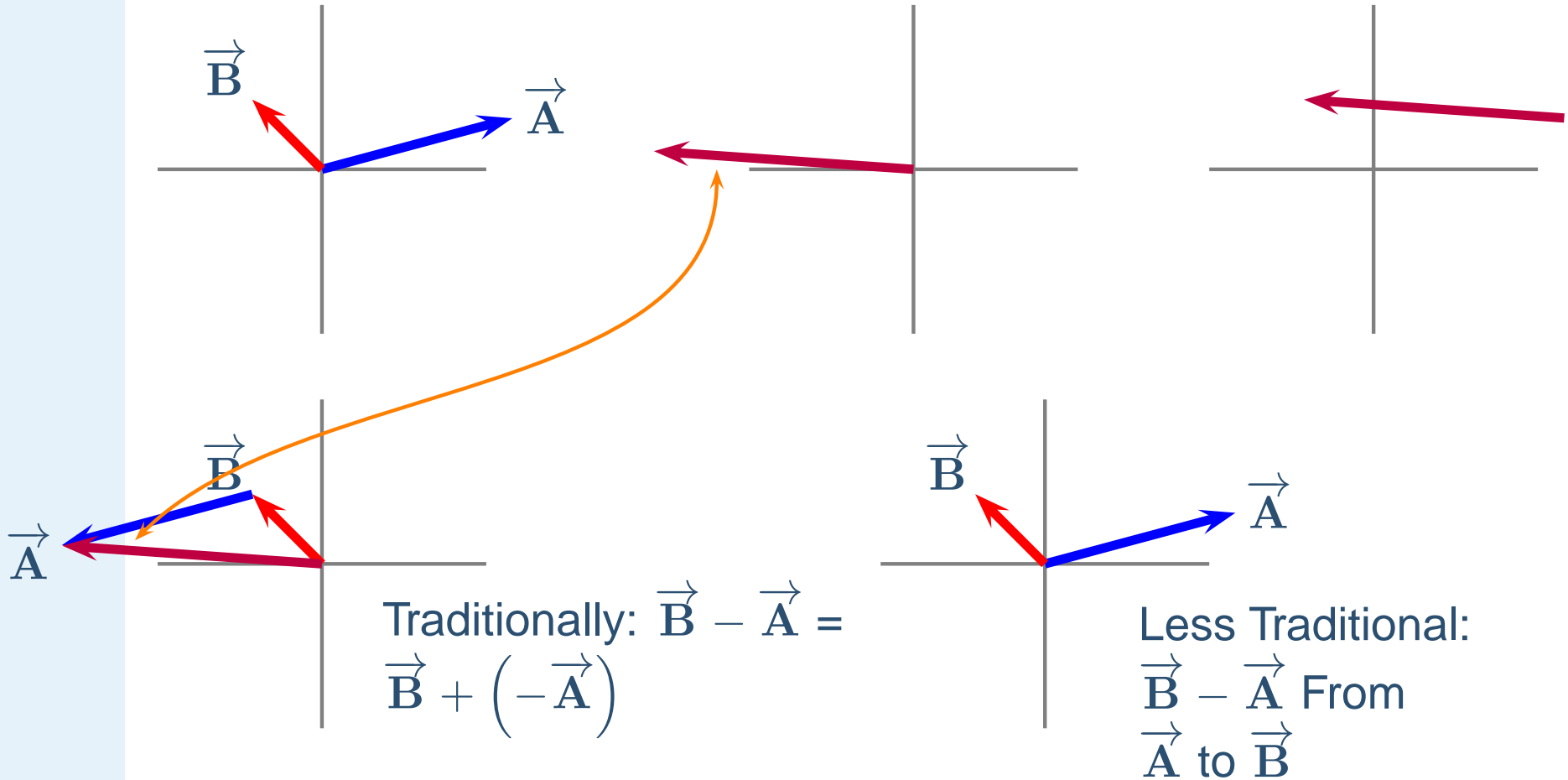
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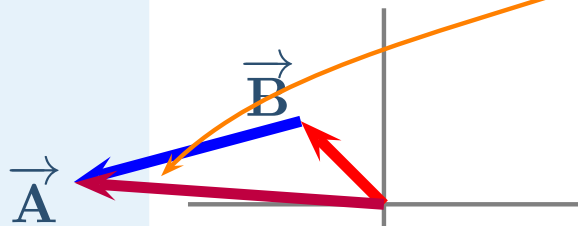
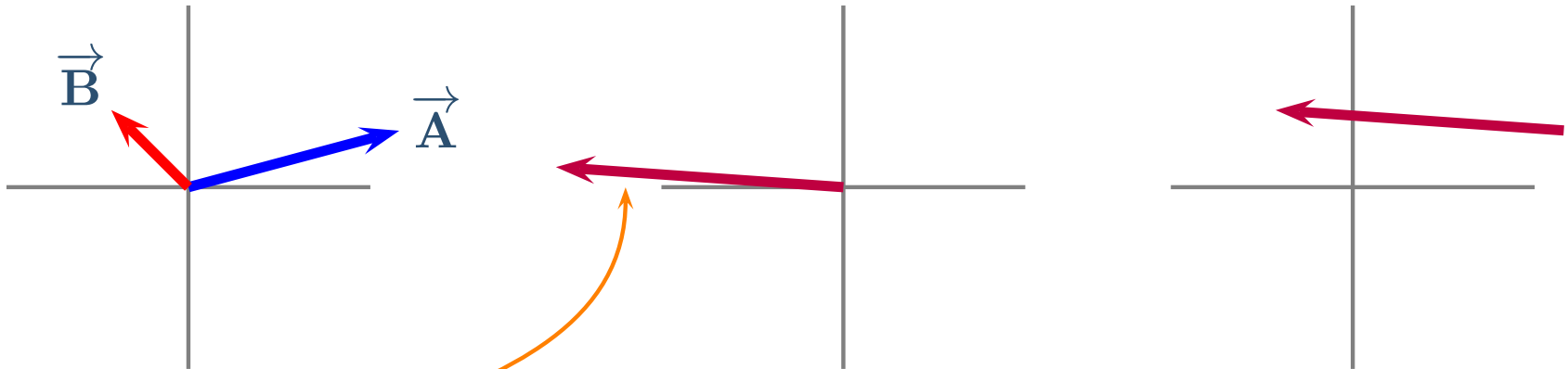
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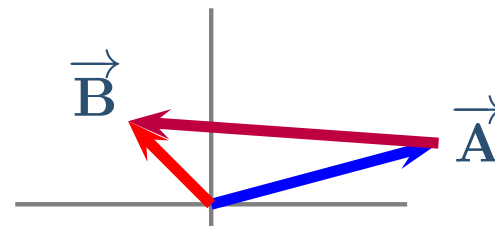
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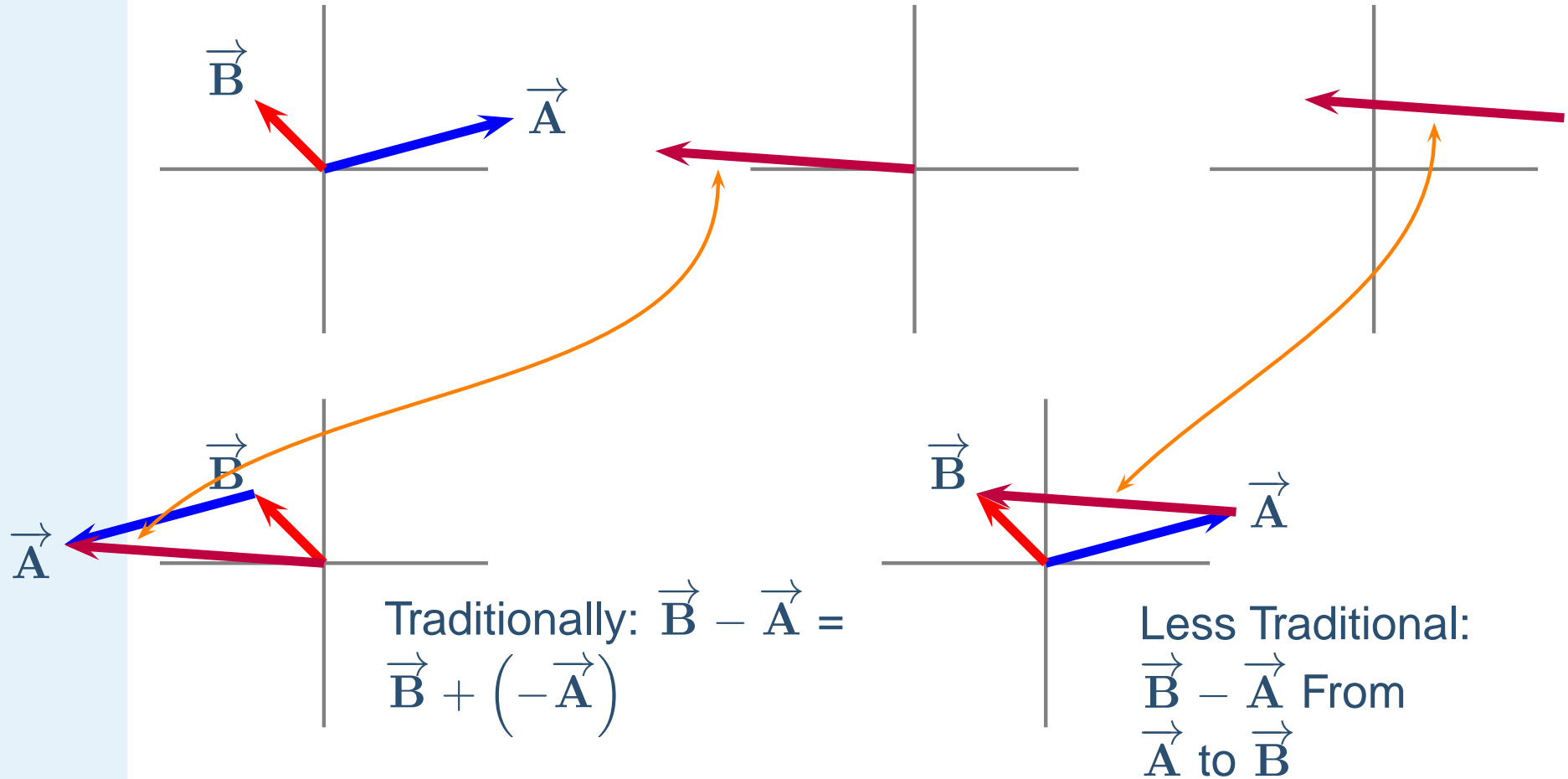


Less Traditional:
 $\vec{B} - \vec{A}$ From
 \vec{A} to \vec{B}

Vector Subtraction

The previous example contained two vector subtractions.

These are both $\vec{B} - \vec{A}$



Vector Subtraction

The previous example contained two vector subtractions.

