Question:

Which of the following statements concerning vectors is correct?

I. **Adding a series of vectors in any order will not change their resultant.**
II. **Moving vectors parallel to themselves changes their direction, but their magnitudes stay the same.**
III. **Multiplying a vector by a scalar only changes the vector's magnitude.**

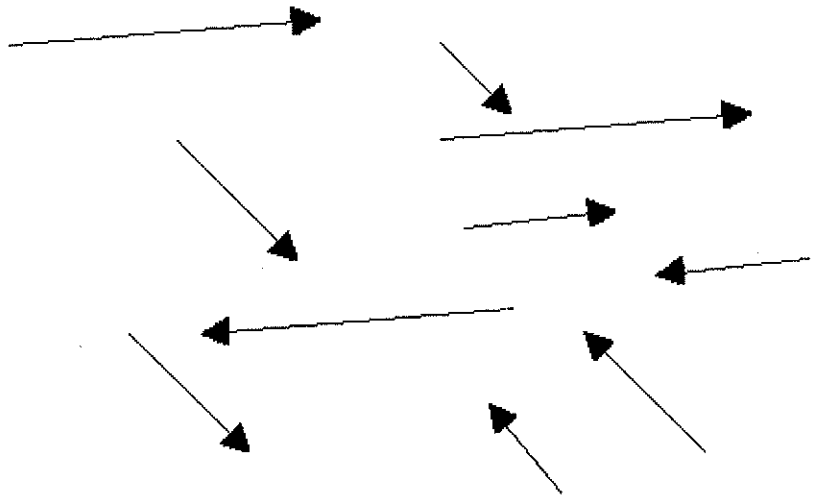
a. I only
b. II only
c. I and II
d. II and III
e. I, II and III

Answer:

a.

Question:

If each of the vectors shown below were to be placed on an $x - y$ coordinate system, how many would have a **negative** ***x*** component as well as a **negative** ***y*** component?

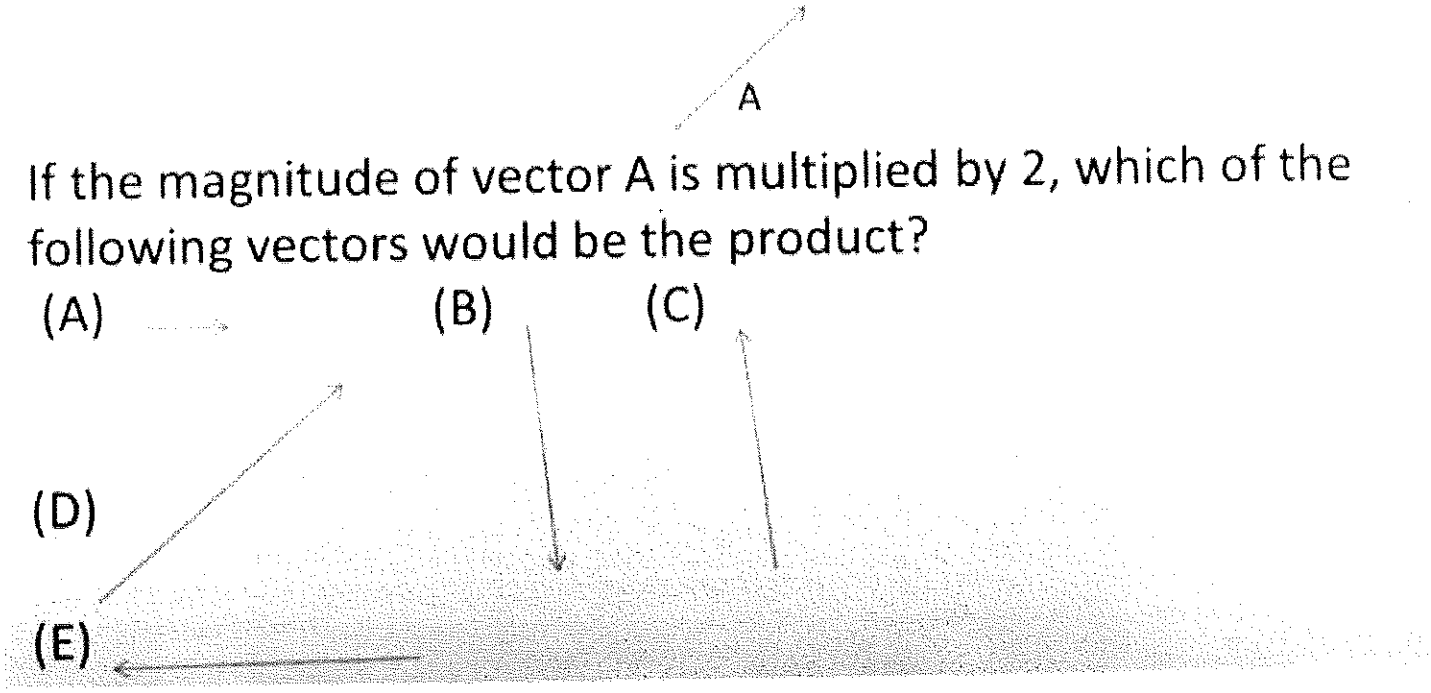


a. 1
b. 2
c. 3
d. 4
e. 5

Answer:

b.

Focus Question



Answer

D

If vector A would have been multiplied by -2, the result would be a vector with the same length as in choice D but in the opposite direction.

Multiplying a vector by a scalar increases or decreases the vector's magnitude (length) and/or flips its direction 180 degrees opposite.

Question:
A ball rolling across a flat, horizontal table has a velocity of v_1. After it leaves the edge of the table, the ball continues to travel with a constant horizontal velocity as it begins to fall. Just before the ball hits the ground, it has a net velocity of v_2. What is the ball's vertical speed at this moment?

a. v_2

b. $v_1 + v_2$

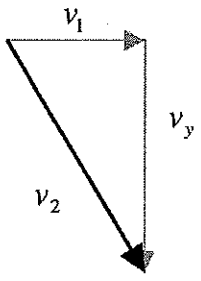
c. $v_2 - v_1$

d. $\sqrt{v_1^2 + v_2^2}$

e. $\sqrt{v_2^2 - v_1^2}$

Answer:
The correct answer is *e*. This is a projectile problem in which the ball has a constant horizontal velocity v_1 and an unknown vertical velocity. The given *net* velocity v_2 can be used to find the unknown vertical velocity v_y by applying the Pythagorean theorem:

$$v_1^2 + v_y^2 = v_2^2$$
$$v_y^2 = v_2^2 - v_1^2$$
$$v_y = \sqrt{v_2^2 - v_1^2}$$



Question:

Which should be the correct order of the steps followed when applying the process of vector resolution to determine the components of a vector?

1. **Draw perpendicular dashed lines from the tip of the original vector to each axis.**
2. **Construct *x* and *y* axes.**
3. **Apply the correct trig functions to calculate the magnitude of the *x* and *y* components.**
4. **Draw and label the *x* and *y* components on their respective axes.**

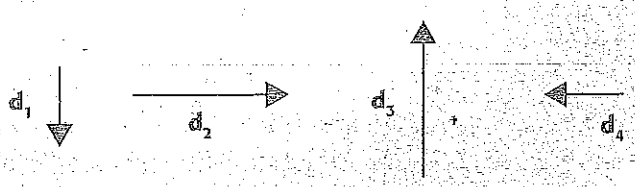
a. **1 – 2 – 3 – 4**
b. **2 – 1 – 3 – 4**
c. **2 – 1 – 4 – 3**
d. **1 – 3 – 2 – 4**
e. **None of the above**

Answer:

c.

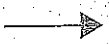
Question:

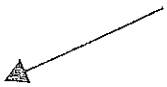
Consider the following displacement vectors shown below.

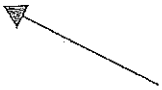


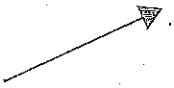
Which vector below represents the:

(1) vector difference $\mathbf{d_2 - d_1}$, (2) vector difference $\mathbf{d_3 - d_2}$, and (3) vector resultant $\mathbf{d_4 + d_2}$?

a. 

b. 

c. 

d. 

e. None of the above

Answer:

(1) **d**
(2) **c**
(3) **a**

Question:

Answer the following vector questions:

1. In a school playground, a child runs 5 m in the x-direction and then 2.0 m in the $-y$-direction. Which of the following expressions represents the magnitude of the child's resultant displacement?

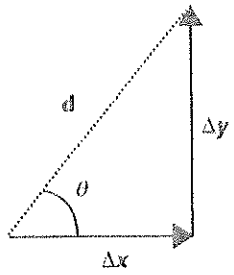
   a. $(5\text{ m}) + (-2\text{ m})$

   b. $\sqrt{(5\text{ m})} - \sqrt{(2\text{ m})}$

   c. $\sqrt{(5\text{ m})^2 - (2\text{ m})^2}$

   d. $\sqrt{(5\text{ m})^2 + (-2\text{ m})^2}$

2. In the triangle below, what does θ equal?



   a. $\tan^{-1}\left(\frac{\Delta y}{\Delta x}\right)$

   b. $\tan^{-1}\left(\frac{\Delta x}{\Delta y}\right)$

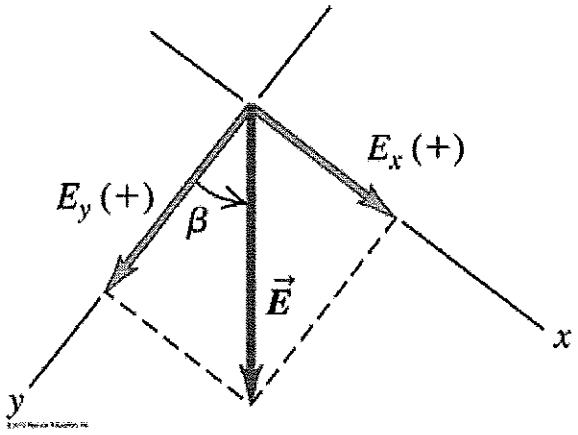
   c. $\tan^{-1}\left(\frac{\Delta x}{d}\right)$

   d. $\tan^{-1}\left(\frac{d}{\Delta y}\right)$

Answer:

1. d
2. a

Question



What are the x- and y-components of the vector $\vec{E}$?

A. $E_x = E\cos\beta,\ E_y = E\sin\beta$

B. $E_x = E\sin\beta,\ E_y = E\cos\beta$

C. $E_x = -E\cos\beta,\ E_y = -E\sin\beta$

D. $E_x = -E\sin\beta,\ E_y = -E\cos\beta$

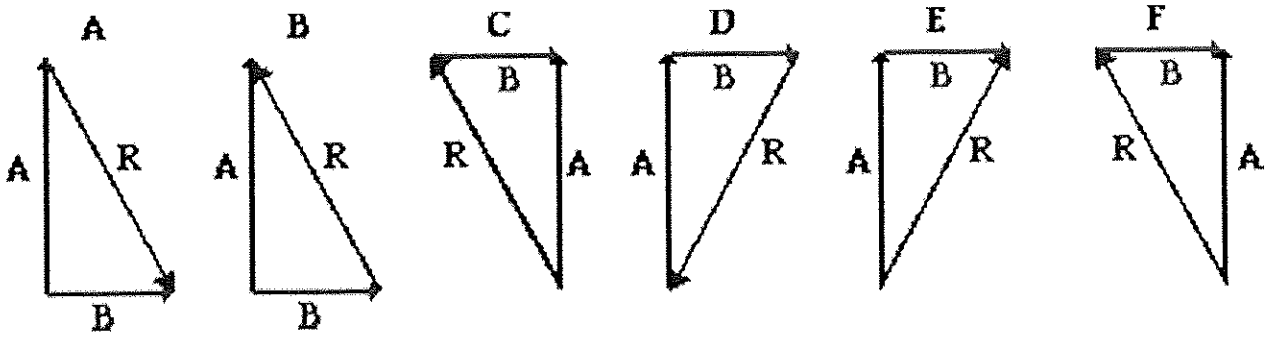
E. $E_x = -E\cos\beta,\ E_y = E\sin\beta$

Answer:

B

Question

Use the following to answer questions 1 and 2.



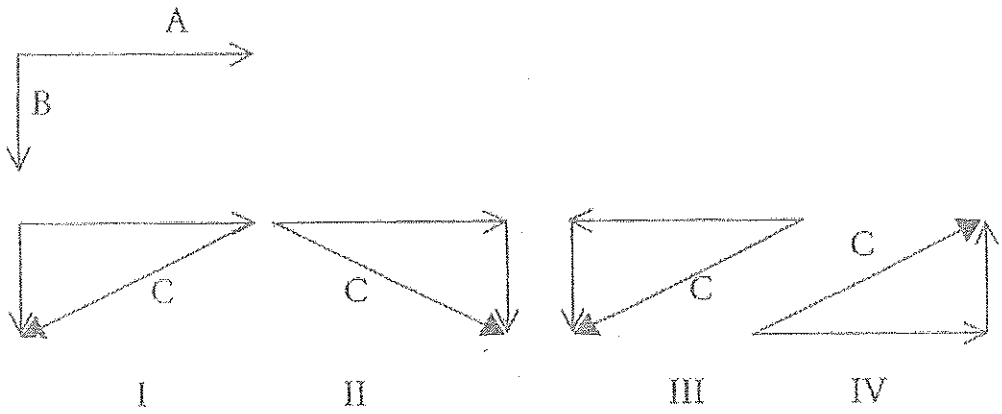
1. Which vector diagram shows the resultant of vectors A and B ?
2. Which vector diagram shows the vector difference A - B ?

Answer:

1. E
2. None of the above

Question:

Consider the following vectors:



3. In the figure above, which diagram represents the vector additi
$C = A + B$?

a. I
b. II
c. III
d. IV

4. In the figure above, which diagram represents vector subtractio
$C = A - B$?

a. I
b. II
c. III
d. IV

3. II
4. IV

Question:

Which of the following are the correct mathematical relationships to apply when calculating the ***magnitude*** and ***direction*** of a resultant vector?

a. Graphical Method – Tangent Function
b. Algebraic Theorem – Inverse Cosine Function
c. Pythagorean Theorem – Sine Function
d. Pythagorean Theorem – Cosine Function
e. None of the above

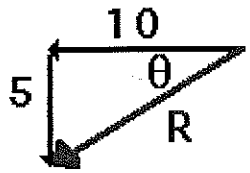
Answer:

e.

Question:

Using mathematical techniques, determine the resultant of the velocity vectors.

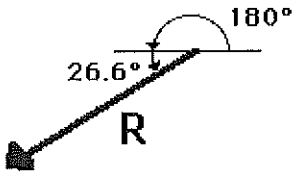
10 km, West + 5 km, South



$$\tan\Theta = \frac{5\text{ km}}{10\text{ km}} = 0.5$$

$$\Theta = \tan^{-1}(0.5) = 26.6°$$

Direction of R is 180° + 26.6°



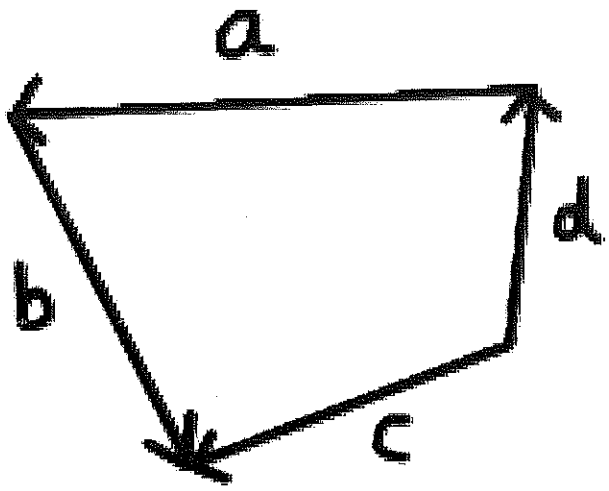
Magnitude: Apply Pythagorean Theorem

$$a^2 + b^2 = c^2$$

R = 11.18 km

Question:

Which vector in the figure below represents a ***resultant*** vector?



e. None of the above

Answer:

c.

Question:

Vector quantities have a *magnitude* and *direction*, while scalar quantities only have a magnitude. Which of the following statements is correct?

a. *Speed* is a vector quantity, and *distance* is a scalar quantity.
b. *Acceleration* is a vector quantity, and *velocity* is a vector quantity.
c. *Acceleration* is a scalar quantity, and *distance* is a scalar quantity.
d. *Distance* is a vector quantity, and *displacement* is a scalar quantity.
e. *Speed* is a scalar quantity, and *distance* is a vector quantity.

Answer:

The correct answer is *b*. A comparison of some common types of *scalar* and *vector* quantities (some of which you may not know yet) is given here.

Scalar quantities (*magnitude* only)	**Vector quantities** (*magnitude* and *direction*)
distance	displacement
speed	velocity
time	acceleration
mass	Force
Work	Weight
Kinetic Energy	momentum
Gravitational Potential Energy	Torque

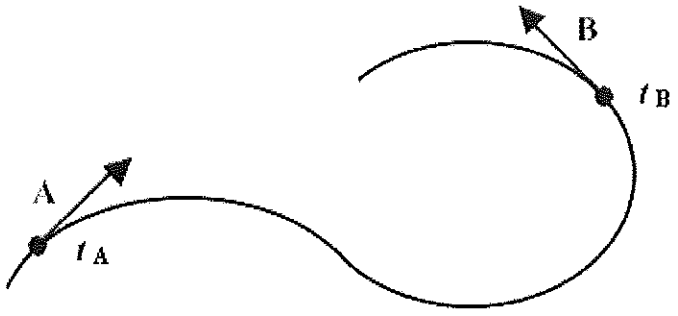
Question:

What is the difference between a ***scalar*** and ***vector***?

Answer:

A scalar is a type of physical quantity that can be completely described using magnitude only, while a vector quantity is a type of physical quantity that incorporates both magnitude and direction.

Question:



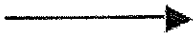
An object travels along a path shown above, with changing velocity as indicated by vectors **A** and **B**. Which vector best represents the net acceleration of the object from time t_A to t_B?

a. 

b. 

c. 

d. 

e. 

Answer:

The correct answer is *d*. The direction of acceleration is the same as the direction of the change in velocity, according to $a = \frac{v_f - v_i}{t}$. Because $\Delta\mathbf{v} = \mathbf{v}_f - \mathbf{v}_i$, we can determine Δv graphically by adding $\mathbf{v}_f$ to the negative of $\mathbf{v}_i$, or B+(-A). Placing the B vector "tip-to-tail" with the –A vector gives a direction for $\Delta\mathbf{v}$ (and therefore, **a**) to the left.