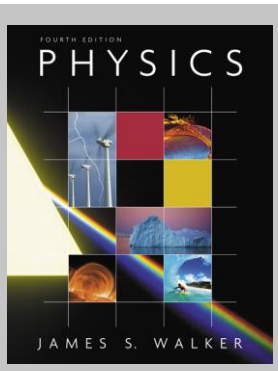

ConcepTest Clicker Questions

Chapter 3

Physics, 4th Edition

James S. Walker

Question 3.1a Vectors I

If two vectors are given such that **A** + **B** = 0, what can you say about the magnitude and direction of vectors **A** and **B**?

a) same magnitude, but can be in any direction
b) same magnitude, but must be in the same direction
c) different magnitudes, but must be in the same direction
d) same magnitude, but must be in opposite directions
e) different magnitudes, but must be in opposite directions

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The magnitudes must be the same, but one vector must be pointing in the opposite direction of the other in order for the sum to come out to zero. You can prove this with the tip-to-tail method.

Question 3.1b Vectors II

Given that **A** + **B** = **C**, and that $|A|^2 + |B|^2 = |C|^2$, how are vectors **A** and **B** oriented with respect to each other?

a) they are perpendicular to each other
b) they are parallel and in the same direction
c) they are parallel but in the opposite direction
d) they are at 45° to each other
e) they can be at any angle to each other

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Note that the magnitudes of the vectors satisfy the Pythagorean Theorem. This suggests that they form a right triangle, with vector **C** as the hypotenuse. Thus, **A** and **B** are the legs of the right triangle and are therefore perpendicular.

Question 3.1c Vectors III

Given that **A** + **B** = **C**, and that $|A| + |B| = |C|$, how are vectors **A** and **B** oriented with respect to each other?

a) they are perpendicular to each other
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Question 3.1c Vectors III

Given that **A** + **B** = **C**, and that |A| + |B| = |C|, how are vectors **A** and **B** oriented with respect to each other?

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c) they are parallel but in the opposite direction
d) they are at 45° to each other
e) they can be at any angle to each other

The only time vector magnitudes will simply add together is when the direction does not have to be taken into account (i.e., the direction is the same for both vectors). In that case, there is no angle between them to worry about, so vectors **A** and **B** must be pointing in the same direction.

Question 3.2a Vector Components I

If each component of a vector is doubled, what happens to the angle of that vector?

a) it doubles
b) it increases, but by less than double
c) it does not change
d) it is reduced by half
e) it decreases, but not as much as half

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The magnitude of the vector clearly doubles if each of its components is doubled. But the angle of the vector is given by tan $\theta = 2y/2x$, which is the same as tan $\theta = y/x$ (the original angle).

Follow-up: if you double one component and not the other, how would the angle change?

Question 3.2b Vector Components II

A certain vector has *x* and *y* components that are equal in magnitude. Which of the following is a possible angle for this vector in a standard *x*-*y* coordinate system?

a) 30°
b) 180°
c) 90°
d) 60°
e) 45°

Question 3.2b Vector Components II

A certain vector has *x* and *y* components that are equal in magnitude. Which of the following is a possible angle for this vector in a standard *x*-*y* coordinate system?

a) 30°
b) 180°
c) 90°
d) 60°
e) 45°

The angle of the vector is given by tan $\theta = y/x$. Thus, tan $\theta = 1$ in this case if *x* and *y* are equal, which means that the angle must be 45°.

Question 3.3 Vector Addition

You are adding vectors of length 20 and 40 units. What is the only possible resultant magnitude that you can obtain out of the following choices?

a) 0
b) 18
c) 37
d) 64
e) 100

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b) 18
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The minimum resultant occurs when the vectors are opposite, giving 20 units. The maximum resultant occurs when the vectors are aligned, giving 60 units. Anything in between is also possible for angles between 0° and 180°.