Classroom Response System Questions

Chapter 4 Motion in Two and Three Dimensions

Interactive Lecture Questions
4.2.1. A park ranger wanted to measure the height of a tall tree. The ranger stood 6.10 m from the base of the tree; and he observed that his line of sight made an angle of 73.5° above the horizontal as he looked at the top of the tree. What is the height of the tree?

a) 5.84 m
b) 8.77 m
c) 11.7 m
d) 17.3 m
e) 20.6 m
4.2.1. A park ranger wanted to measure the height of a tall tree. The ranger stood 6.10 m from the base of the tree; and he observed that his line of sight made an angle of 73.5° above the horizontal as he looked at the top of the tree. What is the height of the tree?

a) 5.84 m  
b) 8.77 m  
c) 11.7 m  
d) 17.3 m  
e) 20.6 m
4.3.1. In two-dimensional motion in the $x$-$y$ plane, what is the relationship between the $x$ part of the motion to the $y$ part of the motion?

a) The $x$ part of the motion is independent of the $y$ part of the motion.

b) The $y$ part of the motion goes as the square of the $x$ part of the motion.

c) The $x$ part of the motion is linearly dependent on the $y$ part of the motion.

d) The $x$ part of the motion goes as the square of the $y$ part of the motion.

e) If the $y$ part of the motion is in the vertical direction, then $x$ part of the motion is dependent on the $y$ part.
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e) If the $y$ part of the motion is in the vertical direction, then $x$ part of the motion is dependent on the $y$ part.
4.3.2. Jackson heads east at 25 km/h for 20 minutes before heading south at 45 km/h for 20 minutes. Hunter heads south at 45 km/h for 10 minutes before heading east at 25 km/h for 30 minutes. Which driver has the greater average velocity, if either?

a) Jackson

b) Hunter

c) They both have the same average velocity.
4.3.2. Jackson heads east at 25 km/h for 20 minutes before heading south at 45 km/h for 20 minutes. Hunter heads south at 45 km/h for 10 minutes before heading east at 25 km/h for 30 minutes. Which driver has the greater average velocity, if either?

a) Jackson

b) Hunter

c) They both have the same average velocity.
4.3.3. An eagle takes off from a tree branch on the side of a mountain and flies due west for 225 m in 19 s. Spying a mouse on the ground to the west, the eagle dives 441 m at an angle of 65° relative to the horizontal direction for 11 s to catch the mouse. Determine the eagle’s average velocity for the thirty second interval.

a) 19 m/s at 44° below the horizontal direction
b) 22 m/s at 65° below the horizontal direction
c) 19 m/s at 65° below the horizontal direction
d) 22 m/s at 44° below the horizontal direction
e) 25 m/s at 27° below the horizontal direction
4.3.3. An eagle takes off from a tree branch on the side of a mountain and flies due west for 225 m in 19 s. Spying a mouse on the ground to the west, the eagle dives 441 m at an angle of 65° relative to the horizontal direction for 11 s to catch the mouse. Determine the eagle’s average velocity for the thirty second interval.

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4.4.1. Complete the following statement: In two-dimensional motion in the $x$-$y$ plane, the $x$ part of the motion and the $y$ part of the motion are independent

a) only if there is no acceleration in either direction.

b) only if there is no acceleration in one of the directions.

c) only if there is an acceleration in both directions.

d) whether or not there is an acceleration in any direction.

e) whenever the acceleration is in the $y$ direction only.
4.4.1. Complete the following statement: In two-dimensional motion in the \( x-y \) plane, the \( x \) part of the motion and the \( y \) part of the motion are independent

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c) only if there is an acceleration in both directions.

d) whether or not there is an acceleration in any direction.

e) whenever the acceleration is in the \( y \) direction only.
4.4.2. A ball is rolling down one hill and up another as shown. Points A and B are at the same height. How do the velocity and acceleration change as the ball rolls from point A to point B?

a) The velocity and acceleration are the same at both points.

b) The velocity and the magnitude of the acceleration are the same at both points, but the direction of the acceleration is opposite at B to the direction it had at A.

c) The acceleration and the magnitude of the velocity are the same at both points, but the direction of the velocity is opposite at B to the direction it had at A.

d) The horizontal component of the velocity is the same at points A and B, but the vertical component of the velocity has the same magnitude, but the opposite sign at B. The acceleration at points A and B is the same.

e) The vertical component of the velocity is the same at points A and B, but the horizontal component of the velocity has the same magnitude, but the opposite sign at B. The acceleration at points A and B has the same magnitude, but opposite direction.
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e) The vertical component of the velocity is the same at points A and B, but the horizontal component of the velocity has the same magnitude, but the opposite sign at B. The acceleration at points A and B has the same magnitude, but opposite direction.
4.4.3. A space craft is initially traveling toward Mars. As the craft approaches the planet, rockets are fired and the spacecraft temporarily stops and reorients itself. Then, at time $t = 0$ s, the rockets again fire causing the craft to move toward Mars with a constant acceleration. At time $t$, the craft’s displacement is $\vec{r}$ and its velocity $\vec{v}$. Assuming the acceleration is constant, what would be its displacement and velocity at time $3t$?

a) $3\vec{r}$ and $3\vec{v}$

b) $4\vec{r}$ and $2\vec{v}$

c) $6\vec{r}$ and $3\vec{v}$

d) $9\vec{r}$ and $3\vec{v}$

e) $9\vec{r}$ and $6\vec{v}$
4.4.3. A spacecraft is initially traveling toward Mars. As the craft approaches the planet, rockets are fired and the spacecraft temporarily stops and reorients itself. Then, at time \( t = 0 \) s, the rockets again fire causing the craft to move toward Mars with a constant acceleration. At time \( t \), the craft’s displacement is \( r \) and its velocity \( \vec{v} \). Assuming the acceleration is constant, what would be its displacement and velocity at time \( 3t \)?

a) \( 3 \vec{r} \) and \( 3 \vec{v} \)

b) \( 4 \vec{r} \) and \( 2 \vec{v} \)

c) \( 6 \vec{r} \) and \( 3 \vec{v} \)

d) \( 9 \vec{r} \) and \( 3 \vec{v} \)

e) \( 9 \vec{r} \) and \( 6 \vec{v} \)
4.5.1. A bullet is aimed at a target on the wall a distance $L$ away from the firing position. Because of gravity, the bullet strikes the wall a distance $\Delta y$ below the mark as suggested in the figure. Note: The drawing is not to scale. If the distance $L$ was half as large, and the bullet had the same initial velocity, how would $\Delta y$ be affected?

a) $\Delta y$ will double.

b) $\Delta y$ will be half as large.

c) $\Delta y$ will be one fourth as large.

d) $\Delta y$ will be four times larger.

e) It is not possible to determine unless numerical values are given for the distances.
4.5.1. A bullet is aimed at a target on the wall a distance $L$ away from the firing position. Because of gravity, the bullet strikes the wall a distance $\Delta y$ below the mark as suggested in the figure. Note: The drawing is not to scale. If the distance $L$ was half as large, and the bullet had the same initial velocity, how would $\Delta y$ be affected?

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c) $\Delta y$ will be one fourth as large.

d) $\Delta y$ will be four times larger.

e) It is not possible to determine unless numerical values are given for the distances.
4.5.2. A bicyclist is riding at a constant speed along a horizontal, straight-line path. The rider throws a ball straight up to a height a few meters above her head. Ignoring air resistance, where will the ball land?

a) in front of the rider

b) behind the rider

c) in the opposite hand to the one that threw it

d) in the same hand that threw the ball

e) This cannot be determined without knowing the speed of the rider and the maximum height of the ball.
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e) This cannot be determined without knowing the speed of the rider and the maximum height of the ball.
4.5.3. A physics student standing on the edge of a cliff throws a stone vertically downward with an initial speed of 10.0 m/s. The instant before the stone hits the ground below, it is traveling at a speed of 30.0 m/s. If the physics student were to throw the rock horizontally outward from the cliff instead, with the same initial speed of 10.0 m/s, what is the magnitude of the velocity of the stone just before it hits the ground? Ignore any effects of air resistance.

a) 10.0 m/s
b) 20.0 m/s
c) 30.0 m/s
d) 40.0 m/s
e) The height of the cliff must be specified to answer this question.
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a) 10.0 m/s

b) 20.0 m/s

c) 30.0 m/s

d) 40.0 m/s

e) The height of the cliff must be specified to answer this question.
4.5.4. Packages A and B are dropped from the same height simultaneously. Package A is dropped from an airplane that is flying due east at constant speed. Package B is dropped from rest from a helicopter hovering in a stationary position above the ground. Ignoring air friction effects, which of the following statements is true?

a) A and B reach the ground at the same time, but B has a greater velocity in the vertical direction.

b) A and B reach the ground at the same time; and they have the same velocity in the vertical direction.

c) A and B reach the ground at different times because B has a greater velocity in both the horizontal and vertical directions.

d) A and B reach the ground at different times; and they have the same velocity in the vertical direction.

e) A reaches the ground first because it falls straight down, while B has to travel much further than A.
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4.6.1. A motorcyclist is riding along a mountain trail that runs parallel to a road below. In fact the trail is 6 meters above the road. The motorcyclist then notices a flat bed truck directly below moving at the same speed and decides to drive off the trail, without changing speed. Fortunately, the motorcycle safely lands on the flatbed of the truck. What would the outcome have been if the trail was 12 meters above the road, but all other parameters remain the same?

a) The motorcycle would land slightly behind the truck.

b) The motorcycle would land in front of the truck.

c) The motorcycle would land on the flatbed of the truck as before.

d) The motorcycle would land several meters behind the truck.
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a) The motorcycle would land slightly behind the truck.

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4.6.3. At a circus, two clowns, Bippy and Bobo, climb into identical cannons and are launched at identical initial velocities from the same starting height at the same instant of time. Bippy’s cannon makes an angle of $55^\circ$ angle with respect to the ground and Bobo’s cannon makes an angle of $45^\circ$ with respect to the ground. Which clown lands in a net parallel to the ground at height $h$ first, if either? Neglect any effects due to air resistance.

a) Bippy

b) Bobo

c) They land at the same time.

d) This question cannot be answered without knowing the mass of each clown.
4.6.3. At a circus, two clowns, Bippy and Bobo, climb into identical cannons and are launched at identical initial velocities from the same starting height at the same instant of time. Bippy’s cannon makes an angle of $55^\circ$ angle with respect to the ground and Bobo’s cannon makes an angle of $45^\circ$ with respect to the ground. Which clown lands in a net parallel to the ground at height $h$ first, if either? Neglect any effects due to air resistance.

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a) Bippy

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a) Bippy  
b) Bobo  
c) They land with the same instantaneous velocity.  
d) This question cannot be answered without knowing the mass of each clown.
4.6.5. Football A is kicked at a speed $v$ at an angle of $\theta$ with respect to the horizontal direction. If football B is kicked at the same angle, but with a speed $2v$, what is the ratio of the range of B to the range of A?

a) 1

b) 2

c) 3

d) 4

e) 9
4.6.5. Football A is kicked at a speed $v$ at an angle of $\theta$ with respect to the horizontal direction. If football B is kicked at the same angle, but with a speed $2v$, what is the ratio of the range of B to the range of A?

a) $1$

b) $2$

c) $3$

d) $4$

e) $9$
4.6.6. Balls A, B, and C are identical. From the top of a tall building, ball A is launched with a velocity of 20 m/s at an angle of 45° above the horizontal direction, ball B is launched with a velocity of 20 m/s in the horizontal direction, and ball C is launched with a velocity of 20 m/s at an angle of 45° below the horizontal direction. Which of the following choices correctly relates the magnitudes of the velocities of the balls just before they hit the ground below? Ignore any effects of air resistance.

a) $v_A = v_C > v_B$

b) $v_A = v_C = v_B$

c) $v_A > v_C > v_B$

d) $v_A < v_C < v_B$

e) $v_A > v_C < v_B$
4.6.6. Balls A, B, and C are identical. From the top of a tall building, ball A is launched with a velocity of 20 m/s at an angle of 45° above the horizontal direction, ball B is launched with a velocity of 20 m/s in the horizontal direction, and ball C is launched with a velocity of 20 m/s at an angle of 45° below the horizontal direction. Which of the following choices correctly relates the magnitudes of the velocities of the balls just before they hit the ground below? Ignore any effects of air resistance.

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b) \( v_A = v_C = v_B \)  

b) \( v_A = v_C = v_B \)  

c) \( v_A > v_C > v_B \)

d) \( v_A < v_C < v_B \)  

e) \( v_A > v_C < v_B \)
4.6.7. A basketball is launched with an initial speed of 8.5 m/s and follows the trajectory shown. The ball enters the basket 0.92 s after it is launched. What are the distances $x$ and $y$? Note: The drawing is not to scale.

a) $x = 6.0$ m, $y = 0.88$ m

b) $x = 5.4$ m, $y = 0.73$ m

c) $x = 5.7$ m, $y = 0.91$ m

d) $x = 7.6$ m, $y = 1.1$ m

e) $x = 6.3$ m, $y = 0.96$ m
4.6.7. A basketball is launched with an initial speed of 8.5 m/s and follows the trajectory shown. The ball enters the basket 0.92 s after it is launched. What are the distances $x$ and $y$? **Note:** *The drawing is not to scale.*

- **a)** $x = 6.0$ m, $y = 0.88$ m
- **b)** $x = 5.4$ m, $y = 0.73$ m
- **c)** $x = 5.7$ m, $y = 0.91$ m
- **d)** $x = 7.6$ m, $y = 1.1$ m
- **e)** $x = 6.3$ m, $y = 0.96$ m
4.6.8. At time $t = 0$ s, Ball A is thrown vertically upward with an initial speed $v_{0A}$. Ball B is thrown vertically upward shortly after Ball A at time $t$. Ball B passes Ball A just as Ball A is reaching the top of its trajectory. What is the initial speed $v_{0B}$ of Ball B in terms of the given parameters? The acceleration due to gravity is $g$.

a) $v_{0B} = 2v_{0A} - gt$

b) $v_{0B} = v_{0A} - (1/2)gt$

c) $v_{0B} = v_{0A} - (1/2)gt^2$

d) $v_{0B} = \frac{v_{0A} + \frac{1}{2}gt^2}{v_{0A} - gt}$

e) $v_{0B} = \frac{v_{0A}^2 + \frac{1}{2}gt^2 - v_{0A}gt}{v_{0A} - gt}$
4.6.8. At time \( t = 0 \) s, Ball A is thrown vertically upward with an initial speed \( v_{0A} \). Ball B is thrown vertically upward shortly after Ball A at time \( t \). Ball B passes Ball A just as Ball A is reaching the top of its trajectory. What is the initial speed \( v_{0B} \) of Ball B in terms of the given parameters? The acceleration due to gravity is \( g \).

a) \( v_{0B} = 2v_{0A} - gt \)

b) \( v_{0B} = v_{0A} - (1/2)gt \)

c) \( v_{0B} = v_{0A} - (1/2)gt^2 \)

d) \( v_{0B} = \frac{v_{0A} + \frac{1}{2}gt^2}{v_{0A} - gt} \)

e) \( v_{0B} = \frac{v_{0A}^2 + \frac{1}{2}g^2t^2 - v_{0A}gt}{v_{0A} - gt} \)
4.6.9. A toy rocket is launched at an angle of 45° with a speed $v_0$. If there is no air resistance, at what point during the time that it is in the air does the speed of the rocket equal $0.5v_0$?

a) when the rocket is at one half of its maximum height as it is going upward

b) when the rocket is at one half of its maximum height as it is going downward

c) when the rocket is at its maximum height

d) when the rocket is at one fourth of its maximum height as it is going downward

e) at no time during the flight
4.6.9. A toy rocket is launched at an angle of 45° with a speed $v_0$. If there is no air resistance, at what point during the time that it is in the air does the speed of the rocket equal 0.5$v_0$?

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b) when the rocket is at one half of its maximum height as it is going downward

c) when the rocket is at its maximum height

d) when the rocket is at one fourth of its maximum height as it is going downward

e) at no time during the flight
4.6.10. In making a movie, a stuntman has to jump from one roof onto another roof, located 2.0 m below. The buildings are separated by a distance of 2.5 m. What is the minimum horizontal speed that the stuntman must have when jumping from the first roof to have a successful jump?

a) 3.9 m/s  
b) 2.5 m/s  
c) 4.3 m/s  
d) 4.5 m/s  
e) 3.1 m/s
4.6.10. In making a movie, a stuntman has to jump from one roof onto another roof, located 2.0 m below. The buildings are separated by a distance of 2.5 m. What is the minimum horizontal speed that the stuntman must have when jumping from the first roof to have a successful jump?

a) 3.9 m/s

b) 2.5 m/s

c) 4.3 m/s

d) 4.5 m/s

e) 3.1 m/s
4.6.11. Consider a ball batted at a 45° angle with respect to a flat baseball field. Neglecting air resistance, how would the range of the ball be affected if the acceleration due to gravity could be reduced to 0.5g as compared to the range under normal conditions? Ignore any effects of air resistance.

a) The range would be one-fourth that under normal conditions.

b) The range would be one-half that under normal conditions.

c) The range would be the same as that under normal conditions.

d) The range would be twice that under normal conditions.

e) The range would be four times that under normal conditions.
4.6.11. Consider a ball batted at a 45° angle with respect to a flat baseball field. Neglecting air resistance, how would the range of the ball be affected if the acceleration due to gravity could be reduced to 0.5g as compared to the range under normal conditions? Ignore any effects of air resistance.

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d) The range would be twice that under normal conditions.

e) The range would be four times that under normal conditions.
4.7.1. A ball is whirled on the end of a string in a horizontal circle of radius $R$ at constant speed $v$. By which one of the following means can the centripetal acceleration of the ball be increased by a factor of two?

a) Keep the radius fixed and increase the period by a factor of two.

b) Keep the radius fixed and decrease the period by a factor of two.

c) Keep the speed fixed and increase the radius by a factor of two.

d) Keep the speed fixed and decrease the radius by a factor of two.

e) Keep the radius fixed and increase the speed by a factor of two.
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c) Keep the speed fixed and increase the radius by a factor of two.

d) Keep the speed fixed and decrease the radius by a factor of two.

e) Keep the radius fixed and increase the speed by a factor of two.

**d)** Keep the speed fixed and decrease the radius by a factor of two.
4.7.2. A steel ball is whirled on the end of a chain in a horizontal circle of radius $R$ with a constant period $T$. If the radius of the circle is then reduced to $0.75R$, while the period remains $T$, what happens to the centripetal acceleration of the ball?

a) The centripetal acceleration increases to 1.33 times its initial value.

b) The centripetal acceleration increases to 1.78 times its initial value.

c) The centripetal acceleration decreases to 0.75 times its initial value.

d) The centripetal acceleration decreases to 0.56 times its initial value.

e) The centripetal acceleration does not change.
4.7.2. A steel ball is whirled on the end of a chain in a horizontal circle of radius $R$ with a constant period $T$. If the radius of the circle is then reduced to $0.75R$, while the period remains $T$, what happens to the centripetal acceleration of the ball?

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c) The centripetal acceleration decreases to 0.75 times its initial value.

d) The centripetal acceleration decreases to 0.56 times its initial value.

e) The centripetal acceleration does not change.
4.7.3. While we are in this classroom, the Earth is orbiting the Sun in an orbit that is nearly circular with an average radius of $1.50 \times 10^{11}$ m. Assuming that the Earth is in uniform circular motion, what is the centripetal acceleration of the Earth in its orbit around the Sun?

a) $5.9 \times 10^{-3}$ m/s$^2$

b) $1.9 \times 10^{-5}$ m/s$^2$

c) $3.2 \times 10^{-7}$ m/s$^2$

d) $7.0 \times 10^{-2}$ m/s$^2$

e) 9.8 m/s$^2$
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a) $5.9 \times 10^{-3}$ m/s$^2$

b) $1.9 \times 10^{-5}$ m/s$^2$

c) $3.2 \times 10^{-7}$ m/s$^2$

d) $7.0 \times 10^{-2}$ m/s$^2$

e) $9.8$ m/s$^2$
4.8.1. At an air show, three planes are flying horizontally due east. The velocity of plane A relative to plane B is \( \mathbf{v}_{AB} \); the velocity of plane A relative to plane C is \( \mathbf{v}_{AC} \); and the velocity of plane B relative to plane C is \( \mathbf{v}_{BC} \). Determine \( \mathbf{v}_{AB} \) if \( \mathbf{v}_{AC} = +10 \text{ m/s} \) and \( \mathbf{v}_{BC} = +20 \text{ m/s} \)?

a) \(-10 \text{ m/s}\)

b) \(+10 \text{ m/s}\)

c) \(-20 \text{ m/s}\)

d) \(+20 \text{ m/s}\)

e) zero \text{ m/s}\)
4.8.1. At an air show, three planes are flying horizontally due east. The velocity of plane A relative to plane B is $v_{AB}$; the velocity of plane A relative to plane C is $v_{AC}$; and the velocity of plane B relative to plane C is $v_{BC}$. Determine $v_{AB}$ if $v_{AC} = +10$ m/s and $v_{BC} = +20$ m/s?

a) $-10$ m/s

b) $+10$ m/s

c) $-20$ m/s

d) $+20$ m/s

e) zero m/s
4.8.2. A train is traveling due east at a speed of 26.8 m/s relative to the ground. A passenger is walking toward the front of the train at a speed of 1.7 m/s relative to the train. Directly overhead the train is a plane flying horizontally due west at a speed of 257.0 m/s relative to the ground. What is the horizontal component of the velocity of the airplane with respect to the passenger on the train?

a) 258.7 m/s, due west
b) 285.5 m/s, due west
c) 226.8 m/s, due west
d) 231.9 m/s, due west
e) 257.0 m/s, due west
4.8.2. A train is traveling due east at a speed of 26.8 m/s relative to the ground. A passenger is walking toward the front of the train at a speed of 1.7 m/s relative to the train. Directly overhead the train is a plane flying horizontally due west at a speed of 257.0 m/s relative to the ground. What is the horizontal component of the velocity of the airplane with respect to the passenger on the train?

a) 258.7 m/s, due west

b) 285.5 m/s, due west

c) 226.8 m/s, due west

d) 231.9 m/s, due west

e) 257.0 m/s, due west
4.8.3. Sailors are throwing a football on the deck of an aircraft carrier as it is sailing with a constant velocity due east. Sailor A is standing on the west side of the flight deck while sailor B is standing on the east side. Sailors on the deck of another aircraft carrier that is stationary are watching the football as it is being tossed back and forth as the first carrier passes. Assume that sailors A and B throw the football with the same initial speed at the same launch angle with respect to the horizontal, do the sailors on the stationary carrier see the football follow the same parabolic trajectory as the ball goes east to west as it does when it goes west to east?

a) Yes, to the stationary sailors, the trajectory the ball follows is the same whether it is traveling west to east or east to west.

b) No, to the stationary sailors, the length of the trajectory appears shorter as it travels west to east than when it travels east to west.

c) No, to the stationary sailors, the ball appears to be in the air for a much longer time when it is traveling west to east than when it travels east to west.

d) No, to the stationary sailors, the length of the trajectory appears longer as it travels west to east than when it travels east to west.

e) No, to the stationary sailors, the ball appears to be in the air for a much shorter time when it is traveling west to east than when it travels east to west.
4.8.3. Sailors are throwing a football on the deck of an aircraft carrier as it is sailing with a constant velocity due east. Sailor A is standing on the west side of the flight deck while sailor B is standing on the east side. Sailors on the deck of another aircraft carrier that is stationary are watching the football as it is being tossed back and forth as the first carrier passes. Assume that sailors A and B throw the football with the same initial speed at the same launch angle with respect to the horizontal, do the sailors on the stationary carrier see the football follow the same parabolic trajectory as the ball goes east to west as it does when it goes west to east?

a) Yes, to the stationary sailors, the trajectory the ball follows is the same whether it is traveling west to east or east to west.

b) No, to the stationary sailors, the length of the trajectory appears shorter as it travels west to east than when it travels east to west.

c) No, to the stationary sailors, the ball appears to be in the air for a much longer time when it is traveling west to east than when it travels east to west.

d) No, to the stationary sailors, the length of the trajectory appears longer as it travels west to east than when it travels east to west.

e) No, to the stationary sailors, the ball appears to be in the air for a much shorter time when it is traveling west to east than when it travels east to west.
4.8.4. Cars A and B are moving away from each other as car A moves due north at 25 m/s with respect to the ground and car B moves due south at 15 m/s with respect to the ground. What are the velocities of the other car according to the two drivers?

a) Car A is moving due north at 25 m/s; and car B is moving due south at 15 m/s.

b) Car A is moving due south at 25 m/s; and car B is moving due north at 15 m/s.

c) Car A is moving due north at 40 m/s; and car B is moving due south at 40 m/s.

d) Car A is moving due south at 40 m/s and car B is moving due north at 40 m/s.

e) Car A is moving due north at 15 m/s and car B is moving due south at 25 m/s.
4.8.4. Cars A and B are moving away from each other as car A moves due north at 25 m/s with respect to the ground and car B moves due south at 15 m/s with respect to the ground. What are the velocities of the other car according to the two drivers?

a) Car A is moving due north at 25 m/s; and car B is moving due south at 15 m/s.

b) Car A is moving due south at 25 m/s; and car B is moving due north at 15 m/s.

c) Car A is moving due north at 40 m/s; and car B is moving due south at 40 m/s.

d) Car A is moving due south at 40 m/s and car B is moving due north at 40 m/s.

e) Car A is moving due north at 15 m/s and car B is moving due south at 25 m/s.
4.9.1. John always paddles his canoe at constant speed \( v \) with respect to the still water of a river. One day, the river current was due west was moving at a constant speed that was close to \( v \) with respect to that of still water. John decided to see whether making a round trip across the river and back, a north-south trip, would be faster than making a round trip an equal distance east-west. What was the result of John’s test?

a) The time for the north-south trip was greater than the time for the east-west trip.

b) The time for the north-south trip was less than the time for the east-west trip.

c) The time for the north-south trip was equal to the time for the east-west trip.

d) One cannot tell because the exact speed of the river with respect to still water is not given.
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c) The time for the north-south trip was equal to the time for the east-west trip.

d) One cannot tell because the exact speed of the river with respect to still water is not given.
4.9.2. A boat attempts to cross a river. The boat’s speed with respect to the water is 12.0 m/s. The speed of the river current with respect to the river bank is 6.0 m/s. At what angle should the boat be directed so that it crosses the river to a point directly across from its starting point?

a) 45.0°

b) 26.6°

c) 30.0°

d) 53.1°

e) 60.0°
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