1D Kinematic Items - Master Item List - Active Items

August 3, 2025

1 Kinematics Assessment

The questions which follow ask about the motion of an object in one dimension. All objects move along the x axis. The positive x axis is to the right of the page. For any vector quantity (acceleration, velocity, etc.), the problem asks about the x component of the vector.

Problem 1: (KD1-1)
An object is initially at the point +2 m on the x-axis. The object is moved to the point +1 m.

What is the displacement of the object?

A. 0 m

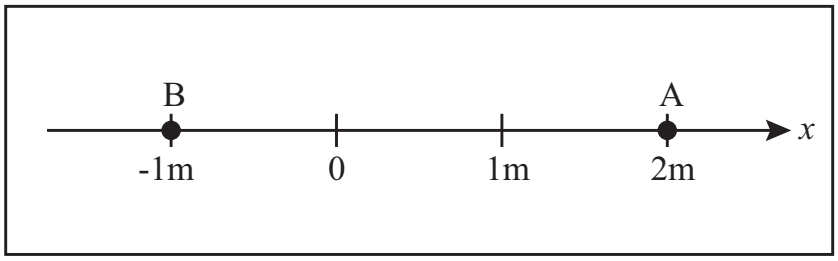
B. +1 m

C. −1 m

D. +2 m

E. +3 m

Problem 2: (KD1-1-V2)



An object is initially at the point A a distance of 2 m on the positive x axis. The object is moved to the point B. Point B is located a distance of 1 m along the negative x axis as drawn in the figure above. Which of the follow best describes the displacement of the object from point A to point B?

A. The displacement has a magnitude of 1 m to the left of the page.

B. The displacement has a magnitude of 2 m to the left of the page.

C. The displacement has a magnitude of 3 m to the left of the page.

D. The displacement has a magnitude of 2 m to the right of the page.

E. The displacement has a magnitude of 3 m to the right of the page.

Problem 3: (KD1-1-V3)
An object is initially at the point +2 m along the x-axis. The object then moves to the point +1 m.

What is the displacement of the object?

A. The displacement is **1 m**.

B. The displacement is **1 m** in the **positive** x-direction.

C. The displacement is **1 m** in the **negative** x-direction.

D. The displacement is **2 m**.

E. The displacement is **2 m** in the **positive** x-direction.

F. The displacement is **2 m** in the **negative** x-direction.

Problem 4: (KD1-2)
In general, what is the relation of the distance between point A and point B and the displacement from point A to point B?

A. Distance and displacement mean the same thing.

B. The distance is the magnitude of the displacement and has no direction, while the displacement has both a magnitude and a direction.

C. The displacement is the magnitude of the distance and has no direction, while the distance has both a magnitude and a direction.

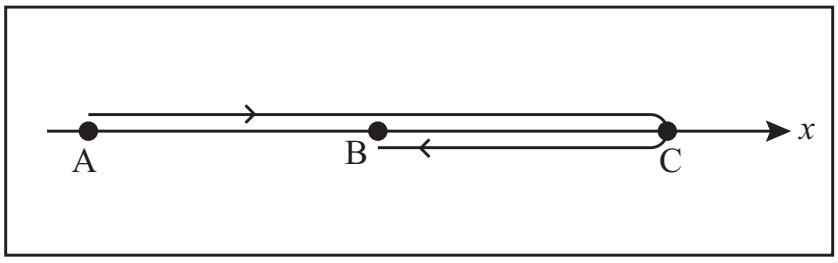
Problem 5: (KD1-3-V2)
An object is initially at the point $x = -2\,\text{m}$ on the x-axis. The object is moved to the point $x = -1\,\text{m}$. What is the direction of the displacement of the object?

A. The displacement is zero.

B. The positive x direction.

C. The negative x direction.

Problem 6: (KD1-4)



The figure above shows the trajectory of an object that starts at point A, travels to the right until it reaches point C, then reverses direction and travels to the left to point B.

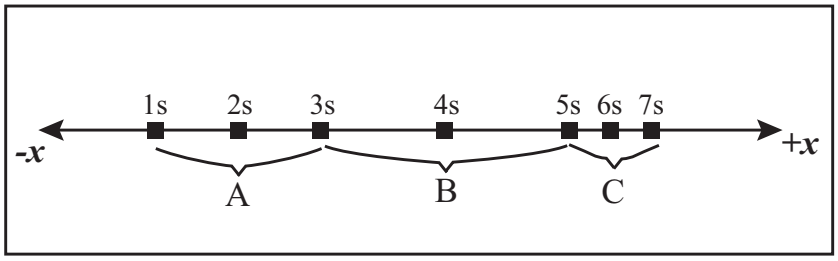
Compare the distance between point A and B to the total distance traveled.

A. The distance between points A and B is equal to the total distance traveled.

B. The distance between points A and B is greater than the total distance traveled.

C. The distance between points A and B is less than the total distance traveled.

Problem 7: (KD1-5-V6JS)



The figure above shows the location of an object moving to the right along the x-axis. Each square represents the location at a point in time. The amount of time between each pair of sequential squares is one second.

Select the inequality below which best represents the relation of the average velocity in the $x-$direction, v, in region A (where the object is from 1 second to 3 seconds), region B (from 3 seconds to 5 seconds), and region C (from 5 seconds to 7 seconds).

A. $v_A = v_B = v_C$

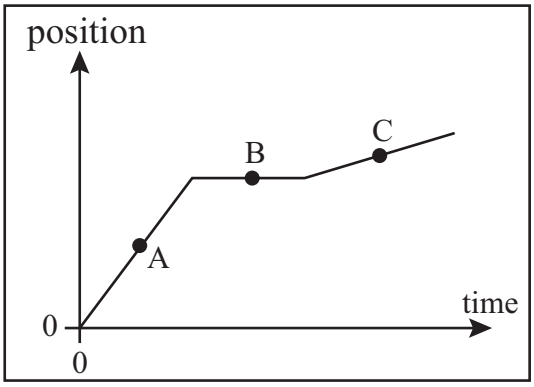
B. $v_A > v_B > v_C$

C. $v_C > v_B > v_A$

D. $v_C > v_A > v_B$

E. $v_B > v_A > v_C$

Problem 8: (KD1-6-V3)



An object moves along the x-axis. The figure above shows the graph of the position on the x-axis as a function of time. Three locations on the plot have been marked.

Select the inequality below which best represents the relation of the velocity in the x direction, v, at the points A, B, and C.

A. $v_A = v_B = v_C$

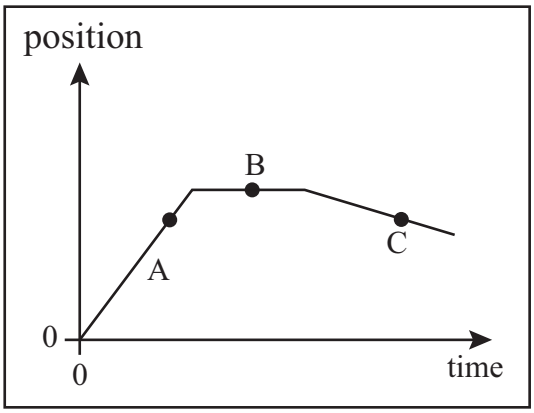
B. $v_A > v_C > v_B$

C. $v_C > v_B > v_A$

D. $v_C > v_A > v_B$

E. $v_B > v_A > v_C$

Problem 9: (KD1-6-V4EC)



An object moves along the x axis. The figure above shows the graph of the position along the x axis as a function of time. Three positions on the plot have been marked.

Select the inequality below that best represents the relation of v, the velocity in the x direction, at the points A, B, and C.

A. $v_A = v_B = v_C$

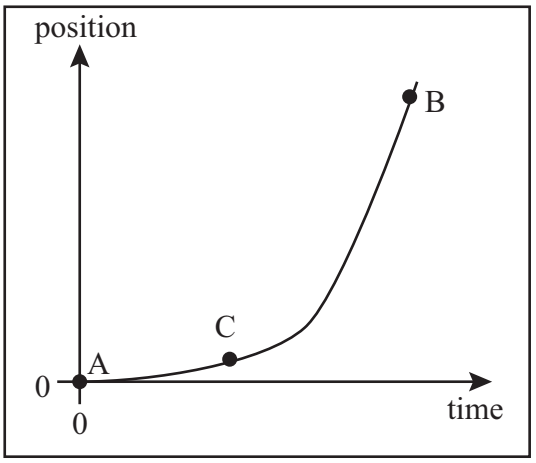
B. $v_A > v_C > v_B$

C. $v_A > v_B > v_C$

D. $v_C > v_A > v_B$

E. $v_B > v_A = v_C$

Problem 10: (KD1-7)



An object moves along the x-axis. The figure above shows the position of the object as a function of time. Three locations on the plot have been marked: A, B, and C.

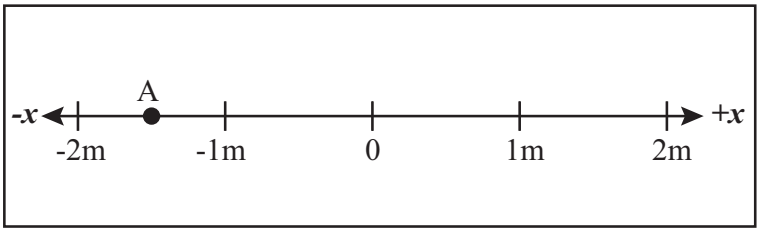
Select the answer which best represents the relation of the velocity at point C and the average velocity between points A and B.

A. The average velocity between point A and B **equals** the velocity at point C.

B. The average velocity between point A and B is **less than** the velocity at point C.

C. The average velocity between points A and B is **greater than** the velocity at point C.

Problem 11: (KD1-8-V5EC)



An object moves along the x-axis. At time $t = 0$, the object is at point A. The object's position is negative at point A as shown in the figure above. The object has a constant negative velocity.

Select the response that best describes the motion of the object after time $t = 0$.

A. The object moves to the **left**.

B. The object moves to the **left** until it **stops** and remains **stationary**.

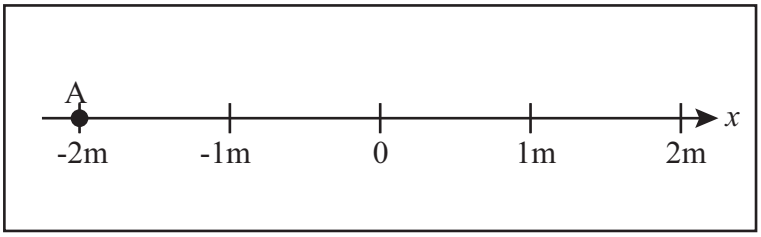
C. The object moves to the **left** until it **stops**, then moves to the **right**.

D. The object moves to the **right**.

E. The object moves to the **right** until it **stops** and remains **stationary**.

F. The object moves to the **right** until it **stops**, then moves to the **left**.

Problem 12: (KD1-9-V3)



An object moves along the x axis. The object is initially at point A, which is at $x = -2$m, as shown in the diagram above. The x component of the velocity is positive and constant.

Select the response that best describes the motion of the object.

A. The object moves to the left.

B. The object moves to the right.

C. The object moves to the right until it reaches the origin and then stops.

D. The object moves to the right until it reaches the origin, stops, then moves to the left.

Problem 13: (KD1-10)

At time t_A, an object is at point A at $x = +1\,\text{m}$ along the positive x axis. The object is moving is the

negative x direction with velocity $-2\,\mathrm{m/s}$.

What is the speed of the object?

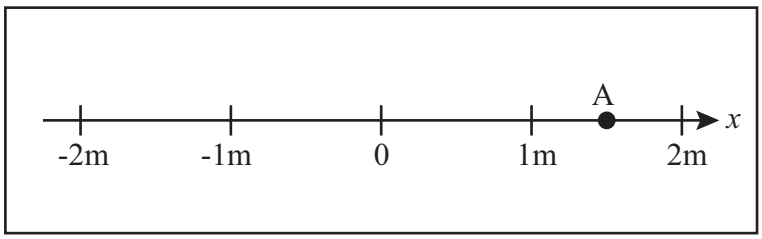
A. $1\,\mathrm{m/s}$

B. $-1\,\mathrm{m/s}$

C. $2\,\mathrm{m/s}$

D. $-2\,\mathrm{m/s}$

Problem 14: (KD1-10-V2)



At time zero, an object is at point A along the positive x axis as shown in the figure above. The object is moving is the left of the page with a velocity with magnitude $2\,\mathrm{m/s}$. Select the following which best describes the speed and velocity of the object?

A. The speed and the velocity are equal; speed and velocity mean the same thing.

B. The speed is $2\,\mathrm{m/s}$ and does not have a direction while the velocity has a magnitude of $2\,\mathrm{m/s}$ and points to the left of the page.

C. The velocity is $2\,\mathrm{m/s}$ and does not have a direction while the speed has a magnitude of $2\,\mathrm{m/s}$ and points to the left of the page.

Problem 15: (KD1-10-V7EC)
Object A moves at a rate of $2\,\mathrm{m/s}$ to the north. Object B moves at a rate of $2\,\mathrm{m/s}$ to the south.

Which of the following best describes the speeds and velocities of the objects?

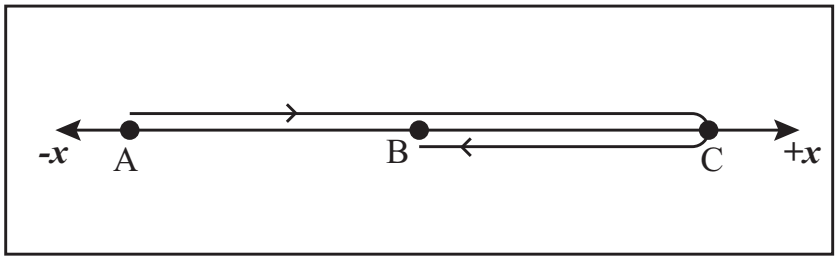
A. Object A and Object B have the **same speed**, and Object A and Object B have the **same velocity**.

B. Object A and Object B have the **same speed**, but Object A and Object B have **different velocities**.

C. Object A and Object B have **different speeds**, but Object A and Object B have the **same velocity**.

D. Object A and Object B have **different speeds**, and Object A and Object B have **different velocities**.

Problem 16: (KD1-11-V2)



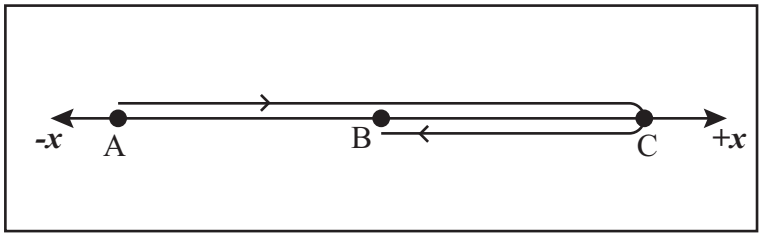
The figure above shows the trajectory of an object that starts at point A, travels to the right with a constant velocity with magnitude 1 m/s until it reaches point C, then reverses direction and travels to the left with a constant velocity with magnitude 1 m/s until it reaches point B. Select the response which best represents the relation of the average speed of the object between points A an B and the magnitude of the average velocity in the x direction between points A and B.

A. The average speed and the average velocity are equal.

B. The average speed is greater than the average velocity.

C. The average speed is less than the average velocity.

Problem 17: (KD1-11-V7JS)



The figure above shows an object that starts at point A, travels to the right with a constant velocity in the x-direction of $+1$ m/s until it reaches point C, then reverses direction and travels to the left with a constant velocity in the x-direction of -1 m/s to point B.

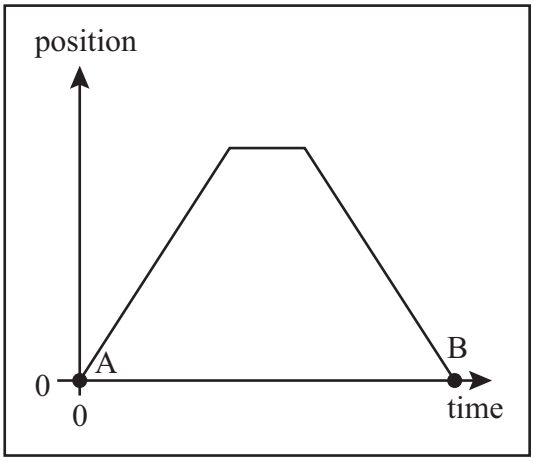
Select the response which best represents the relation of the average speed of the object and the magnitude of the average velocity in the x-direction over the entire motion from A to C and back to B.

A. The average speed and the magnitude of the average velocity are equal.

B. The average speed is greater than the magnitude of the average velocity.

C. The average speed is less than the magnitude of the average velocity.

Problem 18: (KD1-12-V3EC)



The figure above shows the position of an object moving in one dimension as a function of time. The object starts at point A at time $t = 0$.

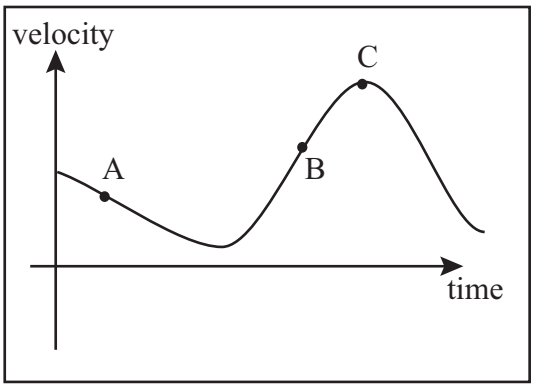
Select the response below that best describes its motion after time zero.

A. The object first moves in the **positive** direction with **constant** velocity, then **stops** moving, then moves in the **negative** direction with **constant** velocity.

B. The object first moves in the **positive** direction with **constant** velocity, then **stops** moving, then moves in the **positive** direction with **constant** velocity.

C. The object first moves in the **positive** direction with **increasing** velocity, then moves in the **positive** direction with **constant** velocity, then moves in the **negative** direction with **negative** velocity **increasing in magnitude** with time.

Problem 19: (KD1-13-V5EC)



An object moves along the x-axis. The figure above shows the graph of the velocity of the object as a

function of time. Select the response that best describes the relation of the acceleration in the x direction, a, at points A, B, and C. The acceleration in the x direction can be positive, negative, or zero.

A. $a_B > a_A > a_C$

B. $a_C > a_A = a_B$

C. $a_B > a_C > a_A$

D. $a_C > a_B > a_A$

E. $a_C = a_A = a_B$

Problem 20: (KD1-14-V3)
An object moves along the x-axis. When the object passes through $x = +1\,\text{m}$, the object has a velocity of $+2\,\text{m/s}$ in the positive x-direction. When the object passes through $x = +2\,\text{m}$, the object has a velocity of $+1\,\text{m/s}$ in the positive x-direction.

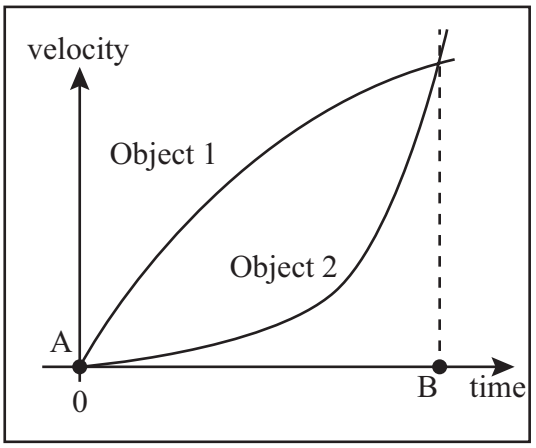
Select the response which best describes the average acceleration of the object between the two points.

A. The object's average acceleration is zero.

B. The object's average acceleration is in the positive x-direction.

C. The object's average acceleration is in the negative x-direction.

Problem 21: (KD1-15-V3EC)



Two objects, Object 1 and 2, move in one dimension. The figure above shows their velocities as a function of time.

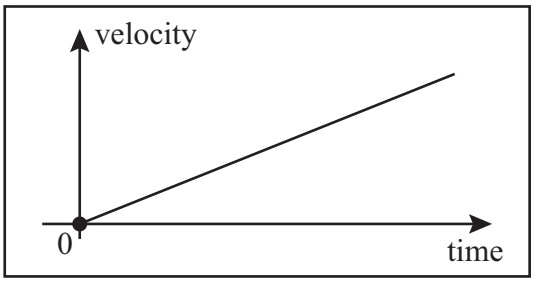
Compare the distance traveled by each object between time $t = A$ and time $t = B$.

A. The distance traveled is the same for both objects.

B. Object 1 travels farther than Object 2.

C. Object 2 travels farther than Object 1.

Problem 22: (KD1-16)



An object moves along the x-axis. The figure above shows the velocity of the object as a function of time.

Select the response which best describes the velocity of the object and the acceleration of the object.

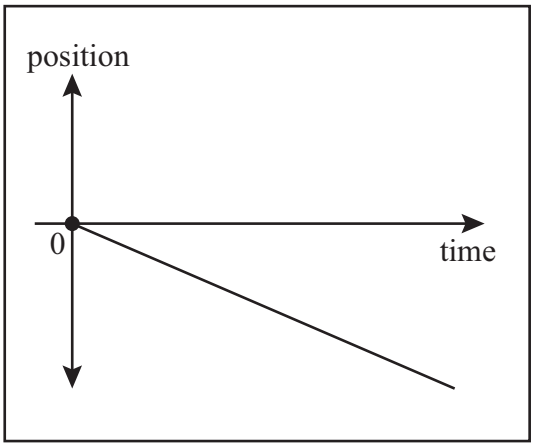
A. The velocity and acceleration are **constant**.

B. The velocity and acceleration **increase with time**.

C. The velocity is **constant** and acceleration **increases with time**.

D. The velocity **increases with time** and acceleration is **constant**.

Problem 23: (KD1-17-V4JS)



The figure above shows the position of an object as a function of time.

Compare the velocity of the object with the acceleration of the object.

A. The velocity and acceleration are **constant**. Both are **greater than zero**.

B. The velocity and acceleration both **decrease in magnitude with time**.

C. The velocity and acceleration are **constant**. Both are **less than zero**.

D. The velocity is **constant and negative** while the acceleration is **constant and positive**.

E. The velocity is **constant and negative** while the acceleration is **zero**.

Problem 24: (KD1-18)
An object moves along the x-axis. The object is at $x = -1\,\text{m}$ on the x axis at time $t = 0$. The object's velocity at time $t = 0$ is positive. The object has a constant positive acceleration in the x-direction.

Select the response which best describes the motion of the object at times after $t = 0$.

A. The object moves in the **positive** x-direction with **increasing** speed.

B. The object moves in the **negative** x-direction with **increasing** speed.

C. The object moves in the **positive** x-direction with **constant** speed.

D. The object moves in the **positive** x-direction with **decreasing** speed until it **stops**. Then it **remains stationary**.

E. The object moves in the **positive** x-direction with **decreasing** speed until it **stops**. Then it travels in the **negative** x-direction with **increasing** speed.

Problem 25: (KD1-18-V5EC)
An object moves along the x-axis. At time $t = 0$, the object is at $x = -1\,\text{m}$ on the x-axis. The object's velocity is negative at time $t = 0$, and the object has constant positive acceleration.

Select the response which best describes the motion of the object at $t = 0$.

A. The object moves in the **negative** x-direction with **increasing** speed.

B. The object moves in the **negative** x-direction with **decreasing** speed.

C. The object moves in the **negative** x-direction with **constant** speed.

D. The object moves in the **positive** x-direction with **increasing** speed.

E. The object moves in the **positive** x-direction with **decreasing** speed.

F. The object moves in the **positive** x-direction with **constant** speed.

Problem 26: (KD1-19-V4EC)
An object moves in one dimension, along the x-axis. At time $t = 0$, the object is at $x = +1\,\text{m}$ on the x-axis.

The object's velocity is positive at time $t = 0$, and the object has constant negative acceleration.

Select the response which best describes the motion of the object, starting at $t = 0$.

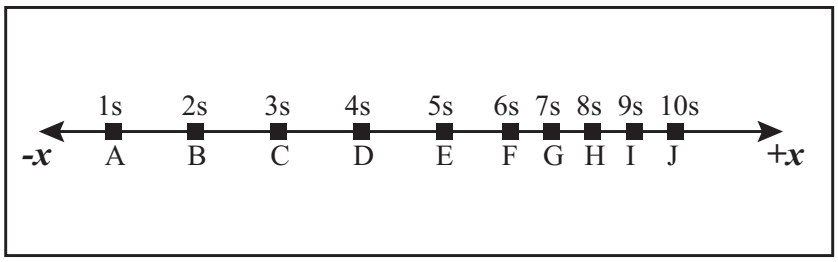
A. The object moves in the **negative** x-direction with **increasing** speed until it eventually **stops**, then travels in the **positive** x-direction with **decreasing** speed.

B. The object moves in the **positive** x-direction with **decreasing** speed until it eventually **stops**, then travels in the **negative** x-direction with **increasing** speed.

C. The object moves in the **positive** x-direction with **decreasing** speed until it eventually **stops**, then continues to travel in the **positive** x-direction with **decreasing** speed.

D. The object moves in the **negative** x-direction with **decreasing** speed until it eventually **stops**, then travels in the **positive** x-direction with **increasing** speed.

Problem 27: (KD1-20-V5JS)



The figure above shows the motion of an object in the positive x direction. The position of the object is indicated by a set of squares. Each sequential square is one second apart in time.

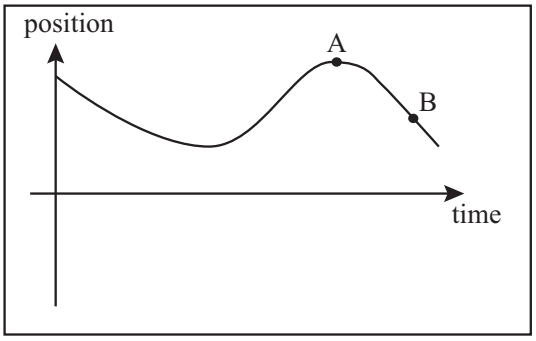
Select the response which describes the average acceleration of the object between point C and point H.

A. The average acceleration is zero.

B. The average acceleration is positive.

C. The average acceleration is negative.

Problem 28: (KD1-21-V2)



The figure above shows the graph of the position of an object as a function of time.

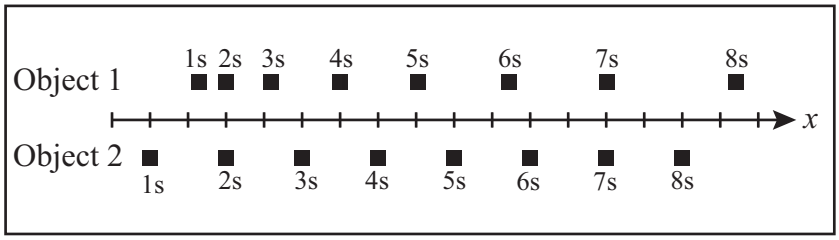
Compare the magnitude of the acceleration of the object at points A and B.

A. The magnitude of the acceleration is **approximately equal** at points A and B.

B. The magnitude of the acceleration is **larger at point A** than point B.

C. The magnitude of the acceleration is **larger at point B** than point A.

Problem 29: (KD1-22-V3JS)



The figure above shows the position of two objects moving in the positive x direction. The time interval between each numbered square is one second.

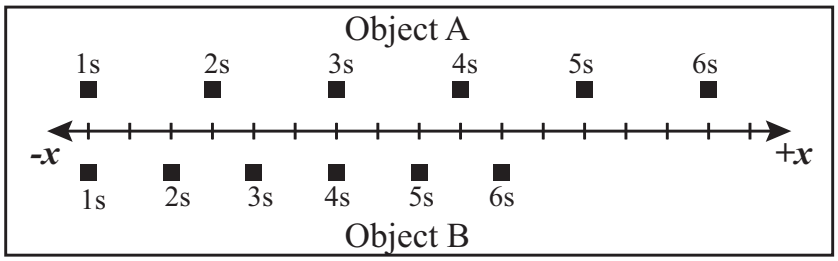
Do the objects ever have the same speed?

A. No. The objects **never** have the same speed.

B. The objects have the same speed **at** points 2s and 7s.

C. The objects have the same speed somewhere **between** points 2s and 6s.

Problem 30: (KD1-23-V4JS)



The figure above shows the position of two objects moving in the positive x-direction. The time interval between each numbered square is one second.

Select the response that best describes the relation of the acceleration of the two objects.

A. The acceleration of **object A** is **greater** than the acceleration of **object B**.

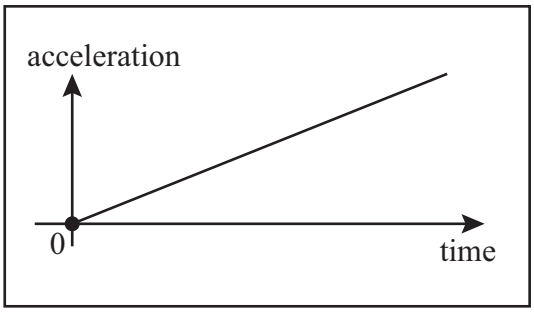
B. The acceleration of objects A and B are **equal**. Both accelerations are **greater than zero**.

C. The acceleration of **object B** is **greater** than the acceleration of **object A**.

D. The acceleration of objects A and B are **equal**. Both accelerations are **zero**.

E. The acceleration of objects A and B are **equal**. Both accelerations are **less than zero**.

Problem 31: (KD1-24)



The figure above shows the acceleration of an object as a function of time. The object moves along the x-axis. The positive direction is to the right of the page. The object is at the origin and has a positive velocity at time zero.

Select the response which best describes the motion of the object after time zero.

A. The object moves to the right **speeding up at a constant rate**.

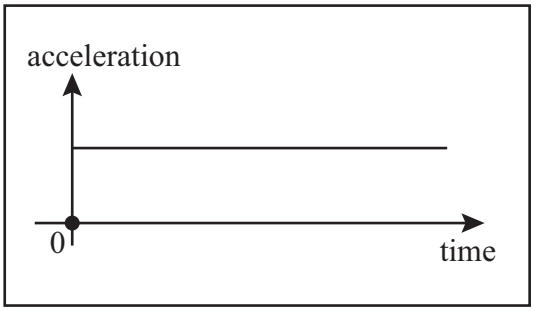
B. The object moves to the right **slowing down at a constant rate**.

C. The object moves to the right with **constant speed**.

D. The object moves to the right **speeding up at an increasing rate**.

E. The object moves to the right **speeding up at a decreasing rate**.

Problem 32: (KD1-25)



The figure above shows the acceleration of an object as a function of time. The object moves along the x-axis. The object is at the origin and has a positive velocity at time zero.

Select the response which best describes the motion of the object.

A. The object is stationary.

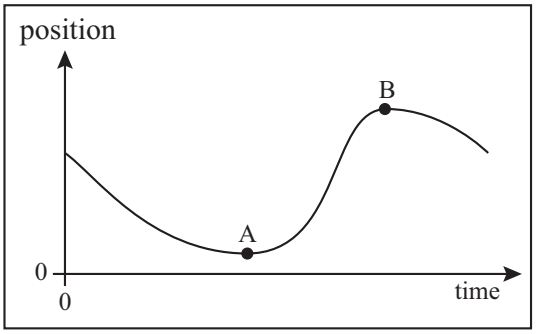
B. The object moves to the right speeding up at a constant rate.

C. The object moves to the right with constant speed.

D. The object moves to the right speeding up at an increasing rate.

E. The object moves to the right slowing down at a constant rate.

Problem 33: (KD1-28)



The figure above shows the position of an object traveling along the x axis as a function of time.

Select the response that best describes the acceleration of the object at point A and at point B.

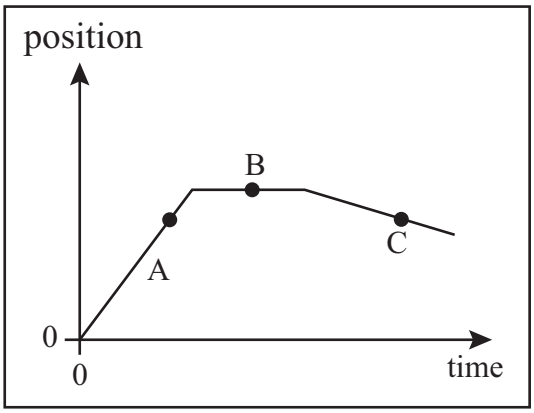
A. The acceleration at point A is approximately equal to the acceleration at point B. Both are zero.

B. The acceleration at point A is less than the acceleration at point B. Both are positive.

C. The acceleration at point A is negative and the acceleration at point B is positive.

D. The acceleration at point A is positive and the acceleration at point B is negative.

Problem 34: (KD1-29)



An object moves along the x axis. The figure above shows the graph of the position along the x axis as a function of time. Three locations on the plot have been marked.

Select the inequality below that best represents the relation of the speed at points A, B, and C.

A. $\text{speed}_A = \text{speed}_B = \text{speed}_C$

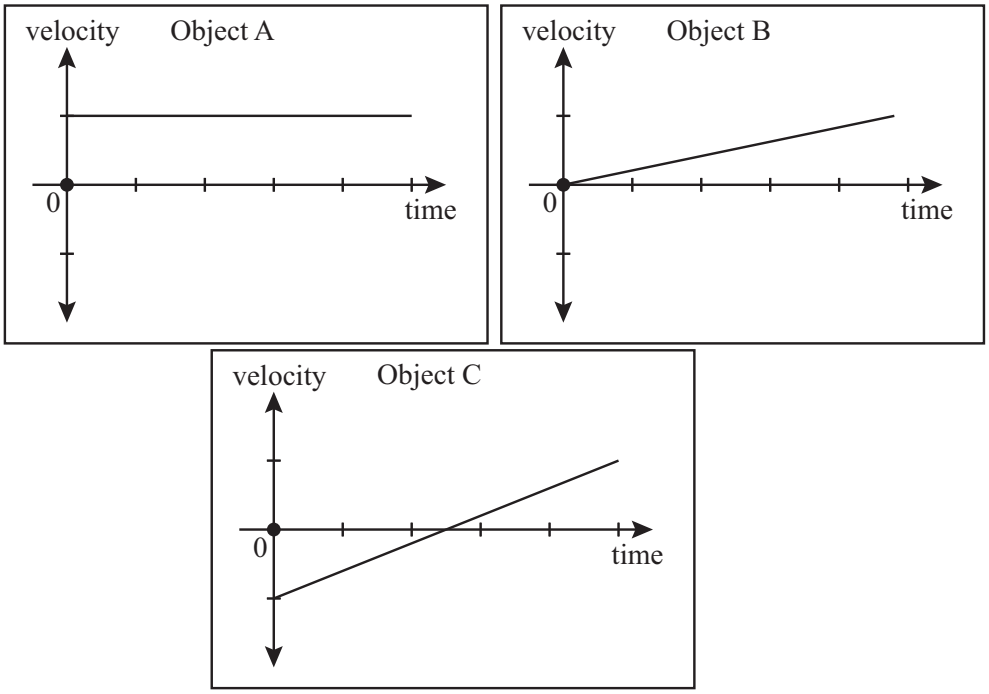
B. $\text{speed}_A > \text{speed}_C > \text{speed}_B$

C. $\text{speed}_C > \text{speed}_B > \text{speed}_A$

D. $\text{speed}_C > \text{speed}_A > \text{speed}_B$

E. $\text{speed}_B > \text{speed}_A > \text{speed}_C$

Problem 35: (KD1-32-V8EC)



Three objects travel in one dimension. The figures above show the velocity of each object as a function of time. All graphs are plotted on the same scale.

Select the response that best describes the relationship of the displacements of the objects over the entire time shown.

A. $\text{displacement}_\text{A} > \text{displacement}_\text{B} > \text{displacement}_\text{C}$

B. $\text{displacement}_\text{A} = \text{displacement}_\text{B} = \text{displacement}_\text{C}$

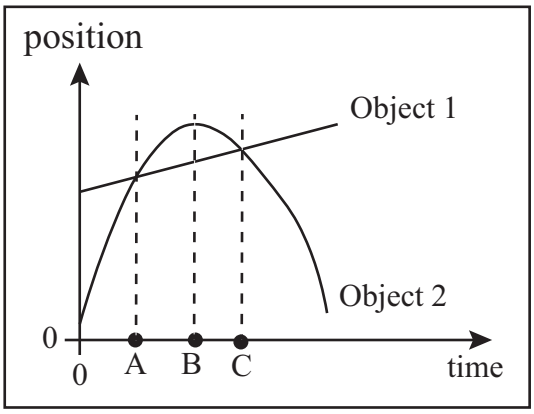
C. $\text{displacement}_\text{A} = \text{displacement}_\text{C} > \text{displacement}_\text{B}$

D. $\text{displacement}_\text{B} > \text{displacement}_\text{A} = \text{displacement}_\text{C}$

E. $\text{displacement}_\text{B} = \text{displacement}_\text{C} > \text{displacement}_\text{A}$

F. $\text{displacement}_\text{C} > \text{displacement}_\text{B} > \text{displacement}_\text{A}$

Problem 36: (KD1-35-V3AH)



The figure below shows the position of two different objects as a function of time.

Do the two objects ever have the same velocity?

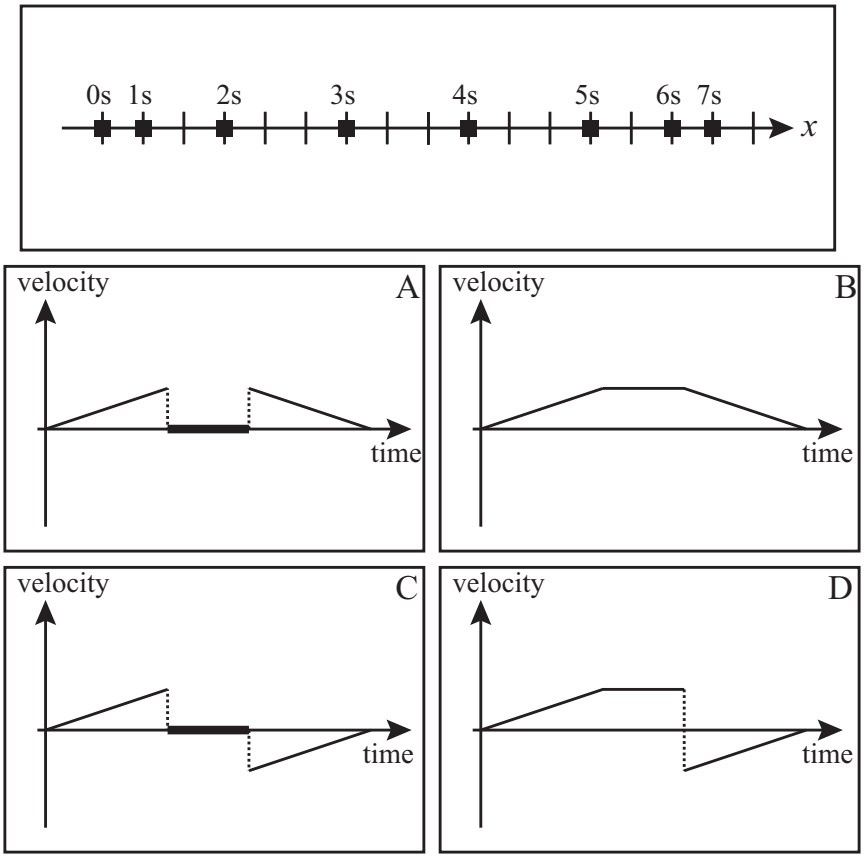
A. No, the two objects **never** have the same velocity.

B. Yes, the objects have the same velocity **at** times A and C.

C. Yes, the two objects have the same velocity **at some time between** time A and time B.

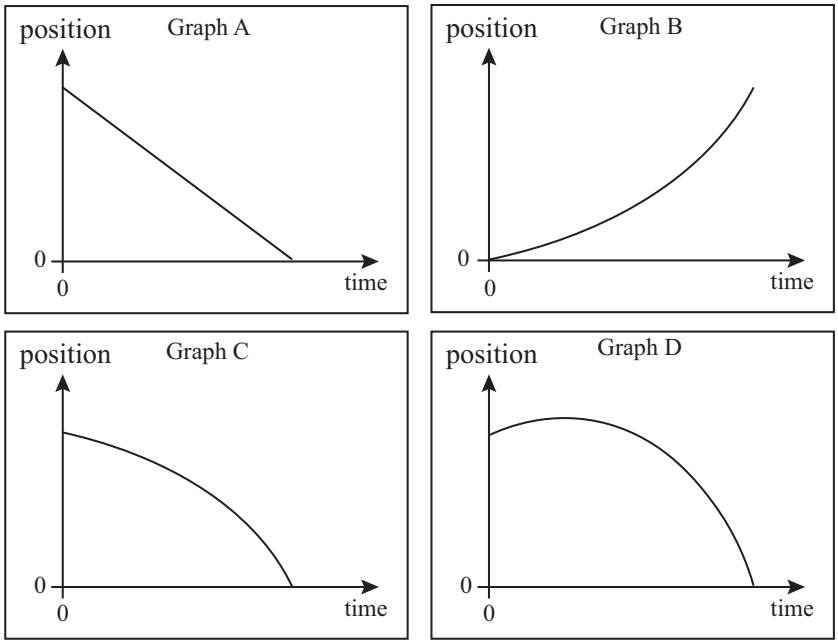
Problem 37: (KD1-36)
The top figure shows the position of an object moving in the x direction. The time interval between each pair of consecutive squares is one second.

Which of the graphs best represents the object's velocity as a function of time?

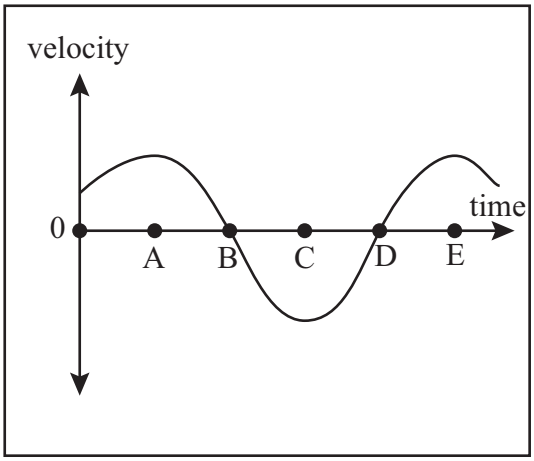


Problem 38: (KD1-37)
An object is initially moving in the positive x-direction with a constant negative acceleration.

Which of the following could be a graph of the object's position as a function of time?



Problem 39: (KD1-38-V8EC)



An object is moving in one dimension. The velocity of the object as a function of time is shown in the figure above.

When does the object change its direction of motion?

A. At times A and E

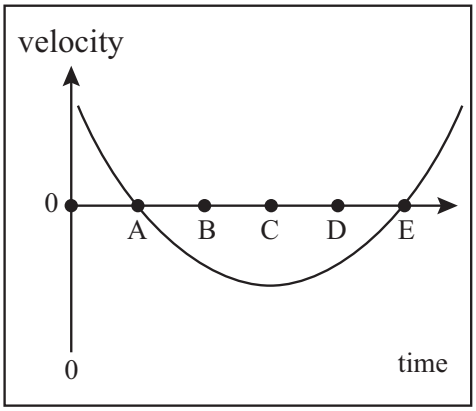
B. At times B and D

C. At time C

D. At times A, C, and E

E. At times A, B, C, D, and E

Problem 40: (KD1-39)



An object is moving along the x axis. The velocity of the object as a function of time is shown in the figure above.

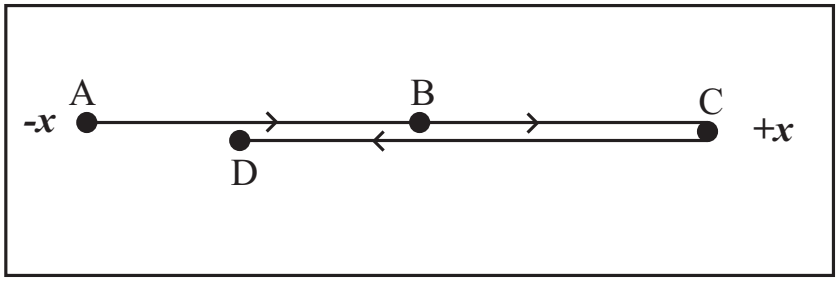
When does the object change its direction of motion?

A. At times A and E

B. At times B and D

C. At time C

Problem 41: (KD1-40-V7JS)
The object starts at point A, travels to the right along the x-axis through point B until it reaches point C, then reverses direction and travels to the left through point D. The object travels along the same line both while traveling to the left and to the right. The two paths are separated in the figure to make it easier to read. Neglect air resistance. The four points are shown on the figure below.



Select the response that best describes the object's velocity and acceleration at point C.

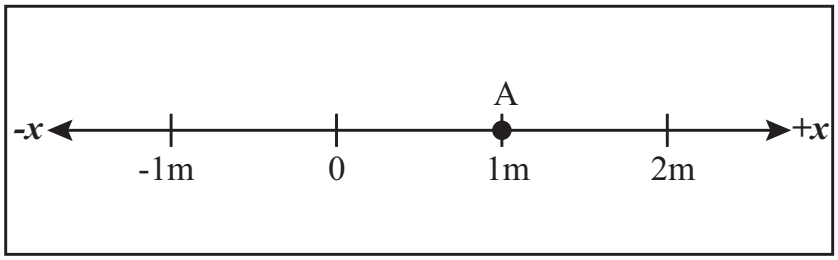
A. The object's velocity in the x-direction is **zero**, and its acceleration in the x-direction is **zero**.

B. The object's velocity in the x-direction is **positive**, and its acceleration in the x-direction is **negative**.

C. The object's velocity in the x-direction is **zero**, and its acceleration in the x-direction is **negative**.

D. The object's velocity in the x-direction is **negative**, and its acceleration in the x-direction is **negative**.

Problem 42: (KD1-41-V3EC)



An object moves along the x-axis as shown above. When it passes the point A, it has velocity $+2\,\mathrm{m/s}$.

Which of the following could be true about the acceleration at point A?

A. The acceleration is not zero and points to the right.

B. The acceleration is not zero and points to the left.

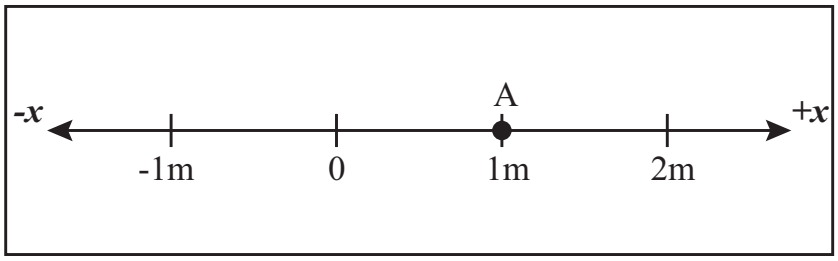
C. The acceleration is zero.

D. Both A and B are possible.

E. Both A and C are possible.

F. A, B, and C are possible.

Problem 43: (KD1-42-V7EC)



An object moves along the x axis as shown above. It is traveling either to the left or the right. When it passes the point A, it has acceleration $+2\,\mathrm{m/s^2}$.

Which of the following could be true about the motion of the object when it passes through point A?

A. The object is moving to the right and its speed is increasing.

B. The object is moving to the right and its speed is decreasing.

C. The object is moving to the left and its speed is increasing.

D. The object is moving to the left and its speed is decreasing.

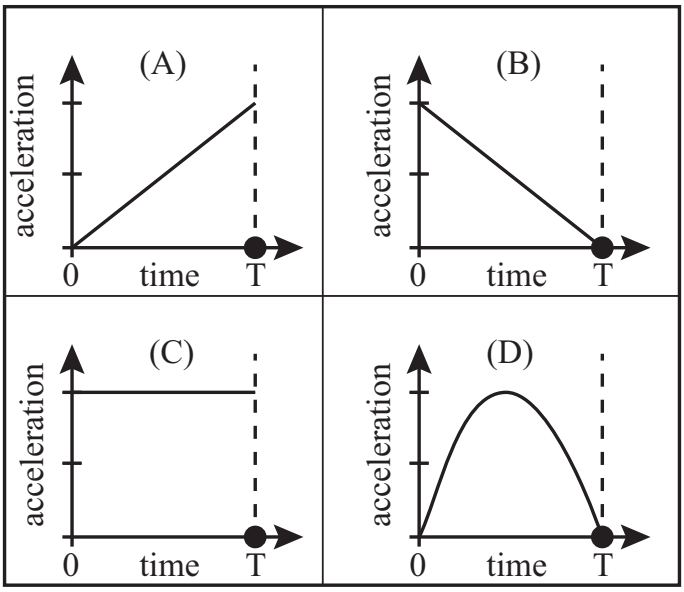
E. Both A and B are possible.

F. Both A and C are possible.

G. Both A and D are possible.

H. A, B, C, and D are possible.

Problem 44: (KD1-43-V8EC)



The figure above shows four graphs of the acceleration as a function of time for an object moving in one dimension. All graphs are plotted on the same scale.

Select the graph where the change in velocity from time $t = 0$ to time $t = T$ is the greatest.

A. Graph A

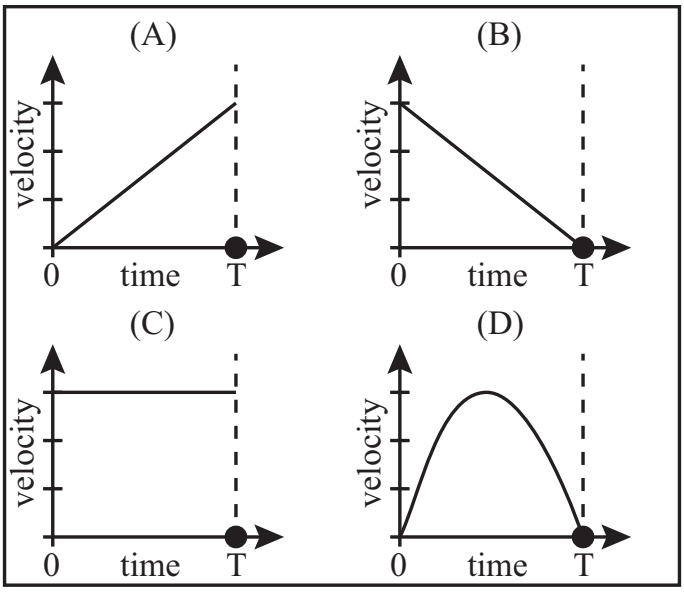
B. Graph B

C. Graph C

D. Graph D

E. Graphs A and B

Problem 45: (KD1-44-V7EC)



The figure above shows four graphs of the velocity as a function of time for an object moving along the x-axis. All graphs are plotted on the same scale.

Select the graph where the displacement from time $t = 0$ to time $t = T$ is the greatest.

A. Graph A

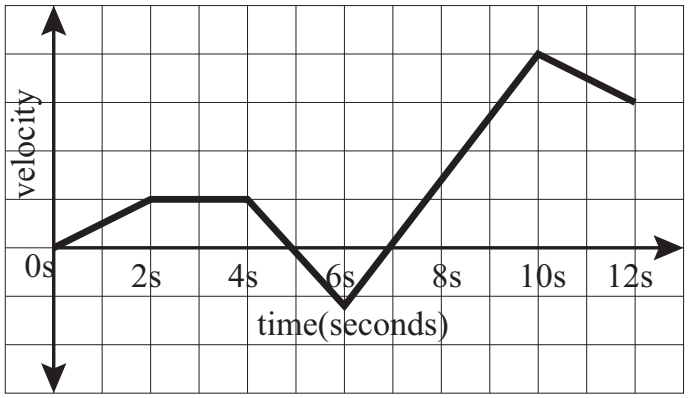
B. Graph B

C. Graph C

D. Graph D

E. Graphs A and B

Problem 46: (KD1-45-V3EC)

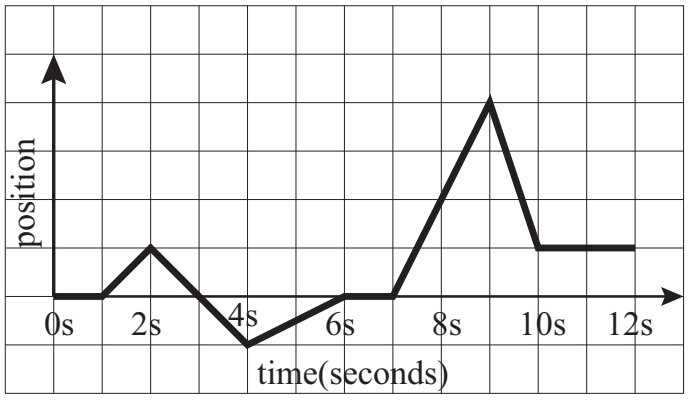


The figure above shows the velocity as a function of time of an object moving in one dimension.

Select the time or times with the greatest negative acceleration.

A. from 4 s to 6 s
B. at 6 s
C. from 5 s to 7 s
D. from 6 s to 10 s
E. at 10 s
F. from 10 s to 12 s

Problem 47: (KD1-46)



The figure above shows a graph of the position as a function of time for an object moving along the x-axis.

Select the time or times with greatest negative velocity.

A. from 2s to 4s

B. at 4s

C. from 4s to 6s

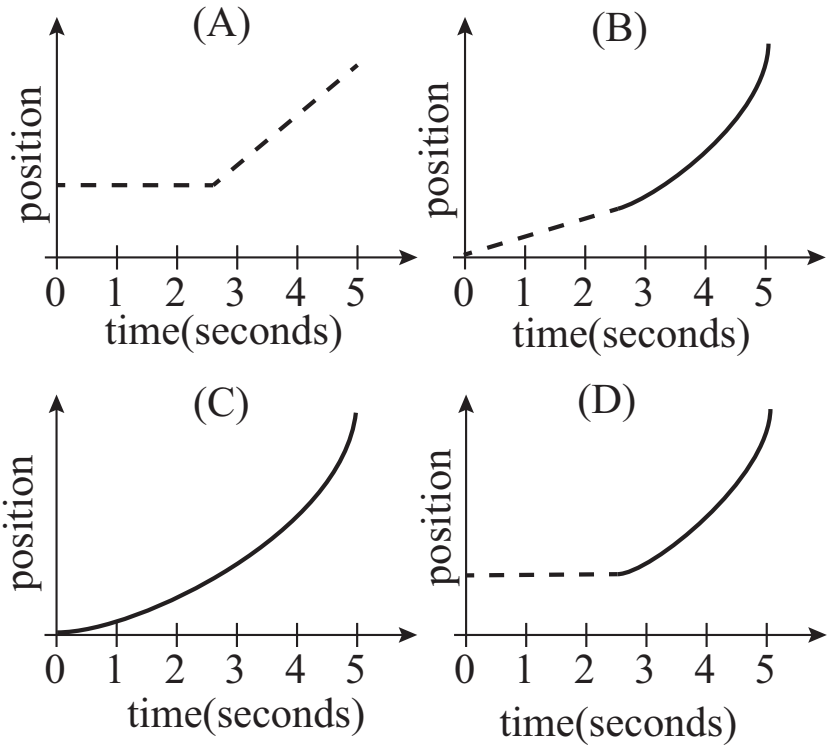
D. from 7s to 9s

E. at 9s

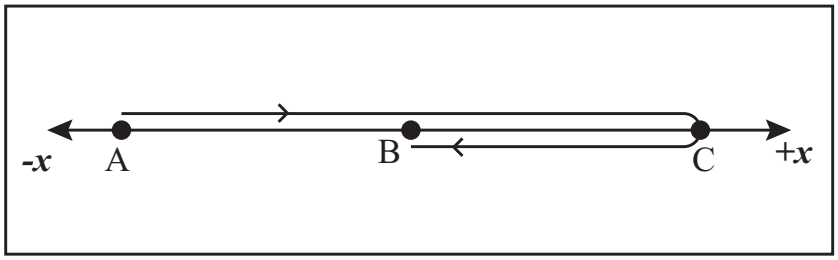
F. from 9s to 10s

Problem 48: (KD1-48-V2JS)
An object travels with a constant positive velocity for 2.5 seconds. It then travels with a positive acceleration until 5 seconds.

Select the figure below which best represents its position as a function of time. To help read the graphs, straight segments are dashed lines and curved segments are solid lines.



Problem 49: (KD1-50-V2EC)



The figure above shows an object that starts at point A, travels to the right until it reaches point C, then reverses direction and travels to the left to point B.

Which of the following best describes the relation between the total distance traveled and the displacement of the object?

A. The magnitude of the displacement is **larger** than the total distance traveled.

B. The magnitude of the displacement is **less than** the total distance traveled.

C. The magnitude of the displacement is **equal** to the total distance traveled.

Problem 50: (KD1-51)
An object moves in one dimension, along the x-axis. An object is at $x = -1\,\text{m}$ on the x axis at time $t = 0$. The object's velocity at time $t = 0$ is negative. The object travels along the x axis with a constant negative acceleration in the x direction.

Select the response which best describes the motion of the object at times after $t = 0$.

A. The object moves in the positive x direction with increasing speed.

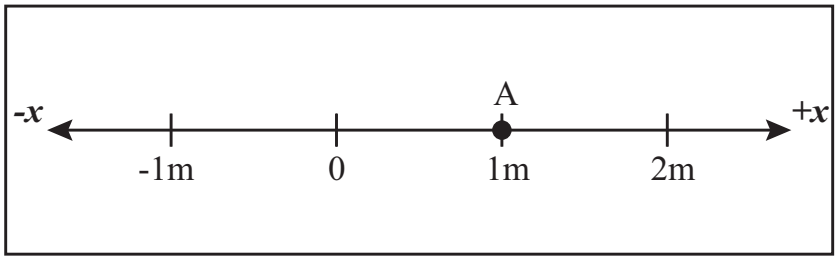
B. The object moves in the negative x direction with increasing speed.

C. The object moves in the positive x direction with constant speed.

D. The object moves in the positive x direction with decreasing speed until it stops. It then remains stationary.

E. The object moves in the positive x direction with decreasing speed until it stops. It then travels in the negative x direction with increasing speed.

Problem 51: (KD1-52-V5JS)



An object is constrained to travel on the x-axis. When it is at point A, as shown above, it has acceleration $-2\,\mathrm{m/s^2}$.

Which of the following could be true about the speed of the object when it is at point A?

A. The speed is decreasing.

B. The speed is increasing.

C. The speed is instantaneously zero.

D. Both A and B are possible.

E. Both A and C are possible.

F. A, B, and C are possible.