Al Jahili School C2/3

School Operation Sector 2

Council 6 Cluster 6

Grade 09 Advanced Physics
Academic Year 2023/2024 – Term 1

EoT1 Exam Coverage In Term 1
(2023 - 2024)

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Part 1:

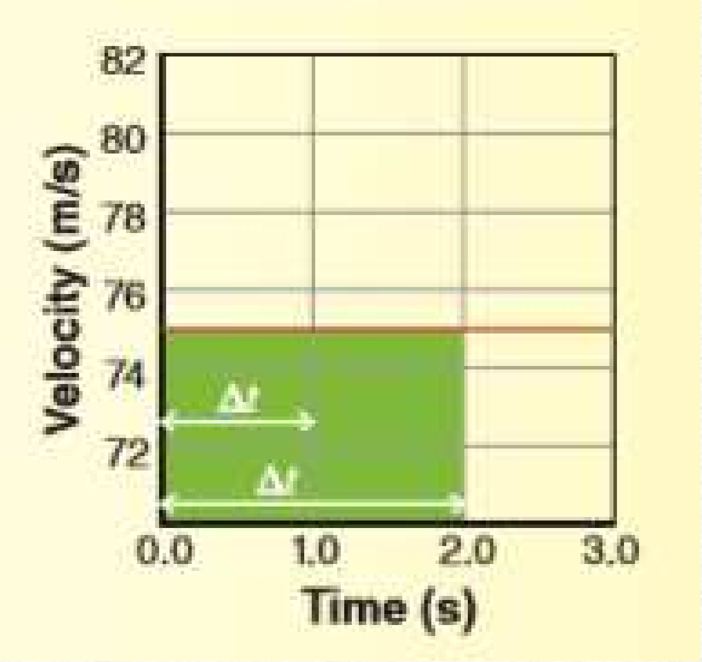
Swift Assess

LO: 1	Relate the slope of a velocity time graph to the average acceleration of the object in motion	Example 3	Page 68

Example 3:

FINDING DISPLACEMENT FROM A VELOCITY-TIME GRAPH

The velocity-time graph at the right shows the motion of an airplane. Find the displacement of the airplane for $\Delta t = 1.0$ s and for $\Delta t = 2.0$ s. Let the positive direction be forward.



$\Delta t = 1.0$ s.

$\Delta x = v\,\Delta t$

$= (+\,75\text{ m/s})(1.0\text{ s})$

$= +\,75\text{ m}$

$\Delta t = 2.0$ s.

$\Delta x = v\,\Delta t$

$= (+\,75\text{ m/s})(2.0\text{ s})$

$= +\,150\text{ m}$

LO: 2	**Apply the equation of motion relating the final velocity of an object to its initial velocity, uniform acceleration, and time (vf = vi + at)**	**Problem 5, 6**	**Page 63**

Q5. A race car's forward velocity increases from 4.0 m/s to 36 m/s over a 4.0-s time interval. What is its average acceleration?

$$\bar{a} = \frac{\Delta v}{\Delta t} = \frac{36 \text{ m/s} - 4.0 \text{ m/s}}{4.0 \text{ s}} = 8.0 \text{ m/s}^2$$

Q6. The race car in the previous problem slows from 36 m/s to 15 m/s over 3.0 s. What is its average acceleration?

$$\bar{a} = \frac{\Delta v}{\Delta t} = \frac{15 \text{ m/s} - 36 \text{ m/s}}{3.0 \text{ s}} = -7.0 \text{ m/s}^2$$

Q7. A bus is moving west at 25 m/s when the driver steps on the brakes and brings the bus to a stop in 3.0 s.

a) What is the average acceleration of the bus while braking?

$$\bar{a} = \frac{\Delta v}{\Delta t}$$

$$= \frac{0.0 \text{ m/s} - 25 \text{ m/s}}{3.0 \text{ s}} = -8.3 \text{ m/s}^2$$

b) If the bus took twice as long to stop, how would the acceleration compare with what you found in part a?

half as great (-4.2 m/s^2)

LO: 3	Use appropriate significant figures to record answers from a mathematical operation, with the correct number of digits	Problem 8	Page 13

Q12. Significant Figures Solve the following problems, using the correct number of significant figures each time.

a) 10.8 g - 8.264 g = 2.536 ..rounding to S.F.. → **2.5 g**

b) 4.75 m - 0.4168 m = 4.3332 ..rounding to S.F.. → **4.33 m**

c) 139 cm × 2.3 cm = 319.7 ..rounding to S.F.. → **320 cm^2 = 3.2 $x10^2$ cm^2**

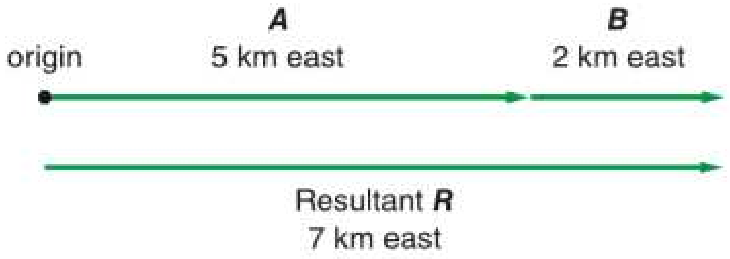
d) 13.78 g / 11.3 mL = 1.21946903 ..rounding to S.F.. → **1.22 g /mL**

e) 6.201 cm + 7.4 cm + 0.68 m + 12.0 cm = 6.201 cm + 7.4 cm + 0.68x10-2 cm + 12.0 cm 93.601 cm ..rounding to S.F.. → **93.6 cm**

f) 1.6 km + 1.62 m + 1200 cm = 1.6 $x10^3$ m +1.62 m +12 m= 1613.62 ..rounding to S.F.. → **1600 m**

LO: 4	Differentiate between distance travelled and displacement	Figure 10	Page 37

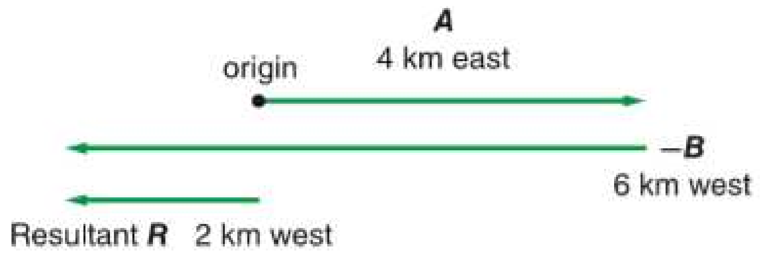
Example of Vector Addition



$R = A + B$
$= 5\text{ km} + 2\text{ km}$
$= 7\text{ km}$

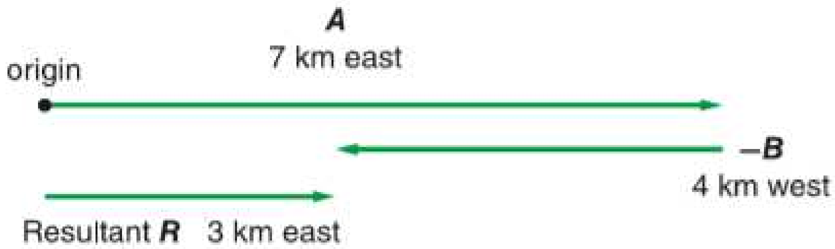
$\mathbf{R} = \mathbf{A} + \mathbf{B}$
$= 7\text{ km east}$

Examples of Vector Subtraction



$R = A - B$
$= 4\text{ km} - 6\text{ km}$
$= -2\text{ km}$

$\mathbf{R} = \mathbf{A} - \mathbf{B}$
$= \mathbf{A} + (-\mathbf{B})$
$= 2\text{ km west}$



$R = A - B$
$= 7\text{ km} - 4\text{ km}$
$= 3\text{ km}$

$\mathbf{R} = \mathbf{A} - \mathbf{B}$
$= \mathbf{A} + (-\mathbf{B})$
$= 3\text{ km east}$

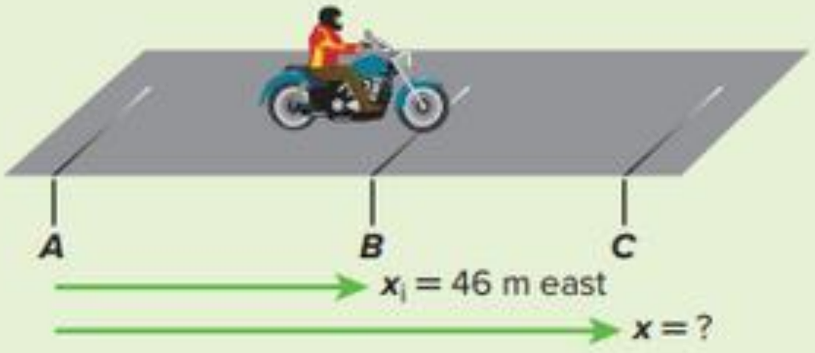
LO: 5	Apply the equation of motion, (xf = v_{avg}t + xi) or (xf - xi = v_{avg}t), in numerical problems to calculate the position or other physical quantities	Example 4	Page 48

EXAMPLE Problem 4

POSITION The figure shows a motorcyclist traveling east along a straight road. After passing point ***B***, the cyclist continues to travel at an average velocity of 12 m/s east and arrives at point **C** 3.0 s later. What is the position of point **C**?

1 ANALYZE THE PROBLEM

Choose a coordinate system with the origin at ***A***.



KNOWN	UNKNOWN
$\bar{v}$ = 12 m/s east	x = ?
x_i = 46 m east	
t = 3.0 s	

2 SOLVE FOR THE UNKNOWN

$x = \bar{v}t + x_i$ — Use magnitudes for the calculations.

$= (12\text{ m/s})(3.0\text{ s}) + 46\text{ m}$ — Substitute $\bar{v}$ = 12 m/s, t = 3.0 s, and x_i = 46 m.

$= 82\text{ m}$

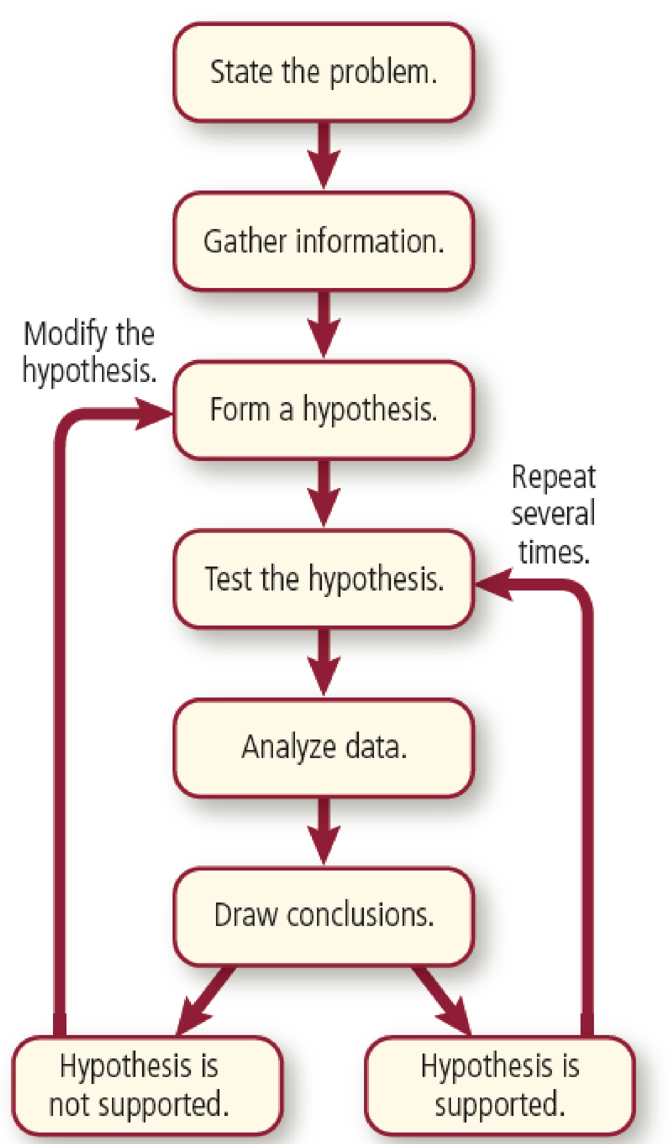
x = 82 m east

3 EVALUATE THE ANSWER

Are the units correct? Position is measured in meters.

Does the direction make sense? The motorcyclist is traveling east the entire time.

LO: 6	List the common steps of scientific method used in investigations	Figure 2	Page 5



patterns of investigation procedures are called scientific methods

LO: 7	**Apply the alternative equation of motion relating an object's final velocity to its initial velocity, its constant acceleration, and its initial and final positions ($v_f^2 = v_i^2 + 2a(xf - xi)$)**	**Problem 16**	**Page 67**

Q16. A golf ball rolls up a hill toward a miniature-golf hole. Assume the direction toward the hole is positive.

a) If the golf ball starts with a speed of 2.0 m/s and slows at a constant rate of 0.50 m/s^2, what is its velocity after 2.0 s?

$$v_f = v_i + at$$
$$= 2.0 \text{ m/s} + (-0.50 \text{ m/s}^2)(2.0 \text{ s})$$
$$= 1.0 \text{ m/s}$$

b) What is the golf ball's velocity if the constant acceleration continues for 6.0 s?

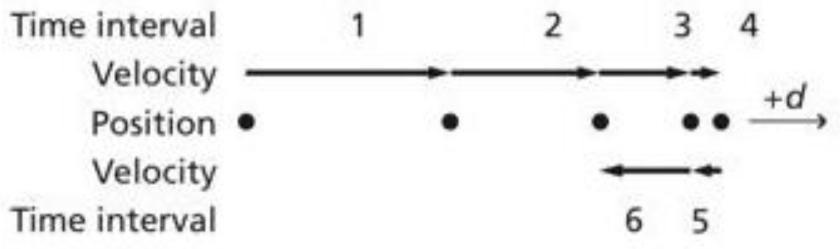
$$v_f = v_i + at$$
$$= 2.0 \text{ m/s} + (-0.50 \text{ m/s}^2)(6.0 \text{ s})$$
$$= -1.0 \text{ m/s}$$

LO: 7	**Apply the alternative equation of motion relating an object's final velocity to its initial velocity, its constant acceleration, and its initial and final positions** $(v_f^2 = v_i^2 + 2a(xf - xi))$	**Problem 16**	**Page 67**

Q16. A golf ball rolls up a hill toward a miniature-golf hole. Assume the direction toward the hole is positive.

c) Describe the motion of the golf ball in words and with a motion diagram.

The ball's velocity simply decreased in the first case. In the second case, the ball slowed to a stop and then began rolling back down the hill.



LO: 8	Define a coordinate system and identify the origin, position, and distance in a coordinate system	Figure 9	Page 36

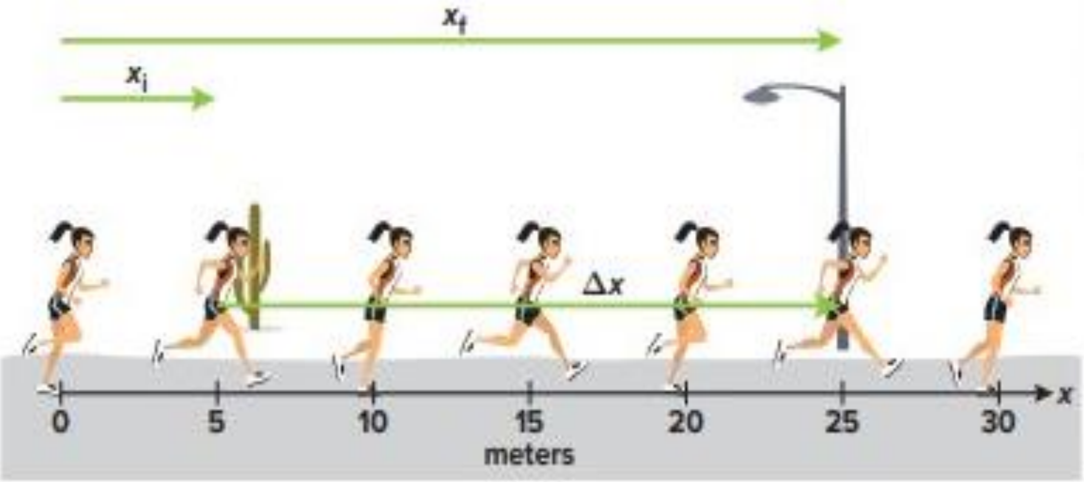


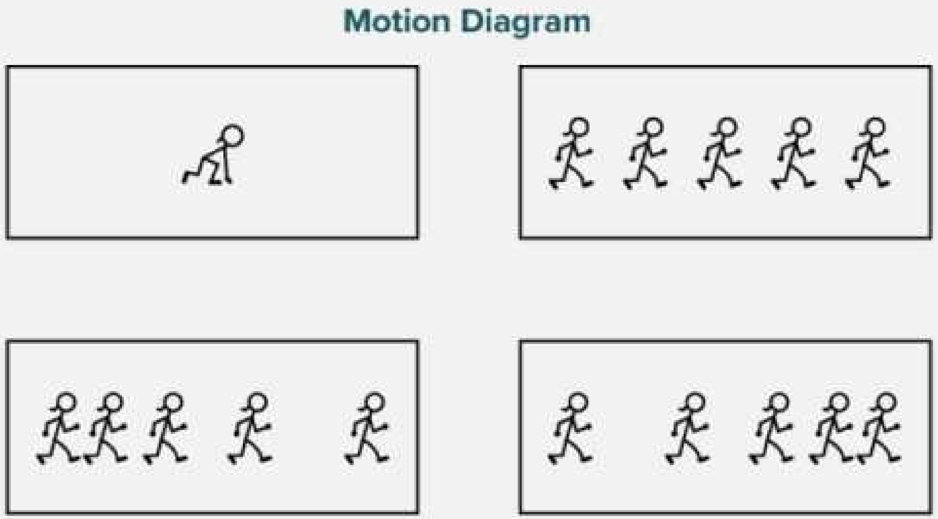
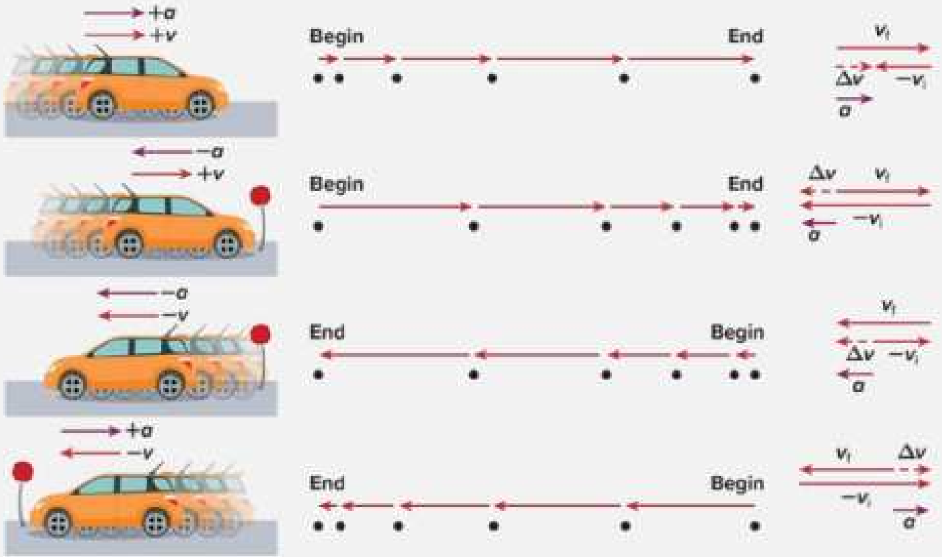
Figure 9 The vectors x_i and x_f represent positions. The vector Δx represents displacement from x_i to x_f.

Describe *the displacement from the lamppost to the cactus.*

$\Delta x = xf - xi \Rightarrow \Delta x = 25 - 5 = 20$

- **A coordinate system** tells you the location of the zero point of the variable you are studying and the direction in which the values of the variable increase.
- **The origin** is the point at which both variables have the value zero.
- **Distance** is the entire length of an object's path
- **Position** is the distance and direction from the origin to the object
- **Displacement** is a change in position. Because displacement has both magnitude and direction, it is a vector.

LO: 9	Describe the motion of an object if its velocity and acceleration are either in the same directions or opposite directions, hence state if an object is slowing down or speeding up	As mentioned in the book	Page 57

Figure (1) The distance the jogger moves in each time interval indicates the type of motion. Motionless, Uniform (constant velocity), speeding up, slowing down)	Figure 4 You need to know the direction of both the velocity and acceleration vectors in order to determine whether an object is speeding up or slowing down.
	

LO: 10	Define and calculate the average acceleration.	Question 12	Page 64

Q12. Two joggers run at a constant velocity of 7.5 m/s east. Figure 10 shows the positions of both joggers at time t = 0.

a) What would be the difference(s) in the position-time graphs of their motion?

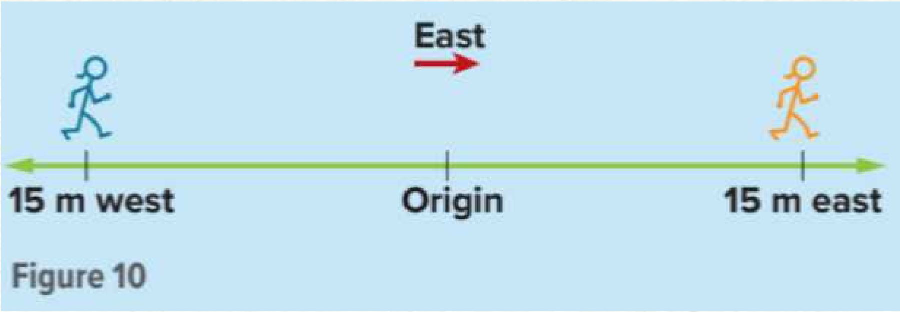
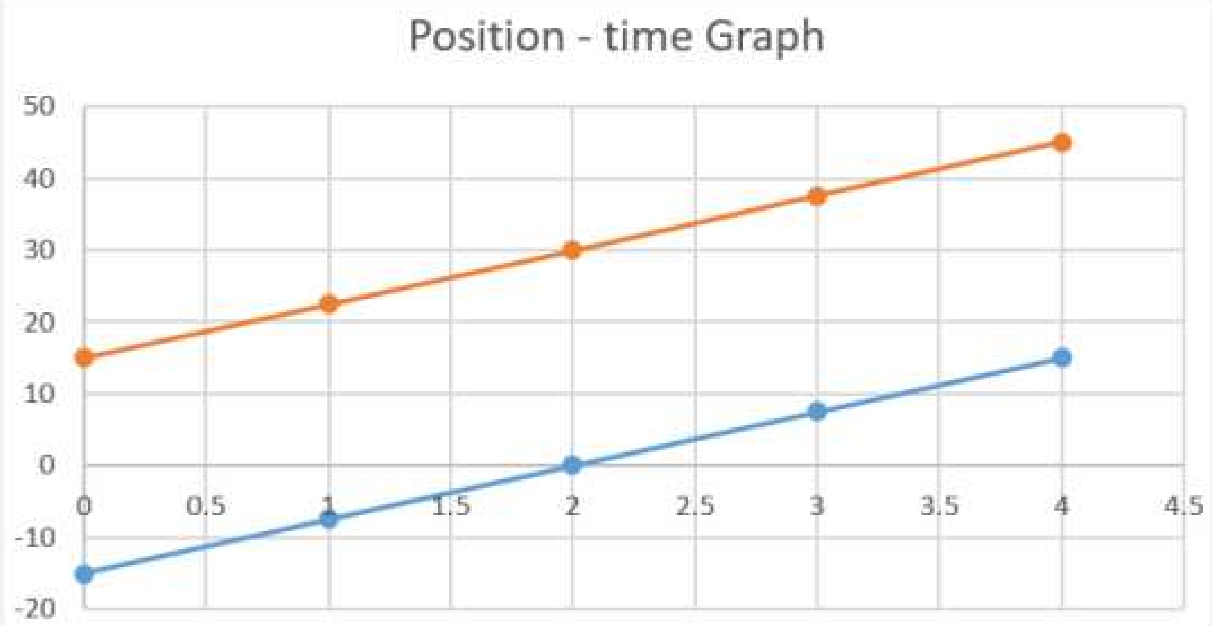


Figure 10

$$x_f = v\,t + x_i$$

Blue Jogger	Orange Jogger
$x_f = 7.5\,t - 15$	$x_f = 7.5\,t + 15$

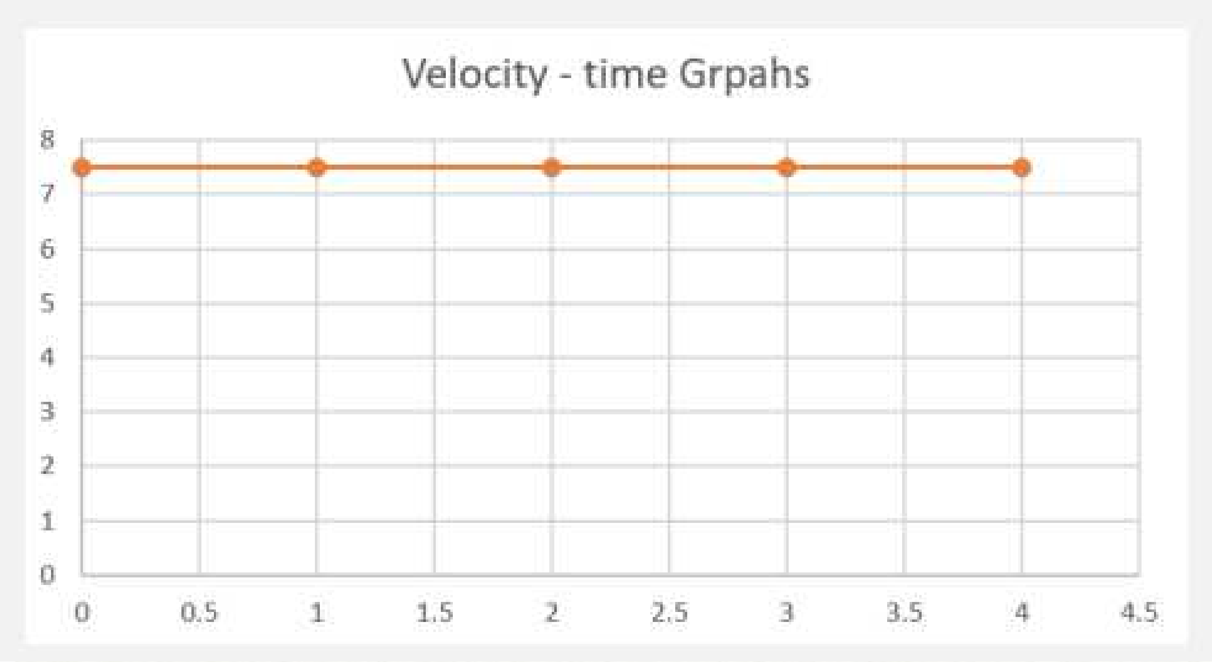


Both lines would have the same slope, but they would rise from the d-axis at different points,#15 m, and "15 m.

LO: 10	Define and calculate the average acceleration.	Question 12	Page 64

Q12. Two joggers run at a constant velocity of 7.5 m/s east. Figure 10 shows the positions of both joggers at time t = 0.

b) What would be the difference(s) in their velocity-time graphs?



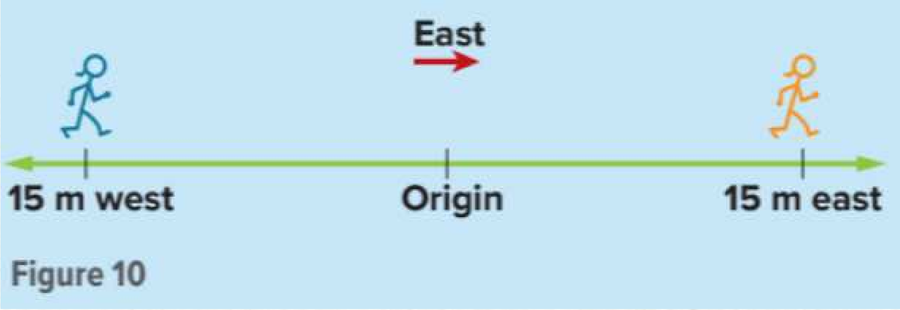


Figure 10

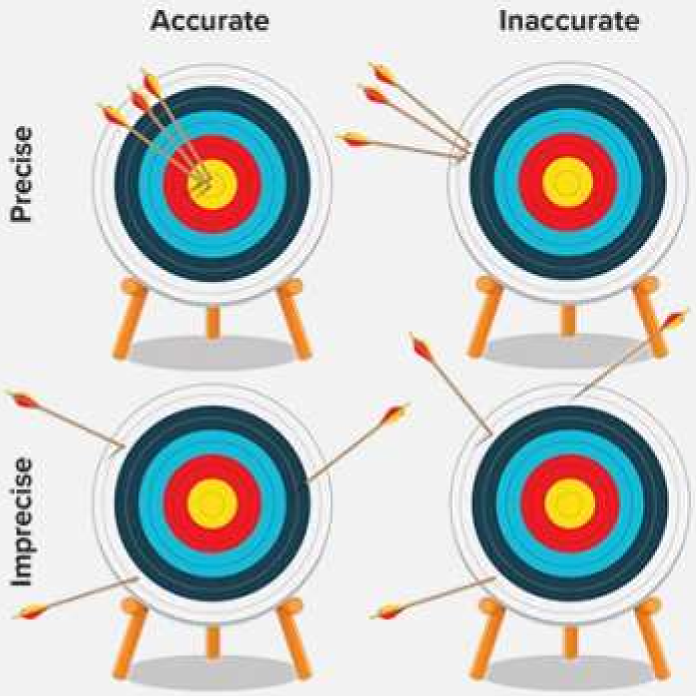
$$x_f = v\,t + x_i$$

Blue Jogger	Orange Jogger
$x_f = 7.5\,t - 15$	$x_f = 7.5\,t + 15$

Their velocity-time graphs would be identical.

LO: 11	Compare and contrast precision and accuracy with examples.	Figure 11	Page 15

Figure 11 The yellow area in the center of each target represents an accepted value for a particular measurement. The arrows represent measurements taken by a scientist during an experiment



Precision is a characteristic of a measured value describing the degree of exactness of a measurement.

Accuracy is a characteristic of a measured value describes how well the results of a measurement agree with the 'real' value, which is the accepted value, as measured by competent experimenters.

LO: 12	Calculate the displacement as the area under the curve of a velocity-time graph.	Question 2 Question 20	Page 62 Page 68

2. Use the v-t graph of the toy train in Figure 9 to answer these questions.

a. When is the train's speed constant?

t = 5.0 s to t = 15.0 s

b. During which time interval is the train's acceleration positive?

t = 0.0 s to t = 5.0 s

c. When is the train's acceleration most negative?

t = 15.0 s to t = 20.0 s

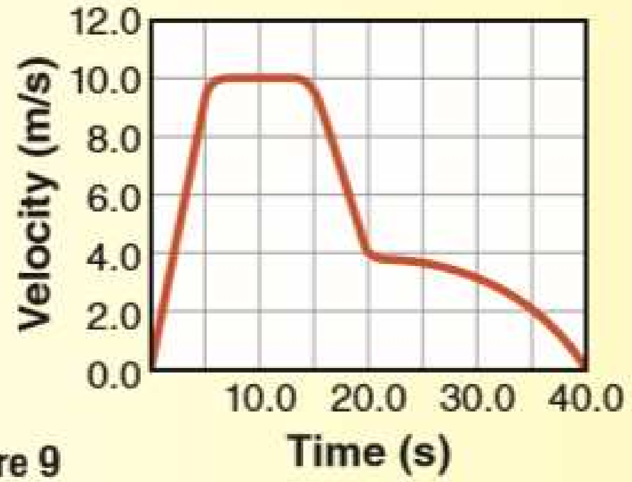


Figure 9

LO: 12	Calculate the displacement as the area under the curve of a velocity-time graph.	Question 2 Question 20	Page 62 Page 68

Q20. The graph in Figure 13 describes the motion of two bicyclists, Akiko and Brian, who start from rest and travel north, increasing their speed with a constant acceleration. What was the total displacement of each bicyclist during the time shown for each?

Hint: Use the area of a triangle: area = (1/2) (base) (height)

Cyclist A.

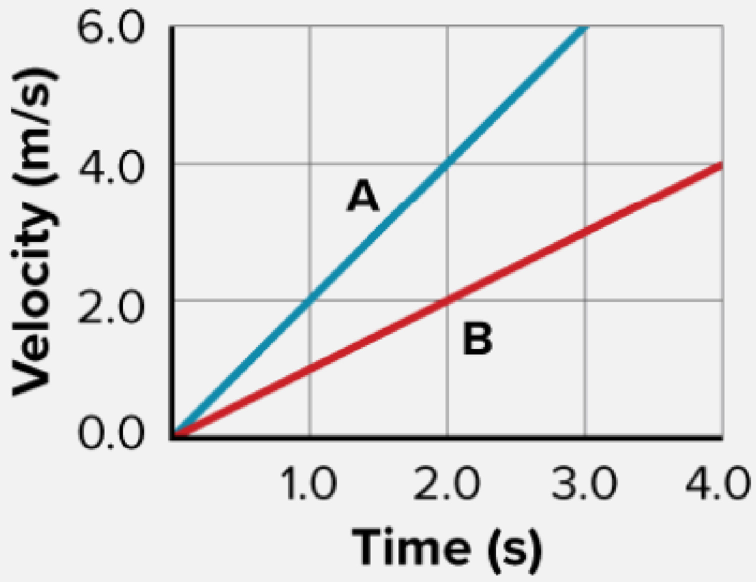
Displacement = Bounded Area

Displacement = $\left(\frac{1}{2} \times base \times height\right)$

Displacement = $\left(\frac{1}{2} \times 3.0 \times 6.0\right) = 9.0\, m\ North$

Cyclist B.

Displacement = $\left(\frac{1}{2} \times 4.0 \times 4.0\right) = 8.0\, m\ North$



LO: 13	Classify physical quantities into vector and scalar quantities (distance, mass, displacement, speed, velocity, acceleration, force, work, energy, pressure).	As mentioned in the textbook	Page 34

- **Scalar** is a quantity, such as temperature or distance, that is a just a number without any direction.
- **Vector** is a quantity, such as position, that has both magnitude and direction.

Practice Problem:

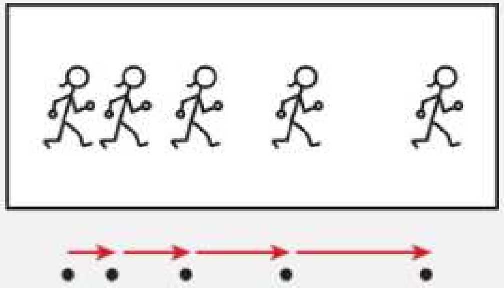
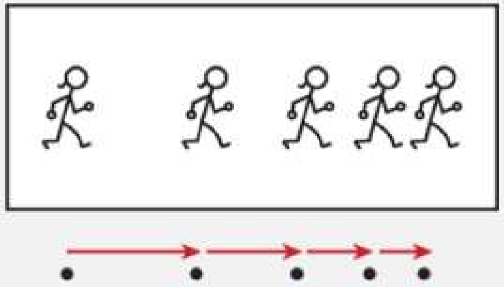
Classify the next quantities into scalar or vector.
(Distance, mass, displacement, speed, velocity, acceleration, force, work, energy, pressure)

Scalars	Vectors
Distance, mass, speed, work, energy, pressure.	Displacement, velocity, acceleration, force.

LO: 14	Recognize uniform or non-uniform motion from a motion diagram or a particle model.	Figure 2	Page 57

- **uniform motion** moves along a straight line with an unchanging velocity.
- **Non-uniform motion** has a changing velocity.

Figure 2 The change in length of the velocity vectors on these motion diagrams indicates whether the jogger is speeding up or slowing down.

	If an object speeds up, each subsequent velocity vector is longer, and the spacing between dots increases.
	If the object slows down, each vector is shorter than the previous one, and the spacing between dots decreases.

LO: 15	List the seven fundamental base quantities and their SI units.	Table 1	Page 10

Table 1 SI Base Units

Base Quantity	Base Unit	Symbol
Length	meter	m
Mass	kilogram	kg
Time	second	s
Temperature	kelvin	K
Amount of a substance	mole	mol
Electric current	ampere	A
Luminous intensity	candela	cd

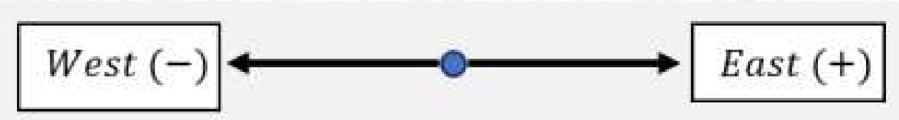
Part 2:

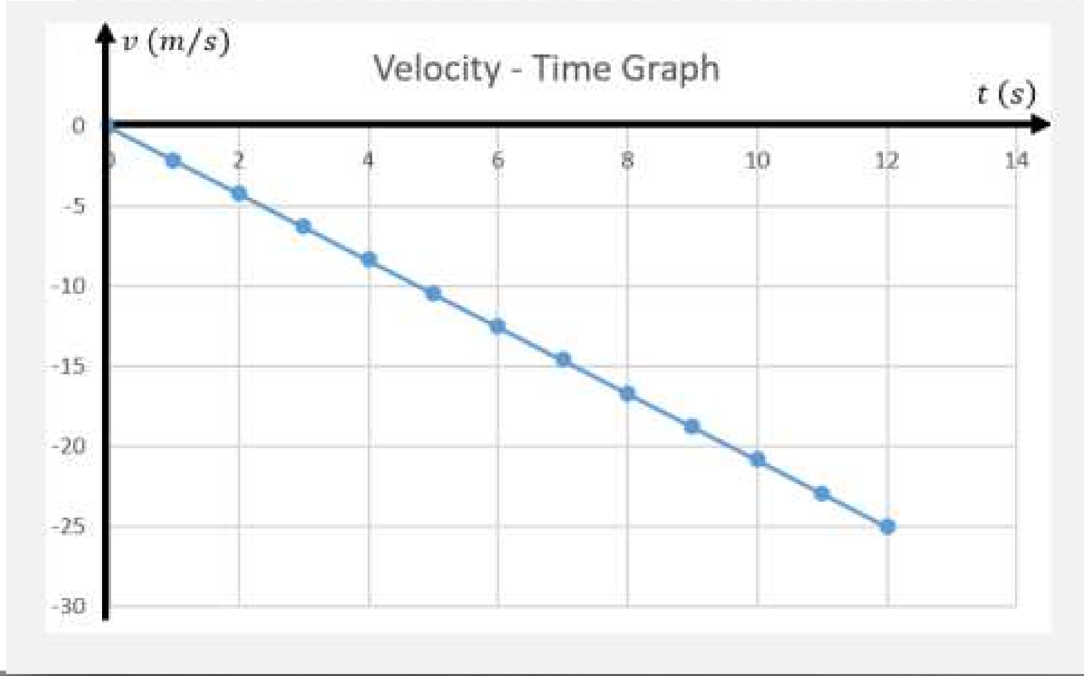
Written Part

LO: 16	Identify the shape of a position-time and velocity-time graph for an object with constant acceleration. Interpret the velocity-time graph for a single or multiple objects in motion.	Question 22 Question 13	Page 68 Page 64

Q22. A car, just pulling onto a straight stretch of highway, has a constant acceleration from 0 m/s to 25 m/s west in 12 s.

a) Draw a v-t graph of the car's motion.





LO: 16	Identify the shape of a position-time and velocity-time graph for an object with constant acceleration. Interpret the velocity-time graph for a single or multiple objects in motion.	Question 22 Question 13	Page 68 Page 64

Q22. A car, just pulling onto a straight stretch of highway, has a constant acceleration from 0 m/s to 25 m/s west in 12 s.

b) Use the graph to determine the car's displacement during the 12.0-s time interval.

$$\text{Displacement } (\Delta x) = \textit{Bounded Area}$$

$$\Delta x = \frac{1}{2} \times base \times height$$

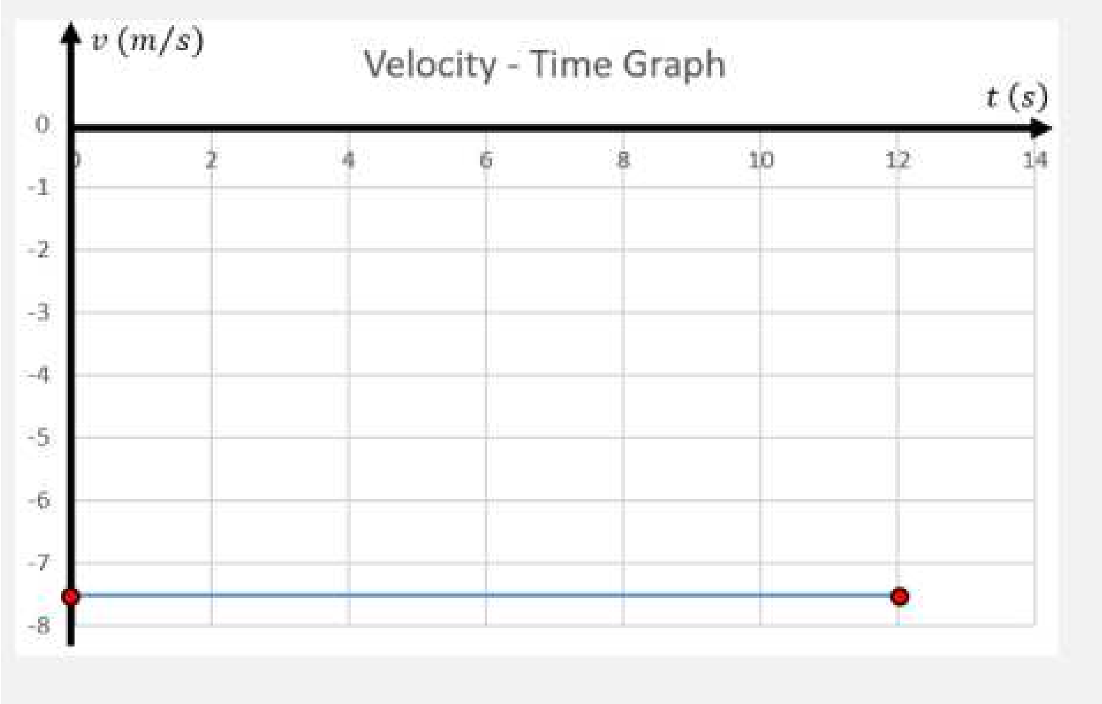
$$\Delta x = \frac{1}{2} \times 12 \times (-25)$$

$$\Delta x = -150\ m = 150\ m\ west$$

LO: 16	Identify the shape of a position-time and velocity-time graph for an object with constant acceleration. Interpret the velocity-time graph for a single or multiple objects in motion.	Question 22 Question 13	Page 68 Page 64

Q22. A car, just pulling onto a straight stretch of highway, has a constant acceleration from 0 m/s to 25 m/s west in 12 s.

c) Another car is traveling along the same stretch of highway. It travels the same distance in the same time as the first car, but its velocity is constant. Draw a v-t graph for this car's motion.



LO: 16	Identify the shape of a position-time and velocity-time graph for an object with constant acceleration.	Question 22	Page 68
	Interpret the velocity-time graph for a single or multiple objects in motion.	Question 13	Page 64

Q22. A car, just pulling onto a straight stretch of highway, has a constant acceleration from 0 m/s to 25 m/s west in 12 s.

d) Explain how you knew this car's velocity.

The displacement was the same for both cars. For the second car, then,

$$\bar{v} = \frac{\Delta x}{\Delta t}$$

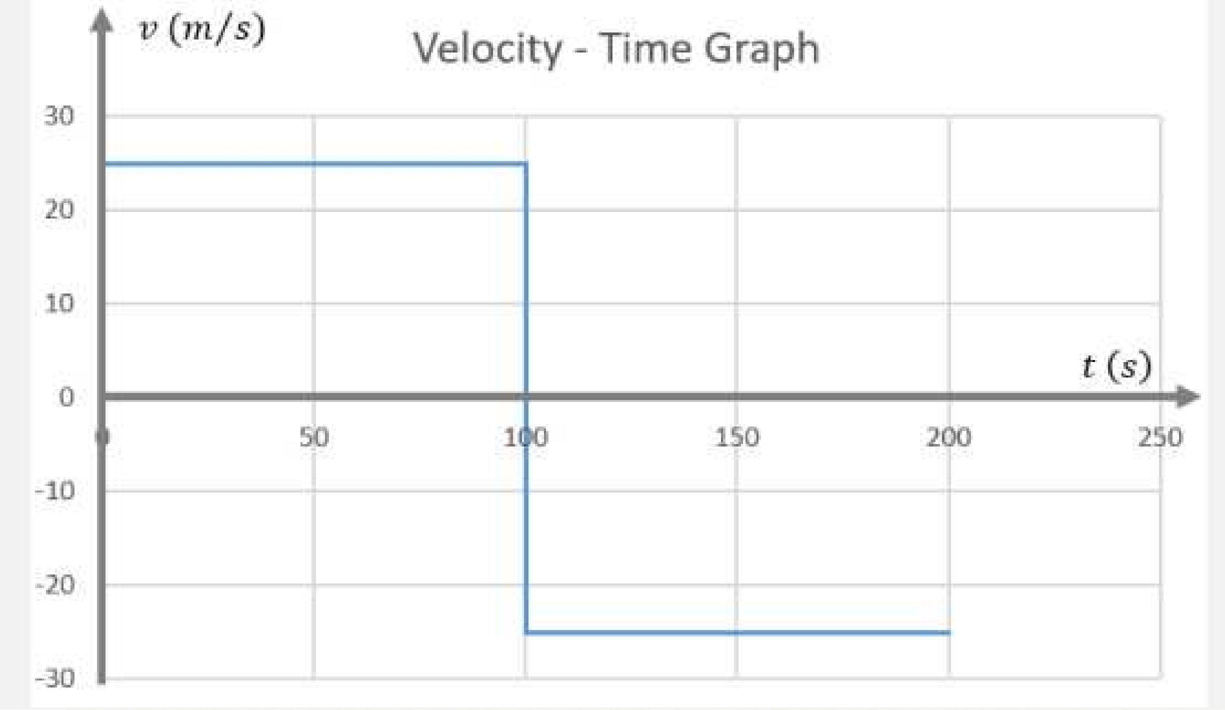
$$\bar{v} = \frac{-150}{12}$$

$$\bar{v} = -12.5\ m/s$$

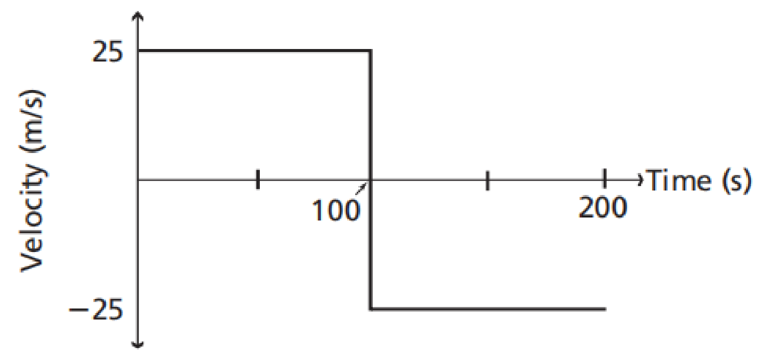
$$\bar{v} = 12.5\ m/s\ West$$

LO: 16	Identify the shape of a position-time and velocity-time graph for an object with constant acceleration. Interpret the velocity-time graph for a single or multiple objects in motion.	Question 22 Question 13	Page 68 Page 64

13. **Velocity-Time Graph** Sketch a velocity-time graph for a car that goes east at 25 m/s for 100 s, then west at 25 m/s for another 100 s.



OR

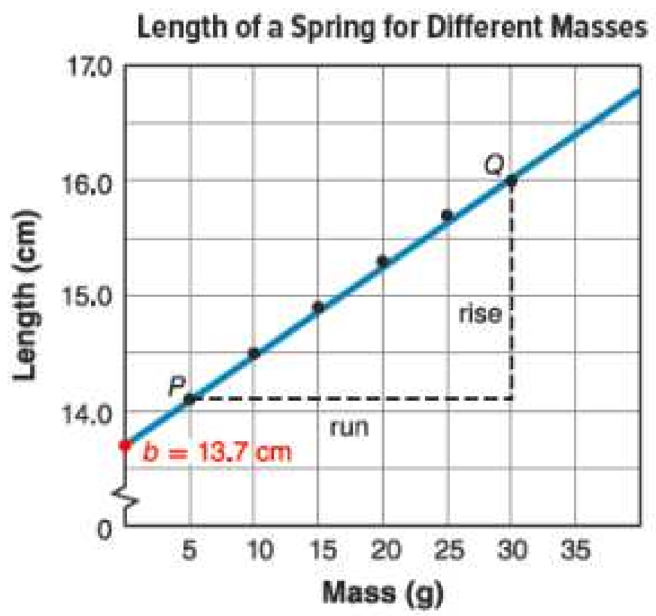


LO: 17	**Represent data in graphical form, draw the best fit line, and identify from the shape of the graph if the relationship between the variables is linear, quadratic, or inverse.** **Find the slope from the graph of a linear relationship.**	**As mentioned in the textbook**	**Pages 20-22**

Linear Relationships

Scatter plots of data take many different shapes, suggesting different relationships. Three of the most common relationships are linear relationships, quadratic relationships, and inverse relationships. You probably are familiar with them from math class.

When the line of best fit is a straight line, as in **Figure 15,** there is a linear relationship between the variables. In a **linear relationship,** the dependent variable varies linearly with the independent variable. The relationship can be written as the following equation.



Linear Relationship Between Two Variables

$$y = mx + b$$

$$y = m\,x + b$$

slope

Y-intercept

$$slope = \frac{y2 - y1}{x2 - x1}$$

LO: 17	Represent data in graphical form, draw the best fit line, and identify from the shape of the graph if the relationship between the variables is linear, quadratic, or inverse. Find the slope from the graph of a linear relationship.	As mentioned in the textbook	Pages 20, 21, 22

Nonlinear Relationships

Figure 17 graphs the distance a brass ball falls versus time. Note that the graph is not a straight line, meaning the relationship is not linear. There are many types of nonlinear relationships in science. Two of the most common are quadratic and inverse relationships.

Quadratic relationships The graph in **Figure 17** is a quadratic relationship, represented by the equation below. A **quadratic relationship** exists when one variable depends on the square of another.

Quadratic Relationship Between Two Variables

$$y = ax^2 + bx + c$$

A computer program or graphing calculator can easily find the values of the constants a, b, and c in the above equation. In **Figure 17,** the equation is $d = 5t^2$. See the Math Skill Handbook in the back of this book or online for more on making and using line graphs.

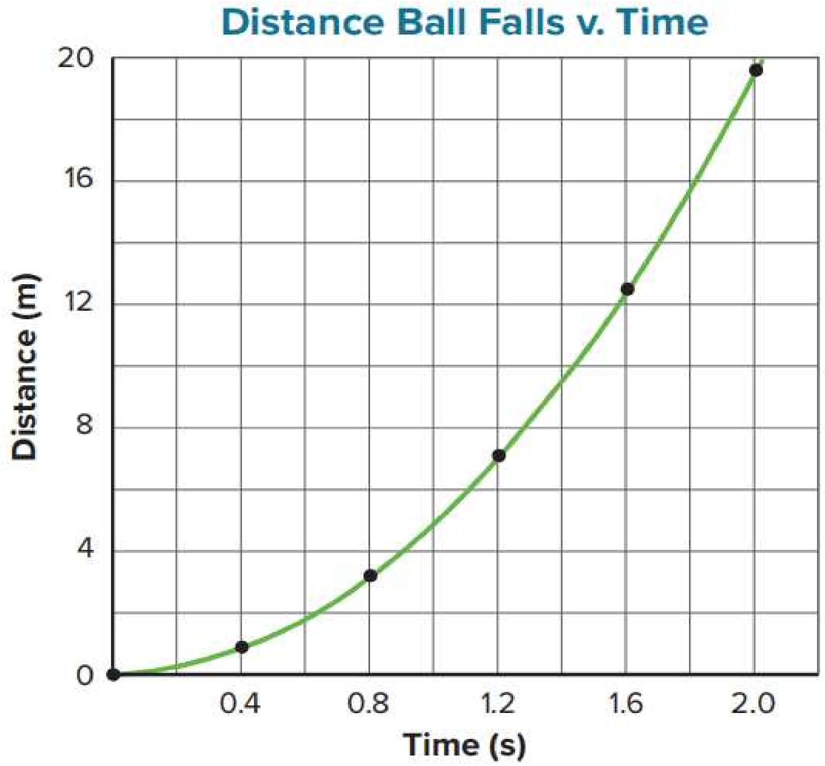


Figure 17 The quadratic, or parabolic, relationship shown here is an example of a nonlinear relationship.

LO: 17	**Represent data in graphical form, draw the best fit line, and identify from the shape of the graph if the relationship between the variables is linear, quadratic, or inverse. Find the slope from the graph of a linear relationship.**	**As mentioned in the textbook**	**Pages 20, 21, 22**

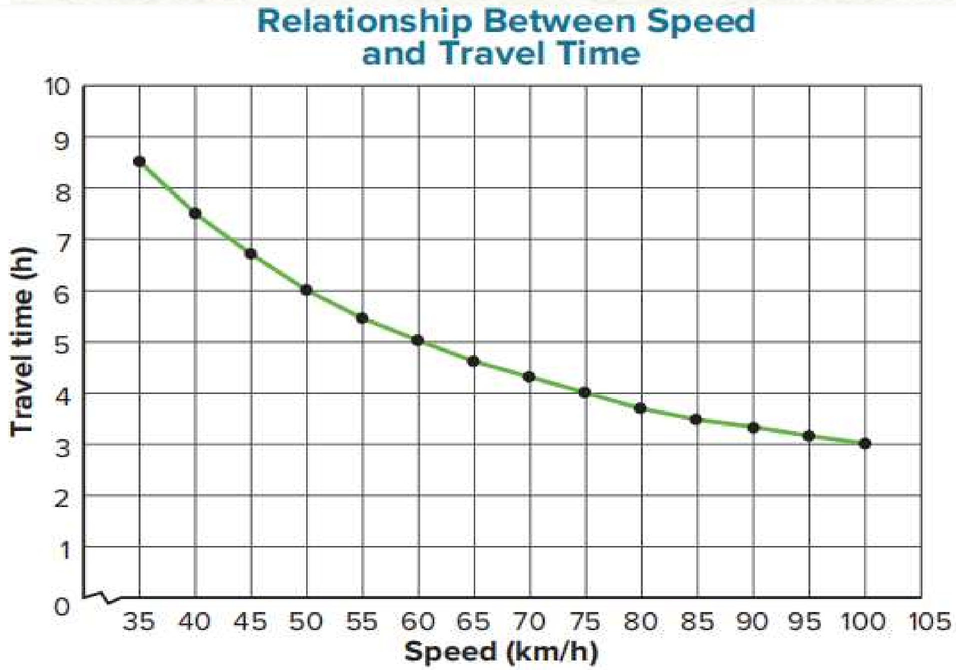


Figure 18 This graph shows the inverse relationship between speed and travel time.

Describe *How does travel time change as speed increases?*

Inverse relationships The graph in **Figure 18** shows how the time it takes to travel 300 km varies as a car's speed increases. This is an example of an inverse relationship, represented by the equation below. An **inverse relationship** is a hyperbolic relationship in which one variable depends on the inverse of the other variable.

Inverse Relationship Between Two Variables

$$y = \frac{a}{x}$$

LO: 17	Represent data in graphical form, draw the best fit line, and identify from the shape of the graph if the relationship between the variables is linear, quadratic, or inverse. Find the slope from the graph of a linear relationship.	As mentioned in the textbook	Pages 20, 21, 22

PRACTICE Problems

ADDITIONAL PRACTICE

18. Refer to the data listed in **Table 4.**

a. Plot mass versus volume, and draw the curve that best fits all points. Describe the curve.

b. What type of relationship exists between the mass of the gold nuggets and their volume?

c. What is the value of the slope of this graph? Include the proper units.

d. Write the equation showing mass as a function of volume for gold.

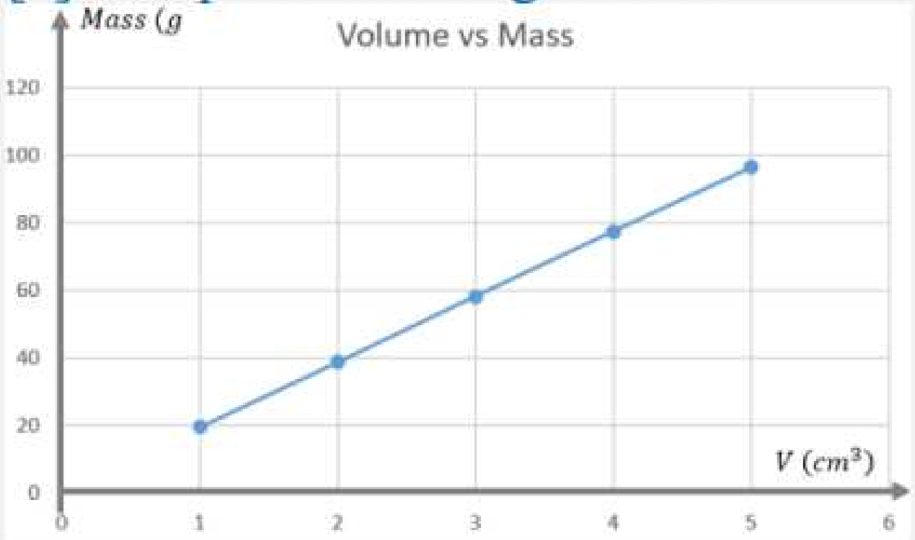
e. Write a word interpretation for the slope of the line.

Table 4 Mass of Pure Gold Nuggets

Volume (cm^3)	Mass (g)
1.0	19.4
2.0	38.6
3.0	58.1
4.0	77.4
5.0	96.5

LO: 17	Represent data in graphical form, draw the best fit line, and identify from the shape of the graph if the relationship between the variables is linear, quadratic, or inverse. Find the slope from the graph of a linear relationship.	As mentioned in the textbook	Pages 20, 21, 22

[a] The plot is a straight line.



[b] The relationship is linear.

[c] $Slope = \frac{\Delta M}{\Delta V}$

$$Slope = \frac{38.6 - 19.4}{2.0 - 1.0} = 19.2 \approx 19 \ g/cm^3$$

[d] $m = (19 \ g/cm^3)\, V$

[e] The mass for each cubic centimeter of pure gold is 19 g.

LO: 17	Represent data in graphical form, draw the best fit line, and identify from the shape of the graph if the relationship between the variables is linear, quadratic, or inverse. Find the slope from the graph of a linear relationship.	As mentioned in the textbook	Pages 20, 21, 22

Example Practice:

Use the relationship illustrated in Figure 16 to determine the mass required to stretch the spring **15 cm.**

$$Slope = \frac{\Delta L}{\Delta M} = \frac{L_2 - L_1}{M_2 - M_1} = \frac{16.0-13.7}{30-0.0} = 0.0766\ cm/g$$

$$L = Slope(M) + Intercept.$$

$$L = 0.0766(M) + 13.7$$

$$15 = 0.0766(M) + 13.7 \quad \Rightarrow \quad M = \frac{15 - 13.7}{0.0766} = 17\ g$$

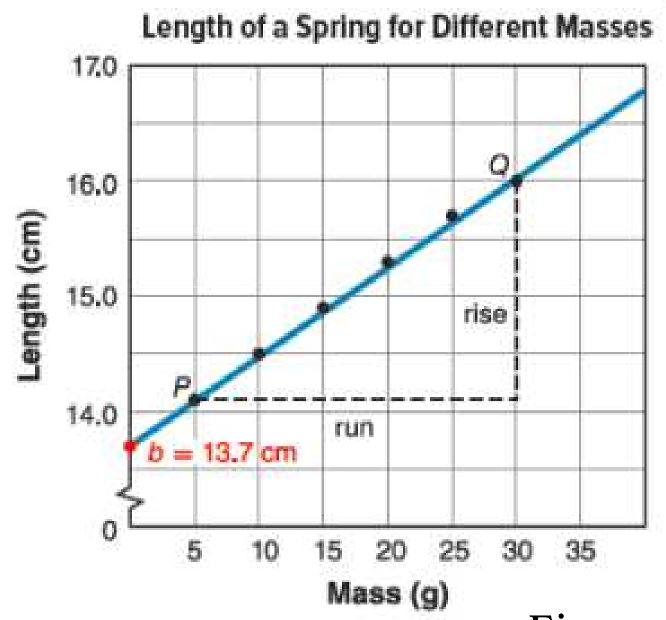
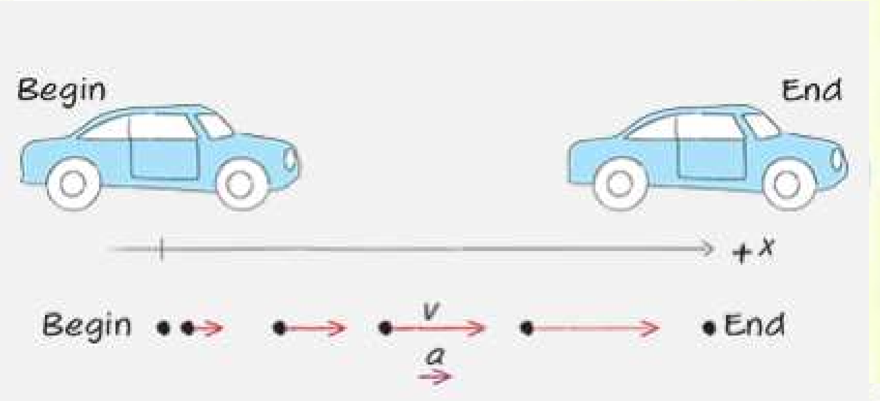


Figure 16

LO: 18	Apply the equation of motion relating the final position of an object to its initial position, initial velocity, uniform acceleration, and time. $v_f^2 = v_i^2 + 2a(x_f - x_i)$	Example 4	Pages 70

DISPLACEMENT An automobile starts at rest and accelerates at 3.5 m/s² after a traffic light turns green. How far will it have gone when it is traveling at 25 m/s?



$$v_f^2 = v_i^2 + 2a(x_f - x_i)$$

$$x_f = x_i + \frac{v_f^2 - v_i^2}{2a}$$

$$= 0.00\text{ m} + \frac{(+25\text{ m/s})^2 - (0.00\text{ m/s})^2}{2(+3.5\text{ m/s}^2)}$$

$$= +89\text{ m}$$

KNOWN

$x_i = 0.00$ m

$v_i = 0.00$ m/s

$v_f = +25$ m/s

$\bar{a} = a = +3.5$ m/s²

UNKNOWN

$x_f = ?$

LO: 19	Define and identify independent and dependent variables for a given data set.	As mentioned in the book	Pages 18

Identifying Variables

When you perform an experiment, it is important to change only one factor at a time. For example, **Table 3** gives the length of a spring with different masses attached. Only the mass varies; if different masses were hung from different types of springs, you wouldn't know how much of the difference between two data pairs was due to the different masses and how much was due to the different springs.

Independent and dependent variables A variable is any factor that might affect the behavior of an experimental setup. The factor that is manipulated during an investigation is the **independent variable.** In the experiment that gave the data in **Table 3**, the mass was the independent variable. The factor that depends on the independent variable is the **dependent variable.** In this investigation, the amount the spring stretched depended on the mass, so the amount of stretch was the dependent variable.

Line of best fit A line graph shows how the dependent variable changes with the independent variable. The data from **Table 3** are graphed in **Figure 15** on the next page. The line in blue, drawn as close to all the data points as possible, is called a **line of best fit.** The line of best fit is a better model for predictions than any one point along the line. **Figure 15** gives detailed instructions on how to construct a graph, plot data, and sketch a line of best fit.

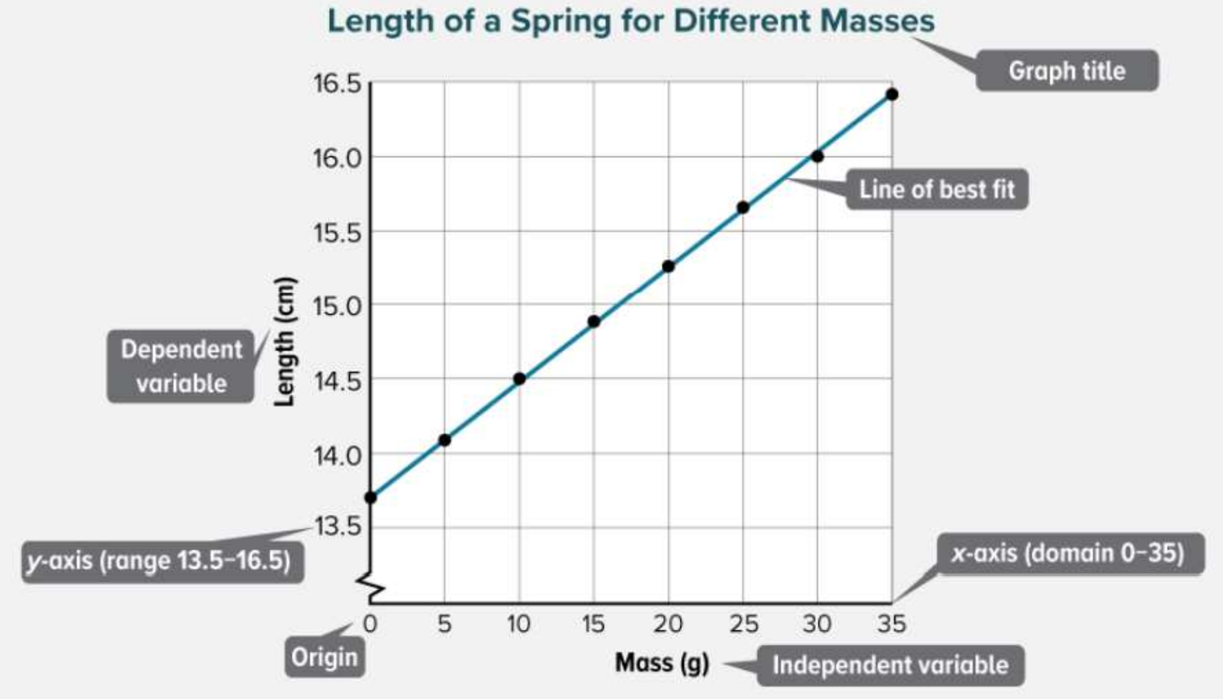
A well-designed graph allows patterns that are not immediately evident in a list of numbers to be seen quickly and simply. The graph in **Figure 15** shows that the length of the spring increases as the mass suspended from the spring increases.

Table 3 Length of a Spring for Different Masses

Mass Attached to Spring (g)	Length of Spring (cm)
0	13.7
5	14.1
10	14.5
15	14.9
20	15.3
25	15.7
30	16.0
35	16.4

LO: 19	Define and identify independent and dependent variables for a given data set.	As mentioned in the book	Pages 18

Figure 15 – Page 19.



The factor that is manipulated during an investigation is the **independent** variable.

The factor that depends on the independent variable is the **dependent** variable.

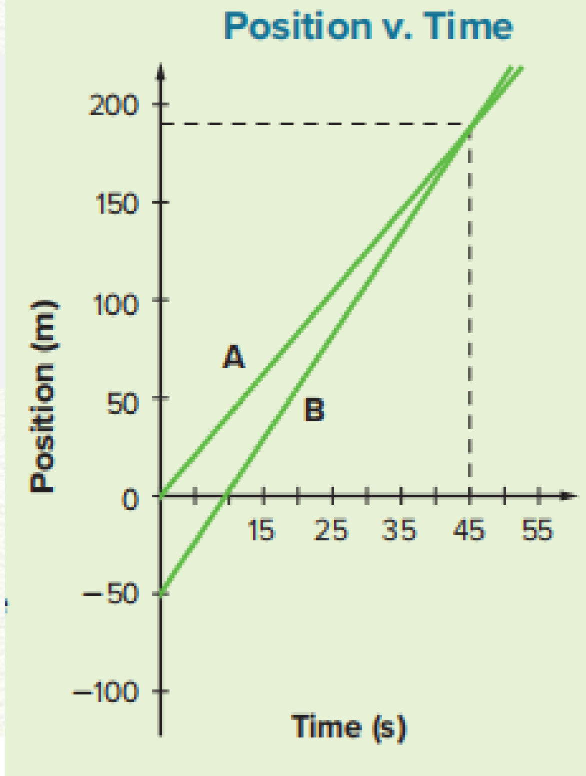
Hint:
The independent variable always lie on the horizontal axis.
The dependent variable always lie on the vertical axis.

LO: 20	Interpret a position-time graph that represents the motion of a single object.	Example Problem 2	Page 41
	Interpret a position-time graph that represents the motion of multiple objects.	Question 20	Page 42

EXAMPLE Problem 2

INTERPRETING A GRAPH The graph to the right describes the motion of two runners moving along a straight path. The lines representing their motion are labeled A and B. When and where does runner B pass runner A?

Question 1	Question 2
At what time are runner A and runner B at the same position?	What is the position of runner A and runner B at this time?
Answer: At $t = 45\ s$	Position is 190 m



LO: 20	Interpret a position-time graph that represents the motion of a single object.	Example Problem 2	Page 41
	Interpret a position-time graph that represents the motion of multiple objects.	Question 20	Page 42

Q20. Using the particle model motion diagram in Figure 16 of a baby crawling across a kitchen floor, plot a position-time graph to represent the motion. The time interval between dots on the diagram is 1 s.

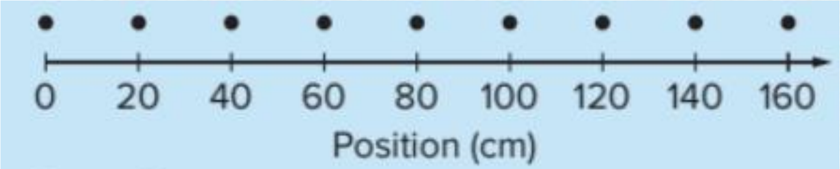


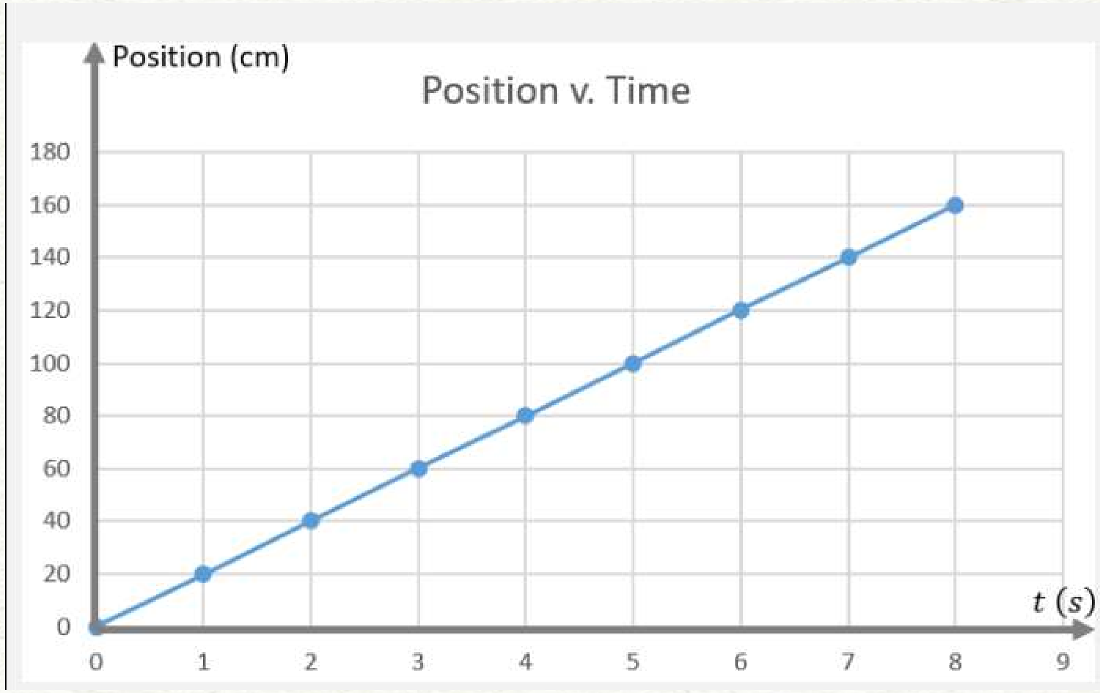
Figure 16

$$Slope\ (velocity) = \frac{\Delta x}{\Delta t}$$

$$v = \frac{x_f - x_i}{t_f - t_i}$$

$$v = \frac{160 - 0}{8 - 0}$$

$$v = 20\ cm/s$$



Additional Practice

Additional Example:

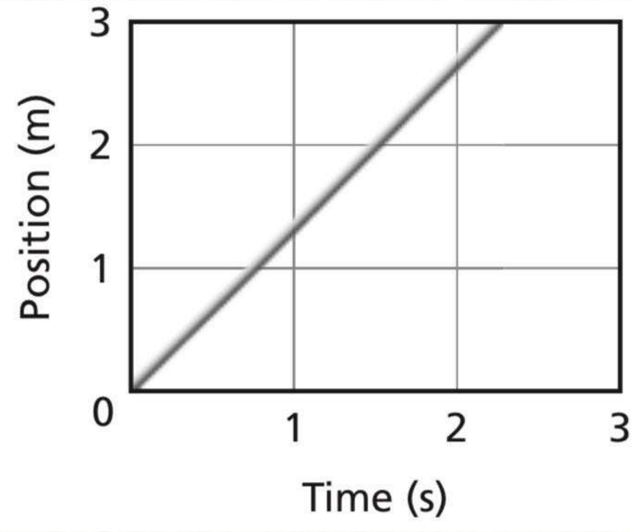
QFigure 28 is a position-time graph for a rabbit running away from a dog.

- How would the graph differ if the rabbit ran twice as fast?

  The only difference is that the slope of the graph would be twice as steep

- How would it differ if the rabbit ran in the opposite direction?

  The magnitude of the slope would be the same, but it would be negative



Q54. You ride a bike at a constant speed of 4.0 m/s for 5.0 s. How far do you travel?

xf = xi + v t
xf = 0 + 4.0 x 5.0
xf = 20 m

$x = \overline{v}\,t$
$v = v_0 + at$
$x = v_0 t + \frac{1}{2} a t^2$
$v^2 = {v_0}^2 + 2ax$

Additional Example:

A dog runs down a straight path with an average velocity of **4.00 m/s** for **2.00 min**. What is its final position, taking his initial position to be zero?

يجري كلب في مسار مستقيم بسرعة متوسطة **4.00 m/s** لمدة **2.00 دقيقة**. ما هو موقعه النهائي ، مع اعتبار موقعه الأبتدائي صفر؟

a. 480 m

b. 240 m

c. 120 m

d. 8 m

$x = \overline{v}\,t$
$v = v_0 + at$
$x = v_0 t + \frac{1}{2} a t^2$
$v^2 = {v_0}^2 + 2ax$

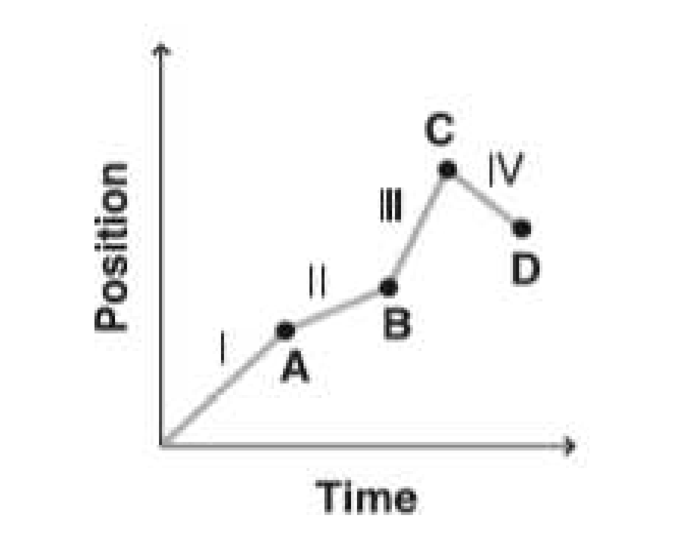
Q3. The figure below shows a simplified graph of a bicyclist's motion. (Speeding up and slowing down motion is ignored.) When is the person's velocity greatest?

A. section I

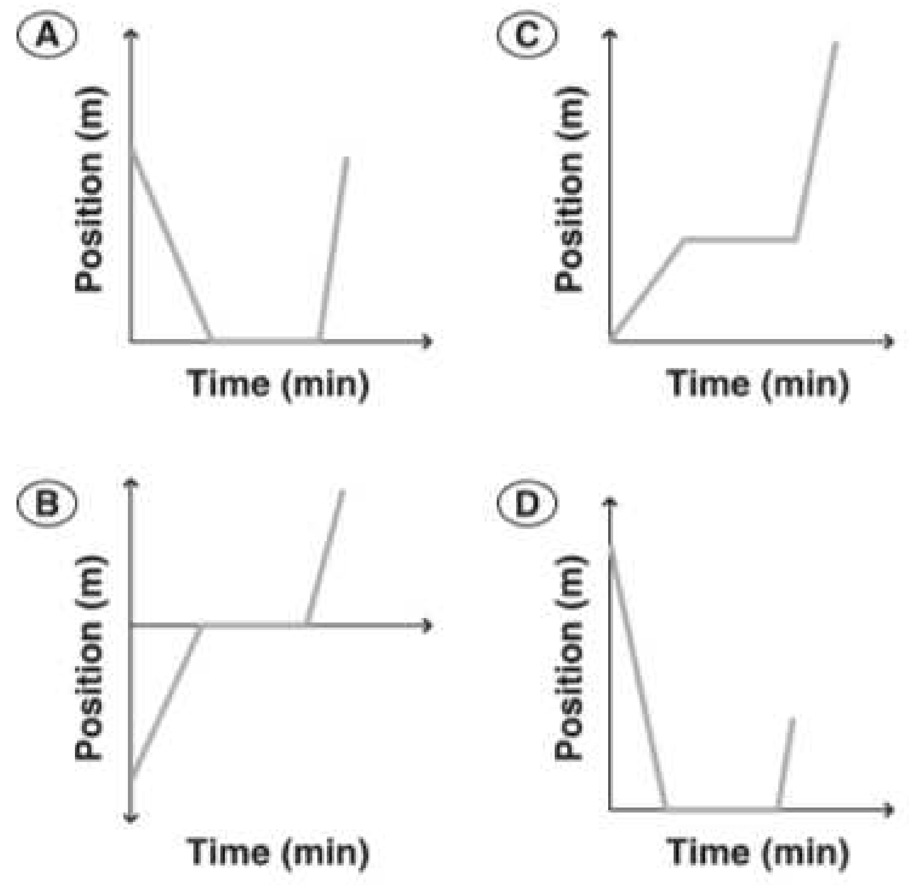
B. section III

C. point D

D. point B



Q5. A squirrel descends an 8 m tree at a constant speed in 1.5 min. It remains still at the base of the tree for 2.3 min. A loud noise then causes the squirrel to scamper back up the tree in 0.1 min to the exact position on the branch from which it started. Ignoring speeding up and slowing down motion, **which graph most closely represents the squirrel's vertical displacement from the base of the tree?**



Answer is A

Additional Example:

Using the position-time graph, what is the runner's average speed for the whole 10 s period?

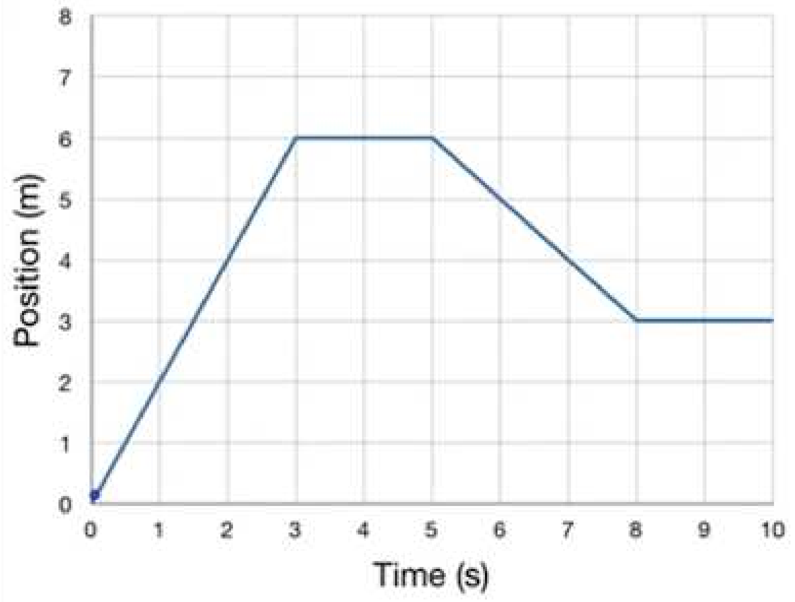
باستخدام الرسم البياني للموقع-الزمن ، ما متوسط سرعة العداء لكامل فترة العشر ثوانٍ؟

a. 3.0 m/s

b. 1.2 m/s

c. 0.3 m/s

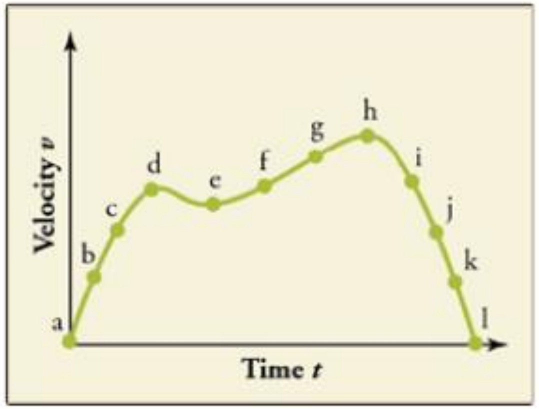
d. 0.6 m/s



Additional Example:

In the velocity- time graph below, during which periods is the object slowing down and speeding up?

في منحنى السرعة- الزمن أدناه ، أي الفترات التي يتباطأ خلالها الجسم وفي أيها يتسارع؟



a. It is slowing down between d-e and then after h. And it is speeding up between a-d and e-h.

يتباطأ بين d-e ثم يتباطأ مجددا بعد h ويتسارع بين a-d و e-h

b. It is slowing down between d-e and it is speeding up between a-d and e-h.

يتباطأ بين d-e ويتسارع بين a-d وe-h

c. It is slowing down between a-d, and e-h. It is speeding up between d-e and then after i

يتباطأ بين a-d و e-h ويتسارع بين d-e ثم بعد i

Additional Example:

What happened to the motion of the object at point C ?

ماذا يحدث لحركة الجسم عند النقطة C ؟

a. The object stopped to change the direction then continue moving in same speed

يتوقف الجسم ليغير الاتجاه ثم يعاود الحركة بنفس السرعة

b. Direction remains the same, but the object stopped

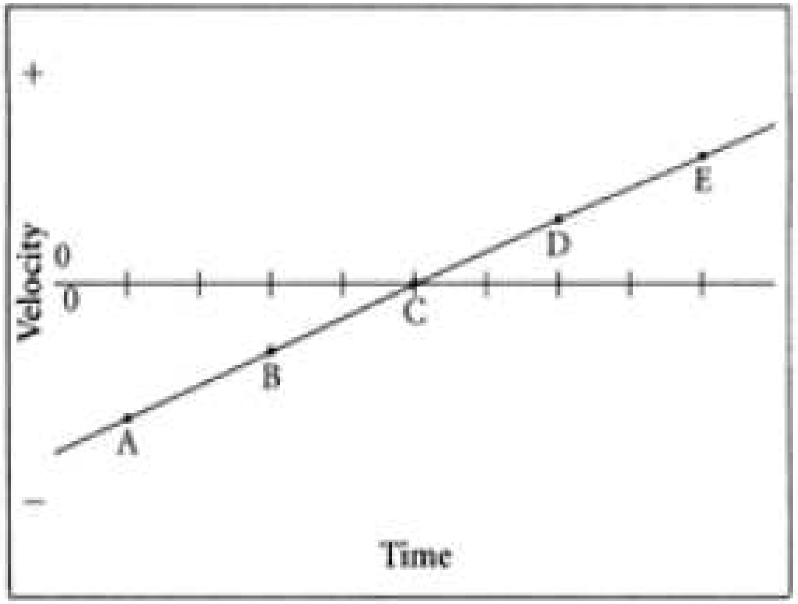
يبقى الاتجاه ثابت ولكن يتوقف الجسم عن الحركة

c. Direction is changed and the object accelerated

يتغير الاتجاه ويتسارع الجسم

d. Both direction and velocity remain the same

كلا السرعة والاتجاه ثابتان



Additional Example:

biker rides north for 50 m from his starting position, then turns and bikes back south 70 m. What is his net **displacement**?

يقود راكب دراجة لمسافة 50متر نحو الشمال من موضع البداية ، ثم يستدير ويعود بالدراجة 70 متر إلى الجنوب. ما هي **ازاحته** الكلية؟

20 miles south

20 m جنوبا

$$\frac{\Delta x}{\Delta t} = \frac{x_f - x_i}{t_f - t_i}$$

$$\boldsymbol{v}_f = \boldsymbol{v}_i + \bar{\boldsymbol{a}}\Delta t$$

$$\boldsymbol{x}_f = \boldsymbol{x}_i + \boldsymbol{v}_i t_f + \left(\tfrac{1}{2}\right)\boldsymbol{a} t_f$$

$$v_f^2 = v_i^2 + 2a(x_f - x_i)$$

$$\Delta \mathbf{x} = \left(\frac{\mathbf{v_i} + \mathbf{v_f}}{2}\right)\Delta \mathbf{t}$$

All The Best!