حل مراجعة وفق الهيكل الوزاري الجديد منهج ريفيل

المزيد من الملفات بحسب الصف التاسع العام والمادة رياضيات في الفصل الأول	
تجميعة أسئلة مراجعة وفق الهيكل الوزاري الجديد منهج بريدج	1
تجميعة أسئلة وفق الهيكل الوزاري الجديد منهج بريدج	2
تجميعة نماذج امتحانية سابقة للوحدة الثانية variable one in Equations المعادلات بمتغير واحد	3
ملزمة شاملة وفق الهيكل الوزاري الجديد منهج ريفيل	4
تجميعة أسئلة شاملة وفق الهيكل الوزاري الجديد منهج ريفيل	5

Differentiate between scientific theory and scientific law -Explain why a scientific theory cannot become a scientific law

Explain why a scientific theory cannot become a scientific law? Theories explain how the law works.

Scientific theories	**laws**
an explanation of things or events based on knowledge gained from many observations and investigations.	a statement about what happens in nature and seems to be **true all the time.**

Express the derived units for common quantities (like velocity, acceleration, force, pressure, volume, density) in terms of their SI base units

SI Base Units

Quantity Measured	Unit	Symbol
Length	meter	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Temperature	kelvin	K
Amount of substance	mole	mol
Intensity of light	candela	cd

Use dimensional analysis to validate equations and to choose the appropriate conversion factor when converting units

Dimensional Analysis (noun)

Definition: Solving a problem so that the units can be derived algebraically.

Arabic: تحليل الأبعاد لاستخلاص الوحدات جبريًا

Example:

How many seconds are there in 1 day?

$$24\ \text{hr} \times \frac{60\ \text{min}}{1\ \text{hr}} \times \frac{60\ \text{s}}{1\ \text{min}} = 86,400\ \text{s/day}$$

To convert 43 km/h to m/s, do the following:

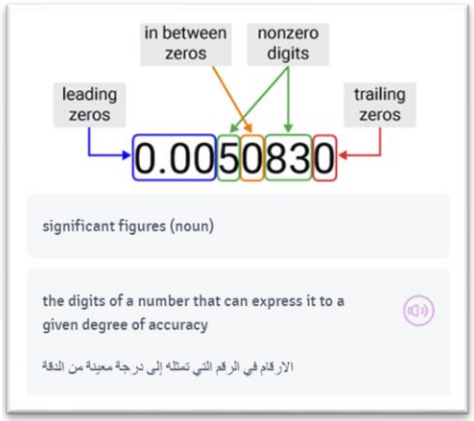
$$\left(\frac{43\ \text{km}}{1\ \text{h}}\right)\left(\frac{1000\ \text{m}}{1\ \text{km}}\right)\left(\frac{1\ \text{h}}{60\ \text{min}}\right)\left(\frac{1\ \text{min}}{60\ \text{s}}\right) = 12\ \text{m/s}$$

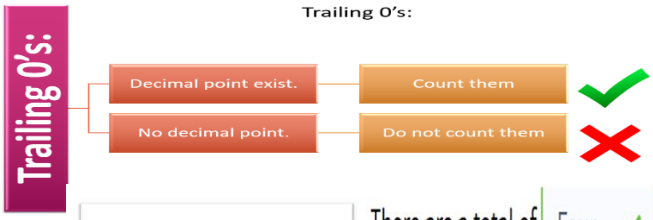
Grade9 -General- Term 1 (2025-2026)-EOT1_Coverage هيكل امتحان الفصل الأول

-Identify the significant digits in each number

-Use appropriate significant figures to record answers from a mathematical operation, with the correct number of digits

1- Nonzero digits are always significant
2- Zeros are always significant if they fall between nonzero digits.
3- Leading 0's are NOT significant:
4-





Rule 1: 9.25 — There are a total of Four ✓ s.f. in 0.05960 m.

Rule 2: 7003000 — There are a total of Two ✓ s.f. in 79000 m.

Rule 3: 2.05600

Rule 4: 0.0036500 — There are a total of Five ✓ s.f. in 7.9000×10^4 m.

To add or subtract sig. fig.:
1- Perform the operation.
2- Round off the result to to the least decimal places.

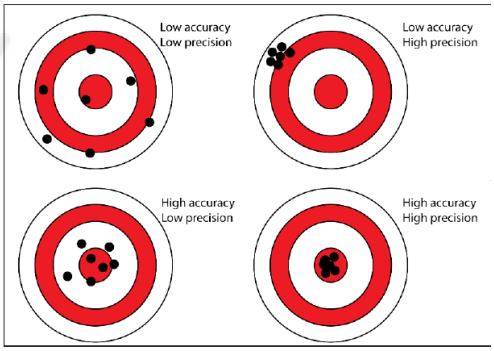
7.81 cm – 2.6 cm =

To multiply or divide sig. fig :
1- Perform the operation.
2- Round off the result to least Sig.Fig.

12.01 cm x 7.1 cm =

Compare and contrast precision and accuracy with examples

1. Not sure about something — **Uncertainty**
2. How closed a measured value is to an accepted value — **Accuracy**
3. How close a series of measurements are one to another — **Precision**



Which is more accurate when measuring a book that has a true length of 17.0 cm?

Susan:
17.0 cm, 17.01 cm, 16.9 cm

Amy:
17.5 cm, 15.0 cm, 15.2 cm

describes how closely measurements are to each other,

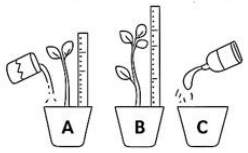
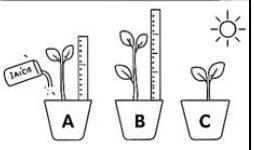
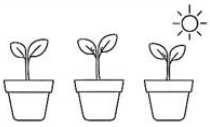
Which set is more precise?

a) 17.2 , 18.4 , 18.35
b) 15.9 , 15.89 , 15.91
c) 16.8 , 17.2 , 19.44

Define and identify independent and dependent variables for a given data

- Independent Variable: What the scientist changes.
- Dependent Variable: What is measured.
- Constants: Factors kept the same.
- Control Group: The standard for comparison.

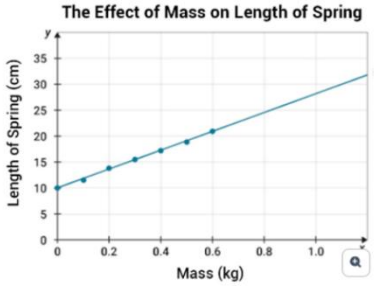
Types of Variables

Type of Variable	Definition	Illustration
Independent Variable	The liquid used to water each plant (e.g. water, juice, soda).	
Dependent Variable	The height or health of the plant.	
Controlled Variables	Everything that must remain constant and unchanging during the experiment.	

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

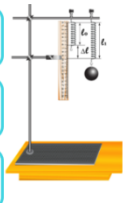
$$y = \overset{?}{m}x + \overset{?}{b}$$

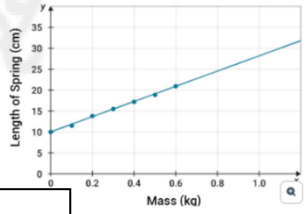
calculate the length of the spring (y) when 0.8 kg (x)



$$y = (18 \times 0.8) + 10$$
$$= 24.4\,\text{cm}$$

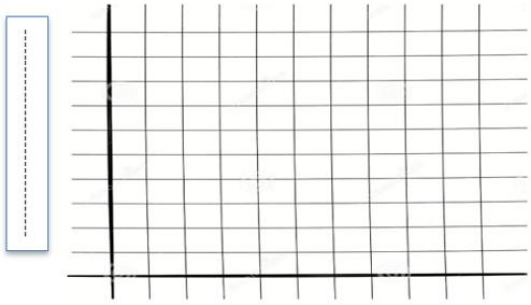
mass	The independent variable
Spring length	The dependent variable
Linear relationship	Type of the relationship between variables





Identify the mathematical equation for linear relations

1. What happens to the spring length when mass is added? _____
2. Name the instrument used to measure length in this experiment. _____
3. Fill in the missing data on the table above.
4. Plot the points on the graph.
5. State one possible error that may happen in this experiment. _____



1. What is the relationship between the length of spring and the mass? _____
2. Draw the line of best fit for the data points.
3. Calculate the slope of the line using two points.

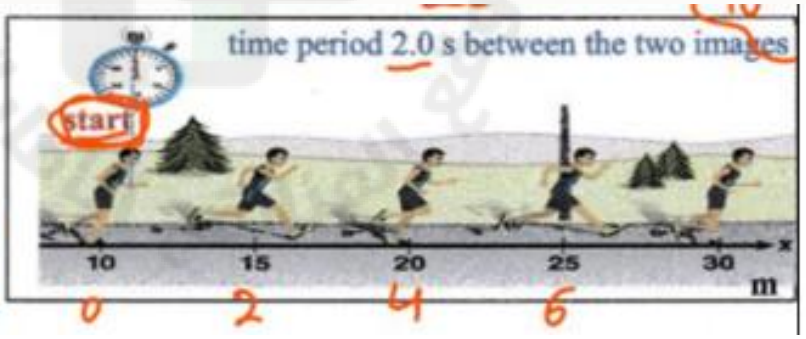
Slope=_____

Differentiate between distance travelled and displacement

Feature	Distance	Displacement
Definition	The length of **the total path** traveled between two positions. 	**The shortest distance** in a specific direction between two points. 
Type of Quantity	**Scalar** (has only magnitude).	**Vector** (has both magnitude and direction).
Value	Always positive or zero.	Can be positive, negative, or zero (depends on direction).
Example	A car travels 5 km around a park and returns to the start → Distance = 5 km.	Same case → Displacement = 0 km (since start and end are same).
Arabic	المسافة	الإزاحة

Depending on the displacement for the runner after (6.0 s) from the beginning of his movement?

- ☐ +25 m
- ☐ +15 m
- ☐ −25 cm
- ☐ −15 m



25 − 10 = +15 m

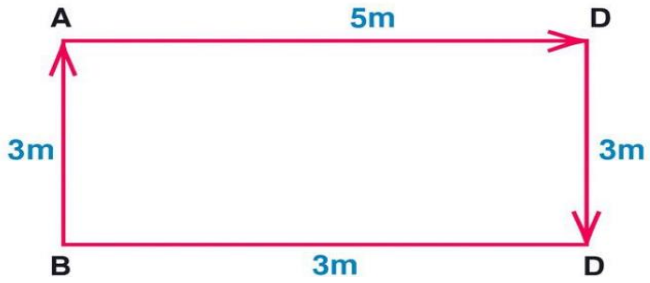
Classify physical quantities into vector and scalar quantities (distance, mass, displacement, speed, velocity, acceleration, force, work, energy, pressure

- A scalar has only magnitude: m/s.
- A vector has both magnitude and direction.

5 m/s east

Scalar	Vector
Work	**Displacement**
Distance	**Velocity**
Speed	**Acceleration**
Mass	**Force**
Pressure	
Energy	

Adam has started moving from point A, he passed the points B, C, D as shown before he came back to point A. What is the displacement and distance respectively?



Distance=16m

Displacement=0m

Plot a position-time graph given position-time value

7- Depending on the (position - time) graph for an object moving to the west.
What is the position of the object after (30 s) if it continues its motion with the same average velocity?

- ☐ −240 m
- ☑ −160 m
- ☐ −110 m
- ☐ −80 m

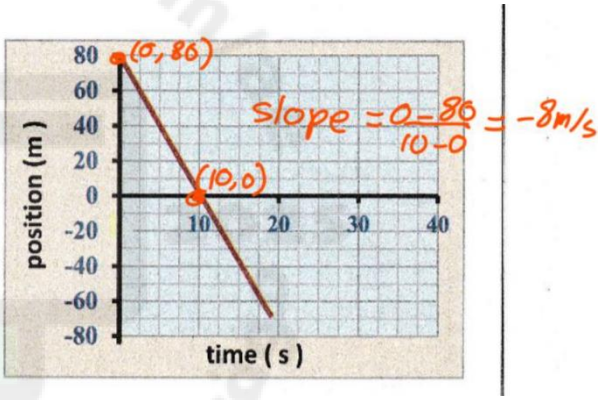
$y = mx + b$

$x = -8t + 80$

$x = -8(30) + 80$

$x = -240 + 80$

$x = -160\ m$

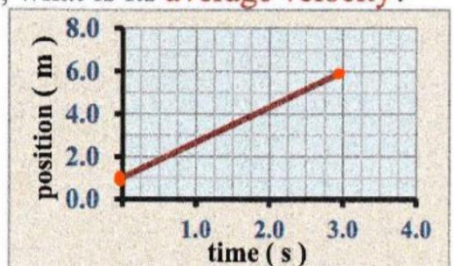


6- Depending on the (position - time) graph for an object, what is its average velocity?

- ☐ +2.0 m/s
- ☐ −2.0 m/s
- ☑ +1.7 m/s
- ☐ −1.7 m/s

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

$v = \frac{6-1}{3-0} = \frac{5}{3} \simeq 1.7$



– The following table shows Maryam's positions and times when she moved to the north inside her school on a straight line.

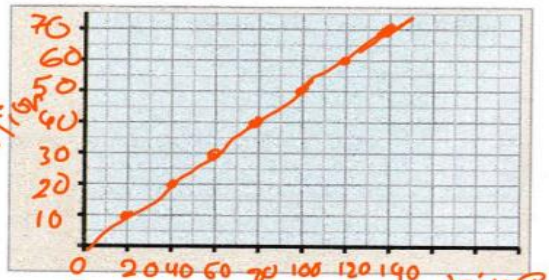
Time(s)	0	20	40	60	80	100	120	140
Position (m)	0	10	20	30	40	50	60	70

Answer (19 ,20 , 21)

x_f back x_i

19–Draw a position-time graph to represent Maryam's motion in the school.

20–Calculate the average velocity of Maryam using the position-time graph.



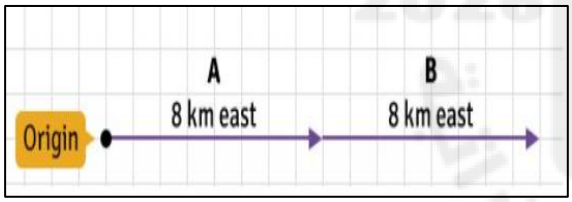
$v = \frac{\Delta x}{\Delta t}$

21-Calculate the average velocity of Maryam in (m/s) if she reaches back in (2.0) minutes.

$x_i = 70$, $x_f = 0$, $t = 2\ min = 2 \times 60s$

$v = \frac{\Delta x}{\Delta t} = \frac{0 - 70}{120} = -0.58\ m/s$

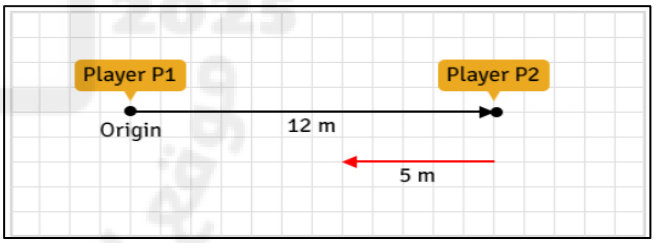
What is displacement?



$R = A + B$

= 8 km East + 8 km East

= **16 km East**

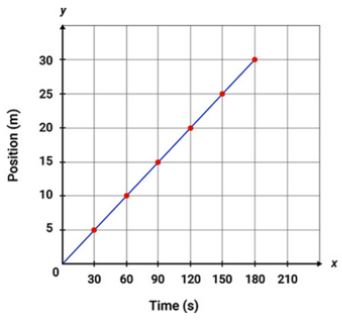


$R = A + B$

= (+12 m) + (-5 m)

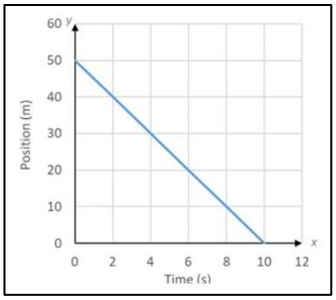
= **+7 m**

Which statement is true about this position-time graph?

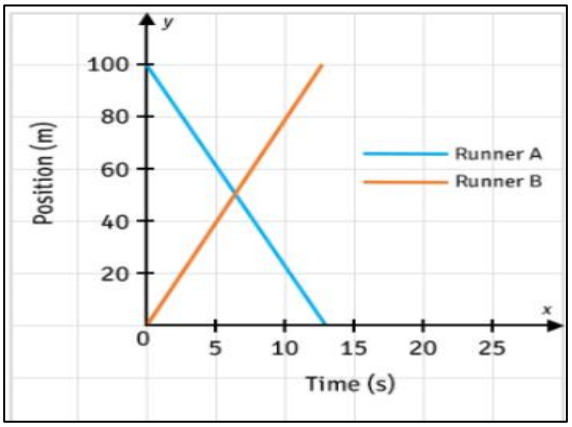


A The object covers 20 m in 120 s.

B The object covers 90 m in 15 s.

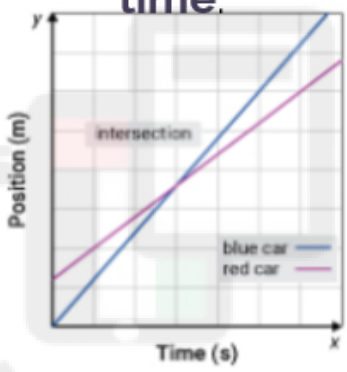


The car starts at 50 m and moves toward its origin.

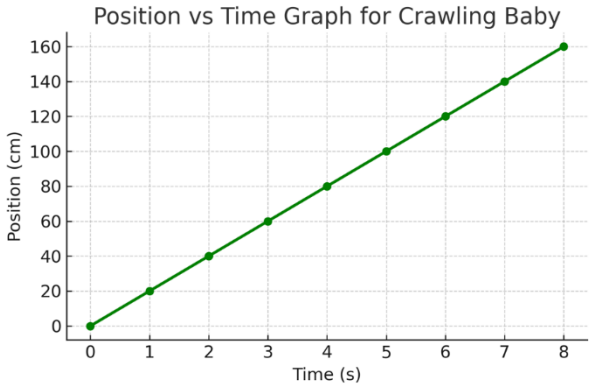


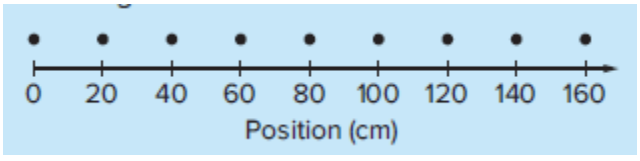
Runner A has an average velocity of **–8 m/s**, while Runner B has an average velocity of **8 m/s**.

The intersection of two lines on a position–time graph means **that both objects are at the same position at the same time.**



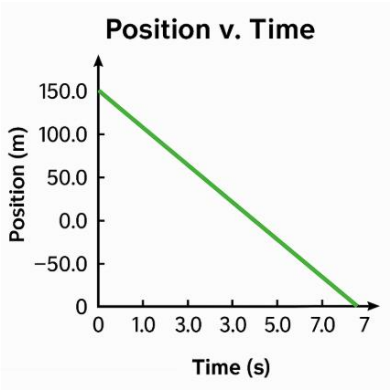
☆ Using the particle model motion diagram in Figure 16 of a baby crawling across a kitchen floor, plot a position–time graph to represent the motion. The time interval between dots on the diagram is 1 s





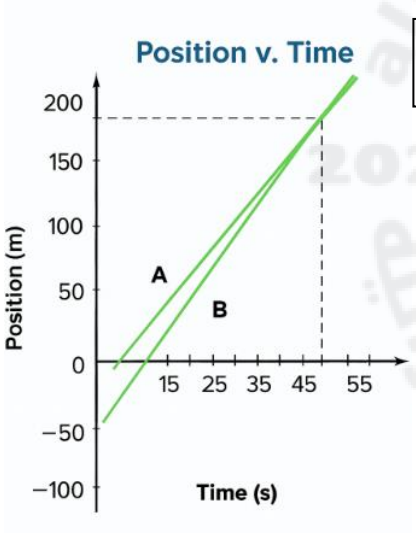
☆ **The graph in Figure represents the motion of a car moving along a straight highway.**

Describe in words the car's motion.



The car starts at 150 m and moves toward the origin.(to the west)

☆ 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?

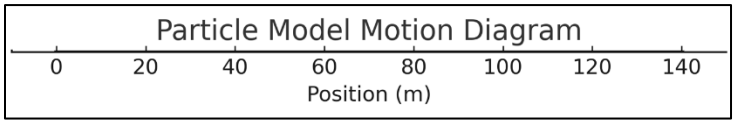


Runner B passes runner A about 180 m after the origin, at 45 s .

☆ For problems 21–24, refer to Figure 17.

21. Particle Model

Create a particle model motion diagram from the position–time graph of a hockey puck gliding across the ice.



22. Time

Use the hockey puck's position–time graph to determine the time when the puck was 60 m beyond the origin.

From the graph, the puck is 60 m beyond the origin at approximately 2.0 seconds

23. Distance

Use the position–time graph to determine how far the hockey puck moved between 0.0 s and 5.0 s.

At 0.0 s, the puck is at 0 m, and at 5.0 s, it is at about 118 m.
Distance moved = 118 m − 0 m = 118 m.

24. Time Interval

Use the position–time graph for the hockey puck to determine the time it took for the puck to go from 40.0 m beyond the origin to 80.0 m beyond the origin

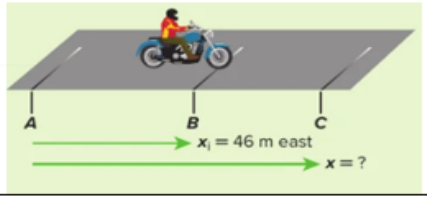
The puck moves from 40.0 m (at around 2.0 s) to 80.0 m (at around 4.0 s).
Time interval = 4.0 s − 2.0 s = 2.0 s.

Apply the equation of motion, (xf= v.t + xi) or (xf-xi = v.t), in numerical problems to calculate the position or other physical quantities

☆

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_i = 46 m east t = 3.0 s	x =?

2. SOLVE FOR THE UNKNOWN

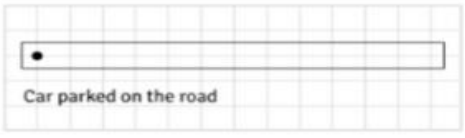
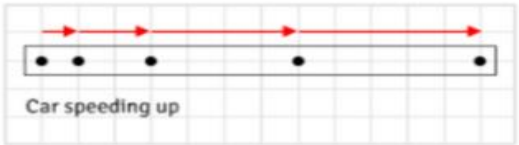
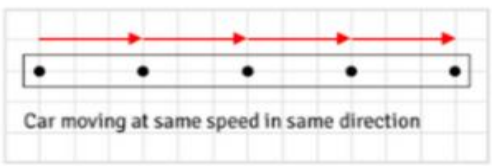
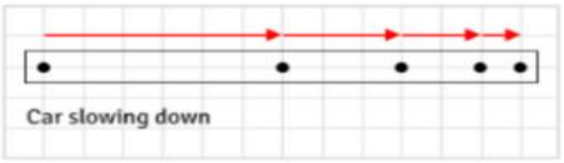
$x = \bar{v}t + x_i$

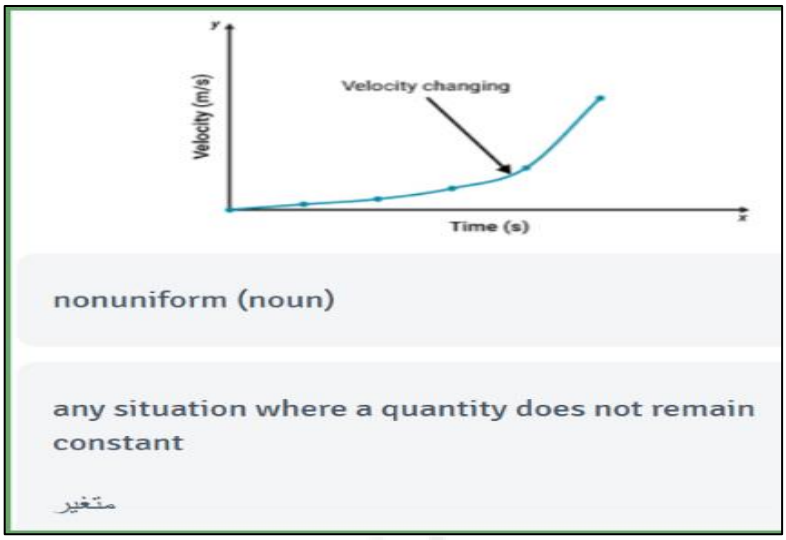
$= (12\ m/s)(3.0\ s) + 46\ m$

$= 82\ m$

$x = 82\ m$ east

Recognize uniform or non-uniform motion from a motion diagram or a particle model.

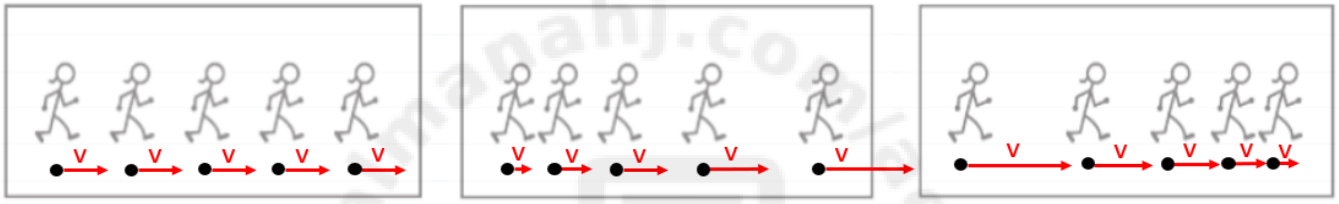
Uniform Motion	Nonuniform Motion
(zero velocity)  	(increasing velocity) 
(constant velocity)  	(decreasing velocity) 



nonuniform (noun)

any situation where a quantity does not remain constant

متغير



Uniform motion
Object moving at constant speed

nonuniform motion
Object accelerating

nonuniform motion
Object decelerating

Describe the motion of an object if its velocity and acceleration are either in the same direction or opposite directions, hence state if an object is slowing down or speeding up

Get It?

Describe the motion of an object if its velocity and acceleration vectors have opposite signs.

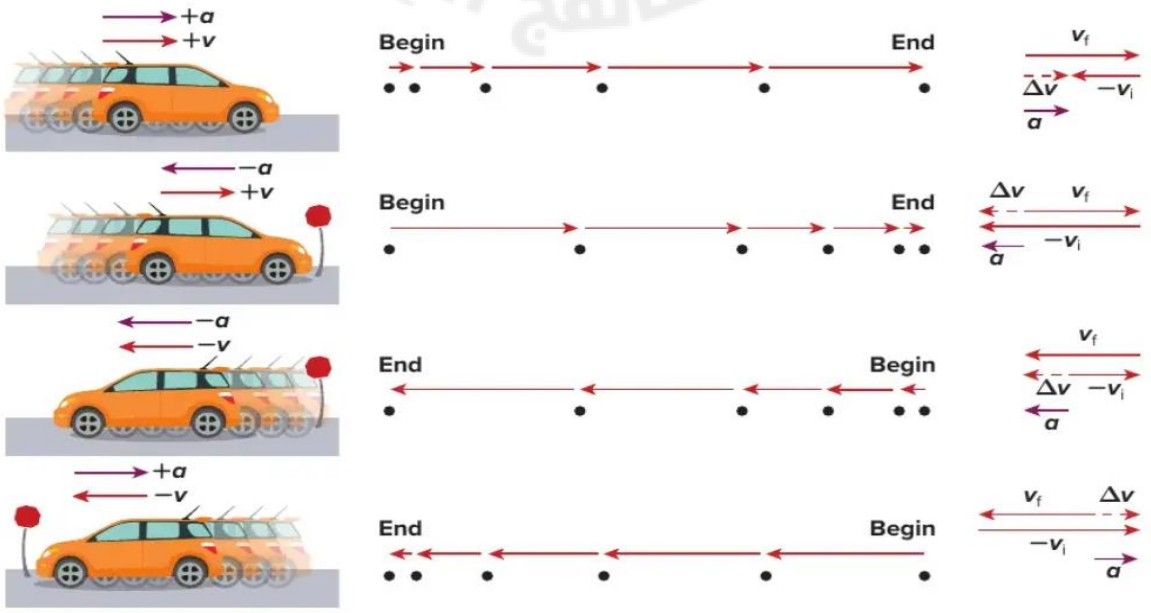


Figure 4 You need to know the direction of both the velocity and acceleration vectors in order to determine whether an object is speeding up or slowing down.

Explain how an object can accelerate while moving at a constant speed

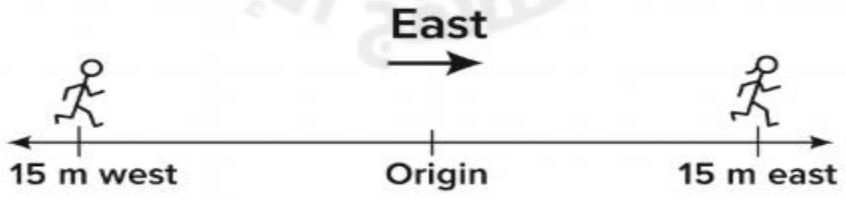
Question: What are three ways an object can accelerate?

1. By increasing speed (speeding up).
2. By decreasing speed (slowing down).
3. By changing direction of motion.

Position-Time and Velocity-Time Graphs

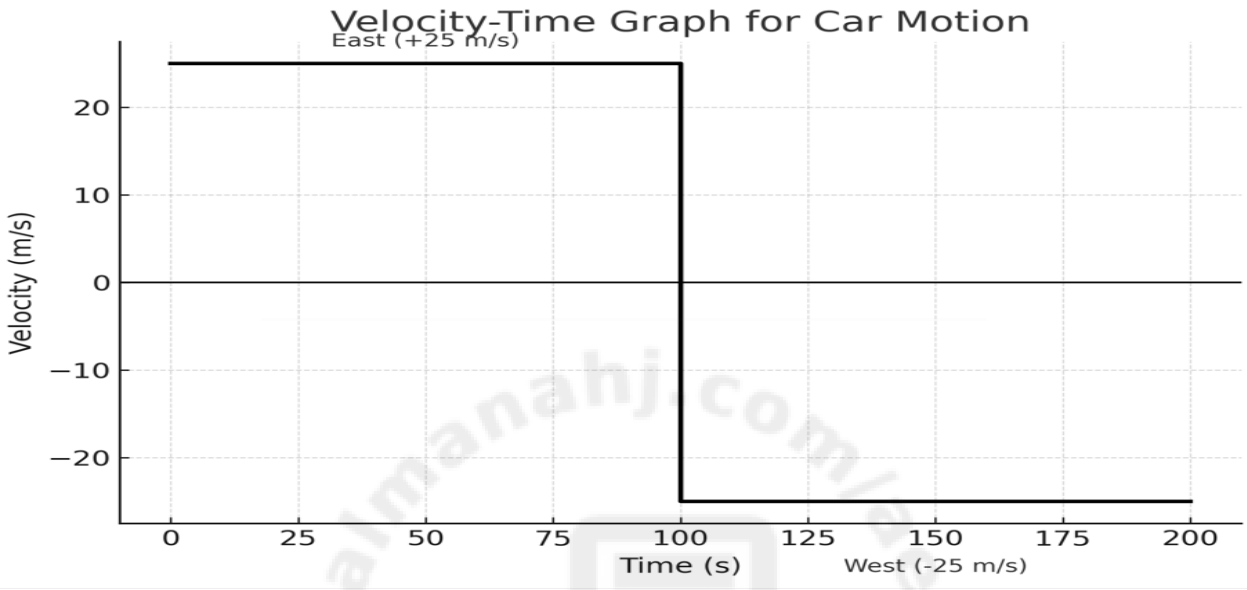
Two joggers run at a constant velocity of 7.5 m/s east. *Figure 10* shows the positions of both joggers at time *t = 0*.

4. **a.** What would be the difference(s) in the position-time graphs of their motion?
   b. What would be the difference(s) in their velocity-time graphs?
5. **Answer:**
   a. In the position-time graph, both joggers would have straight lines with the same slope (same velocity), but the lines would be parallel because they start from different positions — one at 15 m west and the other at 15 m east.
6. **b.** In the velocity-time graph, there would be no difference — both joggers would have horizontal lines at 7.5 m/s east, showing the same constant velocity



Velocity-Time Graph

Question: 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.



Average Velocity and Average Acceleration

A canoeist paddles upstream at a velocity of **2.0 m/s for 4.0 s** and then floats downstream at **4.0 m/s for 4.0 s.**

a. What is the average velocity of the canoe during the 8.0-s time interval?
b. What is the average acceleration of the canoe during the 8.0-s time interval?

b. Segment 1: $v_1 = +2.0$ m/sfor 4.0 s$\rightarrow \Delta x_1 = +8$ m
c. Segment 2: $v_2 = -4.0$ m/s(downstream) for 4.0 s$\rightarrow \Delta x_2 = -16$ m

Total displacement: $\Delta x = 8 - 16 = -8$ m
Total time: $t = 8.0$ s

a. Average velocity

$$\bar{v} = \frac{\Delta x}{t} = \frac{-8}{8.0} = -1.0 \text{ m/s}$$

$\rightarrow$ 1.0 m/s**downstream**.

b. Average acceleration
Initial $v_i = +2.0$ m/s, final $v_f = -4.0$ m/s.

$$\bar{a} = \frac{v_f - v_i}{t} = \frac{-4.0 - 2.0}{8.0} = -0.75 \text{ m/s}$$

Apply the equation of motion relating the final velocity of an object to its initial velocity, uniform acceleration, and time (vf = vi+ at)

$$v_f = v_i + \bar{a}\Delta t$$

16. 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/s², what is its velocity after 2.0 s?

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

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

a.

Given:

$v_i = +2.0 \text{ m/s}, a = -0.50 \text{ m/s}^2, t = 2.0 \text{ s}$

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

b.

If the same acceleration continues for 6.0 s:

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

c. Description of motion:

- The golf ball moves **up the hill, slowing down**

17. A bus traveling 30.0 km/h east has a constant increase in speed of 1.5 m/s². What is its velocity 6.8 s later?

17.

Given:

$v_i = 30.0\ \text{km/h} = 8.33\ \text{m/s}$

$a = 1.5\ \text{m/s}^2$

$t = 6.8\ \text{s}$

$$v_f = v_i + at = 8.33 + (1.5)(6.8) = 8.33 + 10.2 = 18.53\ \text{m/s}$$

✅ **Velocity = 18.5 m/s east**

18. If a car accelerates from rest at a constant rate of 5.5 m/s² north, how long will it take for the car to reach a velocity of 28 m/s north?

18.

Given:

$v_i = 0\ \text{m/s}, a = 5.5\ \text{m/s}^2, v_f = 28\ \text{m/s}$

$$t = \frac{v_f - v_i}{a} = \frac{28 - 0}{5.5} = 5.09\ \text{s}$$

✅ **Time = 5.1 s** (to reach 28 m/s north)

Define free fall and free fall acceleration

Free Fall:

Free fall is the motion of an object when it moves only under the influence of gravity, with no other forces (like air resistance) acting on it.

Free Fall Acceleration (g):

Free fall acceleration is the acceleration experienced by an object in free fall due to Earth's gravity.

It has a constant value near the Earth's surface of approximately **9.8 m/s² downward**.

الأسئلة الكتابية- Writing questions

List the common steps of scientific methods used in investigations Classify common quantities into base and derived quantities with their SI units

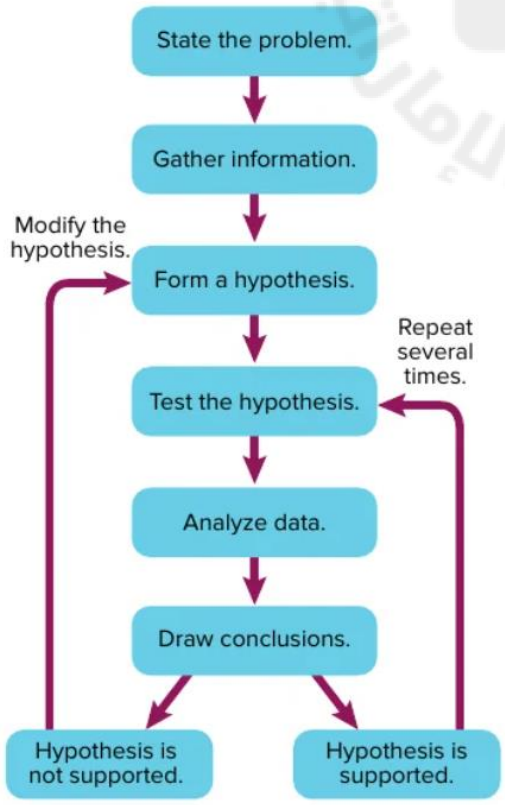


Table 1 SI Base Units

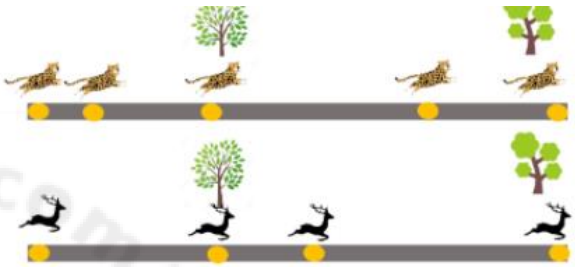
Base Quantity	Base Unit	Symbol
Length	meter	m
Mass	kilogram	kg
Time	second	s
Temperature	kelvin	K
Amount of a substance	mole	mol
Electric current	ampere	A
Luminous intensity	candela	cd

-Interpret the motion represented by motion diagrams and particle models

The runner is speeding up.

The car is traveling at a constant speed.

The runner slows down over time.



The deer takes less time to reach the second tree.

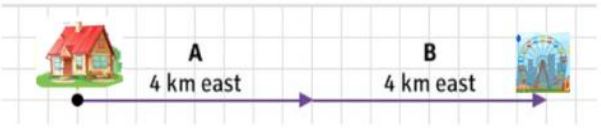
The runner is not moving.

-Determine displacement using vector addition or subtraction in one dimension.

Displacement

Displacement is the change in position from initial position to final position.

$$\Delta x = x_f - x_i$$



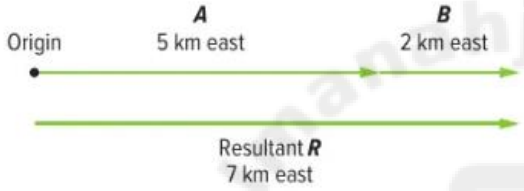
$\Delta x = x_f - x_i = +4\ \text{km} - 0 = +4\ \text{km}$ or **4 km east**

Figure 10 You can use a diagram or an equation to combine vectors.

Analyze *What is the sum of a vector 12 m north and a vector 8 m north?*

COLOR CONVENTION: Displacement (*x*) ⟷ green

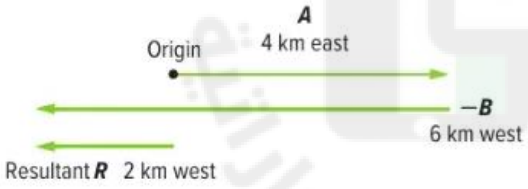
Example of Vector Addition



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

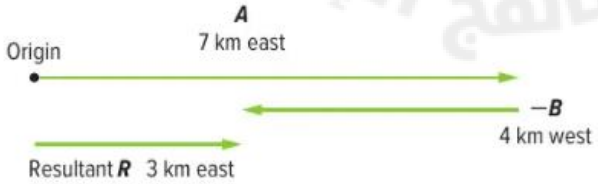
$R = A + B$
$= 7\ \text{km east}$

Examples of Vector Subtraction



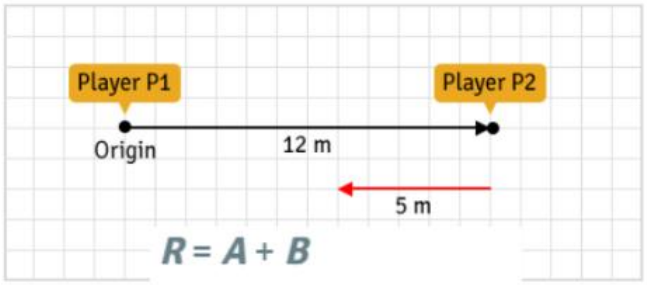
$R = A - B$
$= 4\ \text{km} - 6\ \text{km}$
$= -2\ \text{km}$

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



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

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



$R = A + B$

$= (+12\ \text{m}) + (-5\ \text{m})$

$= \mathbf{+7\ m}$

$R = A + B$

$= 6\ \text{km west} + 6\ \text{km west}$

$= \mathbf{12\ km\ west}$

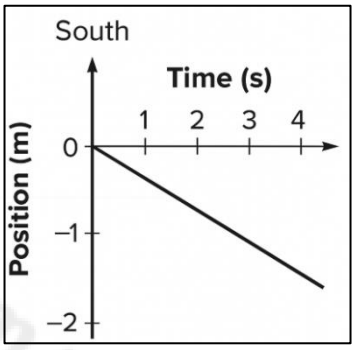
-Define and calculate the average speed using a suitable mathematical representation

Define and calculate the average velocity using a suitable mathematical representation

26. The graph describes the movement of a cruise ship drifting slowly through calm waters. The positive y-direction (along the vertical axis) is defined to be south.

a. What is the ship's average speed?

b. What is its average velocity?



🔹 **From the graph:**

- At **t = 0 s**, position = **0 m**
- At **t = 4 s**, position = **–2 m** (south direction)
- The motion is a straight line (uniform motion)

Q26a. What is the ship's average speed?

$$\text{Average speed} = \frac{\text{Total distance}}{\text{Total time}}$$

$$= \frac{2\ \text{m}}{4\ \text{s}} = 0.5\ \text{m/s}$$

✅ **Answer:** 0.5 m/s

Q26b. What is its average velocity?

$$\text{Average velocity} = \frac{\text{Displacement}}{\text{Time}} = \frac{-2\ \text{m}}{4\ \text{s}} = -0.5\ \text{m/s}$$

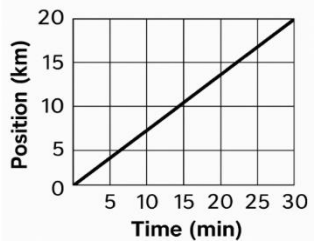
(The negative sign means the motion is toward the **south** direction.)

✅ **Answer:** –0.5 m/s (south)

Q27. Describe, in words, the cruise ship's motion.

The cruise ship moves **steadily southward** in a straight line at a **constant speed of 0.5 m/s.**

29. The graph represents the motion of a bicycle.
a. What is the bicycle's average speed?
b. What is its average velocity?



🔹 **From the graph:**

- At **t = 0 min**, position = **0 km**
- At **t = 30 min**, position = **20 km**
- The line is straight → the motion is **uniform** (constant speed)

Q29a. What is the bicycle's average speed?

$$\text{Average speed} = \frac{\text{Total distance}}{\text{Total time}} = \frac{20\ \text{km}}{30\ \text{min}} = \frac{20}{0.5\ \text{h}} = 40\ \text{km/h}$$

✅ **Answer:** 40 km/h

Q29b. What is its average velocity?

Since the motion is in a **straight line in one direction**,

$$\text{Average velocity} = \text{Average speed} = 40\ \text{km/h (forward)}$$

✅ **Answer:** 40 km/h in the forward direction

Q30. Describe, in words, the bicycle's motion.

The bicycle moves **at a constant speed** in a **straight line**, covering **equal distances in equal time intervals** — meaning it travels **uniformly forward** without changing speed.

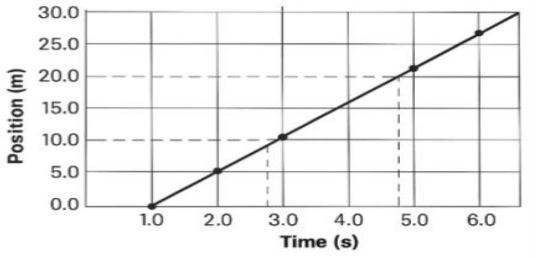
Average velocity

Average velocity is defined as the change in position divided by the time during which the change occurred.

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

-Analyze a position-time graph to describe an object's motion

When did the runner whose motion is described in *Figure reach 12.0 m beyond the starting point?



Where was she after 4.5 s?

1 ANALYZE THE PROBLEM

**Question 1: ** At what time was the magnitude of the runner's position (x) equal to 12.0 m?

The value of *t* there is 2.4 s.

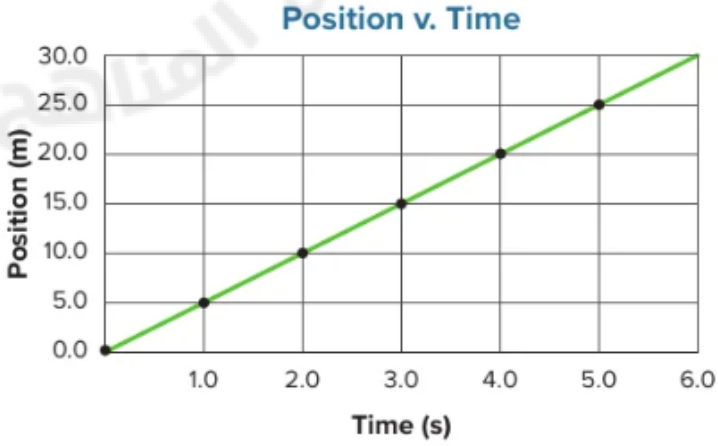
**Question 2: ** What was the runner's position at time t = 4.5 s?

approximately 22.5 m.

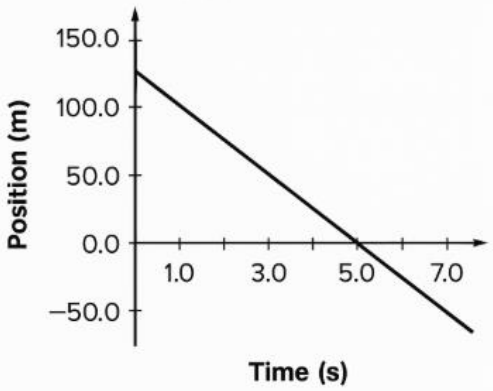
-Calculate average velocity (magnitude and direction) from the slope. Of a position-time graph during a certaintimeinterval and instantaneous velocity from the slope of a position-time graph at a certain instant.

Table 1 Position v. Time

Time (s)	Position (m)
0.0	0.0
1.0	5.0
2.0	10.0
3.0	15.0
4.0	20.0
5.0	25.0



10. The graph in *Figure* represents the motion of a car moving along a straight highway. Describe in words the car's motion.



♦ From the graph:

- At **t = 0 s**, position = **150 m**
- At **t = 5 s**, position = **0 m**
- At **t = 7 s**, position = **–50 m**

→ The car is moving **toward the west** (negative direction).

Q10. Describe in words the car's motion.

The car starts **150 m east** of the origin and moves **steadily westward**, passing the origin at **5 s**, and continues to **50 m west** of the origin by **7 s**.

✅ *The motion is uniform (constant velocity) toward the west.*

12. Answer the following questions about the car's motion. Assume that the positive x-direction is east of the origin and the negative x-direction is west of the origin.

a. At what time was the car's position 25.0 m east of the origin?

b. Where was the car at time t = 1.0 s?

c. What was the displacement of the car between times t = 1.0 s and t = 3.0 s?

a. At what time was the car's position 25.0 m east of the origin?

From the graph: halfway between 0 m and 50 m east occurs at about **t = 4.2 s.**

✅ *Answer: 4.2 s*

b. Where was the car at time t = 1.0 s?

At 1 s, the position is around **120 m east** of the origin.

✅ *Answer: +120 m east*

c. What was the displacement of the car between times t = 1.0 s and t = 3.0 s?

At 1.0 s → +120 m

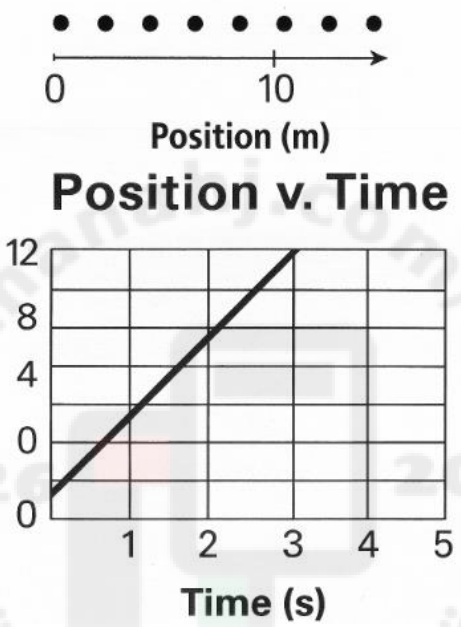
At 3.0 s → +60 m

$$\text{Displacement} = 60 - 120 = -60 \text{ m}$$

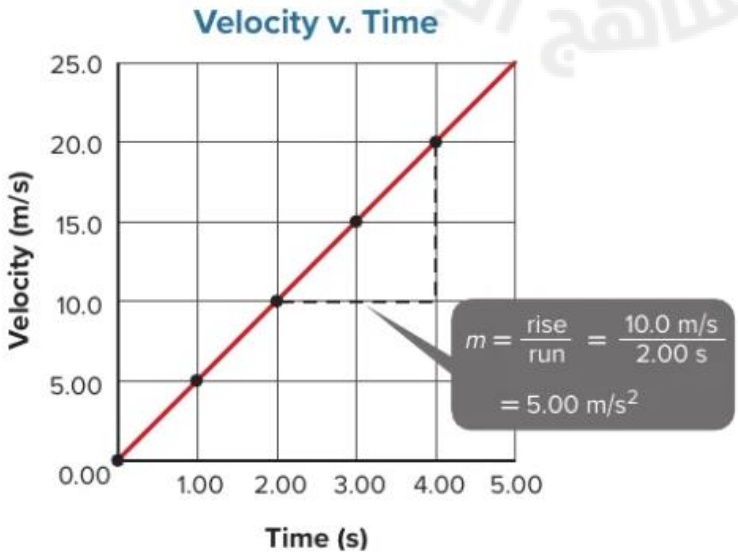
✅ *Answer: –60 m (toward the west)*

Look at the diagram and graph shown in Figure 18. Do they model diagrams are 2 s.

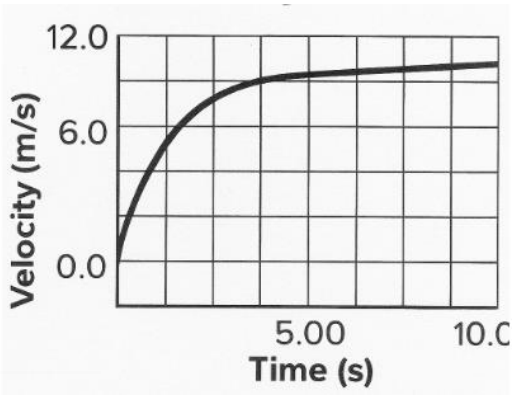
<u>No. In the particle model the dots are equally spaced every 2 s</u> from 0 m to about 10 m, so it would take ~10 s to reach 10 m (speed ≈ 1 m/s). The position–time graph reaches 10 m at t = 3 s (speed ≈ 10/3 ≈ 3.3 m/s). Different times/speeds ⇒ not the same motion.



-Interpret the velocity-time graph for a single or multiple objects in motion.



Draw tangents to the curve at two points. Choose t = 1.00 s and t = 5.00 s. Solve for the magnitude of the instantaneous acceleration at 1.00 s:



$$a = \frac{\text{rise}}{\text{run}}$$

The slope of the line at 1.00 s is equal to the acceleration at that time.

$$a = \frac{10.0\ \text{m/s} - 6.00\ \text{m/s}}{2.4\ \text{s} - 1.00\ \text{s}}$$

$$a = 2.9\ \text{m/s/s} = 2.9\ \text{m/s}^2$$

Solve for the magnitude of the instantaneous acceleration at 5.00 s:

$$a = \frac{\text{rise}}{\text{run}}$$

The slope of the line at 5.00 s is equal to the acceleration at that time.

$$a = \frac{10.3\ \text{m/s} - 10.0\ \text{m/s}}{10.0\ \text{s} - 0.00\ \text{s}}$$

$$a = 0.030\ \text{m/s/s} = 0.030\ \text{m/s}^2$$

The acceleration is not constant because its magnitude changes from 2.9 m/s² at 1.00 s to 0.030 m/s² at 5.00 s.

The acceleration is in the direction chosen to be positive because both values are positive.

-Find the slope and y-intercept of a velocity-time graph to describe the motion of an object

1. The velocity–time graph in *Figure 8* describes Steven's motion as he walks along the midway at the state fair. Sketch the corresponding motion diagram. Include velocity vectors in your diagram.

Image created ›

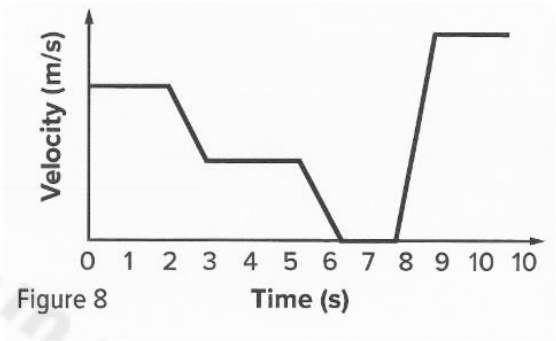


Figure 8

1) Motion diagram for Figure 8 (Steven)

Dots in a straight line left→right.

- From 0–2 s: **equal, medium spacing** with **equal arrows** (constant speed).
- 2–3 s: **arrows shorten** (slowing).
- 3–5 s: **short, equal arrows** (slower constant speed).
- 5–6.5 s: **arrows shorten to zero** (comes to a stop).
- ~6.5–8 s: **no motion** (dot(s) on top of each other).
- 8–10 s: **widely spaced dots with long arrows** (moves fast at constant speed).

2. Use the graph of the toy train in *Figure 9* to answer these questions.

a. When is the train's speed constant?

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

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

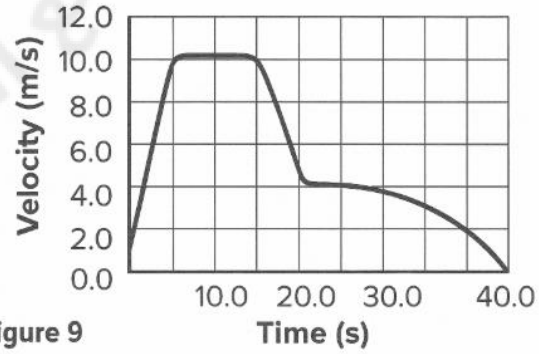


Figure 9

2) Using Figure 9 (toy train)

a. When is the speed constant?

≈ **8 s to 16 s** (horizontal part at ~10 m/s).

b. When is acceleration positive?

From **0 to about 8 s** (velocity increasing).

c. When is acceleration most negative?

During the steep drop **~16 s to 20 s**.

3. Refer to *Figure 9* to find the average acceleration of the train during the following time intervals.
a. 0.0 s to 5.0 s
b. 15.0 s to 20.0 s
c. 0.0 s to 40.0 s

3) Average acceleration from Figure 9

(Use $a_{avg} = \Delta v / \Delta t$ from the graph.)

a. 0.0–5.0 s: $v(0) \approx 0, v(5) \approx 8\,\text{m/s} \rightarrow$
$a_{avg} \approx \frac{8-0}{5} = \mathbf{1.6\ m/s^2}$.

b. 15.0–20.0 s: $v(15) \approx 10\,\text{m/s}, v(20) \approx 4\,\text{m/s} \rightarrow$
$a_{avg} \approx \frac{4-10}{5} = \mathbf{-1.2\ m/s^2}$.

c. 0.0–40.0 s: $v(0) \approx 0, v(40) \approx 0 \rightarrow$
$a_{avg} \approx \frac{0-0}{40} = \mathbf{0\ m/s^2}$.

4. CHALLENGE
Plot a *v–t* graph representing the following motion:
An elevator starts at rest from the ground floor of a three-story shopping mall. It accelerates upward for **2.0 s** at a rate of **0.5 m/s²**, continues up at a constant velocity of **1.0 m/s** for **12.0 s**, and then slows down with a constant downward acceleration of **0.25 m/s²** for **4.0 s** as it reaches the third floor.