Read 2.7

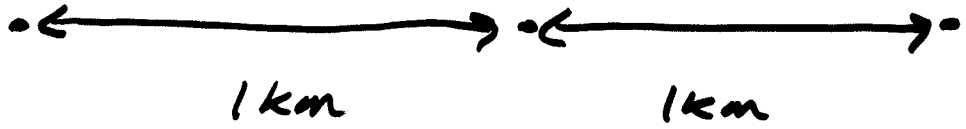
Action Center Thursday
5:00 - 7:00 p.m Wagner 145

Group problem tomorrow

office hrs 10:30 - 11:30 today

webassign
use on hrw use 1 sig digit
i.e 2×10^8

Example



want to Average 2 km/hr.

Travel time? $\frac{2\text{ km}}{1\text{ hr}}$ so you have 1 hour

if you travel 1st km in 1 hour : 1 km/hr

how fast must you travel 2nd km?

wrong way $\frac{1\text{ km/hr} + x}{2} = 2\text{ km/hr} \Rightarrow x = 3\text{ km/hr}$

note you used up your whole hour in 1st half of trip so cannot average 2 km/hr

$$\text{speed} = \frac{\text{total distance}}{\text{total time}}$$

$$\text{distance} = vt$$

$$t = \frac{\text{distance}}{v}$$

$$\frac{2\text{ km}}{1\text{ hr} + \frac{1\text{ km}}{v}} = 2\text{ km/hr}$$

$\underline{v = \infty}$ correct answer

Interactive Question

You jog around a 400 m track in 100 seconds, returning to the place where you started. Which of the following statements is true?

A) Your average speed and average velocity are the same, and neither is zero.
B) Your average speed and average velocity are the same, and both are zero.
C) Your average velocity is zero, and your average speed is 4 m/s.
D) Your average speed is zero, and your average velocity is 4 m/s.

Interactive Question

When is the average velocity of an object equal to the instantaneous velocity?

A) This is always true.

B) This is never true.

C) This is the case when the velocity is constant.

D) This is the case only when the velocity is increasing at a constant rate.

Interactive Question

When is the instantaneous speed of an object equal to the magnitude of the instantaneous velocity?

A) This is always true.

B) This is never true.

C) This is the case only when the velocity is constant.

D) This is the case only when the velocity is increasing at a constant rate.

Interactive Question

Which physical quantity is not correctly paired with its SI unit and dimension?

Quantity	**Unit**	**Dimension**
A) velocity	m/s	[L]/[T]
B) path length	m	[L]
C) speed	m/s	[L]/[T]
D) displacement	m/s^2	$[L]/[T]^2$
E) speed × time	m	[L]

Average acceleration

$$a_{ave} = \frac{v_f - v_i}{t_f - t_i} = \frac{\Delta v}{\Delta t}$$

Note: object is accelerating when it changes speed or Direction

acceleration: rate at which velocity changes

acceleration also has both magnitude and direction

Instantaneous acceleration

$$a = \lim_{\Delta t \to 0} \frac{\Delta v}{\Delta t}$$

ex) Driving at 20 m/s, hit brakes and slow to 5 m/s in 2s. What is your average acceleration?

$$a_{ave} = \frac{v_f - v_i}{t_f - t_i}$$

$v_f = 5\ m/s$

$v_i = 20\ m/s$

$t_f = 2s$

$t_i = 0$

$$a_{ave} = \frac{5\ m/s - 20\ m/s}{2s} =$$

$$\boxed{-7.5\ m/s^2}$$

Is Deceleration the same as negative acceleration?

NO

- Negative acceleration:
  sign of acceleration is negative

- Deceleration:
  acceleration opposite to direction of motion

ex) Car traveling in negative direction at 32 m/s. Car applies brakes and stops in 7.3 s. What is car's acceleration

$$a = \frac{0 - (-32\ m/s)}{7.3\ s} = +4.4\ m/s^2$$

what are examples of the following

1) $v > 0$ $a = 0$

2) $v < 0$ $a = 0$

3) $v > 0$ $a > 0$

4) $v < 0$ $a > 0$

5) $v = 0$ $a \neq 0$

6) speed constant $a \neq 0$

~~D~~ v constant $a \neq 0$

A car travels in a straight line covering a total distance of 90.0 miles in 60.0 minutes. Which statement concerning this situation is true?

A) The velocity of the car is constant.
B) The acceleration of the car must be non-zero.
C) The first 45 miles must have been covered in 30 minutes.
D) The speed of the car must be 90 miles per hour throughout the entire trip.
E) The average velocity of the car is 90 miles per hour in the direction of motion.

Interactive Question

Suppose that an object is moving with constant acceleration. Which of the following is an accurate statement concerning its motion?

A) In equal times its speed increases by equal amounts

B) In equal times its velocity changes by equal amounts.

C) In equal times it moves equal distances.

D) All of the above are true.

E) None of the above are true.

Motion Diagrams

Snapshot of an object at different times

From motion diagram can learn about objects

position
velocity
acceleration

Interactive Question

The picture below shows snapshots of an object taken at equal time intervals. Which statement is true?

A) The object is definitely moving to the right
B) The object is definitely moving to the left
C) The object is definitely speeding up
D) The object is moving at a constant speed
E) None of the above is necessarily true

Interactive Question

Suppose that an object is moving with constant acceleration. Which of the following is an accurate statement concerning its motion?

A) In equal times its speed increases by equal amounts

B) In equal times its velocity changes by equal amounts.

C) In equal times it moves equal distances.

D) All of the above are true.

E) None of the above are true.

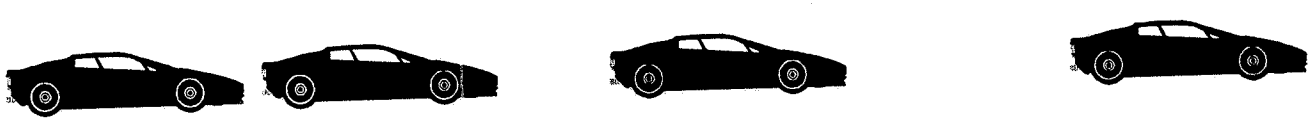
Interactive Question

The picture below shows snapshots of four cars taken at equal time intervals. If the cars are moving forward, which car has the greatest magnitude of acceleration?

1) 

2) 

3) 

4) 

A) Car 1

B) Car 2

C) Car 3

D) Car 4

E) Car 1 and 3 tie

Now That we know How TO CALCULATE Acceleration, we want To ask more Questions

- How fast is it moving?
- How long did it accelerate?
- where is object at a particular time?

want TO RELATE

Position (X)
Velocity (V)
acceleration (a)
time (t)

For <u>constant</u> acceleration

$$a_{avg} = a$$

$$a = \frac{v_f - v_i}{t_f - t_i}$$

choose $t_i = 0$ start stopwatch

$t_f = t$

$V_i = V_0$ ← original

$V_f = V$

$$a = \frac{V - V_0}{t} \Rightarrow \boxed{V = V_0 + at} \quad (1)$$

$$V_{avg} = \frac{x_f - x_i}{t_f - t_i}$$

choose $x_f = x$

$x_i = x_0$

$t_f = t$

$t_i = 0$

$$V_{avg} = \frac{x - x_0}{t}$$

$$x = x_0 + V_{avg}\, t$$