

Acceleration & Distance Problems Part 1

$$\bar{v} = \frac{\Delta d}{\Delta t} = \frac{df - di}{t} = \frac{Vf + Vi}{2} \quad a = \frac{\Delta V}{\Delta t} = \frac{Vf - Vi}{t} \quad \text{or} \quad Vf = Vi + at$$

1. Is a car driving in a circle at a constant speed accelerating? Explain why.

**YES THE CAR IS ACCELERATING** Because Its direction is changing which means Velocity is Changing  $a = \frac{\Delta v}{\Delta t}$

Note: For the next problems, assume the objects are traveling in a straight-line motion and are going the same direction.

2. What is the acceleration of each car?

$V_i = 0$   
 $V_f = 26.8$   
 $a = ?$   
 $t = 5$

- a) A Ford Mustang can go from zero to 60 mph (26.8 m/s) in 5.0 seconds.

$V_f = V_i + at$   
 $26.8 = 0 + a(5)$

$a = \frac{26.8}{5} = 5.36 \text{ m/s}^2$

- b) A Ford Escort can go from zero to 80 mph (35.8 m/s) in 10 seconds.

$V_i = 0$   
 $V_f = 35.8$   
 $t = 10$   
 $V_f = V_i + at$   
 $35.8 = 0 + a(10)$

$a = \frac{35.8}{10} = 3.58 \text{ m/s}^2$

$a = ?$

3. In 3 seconds a car moving in a straight line increases its speed from 50 mph (22.4 m/s) to 65 mph (29.1 m/s) while a truck increases its speed from 0 mph to 15 mph (6.7 m/s) in the same amount of time. What is the acceleration of each vehicle?

CAR  
 $V_i = 22.4$   
 $V_f = 29.1$   
 $a = ?$   
 $t = 3$

$V_f = V_i + at$   
 $29.1 = 22.4 + a(3)$   
 $3a = 29.1 - 22.4$   
 $3a = 6.7$

$a = \frac{6.7}{3} = 2.2 \text{ m/s}^2$

TRUCK  
 $V_i = 0$   
 $V_f = 6.7$   
 $a = ?$   
 $t = 3$

$V_f = V_i + at$   
 $6.7 = 0 + 3a$   
 $a = \frac{6.7}{3}$

$a = 2.2 \text{ m/s}^2$

4. Suppose a sprinter increases her speed each second, first from 0 to 5 meters/sec, then from 5 m/s to 10 m/s, then from 10 m/s to 15 m/s. What is her acceleration?

0-5  
5-10 & 10-15  
§

$\Delta V$  for each = 5 m/s

$a = \frac{\Delta V}{t} = \frac{5}{1} = 5 \text{ m/s}^2$

5. A car starting from rest increases its velocity to 24 (m/s) in 3.0 seconds.

a. What is the car's acceleration?

$$v_i = 0$$

$$v_f = 24$$

$$t = 3$$

$$v_f = v_i + at$$

$$24 = 0 + 3a$$

$$a = \frac{24}{3} = 8 \text{ m/s}^2$$

b. What is the car's average velocity?

$$v_{\text{avg}} = \frac{0 + 24}{2} = 12 \text{ m/s}$$

c. How far did the car go in the 3.0 seconds?

$$d = v \cdot t = (12 \text{ m/s}) 3 \text{ sec} = 36 \text{ m}$$