MOTION - CHANGING POSITION (LOCATION)

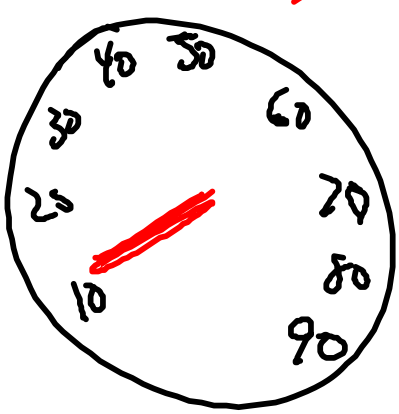
* ENTIRE OBJECT MUST CHANGE LOCATION

SPEED IS RATE OF CHANGE IN POSITION (RATE OF MOTION)

$$\text{SPEED} = \frac{\text{DISTANCE TRAVELED}}{\text{TIME IT TAKES TO TRAVEL}}$$

SPEEDOMETER - MEASURES INSTANTANEOUS SPEED

(SPEED YOU ARE AT RIGHT NOW)



CONSTANT SPEED

SPEED THAT DOESN'T CHANGE

CRUISE CONTROL ON A CAR.

AVERAGE SPEED

TOTAL DISTANCE TRAVELED
DIVIDED BY
TOTAL TIME

$S = \frac{d}{t}$

$$\text{SPEED} = \frac{\text{DISTANCE}}{\text{TIME}}$$

Aim: To describe speed as a rate.

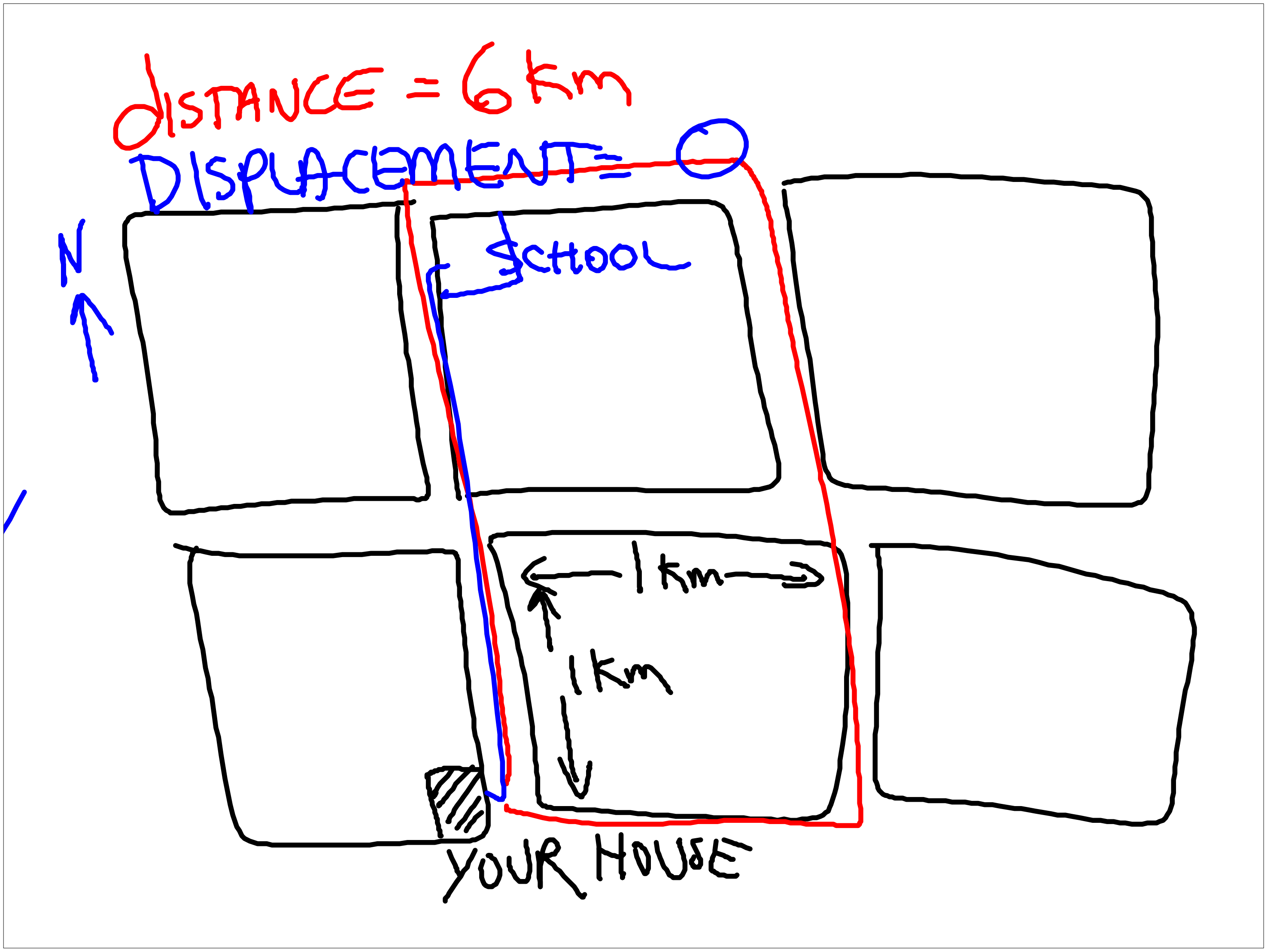
x= Motion can be described as changing position. (LOCATION)

x

Speed is the rate of change of position.

DISTANCE- HOW FAR AN OBJECT MOVES

DISPLACEMENT- THE DISTANCE AND DIRECTION FROM ONE LOCATION TO ANOTHER


DISTANCE = 6 Km
DISPLACEMENT = 0
N
SCHOOL
1 km
1 Km
YOUR HOUSE

Instantaneous speed: The speed shown on a speedometer.

Constant speed: Speed that isn't changing.

Average speed: The total distance divided by the total time.
When speed varies a great deal.

$s = \frac{d}{t}$

Calculating speed

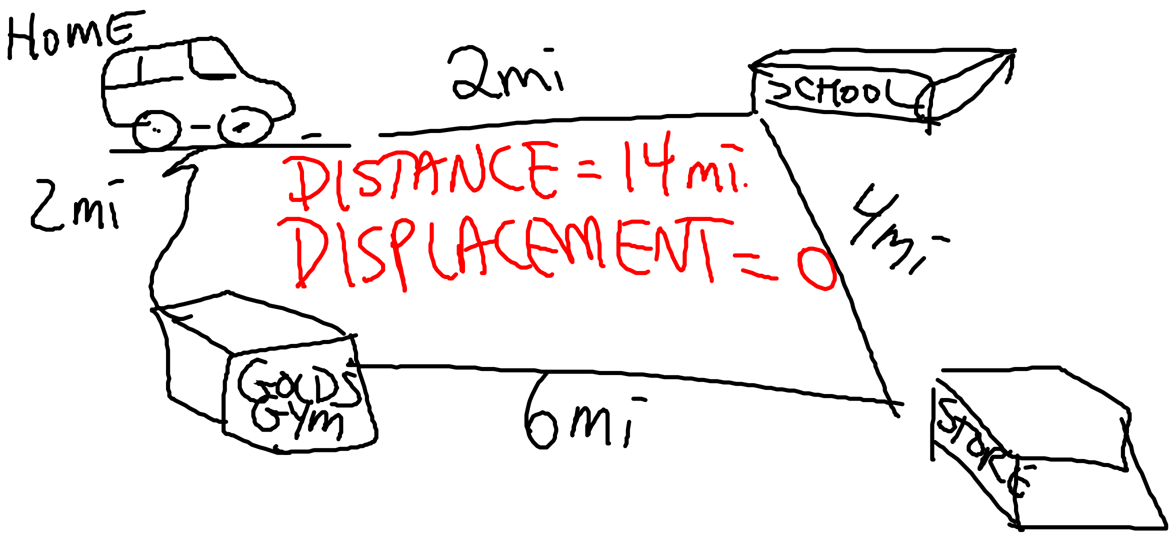
$$\text{AVE. SPEED} = \frac{\text{TOTAL DISTANCE}}{\text{TOTAL TIME}}$$

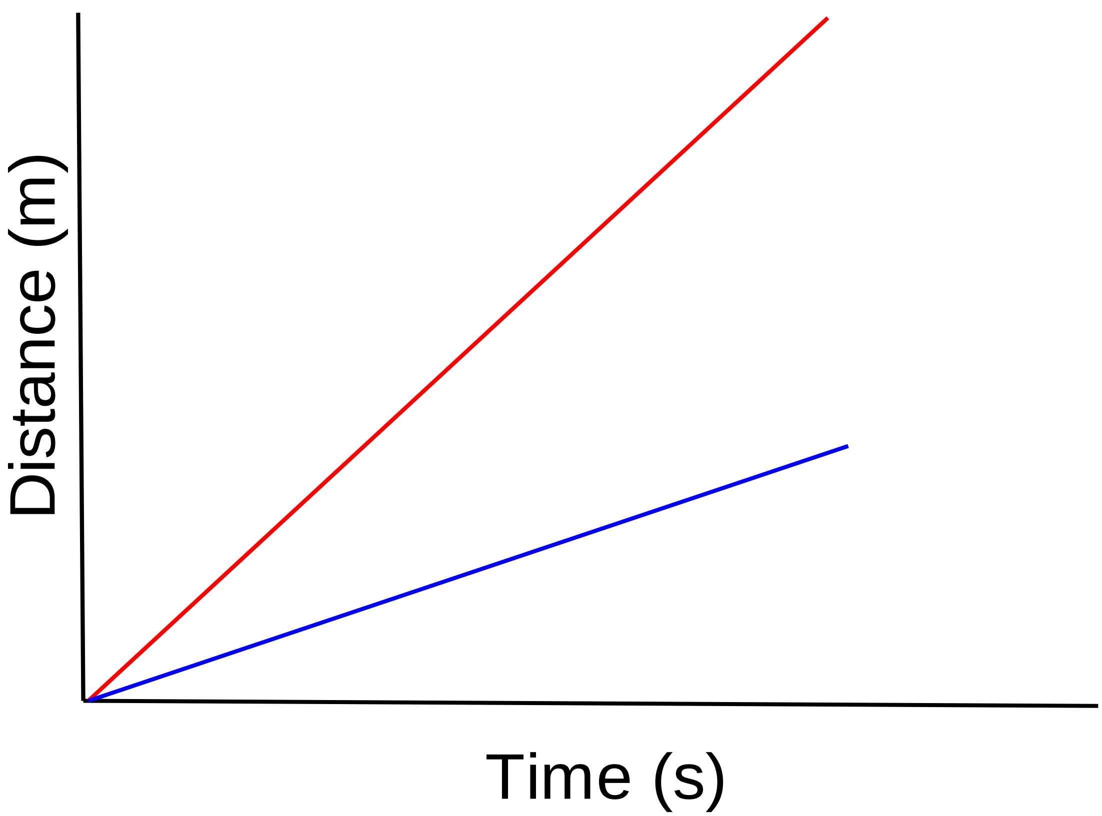
$$\text{AVE. SPEED} = \frac{10\,\text{miles}}{0.5\,\text{hr}}$$

$.5 \overline{)\,100}$ = 20.

$$= 20\ \frac{\text{mi}}{\text{hr}}$$

<u>Displacement:</u> The total distance from the beginning to the end. Direction is important.




Distance (m)
Time (s)

Aim: To describe speed as a rate.

Motion can be described as changing position. (LOCATION)

Speed is the rate of change of position.

DISTANCE- HOW FAR AN OBJECT MOVES

DISPLACEMENT- THE DISTANCE AND DIRECTION FROM ONE LOCATION TO ANOTHER

Instantaneous speed: The speed shown on a speedometer.

Constant speed: Speed that isn't changing.

Average speed: The total distance divided by the total time.
When speed varies a great deal.

GOOD FOR OBJECTS THAT CHANGE SPEED OFTEN

Calculating speed

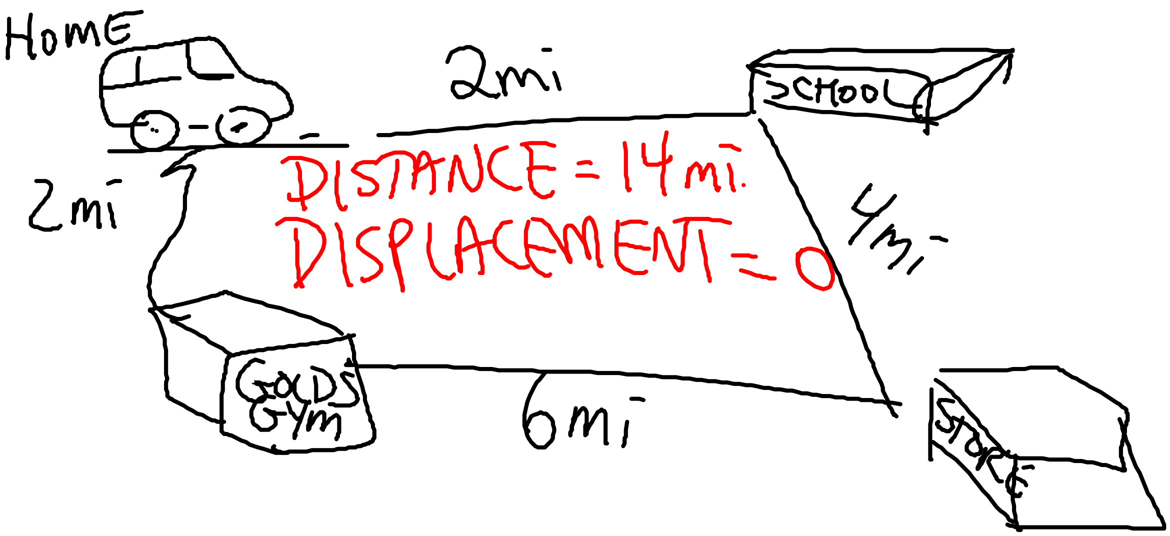
$$\text{AVE. SPEED} = \frac{\text{TOTAL DISTANCE}}{\text{TOTAL TIME}}$$

$$\text{AVE. SPEED} = \frac{10\,\text{miles}}{0.5\,\text{hr}} \qquad S = \frac{d}{t}$$

$$.5\overline{)100.}\;\to\;20.$$

$$= 20\ \frac{\text{mi}}{\text{hr}}$$

Displacement: The total distance from the beginning to the end. Direction is important.



VELOCITY: SPEED AND DIRECTION OF AN OBJECT.

EX. $10\frac{m}{s}$ EAST

SPEED DIRECTION

FORMULA: $V = \frac{d}{t} \quad S = \frac{d}{t}$

A car travels east on the LIE. If it travels 100m in 20 sec., what is its velocity?

$d = 100m$

$t = 20s$

$V = ?$

$$V = \frac{d}{t} = \frac{100m}{20s} = 5\frac{m}{s}$$

$V = 5\frac{m}{s}$ EAST

HOW CAN VELOCITY CHANGE?

1. SPEED CAN CHANGE (FASTER / SLOWER)
2. DIRECTION CAN CHANGE
3. CHANGE BOTH

ACCELERATION

CHANGE VELOCITY?

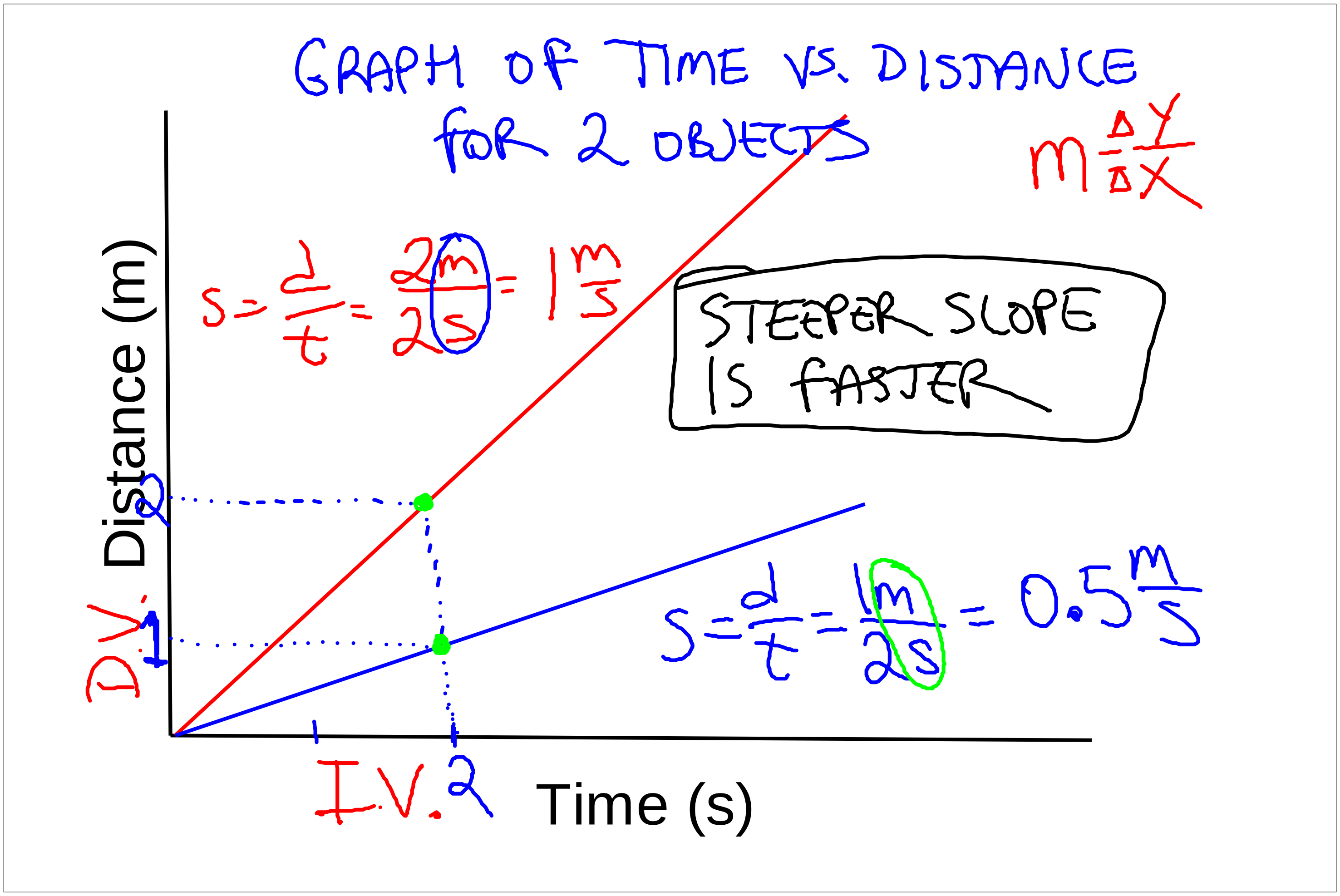
SLOW DOWN
SPEED UP } CHANGE SPEED

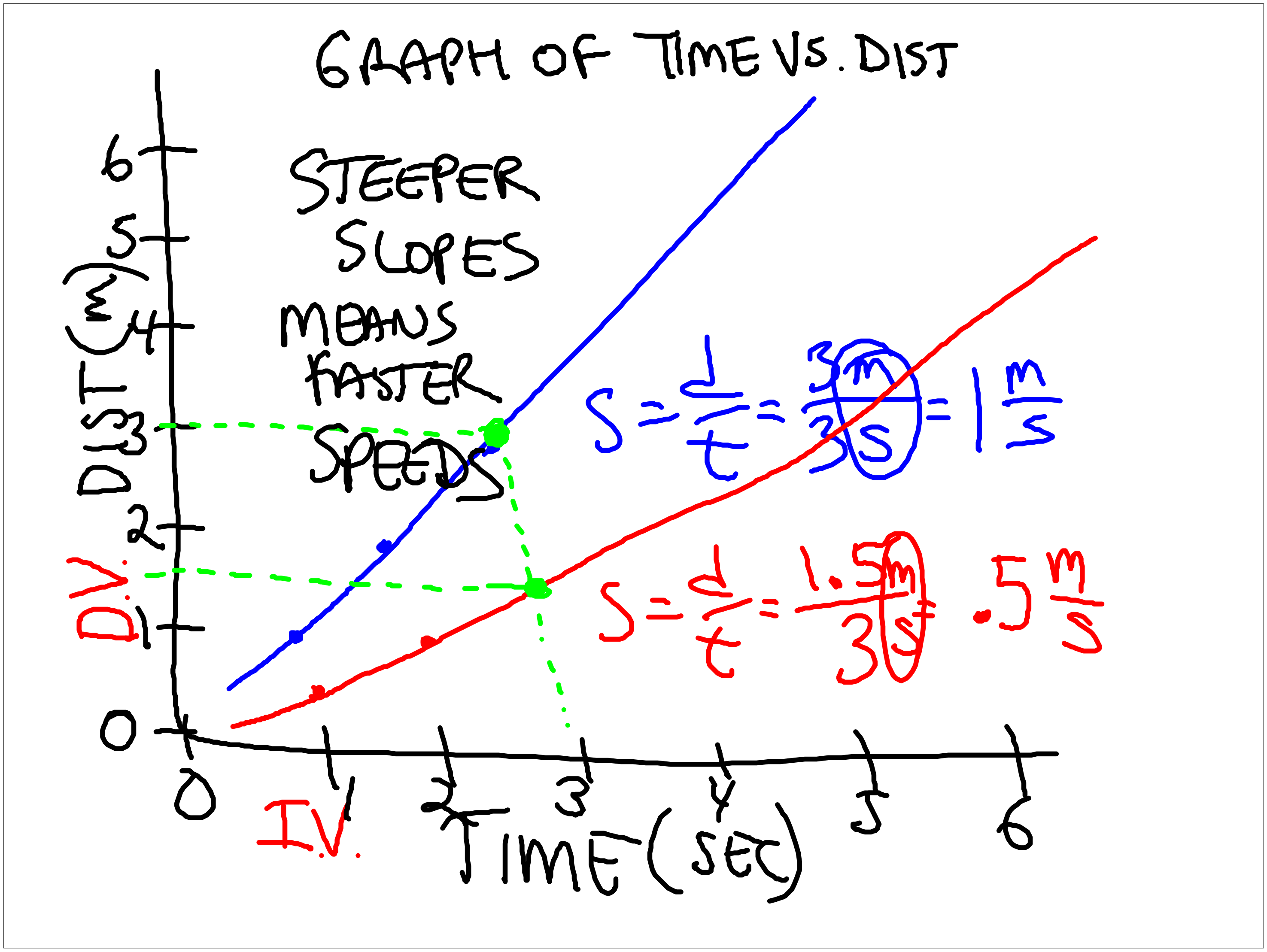
CHANGE DIRECTION

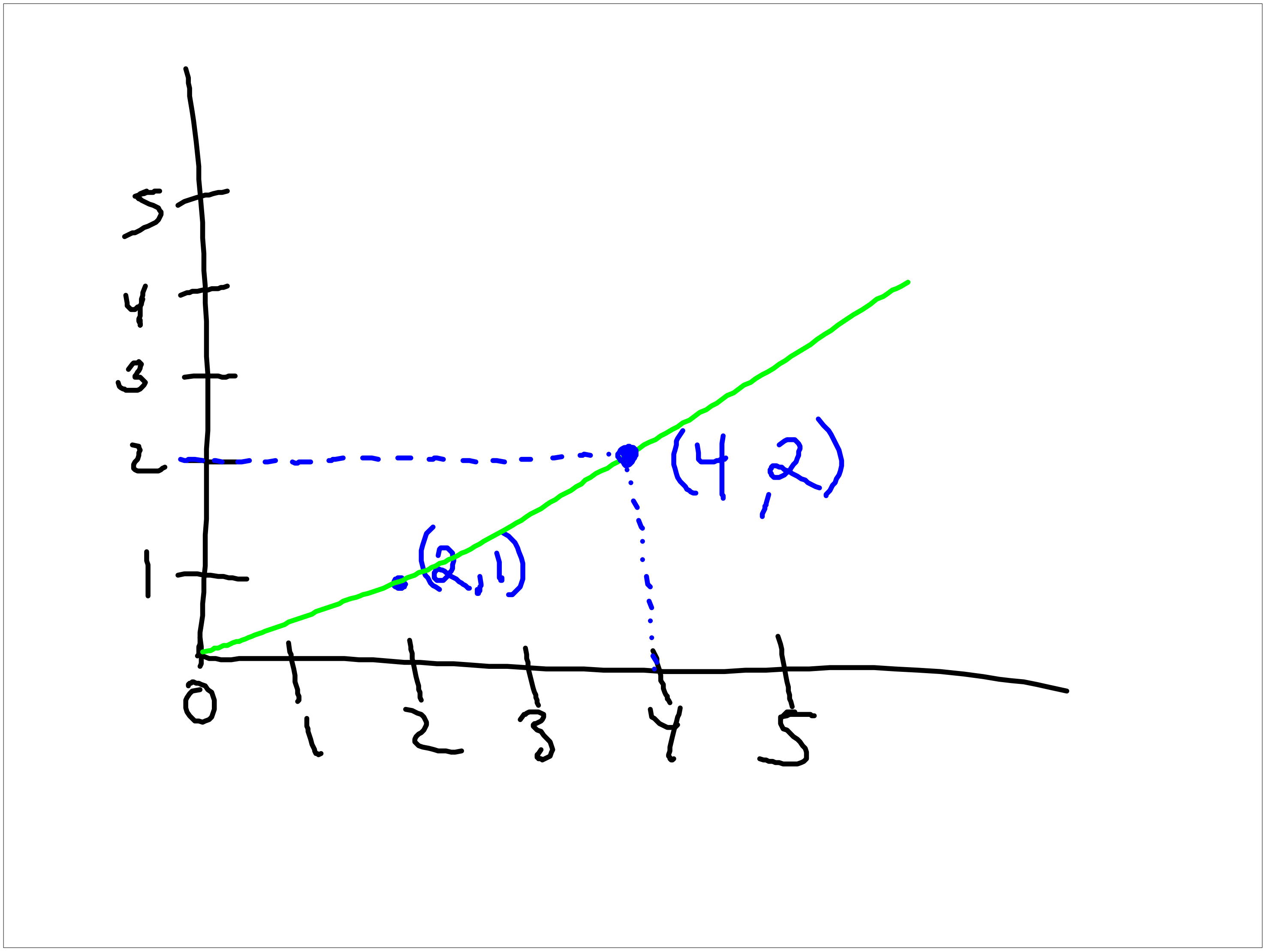
OR CHANGE BOTH

$$\text{accel} = \frac{(\text{final Velocity} - \text{initial Velocity})}{\text{time}}$$

$$a = \frac{V_f - V_i}{t}$$


GRAPH OF TIME VS. DISTANCE FOR 2 OBJECTS
m = ΔY/ΔX
s = d/t = 2m/2s = 1 m/s
STEEPER SLOPE IS FASTER
s = d/t = 1m/2s = 0.5 m/s
Distance (m)
D.V.
2
1
I.V.
1
2
Time (s)


GRAPH OF TIME VS. DIST
STEEPER SLOPES MEANS FASTER SPEEDS
DIST (m)
D.V.
TIME (SEC)
I.V.
0 1 2 3 4 5 6
S = d/t = 3m/3s = 1 m/s
S = d/t = 1.5m/3s = .5 m/s


5
4
3
2
1
0
1
2
3
4
5
(2,1)
(4,2)

FORCE AND MOTION

FORCE IS A PUSH OR A PULL. FORCE IS MEASURED IN NEWTONS

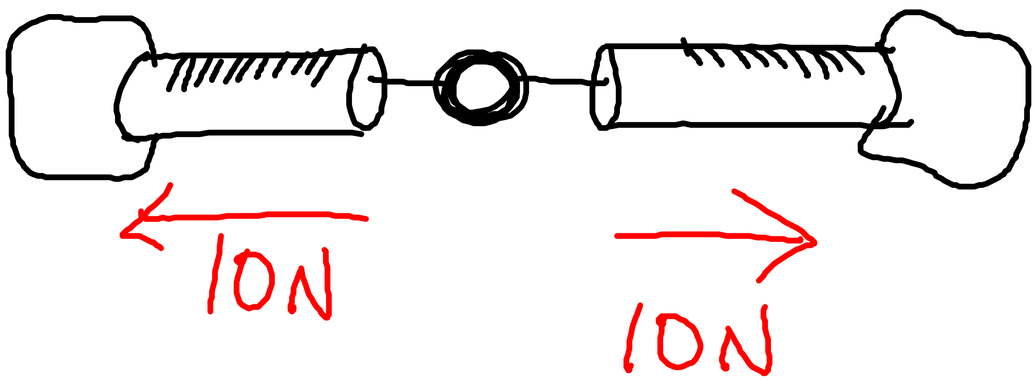
EX. 5N TO THE RIGHT

FORCES ARE MEASURED WITH SPRING SCALES

2 lbs IS ABOUT 10.0 N

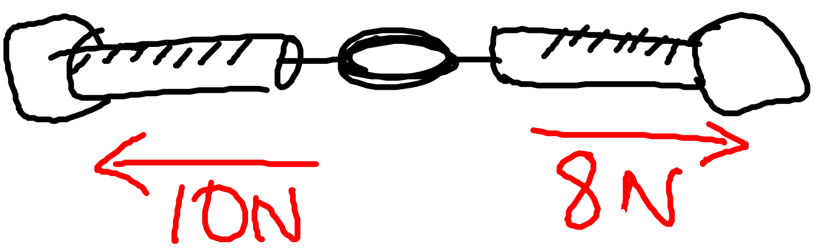
BALANCED FORCES - EQUAL IN SIZE, OPPOSITE IN DIRECTION

VELOCITY = 0 $\frac{m}{s}$



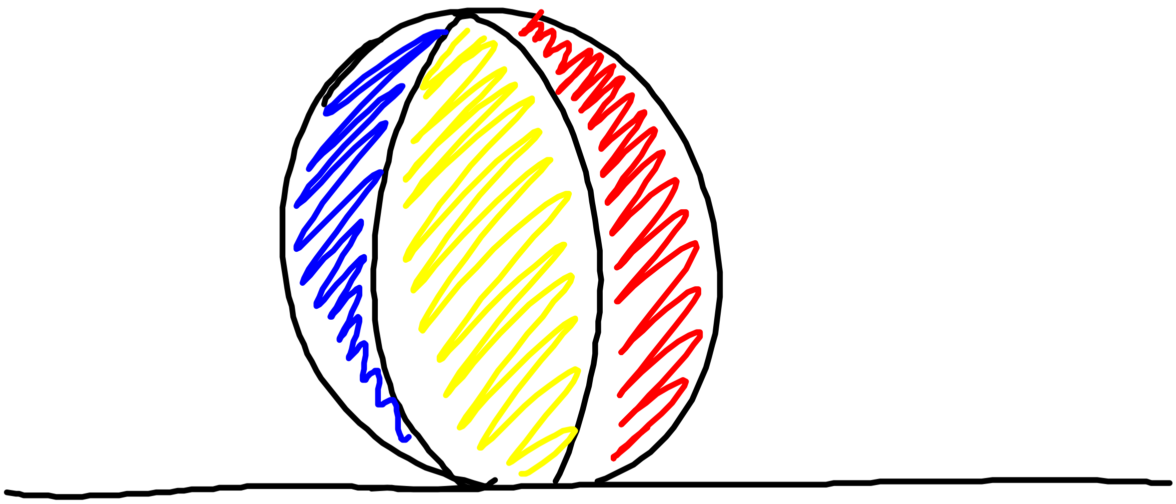
ACCELERATION = 0 $\frac{m}{s^2}$ (CONSTANT SPEED)

UNBALANCED FORCES CAUSE AN OBJECT TO ACCELERATE

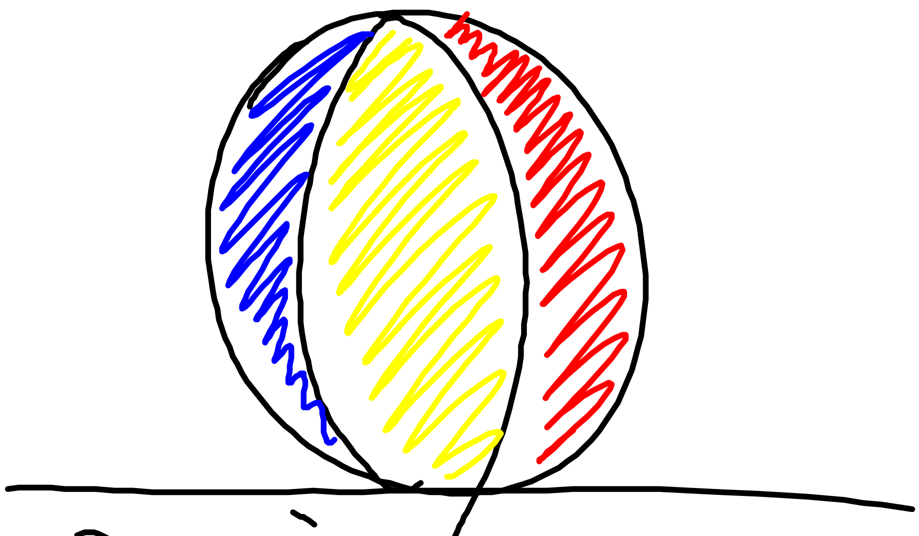


(← 2N) NET FORCE (SUM OF FORCES)

STRING HAS VELOCITY AND ACCELERATION



FORCE CAUSES A CHANGE IN VELOCITY.



BALL DOESN'T CHANGE MOTION

INERTIA – TENDANCY OF AN OBJECT TO RESIST A CHANGE IN MOTION

INERTIA DEPENDS ON
MASS.

MORE MASS MEANS
MORE INERTIA

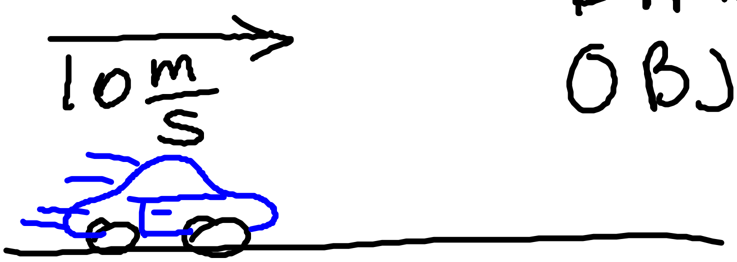
Tablecloth

Crash Test Old Car

Crash Test New Car

NEWTON'S FIRST LAW OF MOTION - OBJECTS AT REST REMAIN AT REST, OBJECTS IN MOTION REMAIN IN MOTION UNLESS ACTED ON BY A FORCE. LAW OF INERTIA

VELOCITY: THE SPEED AND DIRECTION OF AN OBJECT



FORMULA:

$$V = S = \frac{d}{t}$$

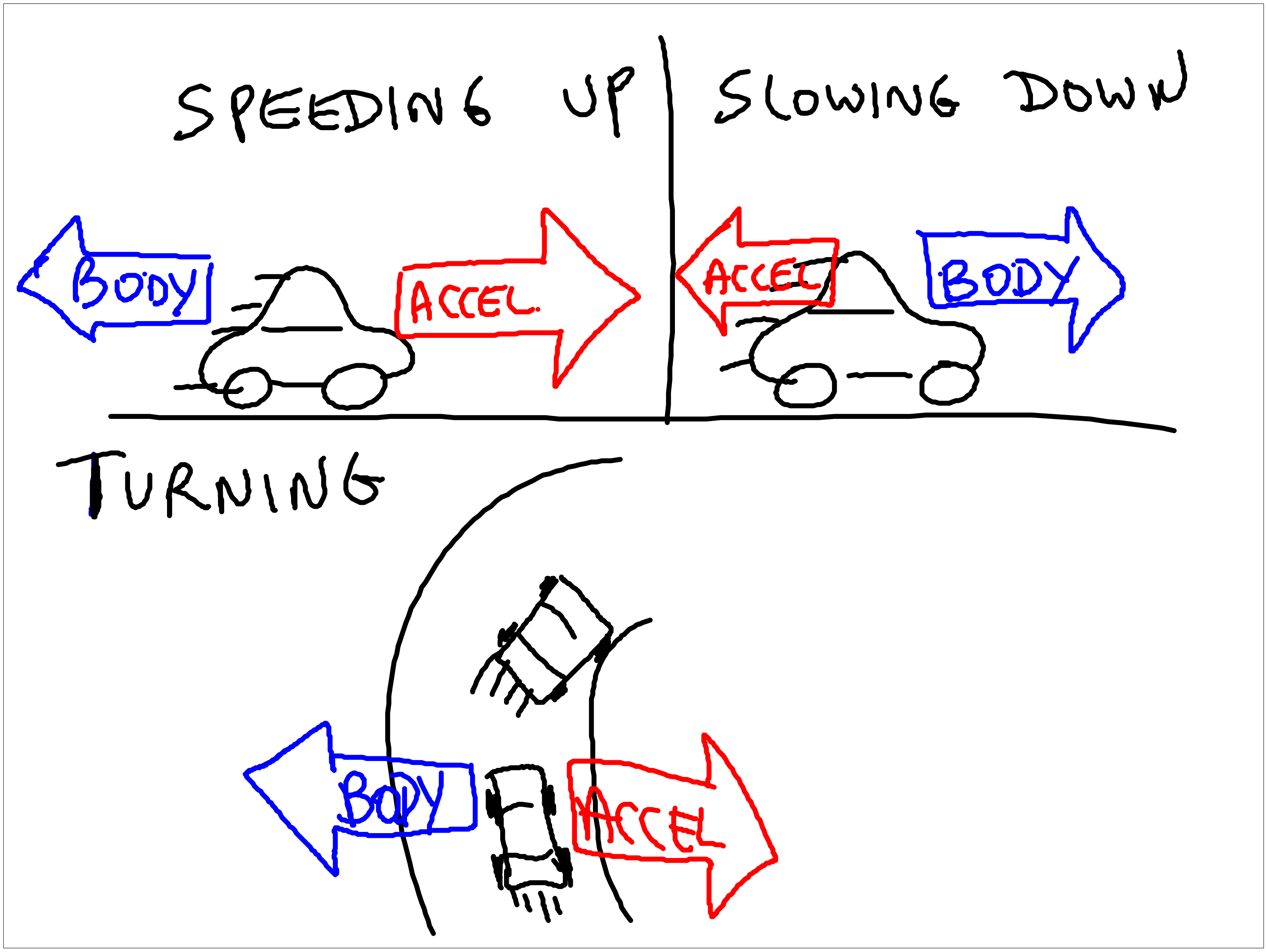
CHANGING VELOCITY

ACCELERATION: A CHANGE IN THE VELOCITY OF AN OBJECT

- CHANGE SPEED < SLOW DOWN / SPEED UP
- CHANGE DIRECTION - TURN
- CHANGE BOTH

YOUR BODY IS AN ACCELEROMETER -

"YOUR BODY WILL MOVE IN THE OPPOSITE DIRECTION OF THE ACCELERATION"


SPEEDING UP
SLOWING DOWN
BODY
ACCEL
ACCEL
BODY
TURNING
BODY
ACCEL

CALCULATE THE ACCELERATION OF A CAR THAT CHANGES ITS VELOCITY FROM $5\frac{m}{s}$ TO $25\frac{m}{s}$ IN 10s.

$$a = \frac{V_F - V_i}{t}$$

CALCULATE THE ACCELERATION OF A CAR THAT CHANGES ITS VELOCITY FROM $5\frac{m}{s}$ TO $25\frac{m}{s}$ IN 10 s.

$$a = \frac{V_F - V_i}{t}$$

(ACCELERATION) → a

FINAL VELOCITY → V_F

INITIAL VELOCITY → V_i

(TIME) → t

CALCULATE THE ACCELERATION OF A CAR THAT CHANGES ITS VELOCITY FROM 5 m/s TO 25 m/s IN 10 s.

$5\ \frac{m}{s}$ = V_i

$25\ \frac{m}{s}$ = V_f

$10\ s$ = t

$$a = \frac{V_f - V_i}{t}$$

$$a = \frac{V_f - V_i}{t}$$

$$a = \frac{\left(25\frac{m}{s}\right) - \left(5\frac{m}{s}\right)}{(10s)}$$

$$a = \frac{V_f - V_i}{t}$$

$$a = \frac{\left(25\frac{m}{s}\right) - \left(5\frac{m}{s}\right)}{(10s)} = \frac{20\frac{m}{s}}{10s} = 2\frac{\frac{m}{s}}{s}$$

$$a = \frac{V_F - V_1}{t}$$

$$a = \frac{25\frac{m}{s} - 5\frac{m}{s}}{10\,s}$$

$$a = \frac{20\frac{m}{s}}{10\,s}$$

$$a = 2\frac{\frac{m}{s}}{s}$$

UNITS FOR ACCELERATION

$$\frac{\frac{m}{s}}{s} = \frac{m}{s} \div \frac{s}{1} = \frac{m}{s} \times \frac{1}{s} = \frac{m \cdot 1}{s \cdot s}$$

$$\frac{\frac{m}{s}}{s} = \frac{m}{s^2}$$

"METERS PER SECOND PER SECOND" = METERS PER SECOND SQUARED

A CAR SLOWS DOWN FROM 20 $\frac{m}{s}$ TO REST. IF IT TAKES 5 SECONDS, CALCULATE ITS ACCELERATION.

A CAR SLOWS DOWN FROM $20 \frac{m}{s}$ TO REST, $0 \frac{m}{s}$ IF IT TAKES 5 SECONDS, CALCULATE ITS ACCELERATION.

$V_f = 0 \frac{m}{s}$ $t = 5 s$

$V_i = 20 \frac{m}{s}$

$$a = \frac{V_F - V_1}{t}$$

$$a = \frac{(0\frac{m}{s}) - (20\frac{m}{s})}{(5s)}$$

$$a = \frac{-20\frac{m}{s}}{5s} = -4\frac{m}{s^2}$$