1.3 VELOCITY AND SPEED – (Guided Notes)

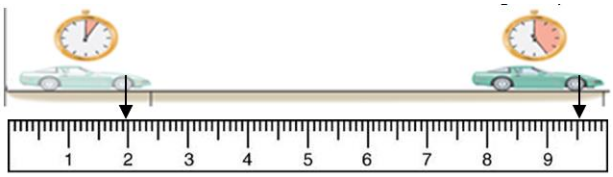
Also in your book on page 332-336

1.2 Distinguish between displacement, distance, velocity, speed, and acceleration. Solve problems involving displacement, distance, velocity, speed, and constant acceleration.

Learning Objectives: What is speed? What is velocity? What is the difference between speed and velocity? What are the units of speed and velocity?

Speed (Scalar)	$R \text{ or } S = \left(\frac{d}{\Delta t}\right) = \left(\frac{d}{t_{final} - t_{initial}}\right)$	Velocity (Vector)	$\vec{v} = \left(\frac{\Delta \vec{x}}{\Delta t}\right) = \left(\frac{\vec{x}_{final} - \vec{x}_{initial}}{t_{final} - t_{initial}}\right)$

VELOCITY AND SPEED – They're similar but not the same.



VELOCITY – this is a measure of the rate of change of position. It is a rate so it will have time in the _____.

The Equation for Velocity = $\frac{Displacement}{change\ in\ time}$

For this situation it is necessary to measure change in time and change in position. The following measurements are made.

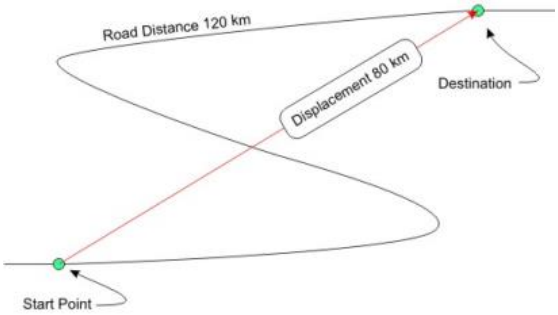
Initial Position = 2 meters, Initial Time = 5 seconds, Final Position = 9.5 meters Final Time = 25 seconds.

Calculate the velocity using the equation: Velocity = $\frac{(9.5m)-(\quad m)}{(\quad sec)-(5\ sec)} = \frac{m}{sec} =$ ☐

Like DISPLACEMENT, VELOCITY only considers the starting and ending position but not on. The units of DISPLACEMENT are _____. The units for time are_____. The units of velocity are_____.

SPEED - This is also a measure of a rate of change of position but it is dependent upon the PATH.

The Equation for Speed = $\frac{Distance\ traveled}{change\ in\ time}$ or R = D/T



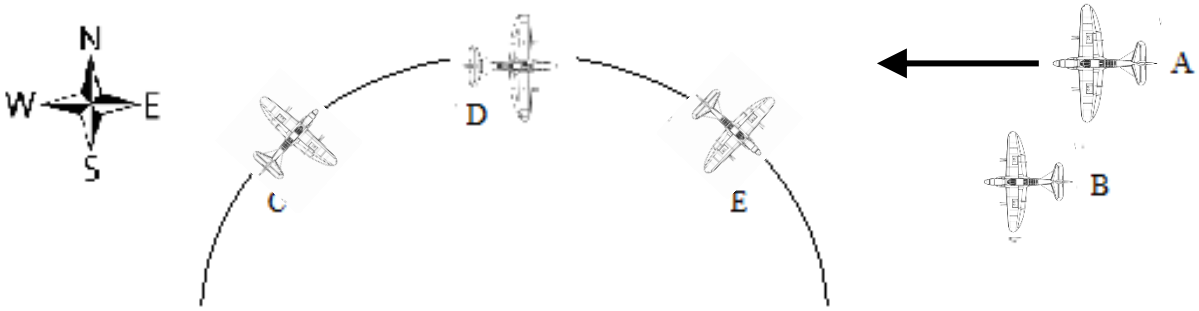
Take a look at the diagram. If a car makes this journey in ½ hour, what is the speed and velocity?

Speed = $\frac{Distance\ traveled}{change\ in\ time} = \frac{km}{hrs} =$ ☐

Velocity = $\frac{\Delta}{change\ in\ time} = \frac{km}{hrs} =$ ☐

Why are the values for speed and velocity so different? _____

Drawing the velocity Vector- Draw the velocity vectors for the airplanes

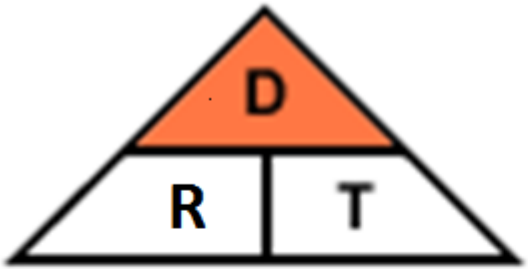


Use 1 cm = 20 m/s (*estimate*, you do not need a ruler)

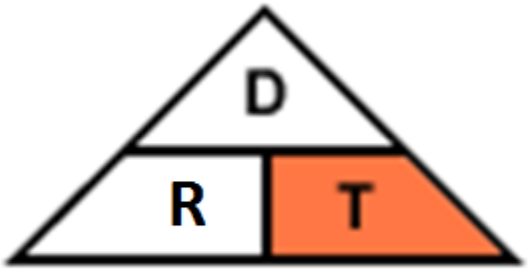
PLANE A is traveling 40 m/s West. (This one is done for you as an example)

Plane B = 20 m/s West, **C** = 60 m/s North East or (45°), **D** = 60 m/s East or (0°), **E** = 60 m/s South East or (-45°)

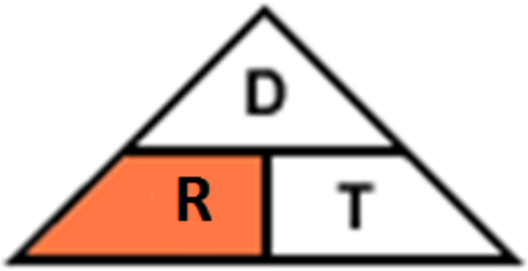
Note: C, D and E have the SAME SPEED but DIFFERENT VELOCITIES. **Why?**_____



Distance = Rate x Time



$$Time = \frac{Distance}{Rate}$$



$$Rate = \frac{Distance}{Time}$$

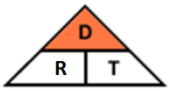
LAST NAME _____ FIRST NAME _____ DATE_____ PERIOD____

1.3 Speed & Velocity (STUDENT EXERCISE)

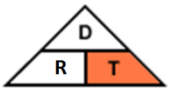
For further review of this material check on page 332-336 in your book)

SOME MATH QUESTIONS WITH SPEED – We use the following variables for Speed: R = rate or speed , D = distance traveled and T = time of journey. This gives us the following equation:

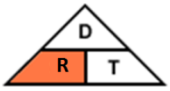
The Equation for Speed = $\frac{Distance\ traveled}{change\ in\ time}$ = R = $\frac{d}{t}$



Distance = Rate x Time



$Time = \frac{Distance}{Rate}$



$Rate = \frac{Distance}{Time}$

1. **Solve the Speed equation for d: d =**
2. **Solve the Speed equation for t: t =**
3. **A car travels 60 km in 2 hrs. What is its speed?**

*(Use the following steps in presenting your solution: **1**. State what you know **2.** State what your calculating **3.** State and name the equation you are using **4.** Substitute your values with units and **5.** Calculate the solution and state it with appropriate units.*

Unknown: R = ?	Substitution:
Known: d = 60km, t = 2 hrs	
Equation: R = $\frac{d}{t}$	R = $\frac{d}{t} = \frac{60km}{2\ hrs} = 30\ km/hr$

Solution Checklist		
1	Known value	√
2	Unknown	√
3	Equation	√
4	Substitution	√
5	Solution with units	√

EXAMPLE: *A car travels 160 km for .75 hrs. What is its speed? (213 km/hr)*

Unknown: R = ?	Substitution:
Known:	
Equation: R = $\frac{d}{t}$	

Solution Checklist		
1	Known value	
2	Unknown	
3	Equation	
4	Substitution	
5	Solution with units	

4. A car travels 100 km for .5 hrs. What is its speed? (200 km/hr)

Unknown: R = ?	Substitution:
Known:	
Equation: R = $\frac{d}{t}$	

Solution Checklist		
1	Known value	
2	Unknown	
3	Equation	
4	Substitution	
5	Solution with units	

5. An airplane from Boston to London travels at 900km/hr. It is a 5-1/2 hour flight. How far is it from Boston to New London? (4950 km)

Unknown: d = ?	Substitution:
Known:	D = (km/hr) (hr) =
Equation: d = Rt	

Solution Checklist		
1	Known value	
2	Unknown	
3	Equation	
4	Substitution	
5	Solution with units	

6. An airplane from Johannesburg to New York travels at 900km/hr. It is a 19 hour flight. How far is it from Johannesburg to New York? (17,100 km)

Unknown:	Substitution:
Known:	
Equation:	

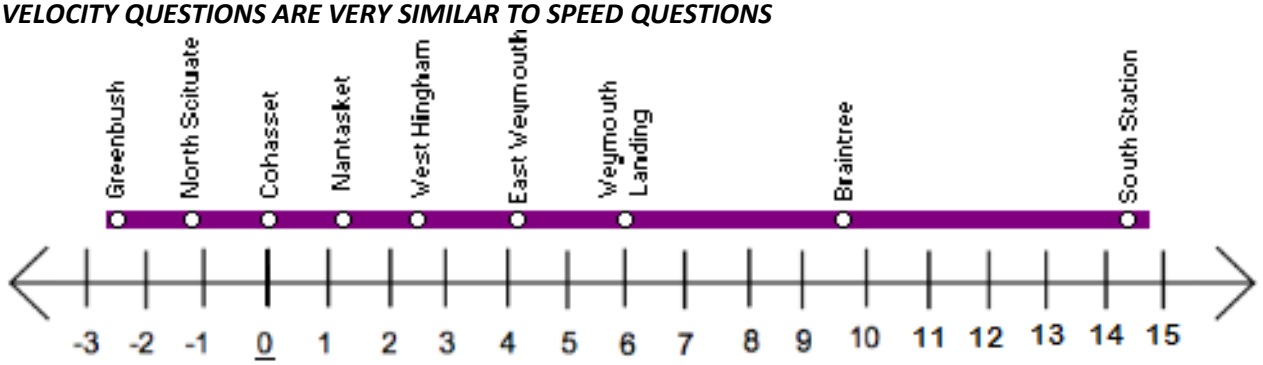
Solution Checklist		
1	Known value	
2	Unknown	
3	Equation	
4	Substitution	
5	Solution with units	

7. ***I***n 1620 a group of Englishmen and women traveled across the Atlantic Ocean to a new land they ended up calling Massachusetts. The journey took 66 days (1584 hours) to travel the 3,600 miles. What was their speed for this trip? (2.3 MPH)

Unknown:	Substitution:
Known:	
Equation:	

Solution Checklist		
1	Known value	
2	Unknown	
3	Equation	
4	Substitution	
5	Solution with units	

VELOCITY QUESTIONS ARE VERY SIMILAR TO SPEED QUESTIONS



Use the diagram above to calculate the solution The units on the diagram above are miles. NOTE: You may have a negative velocity.

8. A train makes it from Weymouth Landing to South Station without stopping in 1/2 hour. What is the velocity?

X_{final} = 14.5 miles $X_{initial}$ = 6 miles T = ½ hour $\vec{v}$ =? $\Delta x = X_{final} - X_{initial}$ = (14.5 miles-6 miles) = 8.5 miles	Velocity = $\frac{displacement}{time}$	$\frac{8.5\ miles}{\frac{1}{2}\ hour} = 17\ \frac{miles}{hour}$

9. *BE CAREFUL WITH THIS ONE.* A train goes from Cohasset to South Station in 1 hour then back to Nantasket in 1 hour. What is the approximate Speed of the train? (15 miles/hour) What is the approximate average velocity of the train for the entire trip? (.75 MILES/HR) (Explain)

10. *Questions regarding the airplanes.*

- ***a.*** *Draw the vector for each airplane which is traveling at 60 m/s. (1 cm = 20 m/s)*
- ***b.*** *If once around the circular path is 600 meters, how long will it take an airplane to complete the circle? (10 seconds)*
- ***c.*** *What is the airplane's average velocity for the trip around the circle one time? BE CAREFUL, THINK ABOUT THE EQUATION FOR VELOCITY.*