Answers

Motion: Position / Velocity

1. Frame of reference is important because it sets up a coordinate system so everyone would look at the problem in the same way

ie) A person standing on the road watching a car go by would describe the objects motion different than the person driving the car.

2. You in car 60 km/h [E]
   a) Bus 35 km/h [E] relative to you 25 km/h [E]
   b) Minivan 50 km/h [E] " " " 10 km/h [E]
   c) Truck 85 km/h [W] " " " -130 km/h [E]
   d) Police 100 km/h [W] " " " -160 km/h [E]

3. Distance is how far from one place to another

Displacement is the objects change in position

Their magnitudes will be the same if the object does not change direction.

Their magnitudes will be different if the object changes direction.

4. Position is where the object is
Displacement is the change in position

Speed is how far something travels in a given time

Velocity is the measure of an objects displacement with respect to time. It measures both speed and direction.

Motion: Position and Velocity

#5. If the objects are going in the same direction their magnitudes for velocity and speed will be the same

They are different if the objects are not moving in the same direction

#6. An example of a situation when an objects average velocity is zero, but its average speed is not zero would be a race car. They begin and end at the same point so the average velocity would be zero, but the object still has an average speed.

also: running from your house and back etc

#7. a) It would take half the time if your average velocity is twice the original trip

b) My average velocity would have been 4 times slower if it took me 4 times as long.

#8. $d = 150\text{km}$
$t = 3.00\text{h}$
$v = ?$

$v_{sp} = \frac{d}{t} = \frac{150\text{km}}{3.00\text{h}} = 50\text{km/h}$

#9. $\vec{d} = 2345\text{m[W]} = -2345\text{m[E]}$
$t = 315\text{s}$
$v = ?$

$v_{avg} = \frac{\vec{d}}{t} = \frac{-2345}{315} = -7.44\text{ m/s [E]}$ or 7.44 m/s [W]

#10. $v = 65\text{km/h}$
$t = 3.0\text{hrs}$
$d = ?$

$v_{sp} = \frac{d}{t}$

$3.0\text{hrs} \cdot 65\text{km/h} = \frac{d}{3.0\text{hrs}} \cdot 3.0\text{hrs}$

$195\text{km} = d$

#11. $\vec{d} = 150\text{km[E]}$
$\vec{v} = 50\text{km/h [E]}$
$t = ?$

$\vec{v}_{avg} = \frac{\vec{d_f} - \vec{d_0}}{t}$

$t \cdot 50\text{km/h[E]} = 150\text{km[E]} \cdot t$

$\frac{t(50\text{km/h[E]})}{50\text{km/h[E]}} = \frac{150\text{km[E]}}{50\text{km/h[E]}}$

$t = 3\text{h}$

#12. Earth 1 orbit around sun = 0m
v_{avg} Earth after 1 orbit = 0m/s

#15. $\vec{d} = 200\,000\text{m[N]}$
$\vec{v}_{avg} = 10\text{m/s [N]}$
$t = ?$

$\vec{v}_{avg} = \frac{\vec{d}}{t}$

$t \cdot 10 = \frac{200\,000}{t} \cdot t$

$\frac{10t}{10} = \frac{200\,000}{10}$

$t = 20\,000\text{s}$

#16- $\vec{v}_{avg} = 12 m/s [S]$ $t = 5.0 s$ $\quad \vec{v}_{avg} = 18 m/s [N]$ $t = 9.0 s$

$\vec{v}_{avg} = 15 m/s [S]$
$t = 11 s$

$v_{sp} = \frac{d}{t}$ $\quad v_{sp} = \frac{d}{t}$

$5 \cdot 12 m/s = \frac{d}{5.0 s} \cdot 5$ $\quad 18 m/s = \frac{d}{9.0 s}$

$d = 60 m$ $\quad 162 m = d$

$v_{sp} = \frac{d}{t}$

$15 m/s = \frac{d}{11 s}$

$165 = d$

$d_{total} = 387 m$

$v_{sp} = \frac{d}{t}$

$v_{sp} = \frac{387 m}{25 s}$

$v_{sp} = 15.5 m/s$

$\vec{d} = 60 m [S]$ $\quad -60$
$\vec{d} = 162 m [N]$ $\quad 162$
$\vec{d} = 165 m [S]$ $\quad -165$

$\vec{d} = -63 m [N]$

$\vec{v}_{avg} = \frac{\vec{d}}{t}$

$\vec{v}_{avg} = \frac{-63}{25}$

$\vec{v}_{avg} = -2.5 m/s [N]$ or $2.5 m/s [S]$

45s

#17.

25m[E]
15m[E]
8m[W] −8m
12m[E]

$\vec{d} = 44\text{m}\ [E]$

$v_{sp} = \frac{d}{t}$

$v_{sp} = \frac{60\text{m}}{45\text{s}}$

$v_{sp} = 1.3\text{m/s}$

$\vec{v}_{avg} = \frac{\vec{d}}{t}$

$\vec{v}_{avg} = \frac{44}{45}$

$\vec{v}_{avg} = 0.98\text{m/s}\ [E]$