

# Key Formulas Recap

Concept	Formula	Units
Speed	$\frac{\text{Distance}}{\text{Time}}$	m/s or km/h
Velocity	$\frac{\text{Displacement}}{\text{Time}}$	m/s (directional)
Acceleration	$\frac{\Delta \text{Velocity}}{\text{Time}}$	m/s <sup>2</sup>
Time Zones	$15^\circ = 1 \text{ hour}$	Degrees/Hours

## Quick Tips:

- **Speed** = how fast, **velocity** = how fast + which direction
- **Acceleration**: positive = speeding up, negative = slowing down
- **Longitude & Time**: Earth rotates  $15^\circ$  per hour

# 1. Calculating Average Speed

**Question:**

A car travels 240 km in 3 hours. What is its average speed?

**Solution:**

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}} = \frac{240}{3} = \boxed{80 \text{ km/h}}$$

# 2. Finding Distance Traveled

**Question:**

A cyclist moves at 15 m/s for 20 seconds. How far does the cyclist go?

**Solution:**

$$\text{Distance} = \text{Speed} \times \text{Time} = 15 \times 20 = \boxed{300 \text{ m}}$$

# 3. Determining Travel Time

**Question:**

An airplane flies 1,800 km at 600 km/h. How long does the flight take?

**Solution:**

$$\text{Time} = \frac{\text{Distance}}{\text{Speed}} = \frac{1800}{600} = \boxed{3 \text{ hours}}$$

# 4. Speed vs. Velocity

**Question:**

A runner completes a 400 m lap in 50 seconds, ending where they started. Find their (a) average speed and (b) average velocity.

**Solution:**

(a)

$$\text{Speed} = \frac{400}{50} = \boxed{8 \text{ m/s}}$$

(b)

$$\text{Displacement} = 0 \Rightarrow \text{Velocity} = \boxed{0 \text{ m/s}}$$

## 5. Calculating Acceleration

**Question:**

A car speeds up from 0 to 20 m/s in 5 seconds. What is its acceleration?

**Solution:**

$$\text{Acceleration} = \frac{20 - 0}{5} = \boxed{4 \text{ m/s}^2}$$

## 6. Time and Longitude

**Question:**

If it's 12:00 PM at 0° (Greenwich), what time is it at 75°E?

**Solution:**

$$\frac{75^\circ}{15^\circ/\text{hour}} = 5 \text{ hours ahead} \Rightarrow 12 : 00 + 5 = \boxed{5 : 00 \text{ PM}}$$

## 7. Deceleration Example

**Question:**

A bus slows from 25 m/s to 10 m/s in 5 seconds. Find its acceleration.

**Solution:**

$$\text{Acceleration} = \frac{10 - 25}{5} = \boxed{-3 \text{ m/s}^2}$$

*(Negative = slowing down)*

## 8. Trains Moving Toward Each Other

**Question:**

Two trains approach each other at 60 km/h and 40 km/h. They're 500 km apart. How long until they meet?

**Solution:**

$$\text{Relative Speed} = 60 + 40 = 100 \text{ km/h}$$

$$\text{Time} = \frac{500}{100} = \boxed{5 \text{ hours}}$$

## 9. Time Zone Similarities

### Question:

Why do New York (75°W) and Los Angeles (120°W) share a time zone?

### Solution:

They're grouped within standard 15° zones.

They lie within the same time zone range.

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## 10. Maximum Height Time

### Question:

A ball is thrown upward at 20 m/s. How long until it reaches its peak? (Use  $g = 10 \text{ m/s}^2$ )

### Solution:

At peak:  $v = 0$

$$0 = 20 - 10t \Rightarrow t = 2 \text{ seconds}$$