



Michael Phelps famously won his 7th gold medal in the 100 m butterfly, a race that was decided on a margin of 1/100th of a second over Serbia's Milorad Cavic. Various media reported, "at the speeds they were going, this amounts to less than the length of a pencil eraser [including the attached metal band]."

1. Estimating the length of a pencil eraser as 2.00 cm and using the reported info above, what is your best estimate for Phelps' final speed in *m/s*?

$$\bar{v} = \frac{2.00 \text{ cm}}{.01 \text{ s}} = 200 \frac{\text{cm}}{\text{s}} \left(\frac{1 \text{ m}}{100 \text{ cm}} \right) = 2.0 \text{ m/s}$$

2. Your preceding answer would be Phelps' (nearly) instantaneous speed at finish; if his total race time was 50.65 s, what was his *average speed* over the entire 100.0 m swim?

$$\bar{v} = \frac{\Delta x}{\Delta t} = \frac{100.0 \text{ m}}{50.65 \text{ s}} = 1.974 \text{ m/s}$$