

Practice Problem Set 1

Question 1 (1 point)

The speed limit on I-75 is 65 miles per hour. If one mile is equal to 1.6 km, what is the same speed limit expressed in meters per second?

$$\left(\frac{65 \text{ mi}}{1 \text{ hr}}\right) \times \left(\frac{1.6 \text{ km}}{1 \text{ mi}}\right) \times \left(\frac{1000 \text{ m}}{1 \text{ km}}\right) \times \left(\frac{1 \text{ hr}}{60 \text{ min}}\right) \times \left(\frac{1 \text{ min}}{60 \text{ sec}}\right) = 29 \frac{\text{m}}{\text{s}}$$

Questions 2-4 involve Rocky McBlock, who is the receiver for the Kennesaw Kilowatts in the Metro Metric Football League. In this league all distances in the field are measured in meters, and in this set of questions Rocky always runs straight up and down the field (there is no sideways motion- only motion to and from the end zone).

Question 2 (3 points)

Rocky leaves the line of scrimmage when the ball is snapped and runs forward for 12 seconds at a speed of 1.5 m/s. He catches the ball and continues to run forward for 8 more seconds at a speed of 2.5 m/s. He is then hit by Big Bobby Clobber of the Marietta Megatons and pushed backwards for 5 seconds at a speed of 0.5 m/s, at which point he is tackled to the ground. From the time he leaves the line of scrimmage until the time at which he is tackled how far does Rocky travel?

$$\Delta x = \Sigma(v \times \Delta t)$$

$$\left(1.5 \frac{\text{m}}{\text{s}} \times 12 \text{ sec}\right) + \left(2.5 \frac{\text{m}}{\text{s}} \times 8 \text{ sec}\right) - \left(0.5 \frac{\text{m}}{\text{s}} \times 5 \text{ sec}\right) = 36 \text{ m}$$

Question 3 (3 points)

Rocky leaves the line of scrimmage when the ball is snapped and runs forward 15 meters at a speed of 1.2 m/s. He catches the ball and continues to run forward for 12 more meters at a speed of 2.4 m/s. He is then hit by Big Bobby Clobber of the Marietta Megatons and pushed backwards for 6 meters at a speed of 0.8 m/s, at which point he is tackled to the ground. How long does it take from the time Rocky leaves the line of scrimmage until the time at which he is tackled?

$$\Delta t = \Sigma\left(\frac{\Delta x}{v}\right)$$

$$\left(\frac{15 \text{ m}}{1.2 \text{ m/s}}\right) + \left(\frac{12 \text{ m}}{2.4 \text{ m/s}}\right) + \left(\frac{-6 \text{ m}}{-0.8 \text{ m/s}}\right) = 25 \text{ sec}$$

Question 4 (3 points)

Rocky leaves the line of scrimmage when the ball is snapped and runs forward 18 meters in 9 seconds. He catches the ball and continues to run forward for 16 more meters in 12 seconds, at which point he reaches the end zone. What is his speed before he catches the ball? What is his speed after he catches the ball? What is his average speed for the whole play from the time he leaves the line of scrimmage until the time he reaches the end zone?

$$V = \frac{\Delta x}{\Delta t}$$

$$\text{Before: } \frac{18 \text{ m}}{9 \text{ sec}} = 2 \frac{\text{m}}{\text{s}}$$

$$\text{After: } \frac{16 \text{ m}}{12 \text{ sec}} = 1.33 \frac{\text{m}}{\text{s}}$$

$$\text{Average Velocity: } \frac{18 \text{ m} + 16 \text{ m}}{9 \text{ sec} + 12 \text{ sec}} = 1.60 \frac{\text{m}}{\text{s}}$$