

3. a) Acceleration is the slope of the velocity-time graph

$$\begin{aligned}\text{slope} &= \frac{\text{rise}}{\text{run}} \\ &= \frac{(15.0 - 0) \text{ m/s}}{(7.0 - 0) \text{ s}} \\ &= 2.1 \text{ m/s}^2 \text{ north}\end{aligned}$$

b) Displacement is the area under the velocity-time graph.

$$\begin{aligned}\text{area} &= \frac{1}{2}(l \times w) \\ &= \frac{1}{2}(7.0 \text{ s} \times 15.0 \text{ m/s}) \\ &= 53 \text{ m north}\end{aligned}$$

4. a) Acceleration = slope

$$\begin{aligned}\text{slope} &= \frac{\text{rise}}{\text{run}} \\ &= \frac{(13.0 - 0) \text{ m/s}}{(9.0 - 0) \text{ s}} \\ &= 1.4 \text{ m/s}^2 \text{ east}\end{aligned}$$

b) Displacement = area

$$\begin{aligned}\text{area} &= \frac{1}{2}(l \times w) \\ &= \frac{1}{2}(10.0 \text{ s} \times 14.5 \text{ m/s}) \\ &= 73 \text{ m east}\end{aligned}$$

5. a) Velocity of A = 9.0 m/s east  
Velocity of B = 5.0 m/s east

$$\begin{aligned}\text{Ratio} &= \frac{\text{velocity of A}}{\text{velocity of B}} \\ &= \frac{9.0 \text{ m/s}}{4.5 \text{ m/s}} \\ &= 2.0 \text{ times}\end{aligned}$$

A is travelling 2.0 times faster than B.

b) Distance = area

$$\text{area} = \frac{1}{2}(l \times w)$$

Distance A travels

$$\begin{aligned}&= \frac{1}{2}(5.0 \text{ s} \times 9.0 \text{ m/s}) \\ &= 22.5 \text{ m}\end{aligned}$$

Distance B travels

$$\begin{aligned}&= \frac{1}{2}(5.0 \text{ s} \times 4.5 \text{ m/s}) \\ &= 11.3 \text{ m}\end{aligned}$$

$$\begin{aligned}\text{Difference} &= 22.5 \text{ m} - 11.3 \text{ m} \\ &= 11.2 \text{ m}\end{aligned}$$

6. a) Acceleration = slope

$$\begin{aligned}\text{slope} &= \frac{\text{rise}}{\text{run}} \\ &= \frac{(16.0 - 0) \text{ m}}{(10.0 - 0) \text{ s}} \\ &= 1.60 \text{ m/s}^2 \text{ south}\end{aligned}$$

b) Displacement = area

$$\begin{aligned}\text{area} &= \frac{1}{2}(l \times w) \\ &= \frac{1}{2}(10.0 \text{ s} \times 16.0 \text{ m/s}) \\ &= 80.0 \text{ m south}\end{aligned}$$

7. a) Acceleration = slope

$$\begin{aligned}\text{slope} &= \frac{\text{rise}}{\text{run}} \\ &= \frac{(10.0 - 4.0) \text{ m/s}}{(16.0 - 0) \text{ s}} \\ &= 0.38 \text{ m/s}^2 \text{ west}\end{aligned}$$

b) Displacement = area

$$\begin{aligned}\text{area} &= (l \times w) + \frac{1}{2}(l \times w) \\ &= (16.0 \text{ s} \times 4.0 \text{ m/s}) + \\ &\quad \frac{1}{2}(16.0 \text{ s} \times 6.0 \text{ m/s}) \\ &= 1.1 \times 10^2 \text{ m west}\end{aligned}$$