

Physics 2414, Spring 2008

Group Exercise 1, Jan 24, 2008

Name 1: Solutions OID 1: _____
 Name 2: _____ OID 2: _____
 Name 3: _____ OID 3: _____
 Name 4: _____ OID 4: _____

Section Number: _____

1-Dimensional Kinematics

1) A train travels east for 60 miles and then turns around and travels west for 40 miles. The total time for the trip was 1 hour.

1 mile $\Rightarrow \frac{5280 \text{ ft}}{\text{mile}} \cdot \frac{12 \text{ in}}{\text{ft}} \cdot \frac{2.54 \text{ cm}}{\text{in}} \cdot \frac{1 \text{ m}}{100 \text{ cm}} = 1609 \text{ m}$ 1 hour $\Rightarrow \frac{60 \text{ min}}{\text{hour}} \cdot \frac{60 \text{ s}}{\text{min}} = 3600 \text{ s}$

1a) What was the average speed of the train in meters/s?

Total distance = 100 miles = 160900 meters $\Rightarrow s = \frac{160900 \text{ meters}}{3600 \text{ s}} = \boxed{44.7 \text{ m/s}}$

1b) What was the average velocity of the train in meters/s?

Displacement = 20 miles = 32180 meters $\Rightarrow v = \frac{32180 \text{ m}}{3600 \text{ s}} = \boxed{8.94 \text{ East}}$

1c) When answering part a) do you need to indicate a direction in your answer? Explain

no, speed only has magnitude

1d) When answering part b) do you need to indicate a direction in your answer? Explain

yes, velocity has both magnitude and direction

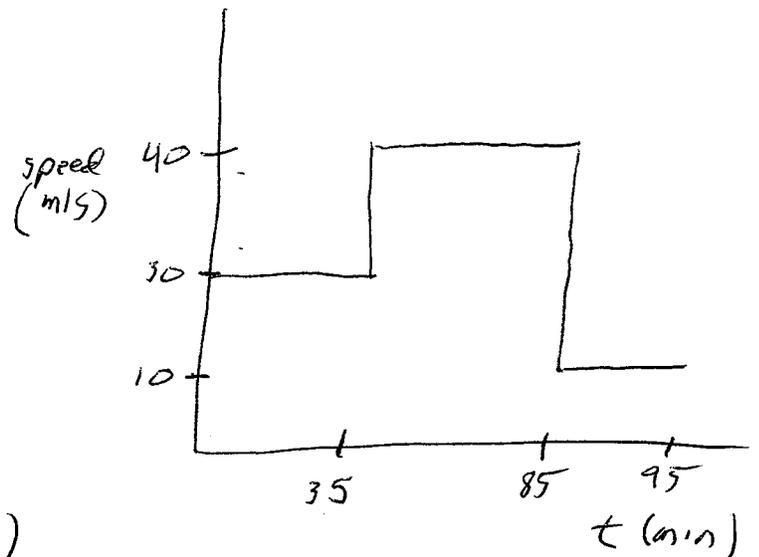
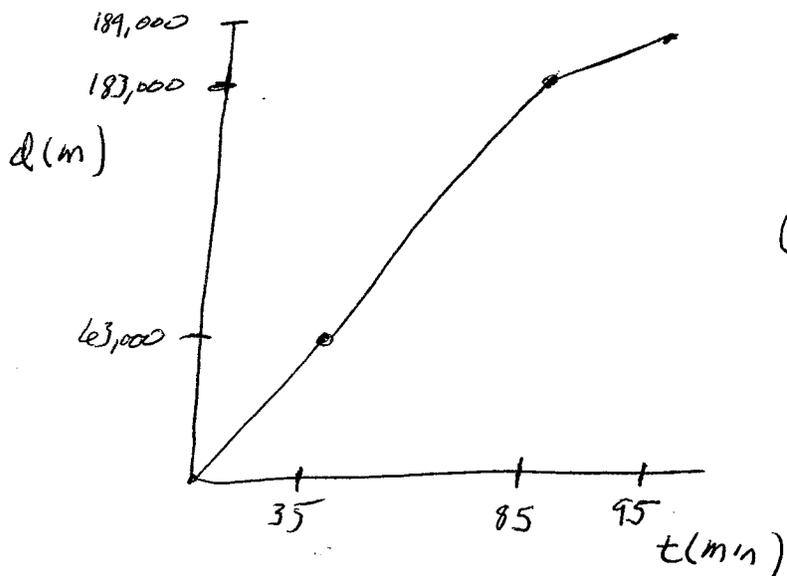
$$d_1 = 30 \text{ m/s} \cdot 35 \text{ min} \cdot \frac{60 \text{ s}}{\text{min}} = 63,000 \text{ m}$$

$$d_2 = 40 \text{ m/s} \cdot 50 \text{ min} \cdot \frac{60 \text{ s}}{\text{min}} = 120,000 \text{ m}$$

$$d_3 = 10 \text{ m/s} \cdot 10 \text{ min} \cdot \frac{60 \text{ s}}{\text{min}} = 6,000 \text{ m}$$

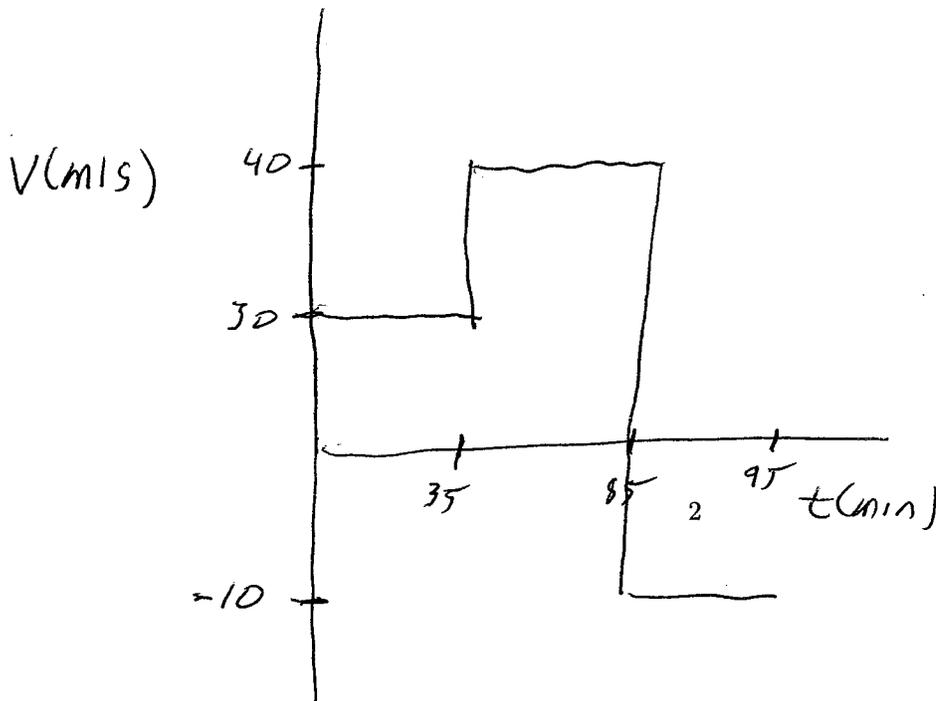
2) A car is traveling east at 30 meters/s for 35 minutes. It then increases its speed to 40 meters/s for 50 minutes. It then reverses course and travels at a speed of 10 meters/s for 10 minutes.

2a) Sketch this on a distance vs time graph and also on a speed vs time graph



2b) Sketch this on a velocity vs time graph

Define East as +



$$\text{Distance} = 63,000 \text{ m} + 120,000 \text{ m} + 60,000 \text{ m} = 189,000 \text{ m}$$

$$\text{Displacement} = 63,000 \text{ m} + 120,000 \text{ m} - 60,000 \text{ m} = 177,000 \text{ m}$$

$$\text{Total time} = 35 \text{ min} + 50 \text{ min} + 10 \text{ min} = 95 \text{ min}$$

2c) What is the average speed of the car?

$$\text{Speed} = \frac{189,000 \text{ m}}{95 \text{ min}} = \boxed{1989 \text{ meters/min}}$$

2d) What is the average velocity of the car?

(Remember the issue about direction when answering parts 2c)

and 2d)

$$V_{\text{avg}} = \frac{177,000 \text{ meters}}{95 \text{ min}} = \boxed{1863 \text{ meters/min East}}$$

3) A car accelerates east from 0 to 60 mph in 45 seconds. A motorcycle accelerates east from 0 to 25 meters/s in 30 seconds.

$$\frac{60 \text{ miles}}{\text{hour}} \rightarrow \frac{60 \text{ miles}}{\text{hour}} \cdot \frac{1609 \text{ m}}{\text{mile}} \cdot \frac{1 \text{ h}}{3600 \text{ s}} = 26.8 \text{ m/s}$$

3a) Does the motorcycle or the car have a greater acceleration.

$$a_{\text{car}} = \frac{26.8 \text{ m/s}}{45 \text{ s}} = \underline{0.59 \frac{\text{m}}{\text{s}^2} \text{ East}}$$

$$a_{\text{motorcycle}} = \frac{25 \text{ m/s}}{30 \text{ s}} = \underline{0.83 \text{ m/s}^2 \text{ East}}$$

3b) By how much more?

motorcycle has greater acceleration

$$\text{by } 0.83 \text{ m/s}^2 - 0.59 \text{ m/s}^2 = \boxed{0.24 \text{ m/s}^2}$$