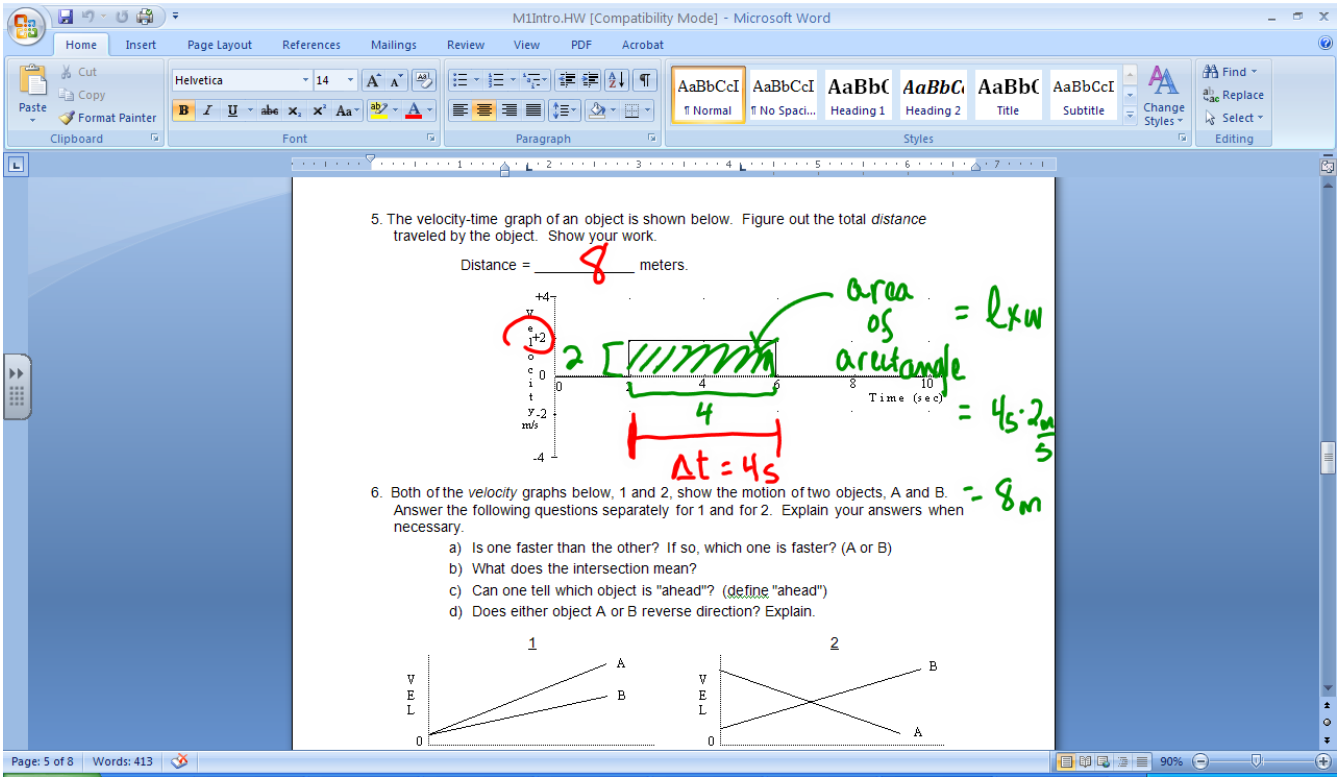
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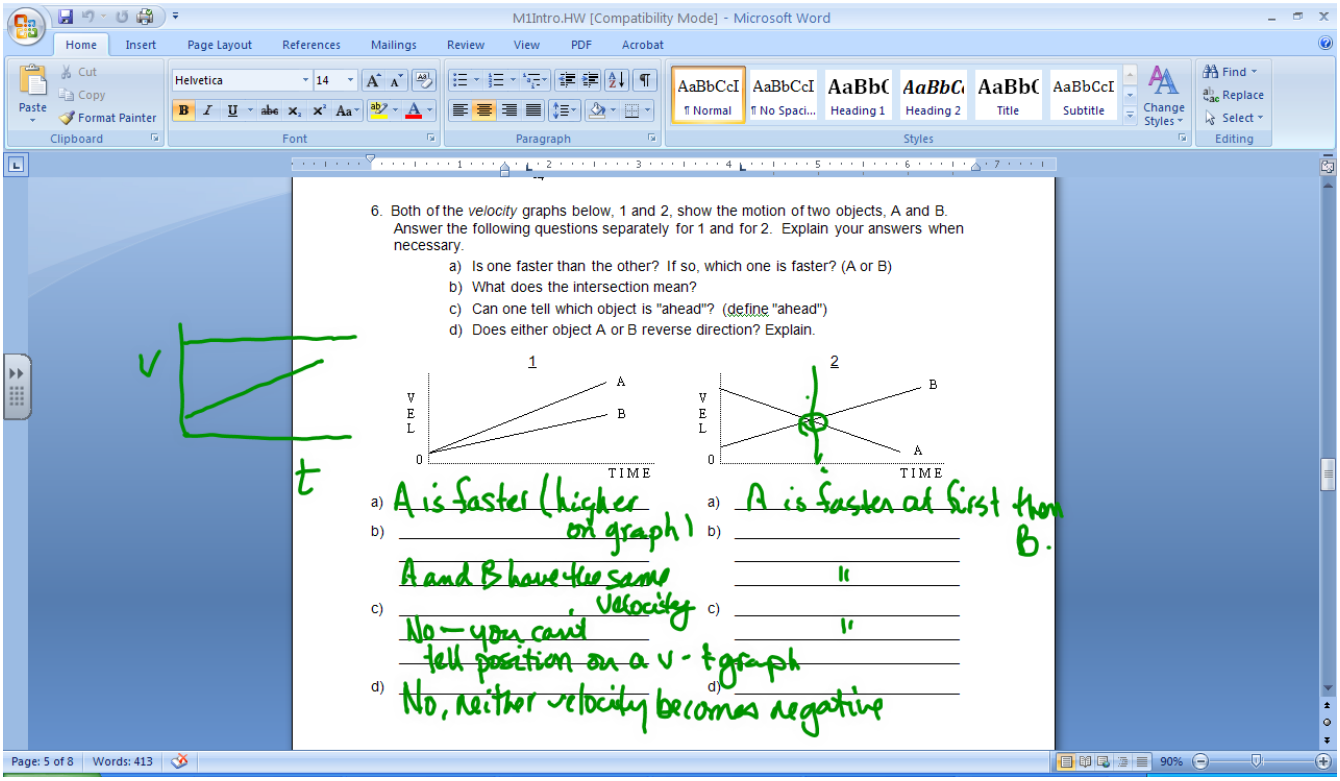
5. The velocity-time graph of an object is shown below. Figure out the total *distance* traveled by the object. Show your work.
Distance = 8 meters.
Velocity m/s
+4
+2
0
-2
-4
0
2
4
6
8
10
Time (sec)
2 [
area of rectangle
= lxw
4
Δt = 4s
= 4s · 2m/s
= 8m
6. Both of the *velocity* graphs below, 1 and 2, show the motion of two objects, A and B. Answer the following questions separately for 1 and for 2. Explain your answers when necessary.
a) Is one faster than the other? If so, which one is faster? (A or B)
b) What does the intersection mean?
c) Can one tell which object is "ahead"? (define "ahead")
d) Does either object A or B reverse direction? Explain.
1
VEL
A
B
0
2
VEL
B
A
0
Page: 5 of 8
Words: 413
90%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b) What does the intersection mean?
c) Can one tell which object is "ahead"? (define "ahead")
d) Does either object A or B reverse direction? Explain.
1
VEL
TIME
0
A
B
2
VEL
TIME
0
A
B
v
t
a) A is faster (higher on graph)
b) A and B have the same velocity
c) No — you can't tell position on a v - t graph
d) No, neither velocity becomes negative
a) A is faster at first than B.
b) "
c) "
d)
Page: 5 of 8
Words: 413
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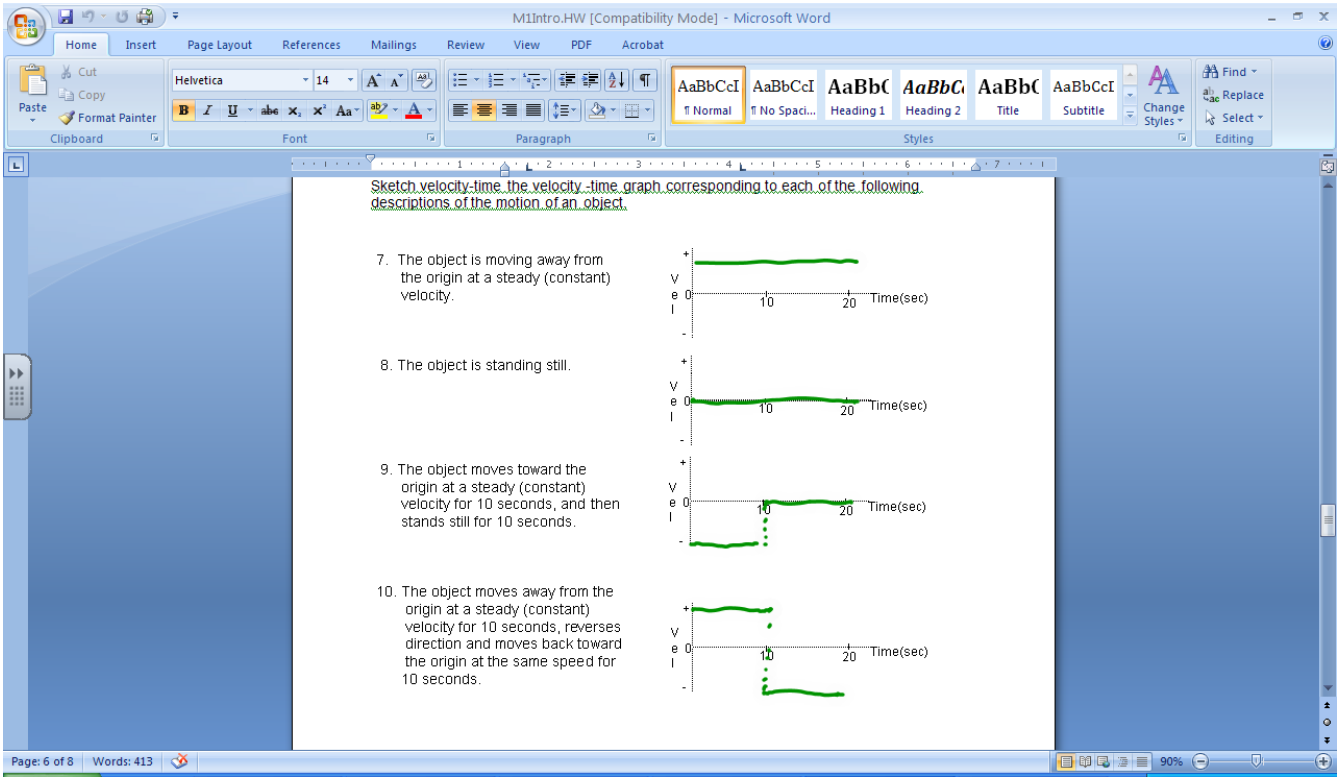
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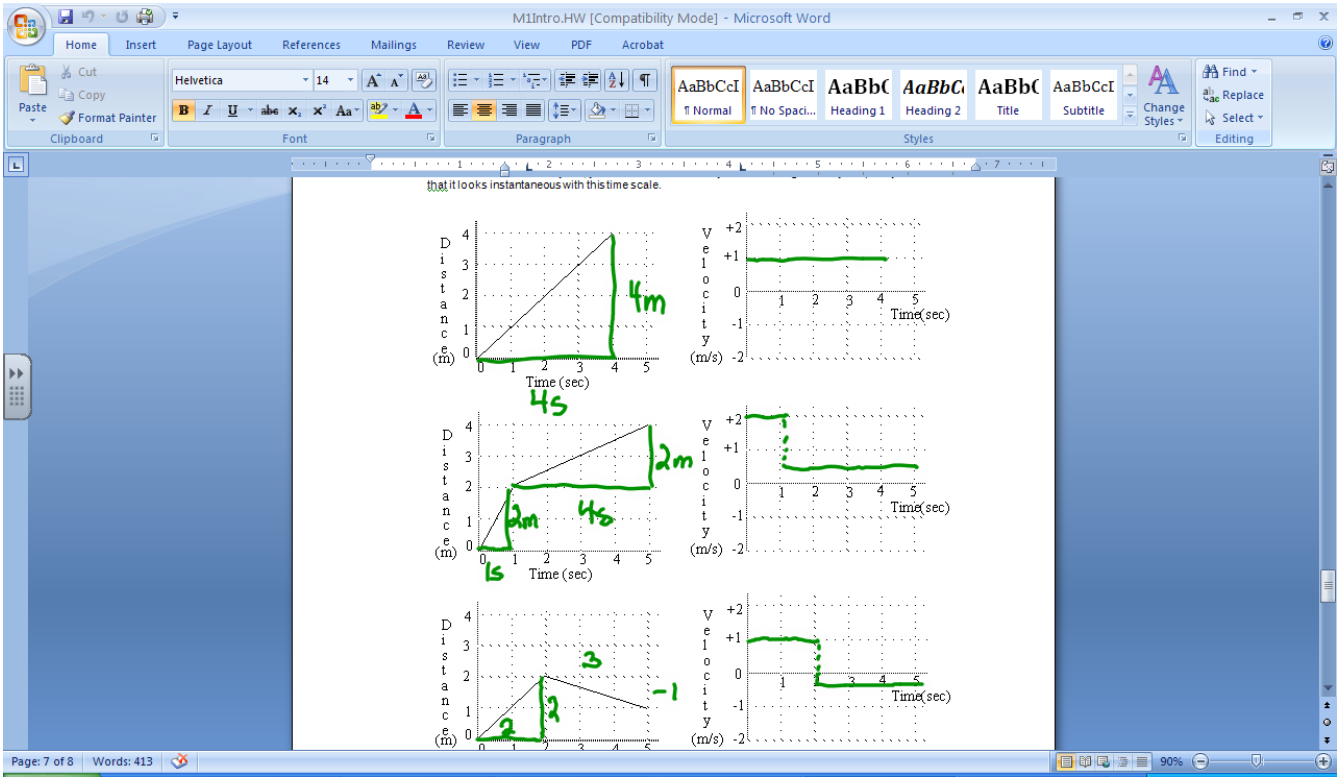
Sketch velocity-time the velocity -time graph corresponding to each of the following descriptions of the motion of an object.
7. The object is moving away from the origin at a steady (constant) velocity.
8. The object is standing still.
9. The object moves toward the origin at a steady (constant) velocity for 10 seconds, and then stands still for 10 seconds.
10. The object moves away from the origin at a steady (constant) velocity for 10 seconds, reverses direction and moves back toward the origin at the same speed for 10 seconds.
Vel
Time(sec)
10
20
Page: 6 of 8
Words: 413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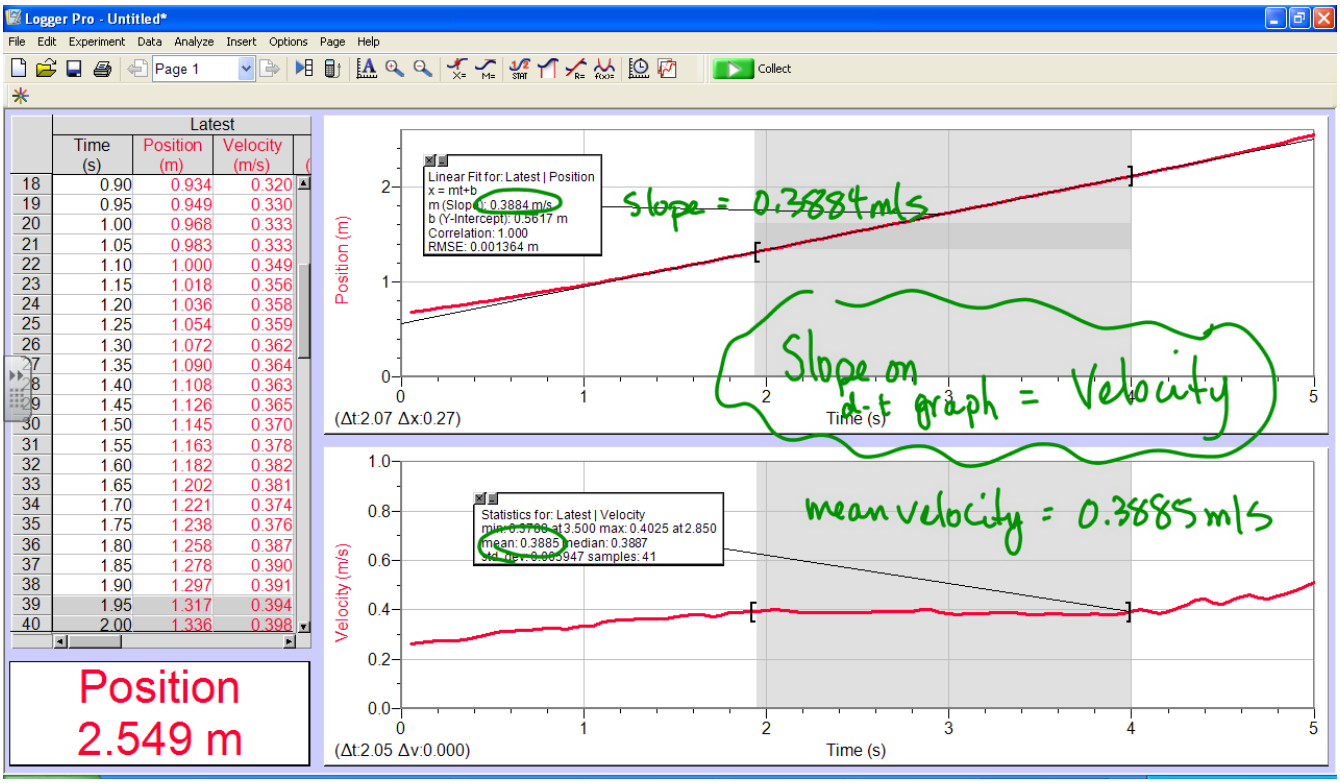
that it looks instantaneous with this time scale.
Distance (m)
Time (sec)
Velocity (m/s)
4m
4s
2m
2m
4s
1s
3
2
-1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Page 1
Collect
Latest
Time (s) Position (m) Velocity (m/s)
18 0.90 0.934 0.320
19 0.95 0.949 0.330
20 1.00 0.968 0.333
21 1.05 0.983 0.333
22 1.10 1.000 0.349
23 1.15 1.018 0.356
24 1.20 1.036 0.358
25 1.25 1.054 0.359
26 1.30 1.072 0.362
27 1.35 1.090 0.364
28 1.40 1.108 0.363
29 1.45 1.126 0.365
30 1.50 1.145 0.370
31 1.55 1.163 0.378
32 1.60 1.182 0.382
33 1.65 1.202 0.381
34 1.70 1.221 0.374
35 1.75 1.238 0.376
36 1.80 1.258 0.387
37 1.85 1.278 0.390
38 1.90 1.297 0.391
39 1.95 1.317 0.394
40 2.00 1.336 0.398
Position
2.549 m
Linear Fit for: Latest | Position
x = mt+b
m (Slope): 0.3884 m/s
b (Y-Intercept): 0.5617 m
Correlation: 1.000
RMSE: 0.001364 m
Slope = 0.3884 m/s
Position (m)
(Δt:2.07 Δx:0.27)
Time (s)
Slope on d-t graph = Velocity
Statistics for: Latest | Velocity
mean: 0.3885 median: 0.3887
mean velocity = 0.3885 m/s
Velocity (m/s)
(Δt:2.05 Δv:0.000)
Time (s)

Position-Time Graphs + Velocity

Constant Velocity

$$\text{Slope} = \frac{\text{rise}}{\text{run}}$$

$$\text{Slope} = \frac{\Delta d}{\Delta t}$$

from INV3 and the previous ~~DEMO~~, we know that slope (d-t) = velocity.

$$\therefore \quad v = \frac{\Delta d}{\Delta t} \quad \text{or} \quad \vec{v} = \frac{\Delta \vec{d}}{\Delta t}$$

Two terms you should know:

① scalar quantity - has size (magnitude) but no direction.

$25 \frac{m}{s}$, 5 m, 4.0 s

② vector quantity - has size and direction

$25 \frac{m}{s}$ [E], 5m [S30°W]

Some terms you should know:

(vector) $\vec{d}$ (position) - where you are in relation to a reference point.

25 km [N] (relative to Wolfville)

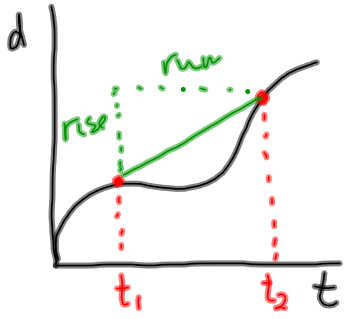
(Scalar) Δd (distance) - how far you have travelled

(vector) $\Delta \vec{d}$ (displacement) - change in position; where you are now in relation to where you started

(Scalar) v (speed) - how fast you go; rate at which the distance is travelled.

(vector) $\vec{v}$ (velocity) - rate of change in position

Non-Constant Velocity



$$\text{slope} = \frac{\text{rise}}{\text{run}}$$

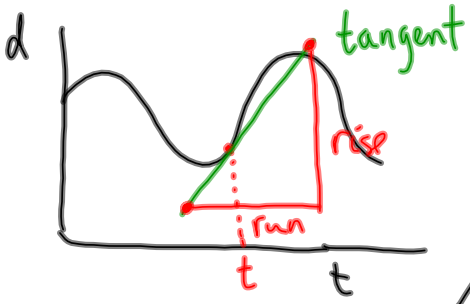
$$\text{slope} = \frac{\Delta d}{\Delta t}$$

(between t_1 and t_2)

AVERAGE VELOCITY $v_{ave} = \frac{\Delta d}{\Delta t}$

Since the velocity is not constant between t_1 and t_2 then we must call it average velocity.

Find the slope between t_1 and t_2.



$$\text{Slope} = \frac{\Delta d}{\Delta t}$$

$v_{inst} = \frac{\Delta d}{\Delta t}$

Imagine finding the slope between two points as close together as possible.

INSTANTANEOUS VELOCITY

Draw a tangent at time t and find its slope to find instantaneous velocity.

The Velocity Equation

$\vec{v} = \frac{\Delta \vec{d}}{\Delta t}$ where $\vec{v}$ is velocity (m/s)

$\Delta \vec{d}$ is the displacement (m) $(\vec{d}_2 - \vec{d}_1)$

Δt is the time interval (s) $(t_2 - t_1)$

$v = \frac{\Delta d}{\Delta t}$ where v is the speed (m/s)

Δd is the distance (m)

Δt is the time interval (s)

NOTE: If the velocity is not constant, then we calculate average velocity in the same way.

Problem Solving:

GRASP method

Given

Required

Analysis.

Solution

Paraphrase

Rearranging: $v = \frac{\Delta d}{\Delta t}$

Δd:

$v\Delta t = \Delta d$

$\Delta d = v\Delta t$

Δt:

$v = \frac{\Delta d}{\Delta t}$

$v\Delta t = \Delta d$

$\Delta t = \frac{\Delta d}{v}$