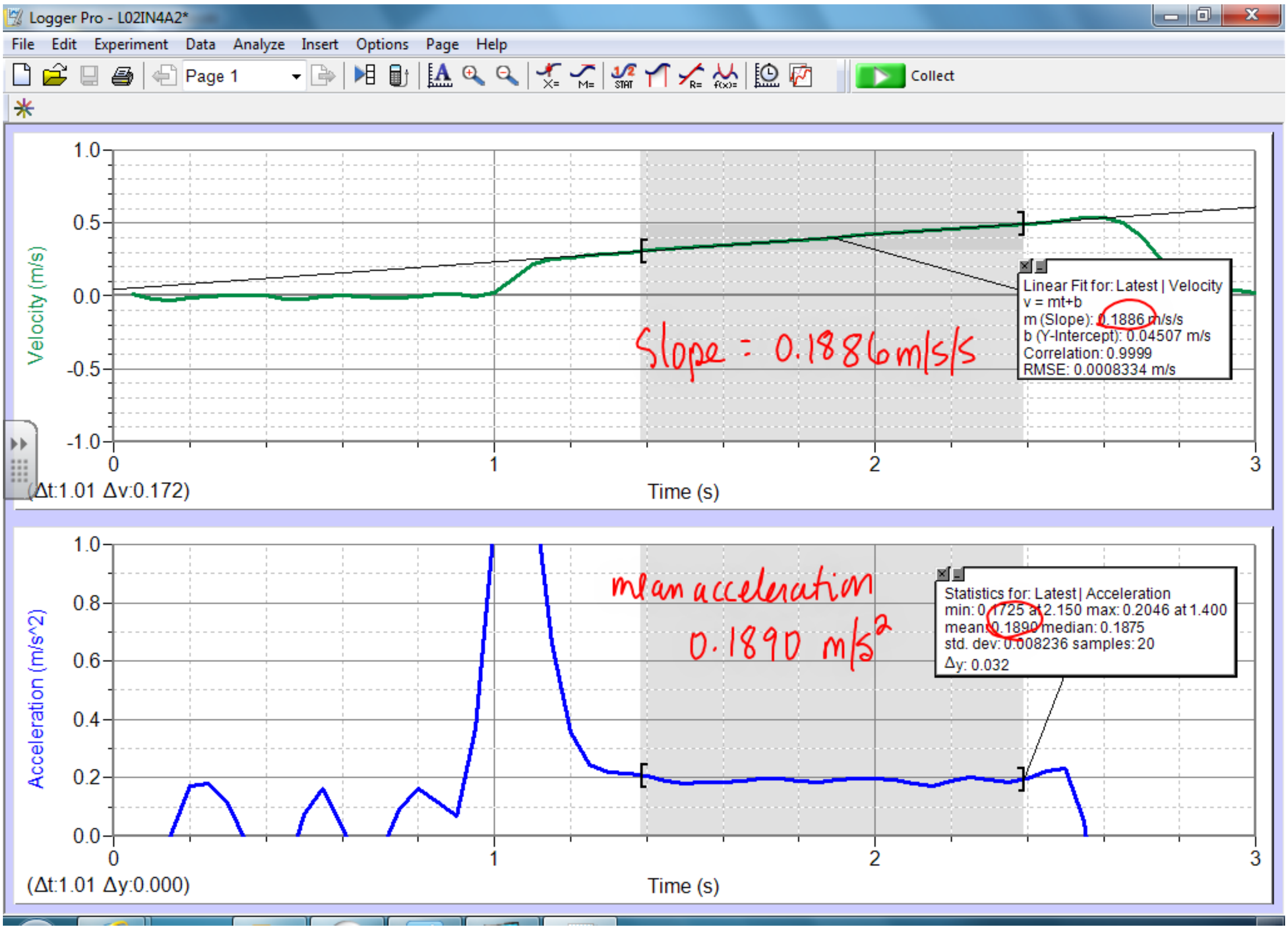
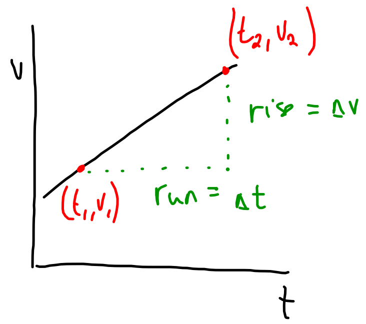

Logger Pro - L02IN4A2*
File Edit Experiment Data Analyze Insert Options Page Help
Page 1
Collect
Velocity (m/s)
Time (s)
(Δt:1.01 Δv:0.172)
Linear Fit for: Latest | Velocity
v = mt+b
m (Slope): 0.1886 m/s/s
b (Y-Intercept): 0.04507 m/s
Correlation: 0.9999
RMSE: 0.0008334 m/s
Slope = 0.1886 m/s/s
Acceleration (m/s^2)
(Δt:1.01 Δy:0.000)
Statistics for: Latest | Acceleration
min: 0.1725 at 2.150 max: 0.2046 at 1.400
mean: 0.1890 median: 0.1875
std. dev: 0.008236 samples: 20
Δy: 0.032
mean acceleration
0.1890 m/s²

Velocity-Time Graphs & Acceleration

Constant Acceleration



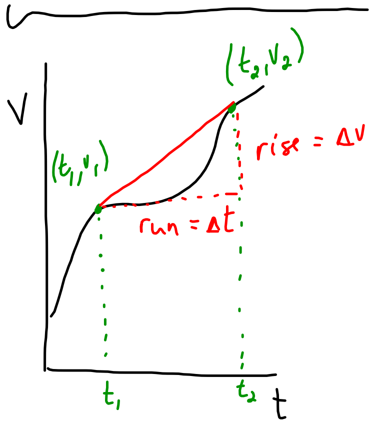
slope = $\frac{\text{rise}}{\text{run}}$

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

From INV5 we know that the slope on a v-t graph is acceleration

$\therefore \quad a = \frac{\Delta v}{\Delta t}$

Non-Constant Acceleration

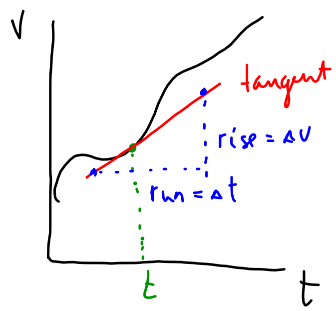


slope = $\frac{\text{rise}}{\text{run}}$

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

$a_{ave} = \frac{\Delta v}{\Delta t}$

Average acceleration is the slope of the line between two points on the v-t graph.

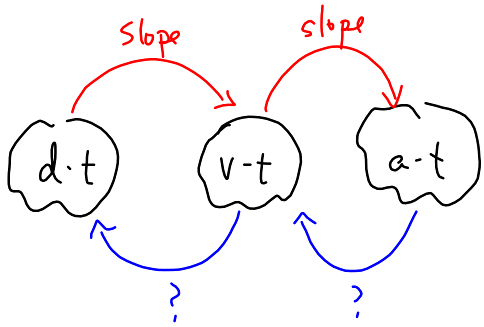


Slope = $\frac{\text{rise}}{\text{run}}$

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

$a_{inst} = \frac{\Delta v}{\Delta t}$

Instantaneous acceleration is the slope of the tangent at time t on a v-t graph.



The acceleration Equation

$$\vec{a} = \frac{\Delta \vec{v}}{\Delta t}$$

acceleration is a vector!

where $\vec{a}$ is the acceleration (m/s^2)

$\Delta \vec{v}$ is the change in velocity (m/s)

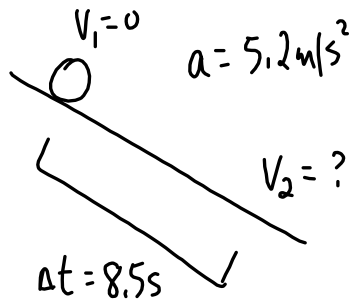
$$\Delta \vec{v} = \vec{v}_2 - \vec{v}_1$$

Δt is the time interval (s)

units: $\frac{m/s}{s} = m/s/s$

$$\frac{m}{s} \div s = \frac{m}{s} \cdot \frac{1}{s} = \frac{m}{s^2} \text{ or } ms^{-2}$$

mp/77



G
$\vec{v}_1 = 0$
$\vec{a} = 5.2 m/s^2$ [downhill] → 5.2 m/s/s
$\Delta t = 8.5 s$

R
$\vec{v}_2 = ?$

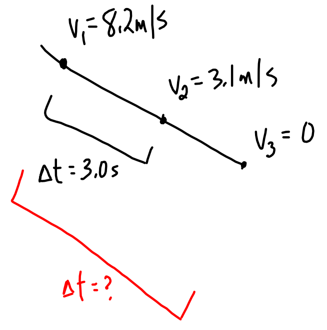
A
$$\vec{a} = \frac{\Delta \vec{v}}{\Delta t}$$
$$\vec{a} = \frac{\vec{v}_2 - \vec{v}_1}{\Delta t}$$
$$\vec{a}\Delta t = \vec{v}_2 - \vec{v}_1$$
$$\vec{v}_2 = \vec{v}_1 + \vec{a}\Delta t$$

units: $\frac{m}{s^2} \cdot \frac{s}{1} = \frac{m}{s}$

S
Δv
$$\vec{v}_2 = 0 m/s + (5.2 m/s^2 \text{ [downhill]})(8.5 s)$$
$$\vec{v}_2 = 44 m/s \text{ [downhill]}$$

P
The velocity of the boulder will be 44 m/s [downhill] after 8.5 s.

mp|78



Find the acceleration during the first 3.0 s.

$\vec{v}_1 = 8.2 m/s$ [downhill]
$\vec{v}_2 = 3.1 m/s$ [downhill]
$\Delta t = 3.0 s$
$a = ?$

$$\vec{a} = \frac{\Delta \vec{v}}{\Delta t}$$

$$\vec{a} = \frac{\vec{v}_2 - \vec{v}_1}{\Delta t}$$

$$\vec{a} = \frac{3.1 m/s [downhill] - 8.2 m/s [downhill]}{3.0 s}$$

$$\vec{a} = \frac{-5.1 m/s [downhill]}{3.0 s}$$

$$\vec{a} = -1.7 m/s^2 [downhill]$$

Now find Δt for whole trip:

$\vec{v}_1 = 8.2 m/s$ [downhill]
$\vec{v}_2 = 0 m/s$
$\vec{a} = -1.7 m/s^2$ [downhill]
$\Delta t = ??$

$$\vec{a} = \frac{\Delta \vec{v}}{\Delta t}$$

$$\vec{a}\Delta t = \Delta \vec{v}$$

$$\Delta t = \frac{\Delta \vec{v}}{\vec{a}}$$

$$\Delta t = \frac{\vec{v}_2 - \vec{v}_1}{\vec{a}}$$

$$\Delta t = \frac{0 m/s - 8.2 m/s [downhill]}{-1.7 m/s^2 [downhill]}$$

$$\Delta t = \frac{-8.2 m/s [downhill]}{-1.7 m/s^2 [downhill]}$$ ← directions must match

$$\Delta t = 4.8 s$$

units: $\frac{m/s}{m/s^2}$

$$\frac{m}{s} \div \frac{m}{s^2} = \frac{\cancel{m}}{\cancel{s}} \cdot \frac{s^{\cancel{2}}}{\cancel{m}} = s$$

The skier came to a stop 4.8 s after falling.

TO DO

- Read over §2.4 (p61-64) and p74-77
- PP/80