

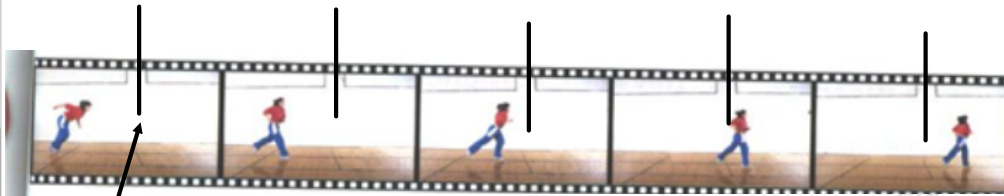
Motion

Diagrams:

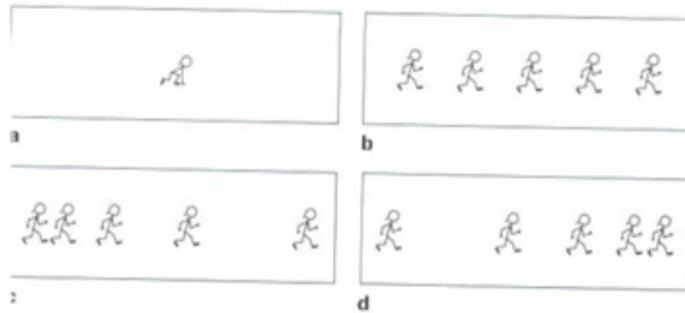


FIGURE 9.4 This is a time-lapsed photo of a runner.

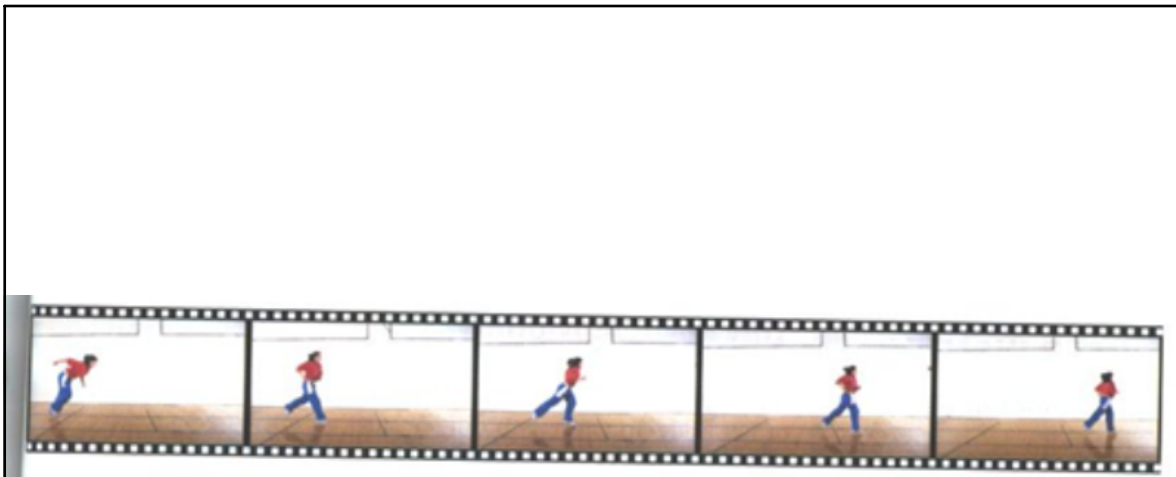
1) Motion (picture)



by inserting lines on the wall in the background you have a "reference point" to compare the motion of the runner



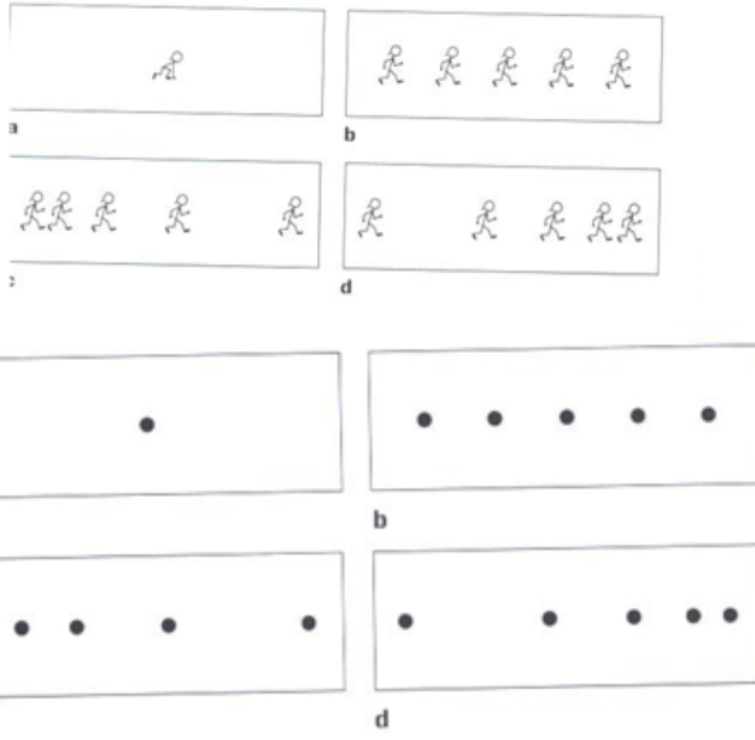
Sep 13-7:34 AM



Sep 17-12:06 PM

2) Particle Model

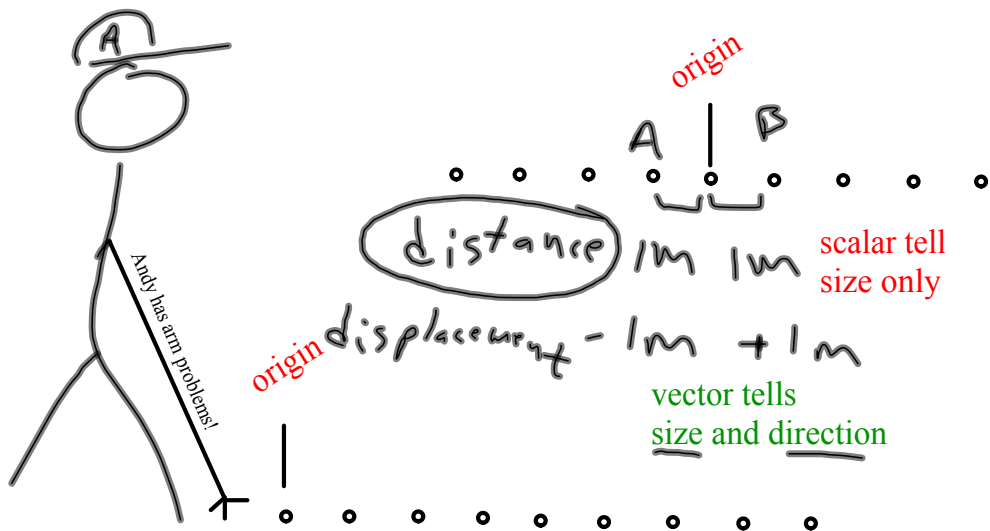
sometimes easier to see what's happening because it reduces the object to a point source and eliminates outside distractions



Sep 13-10:37 AM

1) motion along the "x" axis

Little Andy rolls a ball along the ground



Sep 13-7:21 AM

Little Andy rolls a ball along the ground

Andy has arm problems!

1) motion along the "x" axis

4 m

1 cm = 1 m

origin

d

v

a

origin

A

B

Sep 14-7:20 AM

little Andy drops a rock

Andy still has arm problems!

1) motion along the "y" axis

a

a

d

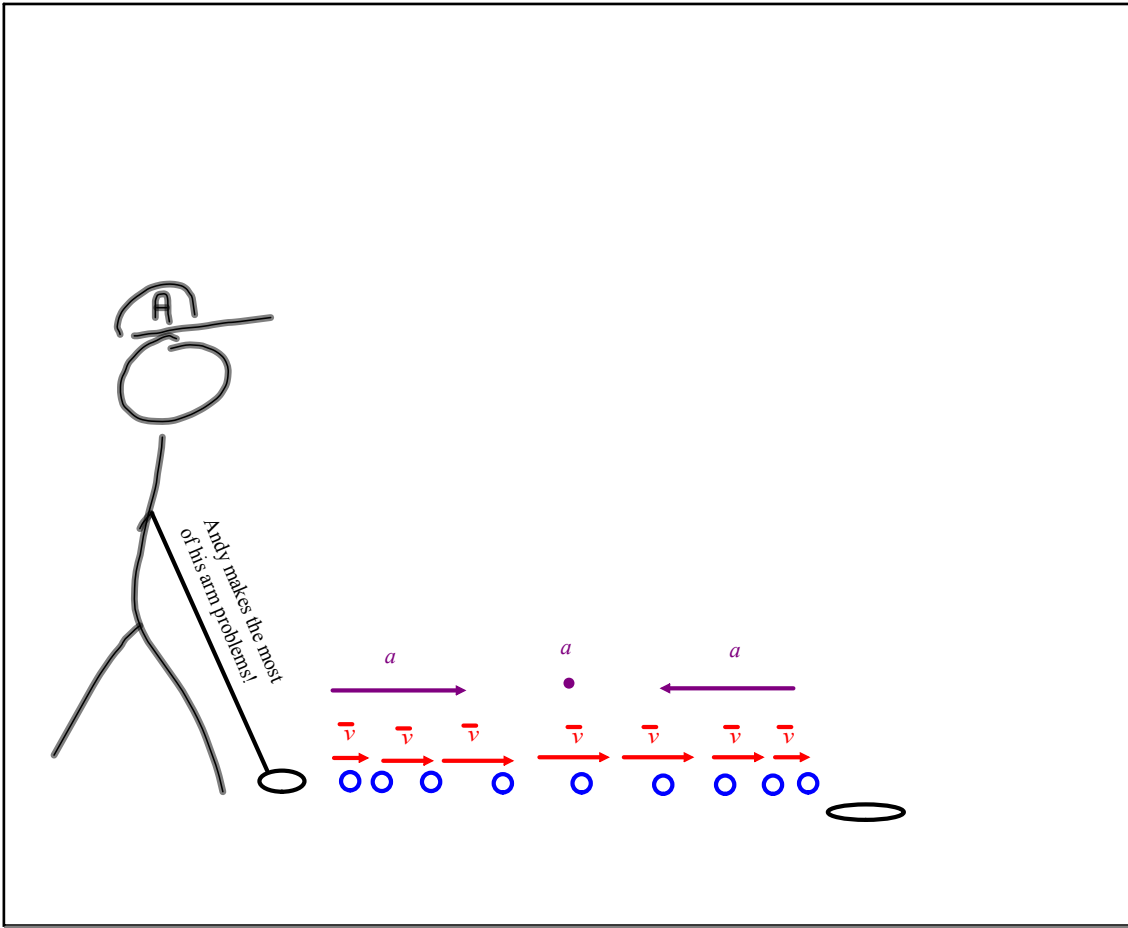
v

v

v

v

Sep 13-7:14 AM



Sep 17-10:24 AM

little Andy drops a rock

- 1) Data?
- 2) Type motion?
- 3) Formulas that apply?

Sep 13-7:14 AM

little Andy drops a rock

Andy doesn't care anymore!

$d = 1.88 \text{ m}$

$t = 0.63 \text{ s}$

- 1) Data?
origin
- 2) Type motion?
- 3) Formulas that apply?

Sep 21-10:24 AM

$v_i = 0$

$d = 1.88 \text{ m}$

$t = .63 \text{ s}$

$v_f = a$

?

Sep 10-7:16 AM

$d = 1.88 \text{ m}$
 $t = 0.63 \text{ s}$
 $v_1 = 0$
 $v_2 = ?$
 $\bar{v} = \frac{d}{t} = \frac{1.88 \text{ m}}{0.63 \text{ s}} = 3.0 \text{ m/s}$
 $\bar{v} = \frac{v_1 + v_2}{2}$
 $v_2 = 2\bar{v} - v_1 = 2(3.0 \text{ m/s}) - 0$
 $v_2 = 6.0 \text{ m/s}$
 $a = \frac{\Delta v}{t} = \frac{v_2 - v_1}{t} = \frac{6.0 \text{ m/s} - 0}{0.63 \text{ s}}$
 $a = 9.5 \frac{\text{m/s}}{\text{s}}$
 $\frac{\text{m/s}}{\text{s}} \quad \frac{\text{m/s}}{\text{s}} \quad \frac{\text{m/s}^2}{1} \quad \text{m/s}^2$

Sep 27-8:26 AM

$v_1 = 0$
 0.155 m
 1.175 m
 $t = 1.68 \text{ s}$

- 1) Data?
- 2) Type Motion?
- 3) Formulas that apply?

Sep 17-10:16 AM

1) Data? $d_{11} = 1.175 \text{ m}$
 $t = 1.68 \text{ s}$ $dh = .155 \text{ m}$

2) Type Motion?
 $v \sim a$
 $\bar{v} = \Delta d / t = \frac{1.175 \text{ m}}{1.68 \text{ s}}$
 $\bar{v} = -699 \text{ m/s}$

3) Formulas that apply?
 $v_1 = \frac{\Delta d}{t}$
 $v_1 = \frac{v_1 + v_2}{2}$
 $a = \frac{\Delta v}{t} = \frac{v_2 - v_1}{t}$
 $\bar{v} = \frac{v_1 + v_2}{2}$
 $v_2 = 2\bar{v} - v_1$
 $v_2 = 2(-699 \text{ m/s}) - 0$
 $v_2 = 140 \text{ m/s}$

$a = \frac{\Delta v}{t} = \frac{v_2 - v_1}{t}$
 $a = \frac{140 \text{ m/s} - 0}{1.68 \text{ s}} = .833 \text{ m/s}^2$

Sep 17-10:16 AM

$v_1 = 55 \text{ mph}$
 $v_2 = 35 \text{ mph}$
 $t = 1.3 \text{ s}$

Sep 15-8:13 AM

$$55 \frac{\text{mi}}{\text{hr}} \left(\frac{1 \text{ hr}}{3600 \text{ s}} \right) \left(\frac{1610 \text{ m}}{1 \text{ mi}} \right) =$$



$$v_1 = 55 \text{ mph} \quad \rightarrow 25 \text{ m/s} \quad a = \frac{v_2 - v_1}{t}$$

$$v_2 = 35 \text{ mph} \quad \rightarrow 16 \text{ m/s} \quad a = \frac{16 \text{ m/s} - 25 \text{ m/s}}{1.3 \text{ s}}$$

$$t = 1.3 \text{ s}$$

$$a) \quad a = ? \quad \bar{v} = d/t \quad a = -6.9 \text{ m/s}^2$$

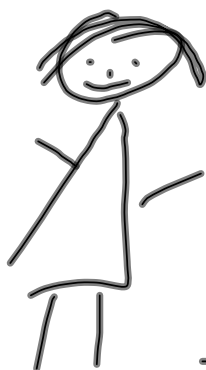
$$b) \quad d = ? \quad d = \bar{v} t$$

$$d = \left(\frac{v_1 + v_2}{2} \right) t$$

$$d = \left(\frac{25 \text{ m/s} + 16 \text{ m/s}}{2} \right) 1.3 \text{ s}$$

$$d = 27 \text{ m}$$

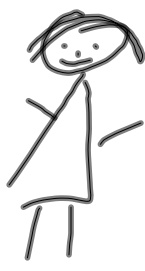
Sep 10-7:26 AM



$$0 - v_1 = 0$$

$$t_2 = 0.46 \text{ s}$$

Sep 16-7:12 AM



$t_2 = 0.46 \text{ s}$
 $v_1 = 0$
 $t_1 = 0$
 $a = 9.8 \text{ m/s}^2$
 $v_2 = 4.5 \text{ m/s}$

————— type motion?

v_2 (acceleration)

$$a = \frac{\Delta v}{\Delta t} = \frac{v_2 - v_1}{\Delta t}$$

$$a = \frac{v_2 - v_1}{\Delta t}$$

$$v_2 = v_1 + a t$$

$$v_2 = 0 + 9.8 \text{ m/s}^2 (.46 \text{ s})$$

$$v_2 = 4.5 \text{ m/s}$$

Sep 27-11:48 AM

← from last page

What distance did fall?

$$\bar{v} = \frac{v_1 + v_2}{2} = \frac{0 + 4.5 \text{ m/s}}{2}$$

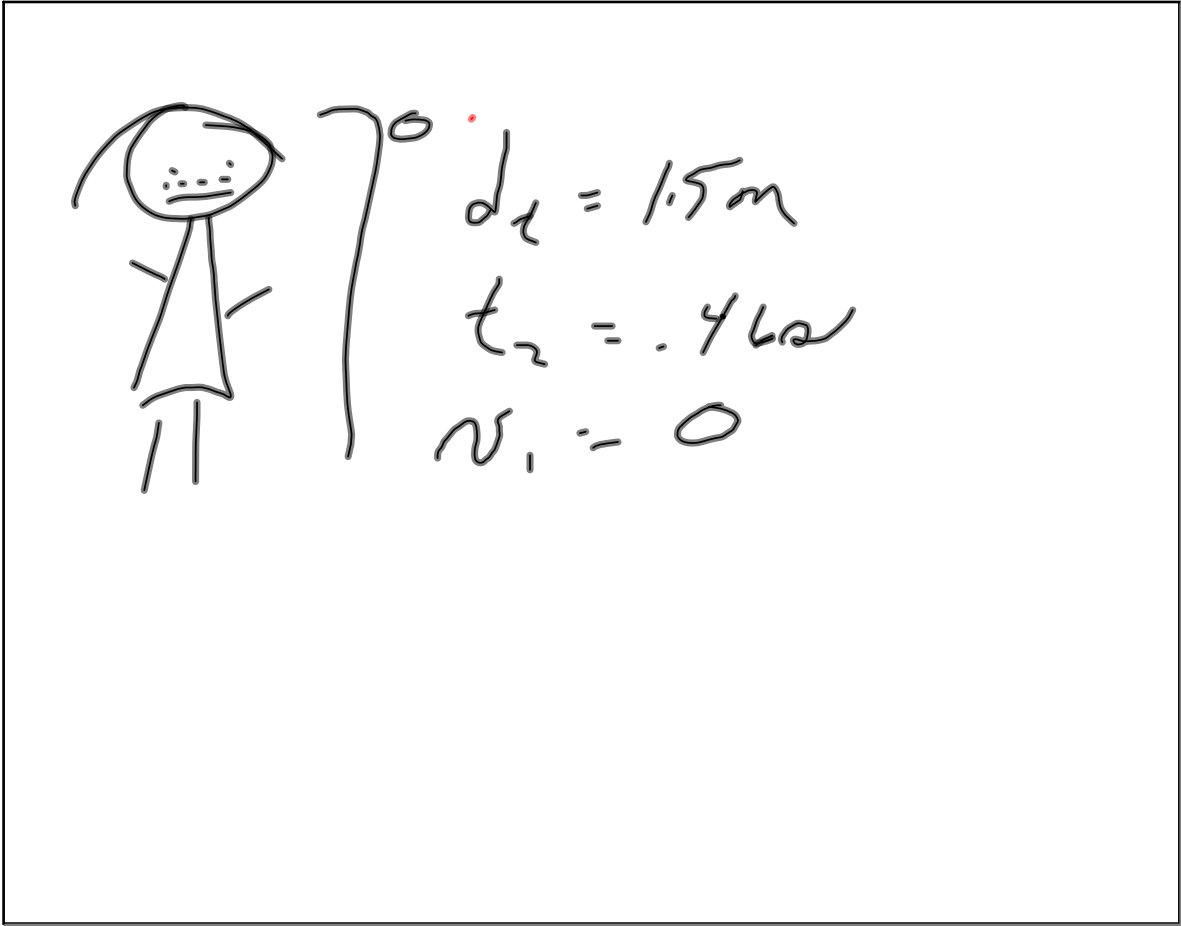
$$\bar{v} = 2.2 \text{ m/s}$$

$$\bar{v} = \frac{d_x}{t_x}$$

$$d_x = \bar{v} t = 2.2 \text{ m/s} (.46 \text{ s})$$

$d_x = 1.0 \text{ m}$

Sep 27-12:08 PM



Sep 16-7:13 AM

$d_1 = 1.5 \text{ m}$
 $t_2 = .46 \text{ s}$
 $v_1 = 0$

anal: $\bar{v} = \frac{\Delta d}{\Delta t}$
 $\bar{v} = \frac{v_1 + v_2}{2}$
 $a = \frac{\Delta v}{\Delta t}$

$\bar{v} = \frac{\Delta d}{\Delta t} = \frac{1.5 \text{ m}}{.46 \text{ s}} = 3.3 \text{ m/s}$

$\bar{v} = \frac{v_1 + v_2}{2}$
 $v_2 = 2\bar{v} - v_1$
 $v_2 = 2(3.3 \text{ m/s}) - 0$
 $v_2 = 6.6 \text{ m/s}$

$a = \frac{\Delta v}{\Delta t} = \frac{v_2 - v_1}{\Delta t} = \frac{6.6 \text{ m/s} - 0}{.46 \text{ s}}$
 $a = 14 \text{ m/s}^2$

boy did I measure time poorly!

Sep 27-12:11 PM

Handwritten notes on a page:

$v_1 = 0$

0

$t = ?$ or

$v_2 = ?$

Sep 16-7:13 AM

vector directions- gravity is down so you list the value as "-"

$v_1 = 0$

0

$T_m: v_2$

$v_1 = \frac{\Delta v}{t}$

$v_1 = \frac{v_2 - v_1}{t}$

$a = \frac{\Delta v}{t} = \frac{v_2 - v_1}{t}$

$a = \frac{v_2 - v_1}{t}$

$t = ?$ or

$v_2 = ?$

$a = -9.8 \text{ m/s}^2$

$v_2 = 0 + (-9.8 \text{ m/s}^2)(3.0 \text{ s})$

$v_2 = -29 \text{ m/s}$

Sep 19-11:10 AM

$$v_1 = 16 \text{ m/s}$$

$$v = 0$$

$$t = ?$$



Sep 16-7:14 AM

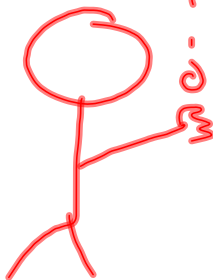
$$v_1 = 16 \text{ m/s}$$

ball thrown upward at 16 m/s

$$v_2 = 0$$

$$t = ?$$

$$a = -9.8 \text{ m/s}^2$$



$$v = \frac{Dd}{t}$$

$$\bar{v} = \frac{v_1 + v_2}{2}$$

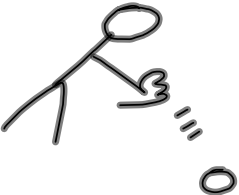
$$a = \frac{v_2 - v_1}{t}$$

$$t = \frac{v_2 - v_1}{a} = \frac{0 - (16 \text{ m/s})}{-9.8 \text{ m/s}^2}$$

$$t = 1.62$$

Sep 19-11:17 AM

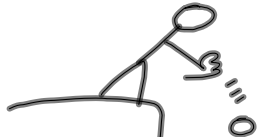
throws it
downward at
15 m/s $t = 3.02$



$v_1 = -15 \text{ m/s}$
 $a = -9.8 \text{ m/s}^2$
 $t = 3.02$

Sep 16-7:15 AM

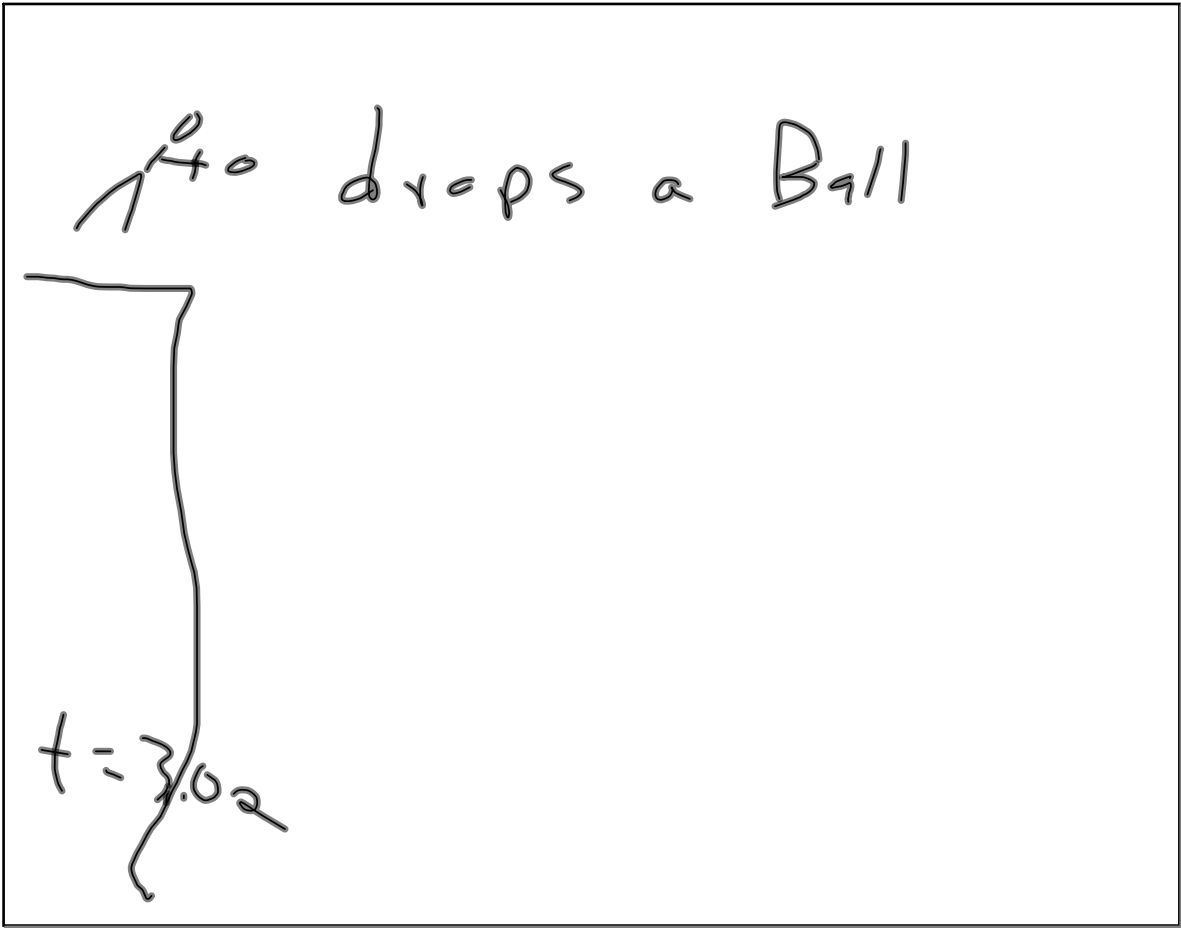
throws it
downward at
15 m/s



$t = 3.02$
 $a = -9.8 \text{ m/s}^2$
 $v_1 = -15 \text{ m/s}$
 $v_2 = ?$
 $a = \frac{v_2 - v_1}{t}$
 $v_2 = v + at$
 $v_2 = (-15 \text{ m/s}) + (-9.8 \text{ m/s}^2) 3.02$
 $v_2 = -44 \text{ m/s}$
 $d = ?$

$\frac{v_2}{v_1}$
 $v_2 = \frac{dv}{dt}$
 $v_1 = v_2 + v_1$
 $a = \frac{v_2 - v_1}{t}$
 $t = 3.02$

Sep 19-11:24 AM



Sep 16-7:16 AM

At $t=0$ drops a Ball

$v_1 = 0$
 $v_2 = -29 \text{ m/s}$
 $\bar{v} = \frac{v_1 + v_2}{2}$
 $\bar{v} = \frac{0 + (-29)}{2}$
 $\bar{v} = -14.5 \text{ m/s}$
 $t = 3.0s$

$d = ?$
 $\bar{v} = \frac{\Delta d}{t}$
 $\Delta d = \bar{v} t$
 $\Delta d = \left(\frac{v_1 + v_2}{2} \right) t$
 $\Delta d = \left(\frac{0 + (-29)}{2} \right) 3.0s$
 $\Delta d = -44 \text{ m}$

Sep 19-1:29 PM