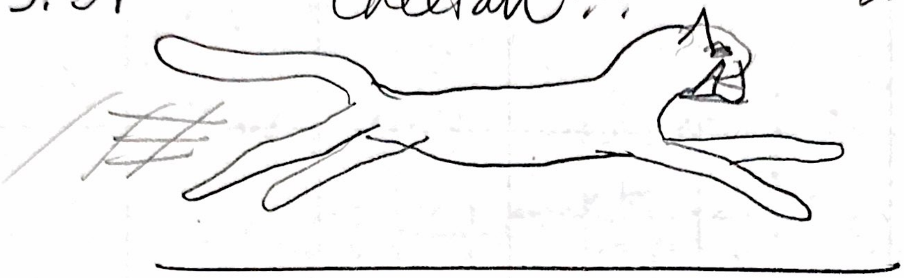
3.37 Cheetah?! lol



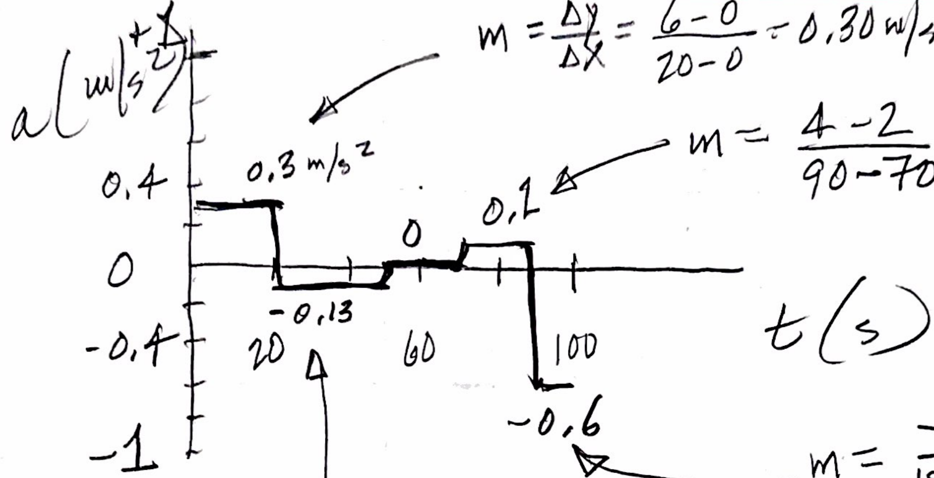
$v_i = 0$ m/s

$v_f = 30.0$ m/s

$\Delta t = 7.00$ s

$$a = \frac{\Delta v}{\Delta t} = \frac{v_f - v_i}{\Delta t} = \frac{30 - 0}{7.00} = \boxed{4.29\ m/s^2}$$

3.39



$m = \frac{\Delta y}{\Delta x} = \frac{6-0}{20-0} = 0.30\ m/s^2$

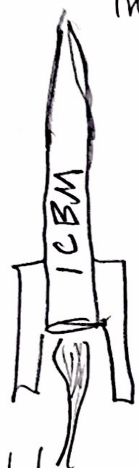
$m = \frac{4-2}{90-70} = 0.10$

$m = \frac{-2-4}{100-90} = -0.6$

To get acceleration values, get slope of v-t graph.

$m = \frac{\Delta y}{\Delta x} = \frac{2-6}{50-20} = -0.13$

3.41 Intercontinental ballistic missile (ICBM)



Is this what they look like?

$v_i = 0$ (rest)

$v_f = 6.50 \frac{km}{s} \times \frac{1000m}{1km} = 6500 \frac{m}{s}$

$\Delta t = 60.0s$

$\bar{a} = \frac{v_f - v_i}{\Delta t} = \frac{6500 - 0}{60}$

$= \boxed{108 \, m/s^2}$

In terms of $g = 9.80 m/s^2$, this would be

$\frac{108 \, m/s^2}{1} \times \frac{1 \text{ "g"}}{9.8 \, m/s^2} =$

$= \boxed{11.1 \text{ "g"s}}$

3.43

$v = 30\,m/s$

displacement $\Delta x = vt$

$= (30\,m/s)(5.0\,s)$

$= \boxed{150\,m}$

Can also use

$\Delta x = v_i t + \frac{1}{2}at^2$, with $a = 0$,
but why complicate things?!

3.45

$v_i = 30\ m/s$

$x_i = 0$

$a = 30\ m/s^2$

Find x_f at $t = 5.0s$.

$$\Delta x = v_i t + \frac{1}{2} a t^2$$

$$x_f = x_i + v_i t + \frac{1}{2} a t^2$$

$$= 0 + (30)(5) + \frac{1}{2}(30)(5)^2$$

$$= \boxed{525\ m}$$

3.49 At $t_i = 10$, $v_i = +\ 5.0\ m/s$

$\uparrow$ left-to-right

$\longrightarrow$

At $t_f = 20s$, $v_f = -\ 8.0\ m/s$

$\uparrow$ right-to-left

$\longleftarrow$

a) a is constant, $a = \frac{\Delta v}{\Delta t} = \frac{v_f - v_i}{t_f - t_i}$

$$= \frac{(-8) - (+5)}{20 - 10}$$

$$= \boxed{-1.3\ m/s^2}$$

b) initial velocity (presumably at time $t = 0$)?

Use Δt ~~from~~ 0 – 10 (there are other ways to solve, too):

$$v_f = v_i + a\Delta t$$

$$5.0\ m/s = v_i + (-1.3)(10)$$

$$v_i = 5 + 13 = \boxed{18\ m/s}$$

c) When does $v = 0$?

Use known v_i & t_i, & solve using acceleration. (I used $v_i = +5$ at $t_i = 10s$):

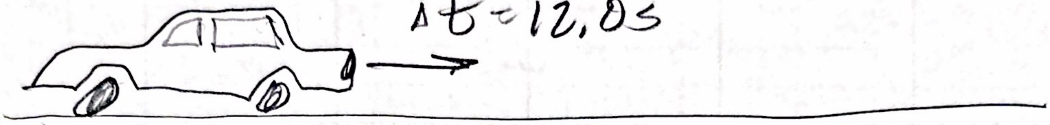
$$v_f = v_i + a(t_f - t_i)$$

$$0 = 5.0 + (-1.3)(t_f - 10)$$

Solve for t_f

$$\frac{-5.0}{-1.3} = t_f - 10 \longrightarrow t_f = \boxed{13.8\ s}$$

3.53 $v_i = 0$ $a = 2.40\ m/s^2$ $\Delta t = 12.0s$

a) 

sketch

b) $v_i = 0$; $a = 2.40\ m/s^2$; $\Delta t = 12.0s$

c) $\Delta x = ?$ Use $\Delta x = v_i t + \frac{1}{2} a t^2$

$$\Delta x = (0)(12) + \frac{1}{2}(2.40)(12)^2$$
$$= \boxed{173\ m}$$

It has the knowns & a single unknown that I'm solving for.

100 m ≈ 100 yds ≈ football field.

So this is a little less than two football fields to accelerate onto a freeway. Seems plausible!

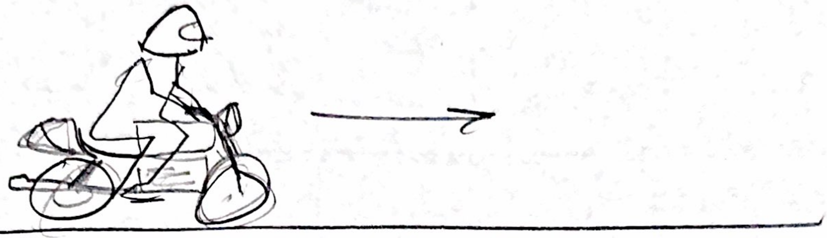
d) $$v_f = v_i + at$$
$$= 0\ m/s + (2.40\ m/s^2)(12.0s)$$
$$= \boxed{28.8\ m/s}$$

Is this plausible?

$$\frac{28.8\ m}{s} \times \frac{1\ mile}{1609\ m} \times \frac{3600s}{1\ hr} = 64.4$$ miles per hour

That's about right!

3.57



$v_i = 0$

$v_f = 26.8\ m/s$

$\Delta t = 3.90s$!

a) $a = \dfrac{v_f - v_i}{\Delta t} = \dfrac{26.8 - 0}{3.9} = \boxed{6.87\ m/s^2}$

b) $\Delta x = v_i t + \frac{1}{2} a t^2$

$= (0)(3.9) + \frac{1}{2}(6.87)(3.9)^2$

$= \boxed{52.2\ m/s}$

Can also solve with

$v_f^2 = v_i^2 + 2a\Delta x$

Rearrange to get $\Delta x = \dfrac{v_f^2 - v_i^2}{2a}$

$\Delta x = \dfrac{(26.8)^2 - (0)^2}{(2)(6.87)}$

Slight difference due to rounding

$= \boxed{52.3\ m/s}$