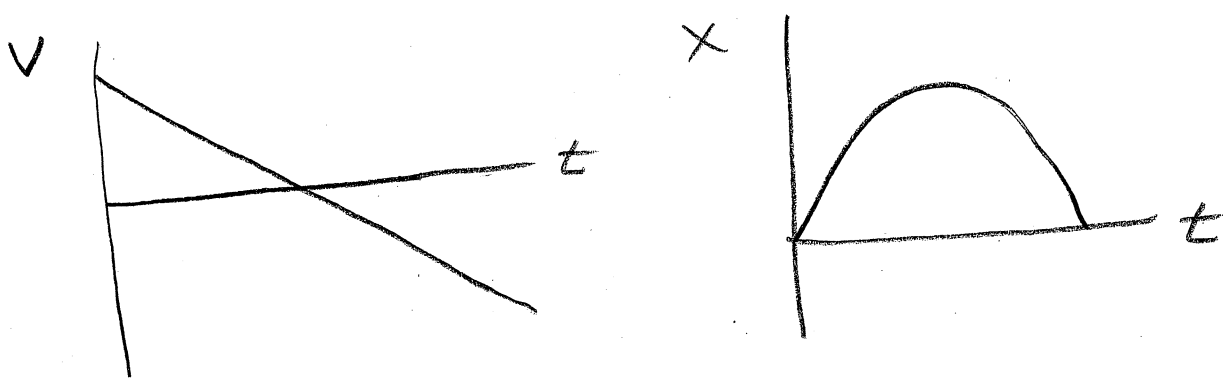
Kinematics Review #1

(1) $200\ km = 200 \times 10^3\ m$

$90\ min = 90(60) = 5400\ s$

$$v = \frac{d}{t} = \frac{200 \times 10^3}{5400} = 37\ m/s$$

(2)



(3) (a) (i) speeding up, North

(ii) constant speed, North

(iii) stationary

(b) (i) $$v = \frac{8-4}{16-4} = \frac{1}{3} = 0.33\ m/s$$

(ii) $$v = \frac{8-0}{20-0} = 0.4\ m/s$$

(4) (a) (i) speeding up, West

(ii) constant speed, West

(iii) slowing down, West until ~10.5 s at which point it stops then speeds up, East.

(b) $a = \frac{-4-0}{4-0} = -1 \text{ m/s}^2$

(c) Area.

$$\frac{4(-4)}{2} + 4(-4) + \frac{2.5(-4)}{2} + \frac{5.5(8)}{2} + 4(8)$$

$$-8 + -16 + -5 + 22 + 32$$

$$= 25 \text{ m}$$

(5) $v_i = 7 \text{ m/s}$

$v_f = 10 \text{ m/s}$

$t = 20 \text{ s}$

$a = ?$

$v_f = v_i + at$

$10 = 7 + a(20)$

$\underline{a = 0.15 \text{ m/s}^2}$

(6) $d = 370 \text{ m}$

$v_i = 0$

$t = 30 \text{ s}$

$v_f = ?$

$d = \left(\frac{v_f + v_i}{2}\right)t$

$370 = \frac{v_f(30)}{2}$

$\underline{v_f = 24.7 \text{ m/s}}$

(7) $v_i = 30$ m/s
$v_f = 40$ m/s
$t = 30$ s
$d = ?$

$d = \left(\frac{v_i + v_f}{2}\right) t$

$= \left(\frac{30+40}{2}\right) 30$

$= \underline{1050 \text{ m}}$

(8) $v_i = 30$ m/s
$a = -0.6$ m/s^2
$v_f = 0$
$t = ?$

$v_f = v_i + at$

$0 = 30 - .6t$

$\underline{t = 50 \text{ s}}$

(9) $v_i = 1.2$ m/s
$t = 50$ s
$d = 90$m
$a = ?$
$v_f = ?$

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

$90 = 1.2(50) + \frac{1}{2} a (50)^2$

$\underline{a = 0.024 \text{ m/s}^2}$

$v_f = v_i + at$

$= 1.2 + (.024)(50)$

$v_f = \underline{2.4 \text{ m/s}}$

(10) $v_i = 0$
$a = -9.8$ m/s^2
$t = 1.5$ s
$v_f = ?$

$v_f = v_i + at$

$= -9.8(1.5)$

$= -14.7$ m/s

(14.7 m/s down)

(11) $t = 1.5\ s$

$a = -9.8\ m/s^2$

$v_f = 0$

$d = ?$

$v_f = v_i + at$

$0 = v_i - 9.8(1.5)$

$v_i = 14.7\ m/s$

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

$= 14.7(1.5) + \frac{1}{2}(-9.8)(1.5)^2$

$d = 11.0\ m$

yes, it is high enough to reach.

(12) (a) $v_f = 0$

$d = 3\ m$

$a = -9.8\ m/s^2$

$v_i = ?$

$v_f^2 = v_i^2 + 2ad$

$0 = v_i^2 + 2(-9.8)(3)$

$v_i = 7.7\ m/s$

(b) $t = ?$

$v_f = v_i + at$

$0 = 7.7 + (-9.8)t$

$t = 0.79\ s$

(13) (a) $v_i = 10\ m/s$

$a = -9.8\ m/s^2$

$d = -50\ m$

$t = ?$

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

$$-50 = 10t + \frac{1}{2}(-9.8)t^2$$

$$4.9t^2 - 10t - 50 = 0$$

$$t = \frac{-(-10) \pm \sqrt{(-10)^2 - 4(4.9)(-50)}}{2(4.9)}$$

$t = -2.24$, $4.37\ s$

(b) $v_f = ?$

$$v_f^2 = v_i^2 + 2ad$$

$$= \sqrt{(10)^2 + 2(-9.8)(-50)}$$

$v_f = -32.9\ m/s$ or $32.9\ m/s$ down

(14) ball 1

$v_i = 0$

$a = -9.8\ m/s^2$

$d = -40\ m$

$t = ?$

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

$$-40 = \frac{1}{2}(-9.8)t^2$$

$t = 2.86\ s$

ball 2

$v_i = ?$

$a = -9.8\ m/s^2$

$d = -40\ m$

$t = t_1 - 1 = 2.86 - 1 = 1.86\ s$

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

$$-40 = v_i(1.86) + \frac{1}{2}(-9.8)(1.86)^2$$

$v_i = -30.6\ m/s$

or

$30.6\ m/s$ down

(15) (a) $v_i = ?$

$v_f = 13 \text{ m/s}$

$d = 28 \text{ m}$

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

$v_f^2 = v_i^2 + 2ad$

$(13)^2 = v_i^2 + 2(-9.8)(28)$

$v_i = 26.8 \text{ m/s}$

(b) $v_i = 26.8 \text{ m/s}$

$v_f = 0$

$d = ?$

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

$v_f^2 = v_i^2 + 2ad$

$0 = (26.8)^2 + 2(-9.8)d$

$d = 36.6 \text{ m}$

(c) $v_i = 26.8 \text{ m/s}$

$d = 0$

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

$t = ?$

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

$0 = 26.8t + \frac{1}{2}(-9.8)t^2$

$t = 5.5 \text{ s}$