1979 m1

a. $mgh = \frac{1}{2}mv^2$

$v = \sqrt{2gh}$

b. $|\Delta x| = |\Delta y|$

$\sqrt{2gh}\,t = \frac{1}{2}gt^2$

$\frac{2}{g}\sqrt{2gh} = t$

$t = 2\sqrt{\frac{2h}{g}}$

c. $\Delta y = \frac{1}{2}g\left[2\sqrt{\frac{2h}{g}}\right]^2$

$= 2g\left[\frac{2h}{g}\right]$

$= 4h$

$L = \sqrt{2} \cdot 4h$

d. $mg\left[h + \Delta y\right] = \frac{1}{2}mv^2$

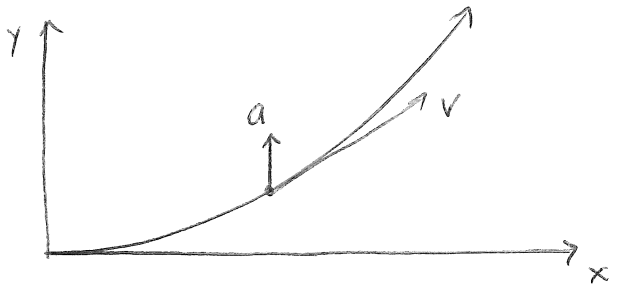
$g \cdot 5h = \frac{1}{2}v^2$

$v = \sqrt{10gh}$

1983 M1

a.

i.



ii. $v_y = \frac{dy}{dt} = \frac{dy}{dx} \cdot \frac{dx}{dt}$

$= x \cdot c$

iii. $v_y = x \cdot c = (ct) \cdot c = c^2 t$

$a_y = \frac{dv_y}{dt} = c^2$

b. i. $v_x = \frac{c}{\sqrt{1+x^2}}$ $\quad v_y = \frac{dy}{dt} = \frac{dy}{dx} \cdot \frac{dx}{dt}$

$= x \cdot v_x$

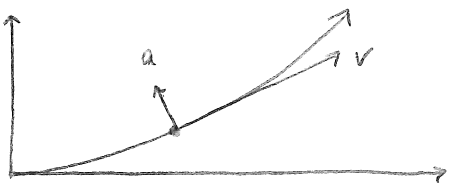
$= \frac{x\,c}{\sqrt{1+x^2}}$

$v^2 = v_x^2 + v_y^2 = \frac{c^2}{1+x^2} + \frac{x^2 c^2}{1+x^2}$

$= \frac{c^2(1+x^2)}{1+x^2} = c^2$

$v = c$

ii.



VELOCITY IS TANGENT TO THE PATH OF MOTION. IF SPEED IS FIXED, ACCELERATION MUST BE NORMAL TO THE VELOCITY VECTOR.

1985 m1

a. $v_f^2 = v_i^2 + 2a\Delta s$

$v_f^2 = (50 \cdot \sin 37°)^2 + 2(-10)(-35)$

$v_f = -40\ m/s$

$\Delta t = \frac{v_f - v_i}{a} = \frac{-40 - 50\sin 37°}{-10} = 7\ sec$

b. $\Delta x = v_x \cdot t$

$= (50\cos 37°)(7)$

$= 280\ m$

c. $v_A = 50 \cdot \cos 37° = 40\ m/s$

$v_B = 50\ m/s$

$v_c = \sqrt{40^2 + (50\sin 37°)^2}$

$= 56.6\ m/s$

d. $R_{cm} = \frac{(m_1)(R_1) + (m_2)(R_2)}{\Sigma m} = 0$

$\frac{(10)(-x) + (6)(30)}{16} = 0$

$x = 18\ m$

1992 M1

a. $v_f^2 = v_i^2 + 2(a)(\Delta s)$

$v_f^2 = 0 + 2(-9.8)(-5)$

$v_f = -10\ m/s$

b. $5 = \Delta s_{CLAY} + \Delta s_{BALL}$

$5 = \frac{1}{2}gt^2 + [v_i t - \frac{1}{2}gt^2]$

$5 = v_i \cdot t$

$5 = 10t$

$t = 0.5\ s$

c. $\Delta s_{BALL} = (10)(0.5) - \frac{1}{2}(9.8)(0.5^2)$

$= 3.75\ m$

d. $v_{CLAY} = -gt$

$= -5\ m/s$

$v_{BALL} = v_i - gt$

$= 5\ m/s$

e. $(9m)(5) + (m)(-5) = (10m)v$

$v = 4\ m/s$ UPWARD

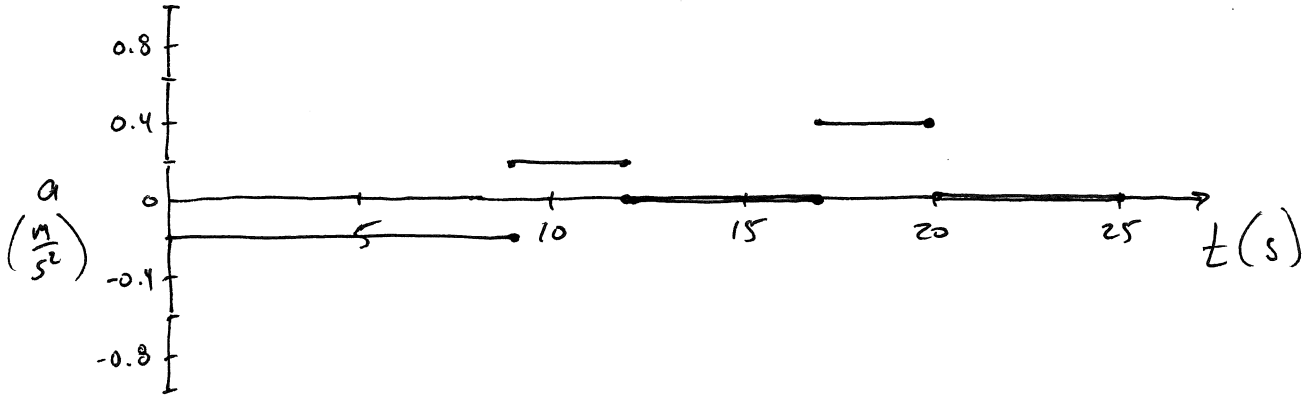
2000 B1

a. 4 SECONDS AND 18 SECONDS

b. 4-9 SECONDS AND 18-20 SECONDS

c. Δs (0 TO 4s) = 1.6 m
Δs (4 TO 8s) = -1.6 m
Δs (8 TO 9s) = -0.9 m
$\Big\}$ $\Sigma \Delta s = -0.9$ m

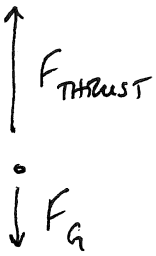
d.



e. i. $t = \sqrt{\frac{2h}{g}} = \sqrt{\frac{2 \cdot 0.4}{10}} = 0.283$s

ii. $\Delta s_x = V_x \cdot t = (0.8)(0.283) = 0.226$ m

2002 B1

a. i. 

ii. 

iii. 

b. $$a = \frac{\Sigma F}{m} = \frac{F_T - mg}{m} = \frac{14.6 - 3.5}{0.35} = 31.7 \text{ m/s}^2$$

c. $v = v_0 + a \cdot t = 0 + (31.7)(2.5) = 79.3 \text{ m/s}$

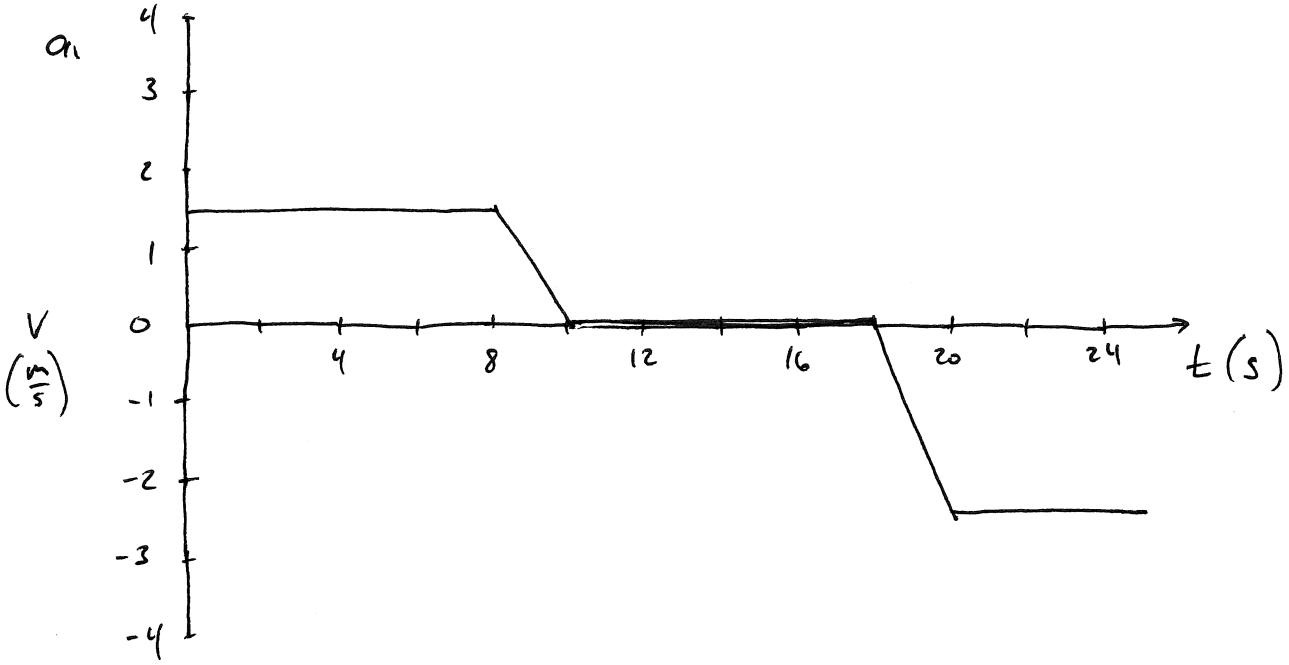
d. GREATER THAN

$ma = F_{SCALE} - mg$

$F_{SCALE} = mg + ma > mg$

2005 B1

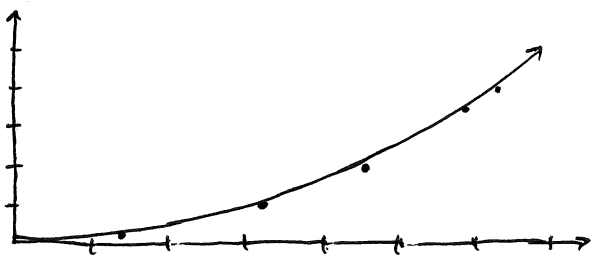
a.



b. $\bar{a} = \dfrac{V_f - V_i}{\Delta t} = \dfrac{0 - 1.5}{2} = -0.75 \text{ m/s}^2$

2006 B1

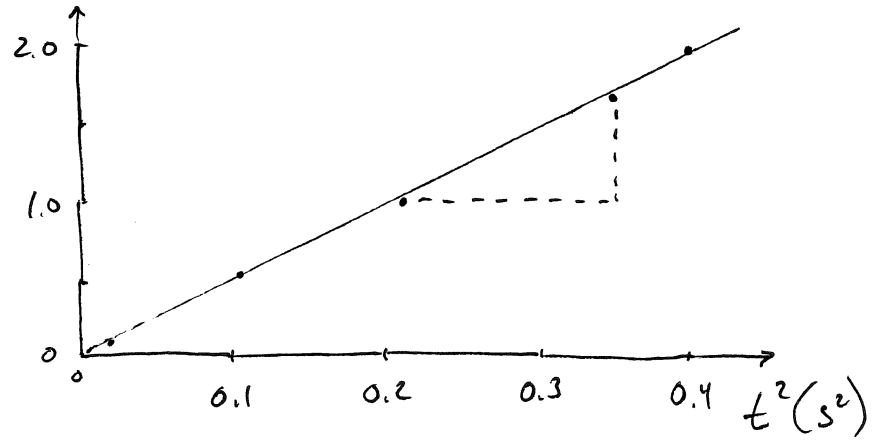
a.



b. D vs t^2

c.

D	t^2
0.1	0.0196
0.5	0.1024
1.0	0.2116
1.7	0.3481
2.0	0.3969



d. $\text{SLOPE} = \frac{0.75\ m}{0.15\ s^2} = 5\ m/s^2$

$D = \frac{1}{2} a t^2$ so $a = 2\left[\frac{D}{t^2}\right] = 2\left[\text{SLOPE}\right] = 10\ m/s^2$

e. MULTIPLE TRIALS WOULD AVERAGE-OUT RANDOM ERROR