Q1's:

Negative displacement 2002 Q1 a (*), ~~2003 Q1a~~

passing posts 2002 Q1 b, 2003 Q1 a (*)
2011 Q1 a,

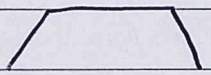
'just catches', closest distance 2003 Q1 b (*) (!)

forces / penetrates 2004 Q1(b) (*), 2005 Q1(b) (*)

Distance Vs Displacement 2004 Q1(a) (*), 2008 Q1(a) (*)

Trains passing / lengths 2006 Q1(b) (*)

Accel / Decel / ratios 2006 Q1(a) 2009 Q1(b)

 2007 Q1(b) 2011 Q1(b) (*)

In 2nd second, in 5th second !! 2007 Q1(a) (*)

watch $\dot{6}$!

Answer Q!!!

Answer part (iii) even if you couldn't do ii)

Do 2012 Q1 (b)

time - think which has been travelling longer, and rem: $\underline{\underline{t+2}}$, t $\underline{t}$, $t-2$

2010 Q1 (b) = hard

* Area under curve is distance travelled
* can only deal with each period of acceleration individually - if accel changes => new u, v, a, s, t,

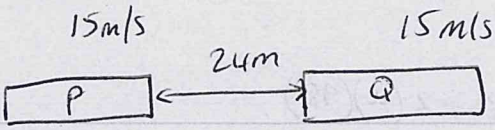
* Average Speed = $\frac{\text{Total distance}}{\text{Total time}}$

* Uniform Speed => No acceleration 2004(b)
=> force overall = 0 !

* Distance in the 7th sec
= distance for 1st 7sec - distance for 1st 6 sec's

2003 (a) passing posts and (b) (just catches)
2004 (a) and (b) (caravan, force, uniform speed)
(a) distance Vs displacement
2002 (a) easy ⊖ displacement (b) passing pols algebra
2001 (a) Do (b) 2 cars (hard) do
1998 (a) Algebra (5/6) (b) Do

Q1 2014 (a)



2014 Q1

In time t: P: Q:

S_P: $15t - 2t^2$

P: $u = 15$, $v =$, $a = -4$, $s = 15t - 2t^2$, $t = t$

Q: $u = 15$, $v =$, $a = -5$, $s = 15t - 2.5t^2$, $t = t$

$S_Q + 24 - S_P = 15t - 2.5t^2 + 24 - 15t + 2t^2$

$-0.5t^2 + 24$

(ii)

$u = 15$, $v = 0$, $a = -4$, $s =$, $t = t$

$0 = 225 - 8s$

$s = \frac{225}{8}$

$u = 15$, $v = 0$, $a = -5$, $s =$, $t = t$

$0 = 225 - 10s$

$225 = S_Q$

$\frac{225}{10}$

$\frac{225}{10} + \frac{240}{10} - \frac{225}{8}$

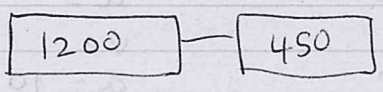
465

$\frac{465}{10} - \frac{225}{8} = 18.375$

$P = \frac{W}{t} = F\frac{d}{t} = Fv$

(b)

(i)



$\frac{50000}{25} = F = 2000N$.

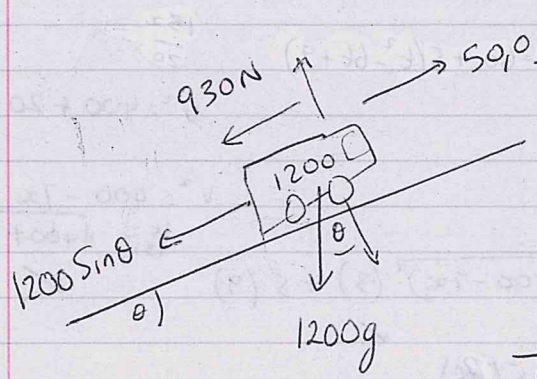
$50000W$

$a = \frac{F}{m} = \frac{2000 - 1130}{1650}$

$= 29/55$

$= 0.527$

(ii)



$F - 1200g\sin\theta_1 = 1200a$ (o) (−930)

$F - 120g_{n1} = 1200a$ (o) (−930)

$F = \frac{50,000}{v}$.

$T = \frac{50000}{v}$

$v = \frac{50000}{2106} = 23.74 m/s$.

2016: (Q1)

(i) $u = 14$, $v = 0$, $a =$, $s = 98$, $t =$

$0^2 = 196 + 2(a)(98)$

$a = -\frac{196}{196} = -1 m/s^2$

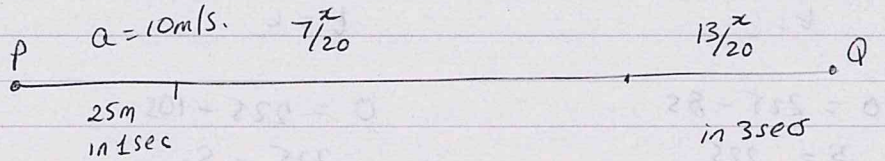
(ii) In 1 sec car travels 14m. It is now 84m from traffic light. $u = 14$, $v = 0$, $a =$, $s = 84$, $t =$

$0^2 = 196 + 2a(84)$

$-196/168 = -1.17 m/s$

20

(b.)



$u = 20$, $v =$, $a =$, $s = 25$, $t = 1$

$25 = 20 + \frac{a}{2}$

$5 = a/2$

$a = 10 m/s$

xm travels P → Q in t secs, $7x/20$ in $t-3$ secs, $\frac{13x}{20}$ in 3 secs.

$u = 20$	$u = 20$	$u =$
$v =$	$v =$	$v =$
$a = 10$	$a = 10$	$a = 10$
$s = x$	$s = 7x/20$	$s = 13x/20$
$t = t$	$t = t-3$	$t = 3$

$v^2 = 400 + 20\left(\frac{7x}{20}\right)$

$v^2 = 400 - 7x$

$u_{(3)} = \sqrt{400+7x}$ ✓

$\frac{13}{20} = \sqrt{(400-7x)}\,(3) + 5\,(9)$ ✓

$13x = 60\sqrt{400+7x} + 45(20)$

$(13x - 900)^2 = 3600(400+7x)$

$169x^2 - 23400x + 810000 = 1440000 + 25200x$

$169x^2 - 48600x - 630000 = 0.$ ← $x = 300m.$

2013:

(a.) $u = 44.1$, $v =$, $a = -9.8$, $s = 39.2$, $t = ?$

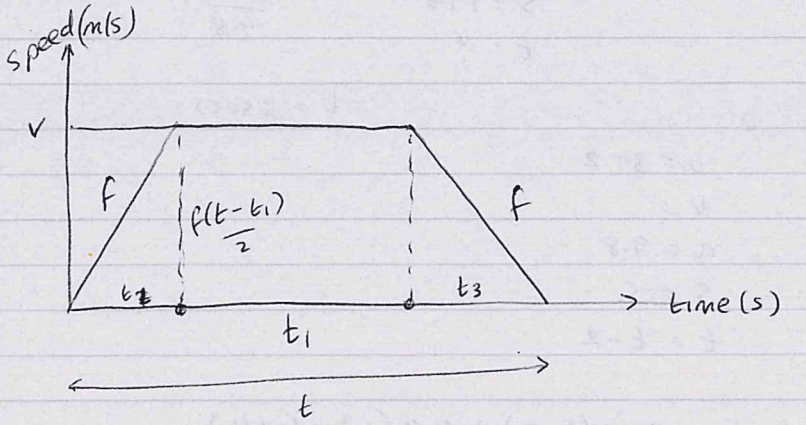
$39.2 = 44.1t - 4.9t^2$

$8 = 9t - t^2$

$t^2 - 9t + 8 = 0$

$(t-1)(t-8)$ $t = 1$ $t = 8$, Ans = 7 secs

(b.)



$u = 0$	$u = v$
$v = v$	$v = 0$
$a = f$	$a = -f$
$s =$	$s =$
$t = t_2$	$t = t_3$
	$0 = v - ft_3$
$v = ft_2$	$v = ft_3$

$t_2 = t_3$

So $t_2 = t_3 = \frac{t - t_1}{2}$

$\therefore v = f\left(\frac{t - t_1}{2}\right)$

$$d = \frac{1}{2}\left(\frac{t-t_1}{2}\right)\left(\frac{t-t_1}{2}\right)f + \frac{1}{2}\left(\frac{t-t_1}{2}\right)\left(\frac{t-t_1}{2}\right)f + f\left(\frac{t-t_1}{2}\right)t_1$$

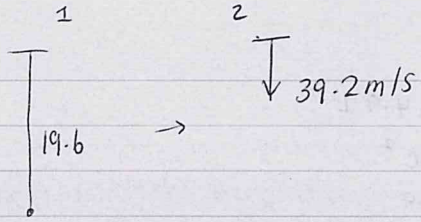
$$d = \frac{(t-t_1)^2}{4}f + f\left(\frac{t-t_1}{2}\right)t_1 =$$

$$d = (t^2 - 2tt_1 + t_1^2)f + 2f(tt_1 - t_1^2)$$

$$\frac{4d}{f} = t^2 - t_1^2 \qquad \sqrt{t^2 - \frac{4d}{f}} = t_1^2$$

2012

Q1 (a)



Particles collide when $S_1 = S_2$

find time to fall 19.6m : $u = 0$, $v =$, $a = 9.8$, $S = 19.6$, $t = ?$

$19.6 = \frac{9.8}{2} t^2$

$t^2 = \frac{39.2}{9.8} = 4$

$t = 2$ secs

1 : $u = 0$, $v =$, $a = 9.8$, $S = S$, $t = t$

2 : $u = 39.2$, $v =$, $a = 9.8$, $S = S$, $t = t - 2$

$S = 4.9t^2$

$S = 39.2(t-2) + 4.9(t^2 - 4t + 4)$

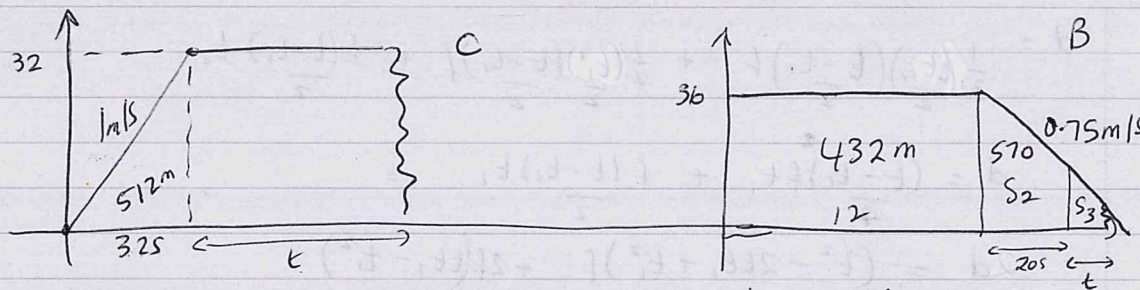
$= S = 39.2t - 78.4 + 4.9t^2 - 19.6t + 19.6$

$4.9t^2 = 4.9t^2 + 19.6t - 58.8$

$t = \frac{58.8}{19.6} = 3$ secs

$d = 4.9(3)^2 = 44.1$ m

(b.)



$u = 0$, $v = 32$, $a = 1$, $s = ?$

$32 = 0 + (1)t$

$32^2 = 0 + 2(1)S$

$S = 512$ m

$t = 32$s

In 32s Bus travels $36(12) + S_2$

$u = 36$, $v =$, $a = -0.75$, $s = ?$, $t = 20$

$S = 36(20) - (375)(400)$

$S = 570$

$v = 36 + 0.75(20)$

$v = 21$ m/s

In 32sec S_{car} : 512 m

in 32sec S_{Bus} : 570m + 432 m

Bus + Car : 1514 m. they overtake when $S_B + S_C = 1914$

$1914 = 512 + 32t + 432 + 570 + S_3$

find S_3 : $u = 21$, $v =$, $a = -0.75$, $S = 21t - \frac{3}{8}t^2$, $t = t$

$1914 = 512 + 32t + 432 + 570 + 21t - 3t^2/8$

$400 = 32t - \frac{3t^2}{8}$

$3t^2 - 424t + 3200 = 0$

$t = 8, \; t = \frac{400}{3}$

Overall $t = 32 + 8 = 40$

After 48secs : 8secs car : $32(8) = 256$

Bus : $v(t=8) = 21 + 0.75(8) = 15$ m/s

$u = 15$ $a = -0.75$ $s = ?$ $t = 8$ $\Rightarrow$ 96m

25
96
35

Q1's:

2013 (a.) 1

(*) S = displacement (for upward throws)

$u = 44.1$
$v =$
$a = -9.8$
$s = 39.2$
$t =$

$39.2 = 44.1t - 4.9t^2$

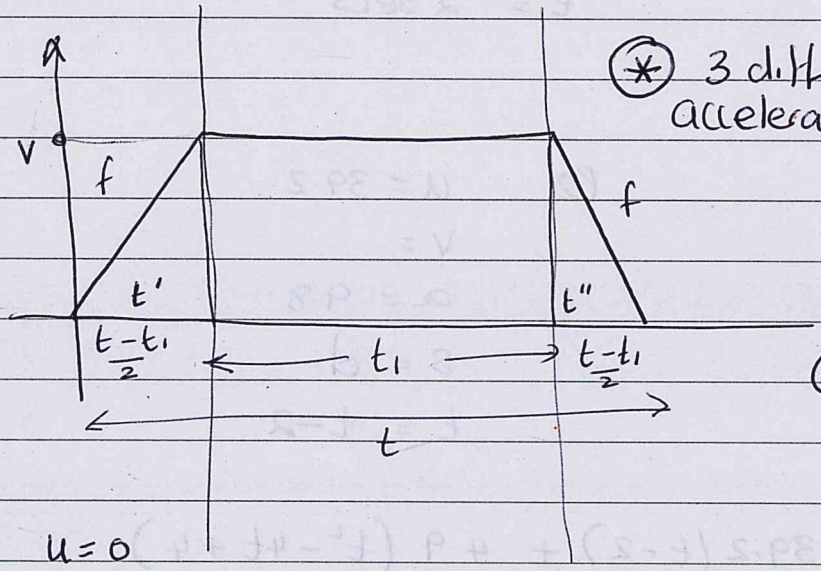
$t^2 - 9t + 8 = 0$

$(t-8)(t-1)$ $t = 8$ secs $t = 1$ sec

Quadratics
(*) divide by 4.9
check

Check you have Ans: $8 - 1 = 7$ secs
(*) Answered the Q being asked or (-5 marks)

b.



(*) 3 different accelerations

$t' = t'' \Rightarrow t - t_1 = 2t'$

$t' = \frac{t - t_1}{2}$

(*) Area under curve = distance

(*) Average speed = $\frac{\text{total distance}}{\text{total time}}$

$u = 0$
$v = V$
$a = f$
$s =$
$t = \frac{t - t_1}{2}$

$V = 0 + f\left(\frac{t - t_1}{2}\right)$

(*)

$d = 2\left(\frac{t - t_1}{4}\right)V + t_1 V \Rightarrow d = \frac{2(t - t_1)}{4} \cdot f\left(\frac{t - t_1}{2}\right) + t_1 f\left(\frac{t - t_1}{2}\right)$

$d = \frac{f(t^2 - 2tt_1 + t_1^2)}{4} + \frac{2t_1 f(t - t_1)}{4} \Rightarrow \frac{4d}{f} = t^2 - t_1^2$

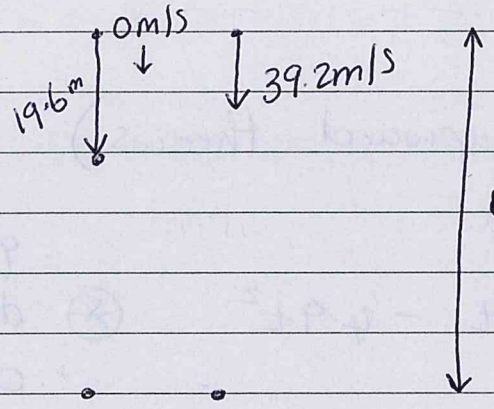
$4d = ft^2 - 2ftt_1 + ft_1^2 + 2t_1 tf - 2t_1^2 f$

$= ft^2 - ft_1^2$

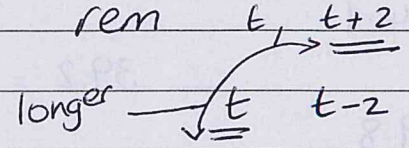
$t^2 - \frac{4d}{f} = t_1^2$

2012

Q1 (a.)



(*) $t+2$ or $t-2$?
think which has been travelling longer and rem



P1 : $u = 0$
$v =$
$a = 9.8$
$s = 19.6$
$t = ?$

$19.6 = 0 + 4.9t^2$

$t^2 = 4$

$t = 2$ secs.

P1 : $u = 0$
$v =$
$a = 9.8$
$s = d$
$t = t$

P2 $u = 39.2$
$v =$
$a = 9.8$
$s = d$
$t = t-2$

$d = 4.9t^2 = 39.2(t-2) + 4.9(t^2 - 4t + 4)$

$4.9t^2 = 39.2t - 78.4 + 4.9t^2 - 19.6t + 19.6$

$19.6t + 19.6 - 78.4 = 0$

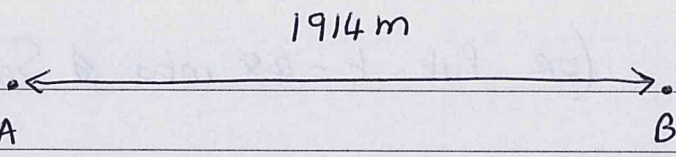
$19.6t = 58.8$

$t = 3$ secs.

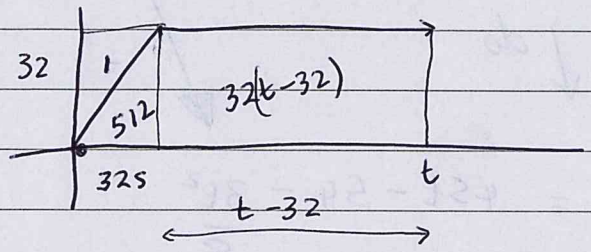
$d = 4.9t^2 = 44.1$m (*) Answer the Q

(*) DO

1 (b.)



Car 1



$u = 0$ $\quad 32^2 = 0^2 + 2s$

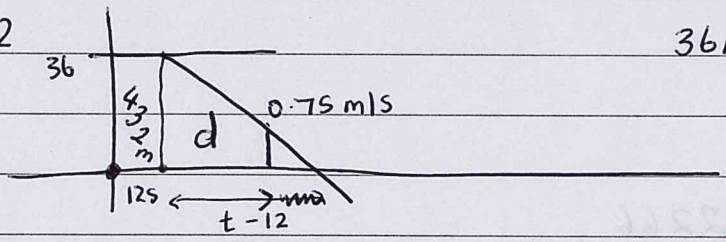
$V = 32$ $\quad \Rightarrow s = 512$

$a = 1$

$s =$ $\quad 32 = 1t$

$t =$ $\quad 32s = t$

Car 2



36m/s for 12s $\Rightarrow$ 432m

$S_C + S_B = 1914$ when they meet.

t = time

$S_C = 512 + 32t - 1024$

$= 32t - 512$

$S_B = 432 + d$

(*) Part (ii) can be done whether or not you get part (i)

$d = ?$ $\quad u = 36$ $\quad d = 36t - 432 - 0.375(t^2 - 24t + 144)$

$V =$

$a = -0.75$ $\quad d = 45t - 486 - \frac{3t^2}{8}$ $\quad$ (*) Don't (x8)!

$s = d$

$t = t - 12$

$\therefore S_B = 432 - 486 + 45t - \frac{3t^2}{8}$

$S_B + S_C = 32t - 512 + 45t - \frac{3t^2}{8} - 54 = 45t - 54 - \frac{3t^2}{8}$

$1914 = -\frac{3t^2}{8} - 566 + 77t \Rightarrow 3t^2 - 616t + 19840 = 0$

$t = 1653$ or $t = 40$

48 - 40

(ii) 8 seconds later? (OR Put $t = 48$ into S_B, S_C and subtr

32(8) = distance travelled by car

Complicated/messy ↓ do

$S_C = 32(48) - 512$

1536.
- 512
1024 m.

$S_B = 45t - 54 - \frac{3t^2}{8}$

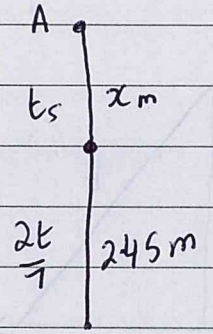
1242.

1024 + 1242 = 2266

2266 − 1914 = 352m.

2011

Q1: (a)



(*) look at A → B

look at A → C ?

get Simultaneous Eqn.

look A → B

$u = 0$	$u = 0$
$v =$	$v =$
$a = 9.8$	$a = 9.8$
$s = x$	$s = x + 2.45$
$t = t$	$t = t + \frac{2t}{7} = \frac{9t}{7}$

$x = 4.9t^2$ ✓ $\quad x + 2.45 = 4.9\left(\frac{81t^2}{49}\right)$

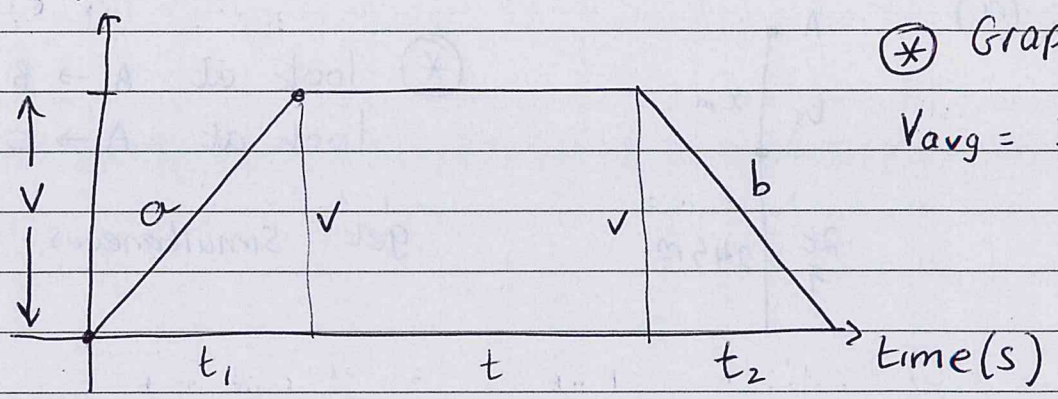
$49x + 120.05 = 396.9t^2$ $(396.9t^2)$

$240.1t^2 + 120.05 = 396.9t^2$

$120.05 = 156.8t^2$

$\frac{49}{64} = t^2 \qquad t = \frac{7}{8}$ secs

2011 (b) (*) Def do!!!



$V_{avg} = \frac{3v}{4}$

(*) Average speed = $\frac{\text{Total distance}}{\text{Total time}} = \frac{3V}{4}$

(ii)

Total time * $\frac{3V}{4}$ = Total distance

Total time = $\frac{4\,(\text{Total distance})}{3V}$ = $t + t_1 + t_2$

Total distance = $\frac{Vt_1}{2} + \frac{Vt_2}{2} + Vt$

So $t + t_1 + t_2 = \frac{4V}{3V}\left(\frac{t_1}{2} + \frac{t_2}{2} + t\right)$

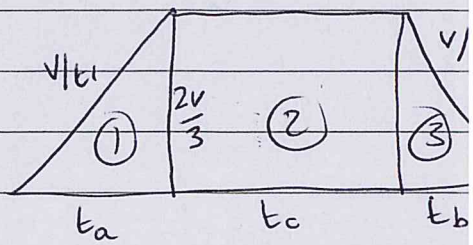
$3t + 3t_1 + 3t_2 = 2t_1 + 2t_2 + 4t$

$t_1 + t_2 = t$

(iii) $u = 0$, $v = V$, $a = a$, $s = vt_1/2$, $t = t_1$

$V = at_1$, $\frac{V}{t_1} = a$

$b = \frac{V}{t_2}$



③ $u = V/t_2$, $v = 2V/3$, $a = V/t_2$, $s =$, $t = t_b$

~~total time~~

② $u = 0$, $v = 2V/3$, $a = V/t_1$, $s =$, $t = t_a$

$\frac{2V}{3} = V : t_a$, $\frac{}{t_1}$

$t_a = \frac{2t_1}{3}$ $t_b = \frac{2t}{3}$

(iii)

Total distance $= \frac{1}{2}(ta)\frac{2v}{3} + \frac{1}{2}(tb)\frac{2v}{3} + tc.\frac{2v}{3}$

$= v\left(\frac{ta}{3} + \frac{tb}{3} + \frac{2tc}{3}\right) = v\left(\frac{2t_1}{9} + \frac{2t_2}{9} + \frac{6tc}{9}\right)$

$= \frac{v}{9}\left(2(t_1+t_2) + 6tc\right) = \frac{v}{9}(2t + 6tc)$

From (ii) total distance $= \frac{vt_1}{2} + \frac{vt_2}{2} + vt$

$= \frac{v(t_1+t_2)}{2} + vt = \frac{vt}{2} + vt = \frac{3vt}{2}$

same distance in (ii) and (iii) so:

$\frac{3vt}{2} = \frac{v}{9}(2t + 6tc)$

$27t = 4t + 12tc \Rightarrow tc = \frac{23t}{12}$

Total time $= \frac{23t}{12} + ta + tb = \frac{23t}{12} + \frac{2(t_1+t_2)}{3}$

$= \frac{23t}{12} + \frac{2t}{3} = \frac{31t}{12}$

2010

(1.) (a.) $u = 14$ m/s

$v = 0$

$a = ?$

$s = 98$

$t =$

$0^2 = 14^2 + 2a(98)$

$a = -1$ m/s^2

if driver hesitates 1s he travels another 14 m

$u = 14$

$v = 0$

$a = ?$

$s = 84$

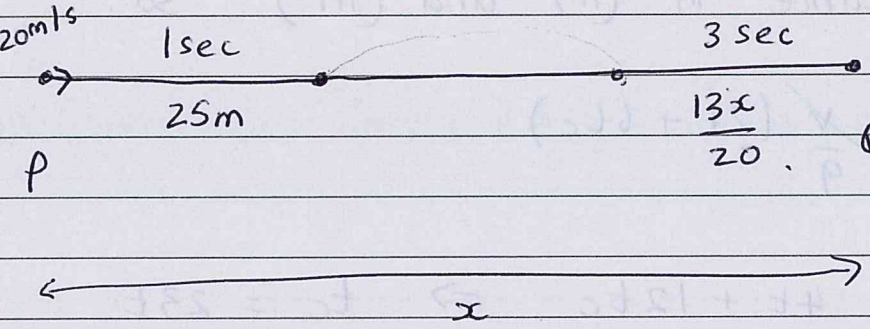
$t =$

$0^2 = 14^2 + 2a(84)$

$0 = 196 + 168a$ ← (*) be careful

$a = \frac{196}{168} - 1.16$ secs

(1.) (b.)



(*) look at whole question not part

$u = 20$

$v =$

$a =$

$s = 25$

$t = 1$

$25 = 20 + \frac{a}{2}$

$a = 10$m/s

$u = \sqrt{400 + 7x}$

$v =$

$a = 10$

$s = \frac{13x}{20}$

$t = 3$

$u = 20$

$v =$

$a = 10$

$s = 7x/20$

$t =$

$V^2 = 400 + 20 \cdot \frac{7x}{20}$

$V^2 = 400 + 7x$

$\frac{13x}{20} = 3\sqrt{400+7x} + 5(9)$

$\frac{13x - 900}{20} = \sqrt{400+7x}$

$169x^2 - 23400x + 810000 = 400 + 7x$

$169x^2 - 26200x + 850000 = 0$

$$\frac{13x-900}{60} = \sqrt{400+7x}$$

$$\frac{169x^2 - 23400x + 810000}{3600} = 400+7x$$

$$169x^2 - 23400x + 810000 = 1440000 + 25200x$$

$$169x^2 - 48600x - 630000 = 0$$

Ans: $x = 300\ m$.

2009 Q1(a)

P1	P2
$u = u$	$u = 0$
$v = v$	$v = v$
$a = -9.8$	$a = 9.8$
$s = S_{rp}$	$s = S_{rq}$
$t = 2$	$t = 2$

$v = u - 9.8(2)$

$u = v + 19.6$

$v = 0 + 9.8(2)$

$v = 19.6$

$S_{rp} = (v + 19.6)2 - 4.9(4)$ → So $19.6 = \frac{S_{rp} - 19.6}{2}$

$S_{rp} = 2v + 39.2 - 19.6$

$S_{rp} = 2v + 19.6$

$39.2 = S_{rp} - 19.6$

$58.8 = S_{rp}$

$v = \frac{S_{rp} - 19.6}{2}$

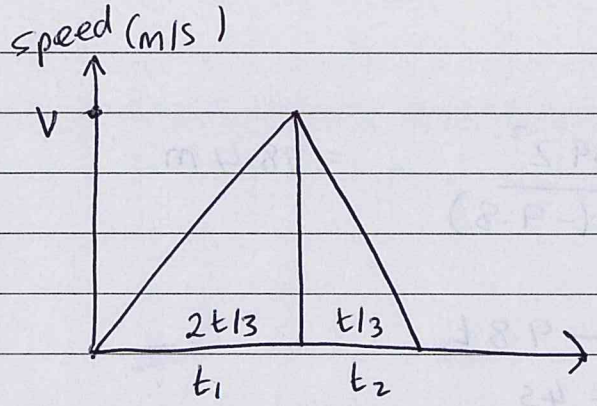
P2: $S_{rq} = \left(\frac{u+v}{2}\right)t$

$S_{rq} = \left(\frac{0 + 19.6}{2}\right)2 = 19.6$

So $\frac{S_{rp}}{S_{rq}} = \frac{58.8}{19.6} = 3.$

(*)

2009 Q1 (b)



$t_1 : t_2 = 2 : 1$

so $t_1 = 2t/3$, $t_2 = t/3$

(t = total time)

$$\frac{\text{Total distance}}{\text{total time}} = \frac{d}{t} = \sqrt{\frac{d}{3}} \quad \Rightarrow \frac{d^2}{t^2} = \frac{d}{3}$$

$$d = \frac{t^2}{3}$$

also d = area of $\triangle$ $= \frac{1}{2}(t)V$

$u = 0$

$v = V$ $\quad V = 0 + f \cdot \frac{2t}{3}$

$a = f$

$s =$ $\quad V = \frac{2ft}{3}$ $\quad$ so $d = \frac{1}{2}(t)\left(\frac{2ft}{3}\right)$

$t = 2t/3$

$$d = \frac{2ft^2}{3}$$

since $\frac{t^2}{3} = d \quad \Rightarrow \quad d = 2fd$

$$\frac{d}{d} = f = 1$$

(*) (*) check times !!! displaceme !!! not distra

2008 : Q1 (a)

$u = 39.2$

$v = 0$

$a = -9.8$

$s =$

$t =$

$s = \frac{-39.2^2}{2(-9.8)} = 78.4\ m$

$0 = 39.2 - 9.8t$

$t = 4s$

so, for final sec:

$u = 0$

$v =$

$a = 9.8$

$s =$

$t = 1$

$s = 4.9(1)^2 = 4.9m$

$78.4 + 4.9 = 83.3m$

OR

$u = 39.2$

$v =$

$a = -9.8$

$s =$

$t = 5$

$s = (39.2)(5) - 4.9(25$

$= 73.5$

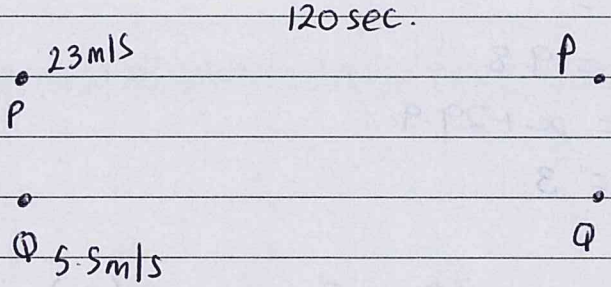
$78.4 - 73.5 = 4.9$

$78.4 + 4.9 = 83.3\ m$

2008

1 (b)

(*) equal speeds shortest dist between them.



P: $u = 23$, $v =$, $a =$, $s = 4260$m, $t = 120$

Q: $u = 5.5$, $v = 65.5$, $a =$, $s =$, $t = 120$

$s = \left(\frac{5.5 + 65.5}{2}\right)120 = 4260$m.

$4260 = 23(120) + a(7200) \Rightarrow a = \frac{5}{24}$ m/s²

$v^2 = 23^2 + 2\left(\frac{5}{24}\right)(4260)$

$65.5 = 5.5 + a(120)$

$60 = a(120)$

$\frac{1}{2} = a$ m/s²

$v^2 = 2304$, $v = 48$ m/s

Moving at equal speeds:

P: $u = 23$, $v = v$, $a = 5/24$, $s =$, $t = t$

Q: $u = 5.5$, $v = v$, $a = \frac{1}{2}$, $s =$, $t = t$

$v = 23 + \frac{5t}{24} = 5.5 + \frac{t}{2}$

$552 + 5t = 132 + 12t$

$420 = 7t$

$60 = t$

$s_p = 23t + \frac{5t^2}{48}$ $s_q = 5.5t + \frac{t^2}{4}$

$s_p - s_q = 17.5t - 7t^2/48$

2007

(*) ' In 2nd Second etc. '

1(a): $u = u$ $\quad$ $u = u$

$V =$ $\quad$ $V =$

$a = 9.8$ $\quad$ $a = 9.8$

$s = x$ $\quad$ $s = x + 29.9$

$t = 2$ $\quad$ $t = 3$

$x = 2u + 4.9(4)$ $\quad$ $x + 29.9 = 3u + 4.9(9)$

$x = 2u + 19.6$ $\quad$ $x = 3u + 14.2$

$2u + 19.6 = 3u + 14.2$

$u = 5.4$ m/s

$u = 5.4$

$V =$

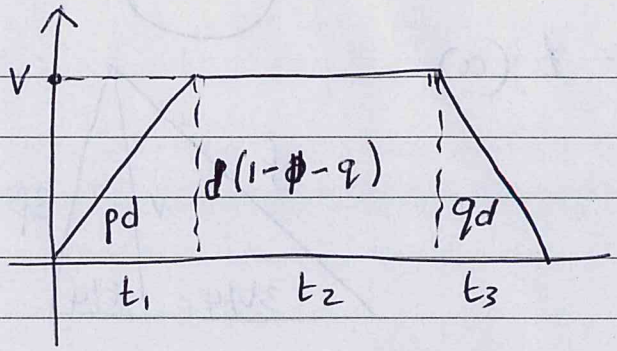
$a = 9.8$ $\quad$ $h = 5.4(4) + 4.9(16)$

$s = h$ $\quad$ $h = 100m$

$t = 4$

2007 (*) def do (!!!)

1 (b.) $u = 0$
$v = V$
$a =$
$s =$
$t =$



$$\frac{d}{t_1 + t_2 + t_3} = \frac{V}{p+q+b} \qquad = \frac{d}{t} \qquad pd + qd + bd = vt$$

$$\frac{\frac{t_1 V}{2} + t_2 V + \frac{t_3 V}{2}}{t_1 + t_2 + t_3} = \frac{V}{p+q+b}$$

$$vt_1 + vt_2 + vt_3 = pd + qd + bd$$

~~$\frac{vt_1}{2} + vt_2 + \frac{vt_3}{2} = d$~~

$$\frac{d}{t} = \frac{v}{p+q+b} \qquad vt = pd + qd + bd$$

$$vt_1 + vt_2 + vt_3 = pd + qd + bd$$

but $pd = \frac{vt_1}{2}$ so $2pd = vt_1$

$qd = \frac{vt_3}{2}$ so $2qd = vt_3$

and $vt_2 = d - pd - qd$ so

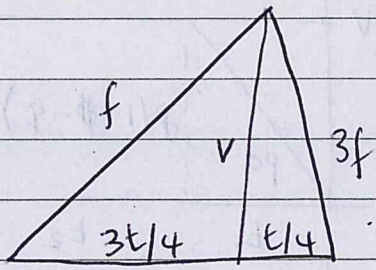
$vt_1 + vt_2 + vt_3 = 2pd + 2qd + d - pd - qd$

$vt_1 + vt_2 + vt_3 = pd + qd + d = pd + qd + bd$

so $b = 1$

(*!!) Train lengths / passing ↓

2006 : 1 (a)

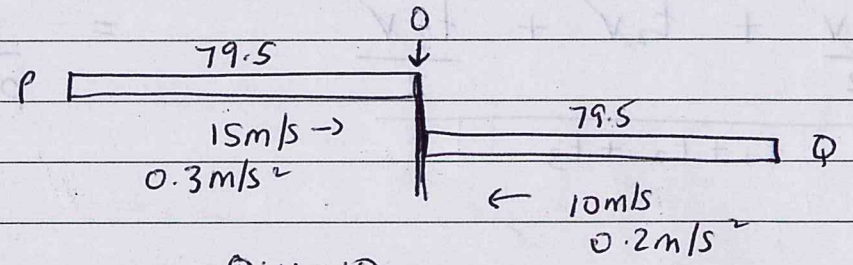


$u = 0$
$v = v$ $\quad V = \frac{3ft}{4}$
$a = f$
$s =$
$t = \frac{3t}{4}$

$d = \frac{1}{2}(t)(v)$

$d = \left(\frac{1}{2}\right)\left(\frac{3ft}{4}\right) = \frac{3ft^2}{8}$

2006 : 1 (b)



$S_p + S_q = 159m$

P: $u = 15m/s$
$v =$
$a = 0.3$
$s = S_p$
$t = t$

Q: $u = 10$
$v =$
$a = 0.2$
$s = S_q$
$t = t$

$S_q = 10t + 0.1t^2$

$S_p = 15t + \frac{0.3t^2}{2} + S_q = 25t + 0.25t^2 = 159$

$2.5t^2 + 250t - 1590 = 0$
$25t^2 + 2500t - 15900 = 0$

~~6182 secs~~
$t = 6$ secs

(iii) Can be done w/o (ii)

(A)

$\frac{2}{5}$ of $79.5 = 31.8m$ $\quad (15.9)$

$u = 10$
$v =$
$a = 0.2$
$s = 31.8$
$t = ?$

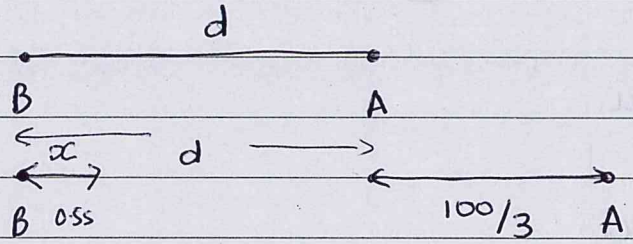
$31.8 = 10t + 0.1t^2$
$0.1t^2 + 10t - 31.8 = 0$
$t^2 + 100t - 318 = 0$

$t = 3.08s.$

2005 1(a) (!!) V.I.P.

A: $u = 20$, $v = 0$, $a = -6$

$$s = \frac{0^2 - 400}{-12} = \frac{100}{3}\text{m}$$



Car B not to collide means x + B's stopping distance $< \frac{100}{3} + d$

B's stopping distance: $u = 20$, $v = 0$, $a = -3$

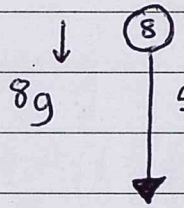
$$s = \frac{0^2 - 400}{6} = \frac{200}{3}\text{m}$$

x = what B travels in 0.5s before he starts to brake:

$20 \times 0.5 = 10$m. So $10 + \frac{200}{3} < \frac{100}{3} + d$

$130/3 < d$ $\quad d_{min} = 43.\dot{3}$

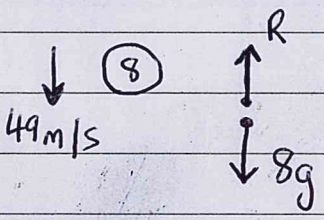
1(b) (!!!) V.I.P. (mass) (Force)



$u = 0$, $v =$, $a = 9.8$, $s =$, $t = 5$

$v = 0 + 9.8(5)$

$v = 49$m/s



$u = 49$, $v = 0$, $a =$, $s =$, $t = 0.01$

$0 = 49 - 0.01a$

$\frac{49}{0.01} = a = 4900\text{ m/s}^2$

$F = ma = 39200$N

$39200 = R - 8g$

$39200 + 8g = R$

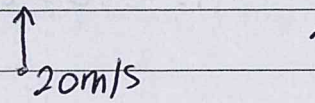
$39278.4\text{N} = R$

(*) can do w/o previous!

$$s = \left(\frac{49+0}{2}\right)(0.01) = 0.245\text{m}$$

2004 Q1 (a) !!! (!!) Distance Vs Displacement

no assumptions!



$u = 20$	$u = u$
$v =$	$v =$
$a = -9.8$	$a = -9.8$
$s = s$	$s = s$
$t =$ ~~3~~	$t =$ ~~4 & 3~~ 2

$s = 20t - 4.9t^2$

$20t - 4.9t^2$

$20t =$

$s = ut - 3u - 4.9t^2 + 6(4.9)t - 9($

$= ut - 3u - 4.9t^2 + 29.4t - 44.$

$4t - 3u + 29.4t - 44.1$

$s = 60 - 4.9(9)$

$= 60 - 44.1 = 15.9\,m$

$s = u(2) - 4.9(4)$

$= 2u - 19.6$

$35.5 = 2u$

$17.75 = u$

Distance travelled : Ball 2 = 15.9m?

Ball 1 = ?

need to find greatest height for ball 1 :

$u = 20$

$v = 0$

$a = -9.8$

$s = s$

$t = ?$

$0 = 400 - 19.6s$

$\frac{400}{19.6} = s = 20.41$

$20.41 + 20.41 - 15.9$

$= 24.92\,m$ (25)!

Ball 2 : $u = 17.75$

$v = 0$

$a = -9.8$

$s =$

$t =$

$0 = 17.75^2 - 2(9.8)s$

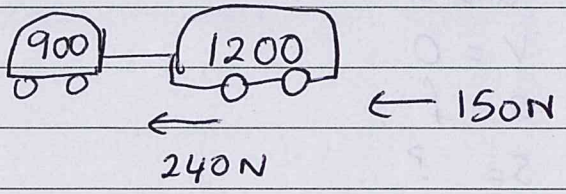
$s = 16.07$

$S = 16.07 + 16.07 - 15.9 = 16.24$

(16)!

2004 1(b) (!!!) Force! Q

(Uniform Speed !!) ∴ F = 0

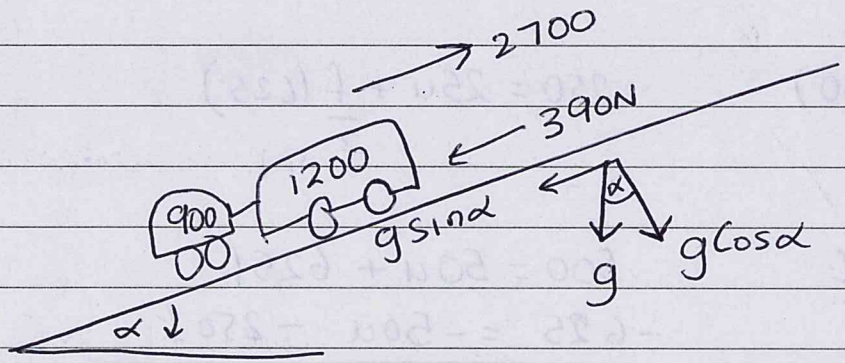


$\rightarrow$

$F = 2700N - 390N$

$F = 2310N$

$f = \frac{2310}{2100} = 1.1 m/s^2$



$390 + 2100g\sin\alpha = 2700$

$2100g\sin\alpha = 2310$

$\sin\alpha = \frac{2310}{2100g} = 0.1122$

$\alpha = 6.44°$

Uniform speed up hill!

2003: Q1 (a) V.I.P. Passing posts(!!) (*)

$u = u$	$u = u$	$u = u$
$v =$	$v =$	$v = 0$
$a = f$	$a = f$	$a = f$
$s = 125$	$s = 250$	$s = ?$
$t = 10$	$t = 25$	$t =$

(i)

$$125 = 10u + \frac{f}{2}(100) \qquad 250 = 25u + \frac{f}{2}(625)$$

$$625 = 50u + 250f \qquad 500 = 50u + 625f$$

$$-625 = -50u - 250f$$

$$-125 = 375f$$

$$-1/3 = f \text{ , } 10u = 125 + \frac{50}{3}$$

$u = 14.16 \text{ m/s} = 425/3$

(ii) $u = u = 14.16 \text{ m/s}$

$v = 0$

$a = f = -1/3$

$s =$

$t =$

~~$s = \frac{(u+v)}{2}t$~~

$$0 = \left(\frac{425}{3}\right)^2 - 2\left(\frac{1}{3}\right)s$$

$$s = \left(\frac{425}{3}\right)^2 \times \frac{3}{2} = 301.04 \text{ m}$$

(*) Ans the Q!!! or (-5 marks)

Ans : $301.04 - 250 = 51.04$

1(b) (!!!) Just catches Closest distance (!!) (*)

$S_m = Vt = 20V$ $S_{bus} = ?$ $u = 0$

$v = V_m$

$a =$

$s =$

$t = 20$

$S_m - 40 = S_{bus}$ $S_{bus} = \left(\frac{0+V}{2}\right)20$

$20V - 40 = 10V$ $S_{bus} = 10V$

$10V = 40 \Rightarrow V = 4 m/s$ $a = 1/5 m/s$

(!) use a from (i)

(ii) $S_{man} = 3t$ $S_{bus} = ?$ $u = 0$

$v = V = 3$

$a = 1/5 m/s$

$s = vt/2 = 3t/2$

$t = t$

$S_{man} = 3(15)$ $3 = 0 + t/5$ $t = 15$ secs

$= 45m$

$S_{bus} = 45/2 = 22.5$

$S_{between} = -45 + 22.5 + 40$

$= 17.5$

OR

$S_{between} = S_b + 40 - S_m$

$= 40 + \frac{t^2}{10} - 3t$ ← different

$\frac{2t}{10} = 3t \Rightarrow t = 15$

$S_{man} - (S_{bus} + 40) = max$

$3t - \frac{1}{5}\left(\frac{1}{2}\right)t^2 + 40 = max$

$3t - \frac{t^2}{10} + 40 = max$ $-\frac{t}{5} = 3$ $t = 15$

17.5m

(∴) negative displacement

2002: Q1 (a.)

$u = u$

$v =$

$a = -9.8$

$s = -30$

$t = 5$

$-30 = 5u - 4.9(25)$

$5u = {}^{185}/_{2}$

$u = 18.5$

$v = 18.5 - 9.8(5)$

$v = 30.5 \downarrow$

2002 Q1(b) Passing Posts (!!)(!)

$u = u$	$u = a$	$u = u$
$v =$	$v =$	$v =$
$a = a$	$a = a$	$a = a$
$s = p$	$s = q + p$	$s = q + p + r$
$t = t$	$t = 2t$	$t = 3t$

$p = ut + \frac{at^2}{2}$ $\quad q+p = 2ut + \frac{a(4t^2)}{2}$

$p = ut + \frac{at^2}{2}$ $\quad q+p = 2ut + 2at^2$ $\quad q+p+r = 3ut + \frac{9t^2}{2}$

$q = 2ut + 2at^2 - ut - \frac{at^2}{2} = ut + \frac{3at^2}{2} = q$

$2q = 2ut + 3at^2$

$r = 3ut + \frac{9at^2}{2} - 2ut - 2at^2 = ut + \frac{5at^2}{2} = r$

$2q = p + r$? $\quad 2ut + 3at^2 = ut + \frac{at^2}{2} + ut + \frac{5at^2}{2}$

$= 2ut + 3at^2$ ✓

(ii)

$u = u$

$v =$

$a = a$

$s = p + q + r + x$

$t = 4t$

$p + q + r + x = 4ut + \frac{a(16t^2)}{2} = 4ut + 8at^2$

$x = 4ut + 8at^2 - 3ut - \frac{9at^2}{2} = 4ut + \frac{7at^2}{2} = 2r - q$

$$2r = 6ut + 9at^2$$
$$-q = -2ut - \frac{3}{2}at^2$$
$$4ut - 7at^2$$

$$2r = 2ut + \frac{5at^2}{2}$$
$$q = ut + \frac{3at^2}{2}$$
$$2r - q = ut + \frac{7at^2}{2} = x$$