Nov 2004 Q6

B $\longrightarrow$ $u=20$, $a=4$

A $\longrightarrow$ $u=30$ (constant speed $\therefore a=0$)

$t=0$

a) $s=78$
$u=20$
$v=?$
$a=4$
t

$v^2=u^2+2as$
$v^2=20^2+2(4)(78)$
$v^2=1024$
$v=\sqrt{1024}$
$=32\ ms^{-1}$

b) We need to find the time when B is 78m from O

$s=78$
$u=20$
$v=32$
$a=4$
$t=?$

$v=u+at$
$32=20+4t$
$12=4t$
$t=3\ s$

Note: Careful here! constant speed means acceleration is 0 since acceleration is rate of change of velocity

Distance travelled by A $=30\times3$
$=90m$

(Speed $=\frac{\text{Distance}}{\text{time}}$)

OR Using $s=ut+\frac{1}{2}at^2$

Since $a=0 \Rightarrow \boxed{s=ut}$

c) At the time of overtaking, distance travelled by A and B would be the same since they both were side by side when $t=0$

let "t" be the time when B overtakes A

Distance travelled by A, $S_A=30\times t$
$=30t$ (speed $=\frac{\text{distance}}{\text{time}}$ OR $s=ut$)

Distance travelled by B, S_B : Using $s=ut+\frac{1}{2}at^2$

$S_B=20t+\frac{1}{2}(4)t^2$
$S_B=20t+2t^2$

$s=S_B$
$u=20$
v
$a=4$
$t=t$

Since $S_A=S_B$

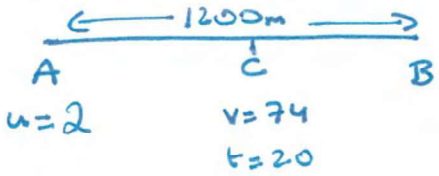
$30t=20t+2t^2$

$2t^2-10t=0$ $\quad t=0$ or $5s$

Question 2: Jan 05 Q6

Question Number		Scheme	Marks
6	(a)	$16^2 = 20^2 - 2 \times a \times 24 \Rightarrow a = \underline{3 \text{ m s}^{-2}}$	M1 A1 (2)
	(b)	$v^2 = 20^2 - 2 \times 3 \times 30$	M1 A1√
		$v = \underline{\sqrt{220} \text{ or } 14.8 \text{ m s}^{-1}}$	A1 (3)
	(c)	$0.3 = m \times 3 \Rightarrow m = 0.1 \text{ kg}$ (*)	M1 A1 (2)
	(d)	$0.1(w + \sqrt{220}) = 2.4$	M1 A1√
		$w = 9.17$	A1 ↓
		$0 = 9{,}17 - 3 \times t$	M1 A1√
		$t \approx \underline{3.06 \text{ s}}$	A1 (6)

June 05 Q1



a) From A to C

s
u = 2
v = 74
a = ?
t = 20

$v = u + at$

$74 = 2 + 20a$

$72 = 20a$

$a = 3.6\,s$

b) We need to find distance AC first

s = ?
u = 2
v = 74
a =
t = 20

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

$= \left(\frac{2+74}{2}\right)20$

$= 760\,m$

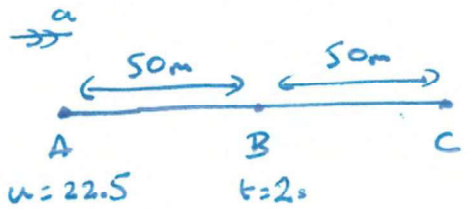
Since distance AB = 1200m

∴ Distance BC = 1200 − 760

= 440m

It makes more sense to use this suvat equation as it involves using original values. Using another suvat equation would mean using 'a' from calculations in part (a) which would make your answer wrong in part (b) if your answer to part (a) was wrong!

June 06 Q3



a) $s = 50$
$u = 22.5$
$v =$
$a = ?$
$t = 2$

$s = ut + \frac{1}{2}at^2$

$50 = 22.5(2) + \frac{1}{2}a(2)^2$

$50 = 45 + 2a$

$5 = 2a$

$a = 2.5\ ms^{-2}$ ←

, When it passes C, the train would have travelled a distance of 100m

$s = 100$
$u = 22.5$
$v = ?$
$a = 2.5$
t

$v^2 = u^2 + 2as$

$v^2 = (22.5)^2 + 2(2.5)(100)$

$v^2 = 1006.25$

$v = \sqrt{1006.25}$ *Taking +ve value of v only

$= 31.721\ ms^{-1}$

$= 31.7\ ms^{-1}$ ← (3 s.f)

) Finding the time when the train passes C

s
$u = 22.5$
$v = 31.721....$
$a = 2.5$
$t = ?$

$v = u + at$

$31.721 = 22.5 + (2.5)t$ *Use the full value for 'v' from calculator from previous calculations to avoid accuracy error!

$2.5t = 9.221....$

$t = 3.688\ s$

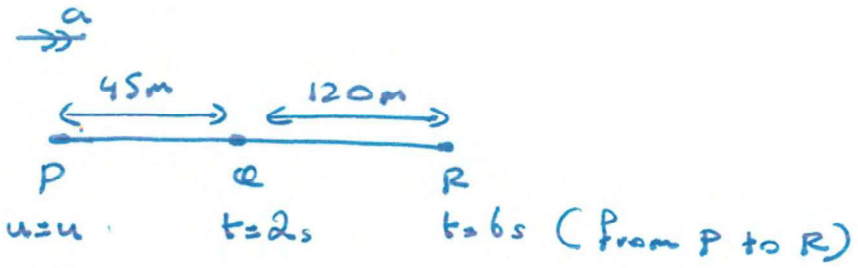
∴ Time to get from B to C

$= 3.688 - 2$

$= 1.688$

$= 1.69\ s$ ← (3 s.f)

June 09 Q1



From P to Q

$s = 45$
$u = u$
$v = ?$
$a = a$
$t = 2$

$s = ut + \frac{1}{2}at^2$

$45 = 2u + \frac{1}{2}a(2)^2$

$45 = 2u + 2a$

$45 - 2u = 2a$ —— (1)

from Q to R

$s = 165$ $(120+45)$
$u = u$
$v = ?$
$a = a$
$t = 6$

$s = ut + \frac{1}{2}at^2$

$165 = u(6) + \frac{1}{2}a(6)^2$

$165 = 6u + 18a$

$165 - 6u = 18a$ —— (2)

(1) $\times 9 \Rightarrow 405 - 18u = 18a$

(2) $\Rightarrow 165 - 6u = 18a$ (−)

$240 - 12u = 0$

$u = \frac{240}{12}$

$u = 20\ ms^{-1}$ ←

Solving both (1) & (2) simultaneously

* Eliminating 'a'

ii) Sub $u=20$ in (1)

$\therefore 45 - 2(20) = 2a$

$45 - 40 = 2a$

$5 = 2a$

$a = 2.5\ ms^{-2}$ ←