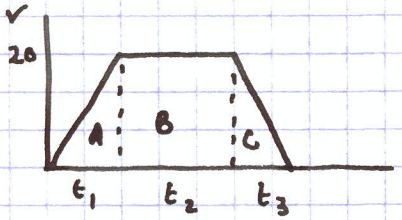
APPIED MATHS 2001

QUESTION ONE



A		B		C	
$u = 0$	$v = u + at$	u 20		u 20	$t = \frac{v-u}{a}$
$v = 20$	$t = \frac{v-u}{a}$	v 20		v 0	
$a = 1$		a 0		a -2	$t = \frac{0-20}{-2}$
$s =$	$t = \frac{20}{1}$	s		s	
$t = ?$		t t_2		t ?	$t = 10$
	$t = 20$				

$$1200 = \tfrac{1}{2}.20.20 + 20.t_2 + \tfrac{1}{2}.10.20$$

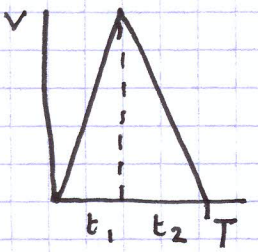
$$1200 = 200 + 20t_2 + 100$$

$$900 = 20t_2$$

$$45 = t_2$$

total time = 75m

No speed limit:



$$t_1 : t_2 = 2 : 1$$

$$t_1 : t_2 = \tfrac{2}{3} : \tfrac{1}{3} \qquad t_1 = \tfrac{2}{3}T \qquad t_2 = \tfrac{1}{3}t$$

acceleration:

u 0	$v = u + at$	
v	$v = \frac{2}{3}T$	$\Rightarrow \quad 1200 = \frac{1}{2}.T.\frac{2}{3}T$
a 1		
s		$1200 = \frac{T^2}{3}$
t_1 $\frac{2}{3}T$		$3600 = T^2$
		$60 = T$

b.

A		B	
u	u	u	u
v		v	
a	-g	a	-g
s	s	s	s
t	t	t	t-T

A: $s = ut + \tfrac{1}{2}.-g.t^2$

B: $s = u(t-T) + \tfrac{1}{2}.-g(t-T)^2$

$(t^2 - 2tT + T^2)$

$$ut - \tfrac{1}{2}gt^2 = ut - uT - \tfrac{1}{2}gt^2 + tgT - \tfrac{1}{2}gT^2$$

$$tgT = \tfrac{1}{2}gT^2 + uT$$

$$t = \frac{gT^2}{2gT} + \frac{uT}{gT}$$

$$t = \frac{T}{2} + \frac{u}{g}$$

$$s = u\left(\frac{T}{2} + \frac{u}{g}\right) + \tfrac{1}{2}.-g\left(\frac{T}{2} + \frac{u}{g}\right)^2 \qquad \left(\frac{T^2}{4} + \frac{2Tu}{2g} + \frac{u^2}{g^2}\right)$$

$$s = \frac{uT}{2} + \frac{u^2}{g} - \frac{T^2 g}{8} - \frac{Tug}{2g} - \frac{gu^2}{2g^2}$$

$$s = \frac{4guT + 8u^2 - T^2g^2 - 4Tug - 4u^2}{8g}$$

$$s = \frac{4u^2 - g^2T^2}{8g}$$