

13) a) $a = \frac{\Delta v}{t} = \frac{v-u}{t} = \frac{0-12}{60} = -0.2 \text{ ms}^{-2}$

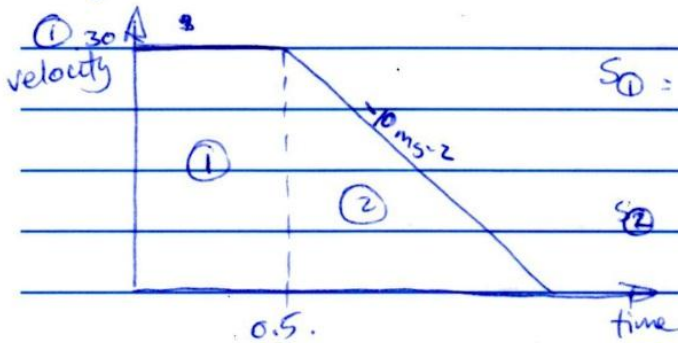
b) from 0-2 mins; $s = \text{Area} = 12 \times 120 = 1440 \text{m}$

from 2-3 mins; $s = \text{Area} = (12 \times 60) \times 0.5 = 360 \text{m}$

Total = $1440 + 360 = 1800 \text{m}$

c) $\bar{v} = \frac{s}{t} = \frac{1800}{180} = 10 \text{ ms}^{-1}$

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$s_{(1)} = \text{Area} = 30 \times 0.5 = 15 \text{m}$ / $v = \frac{s}{t}$ $s_{(1)} = v \times t$

$s_{(1)} = 30 \times 0.5 = 15 \text{m}$

$s_{(2)} = \frac{u+v}{2} t$ Don't have t .

$v = u + at$

$\frac{v-u}{a} = t = \frac{0-30}{-10} = 3 \text{s}$

so $s_{(2)} = \frac{u+v}{2} t = \frac{30+0}{2} \times 3 = 45 \text{m}$.

$s_{(1)} + s_{(2)} = 15 + 45 = 60 \text{m}$

∴ pedestrian gets run over. Oh dear, isn't physics morbid?

2) a) cheetah: $a = \frac{\Delta v}{t} = \frac{v-u}{t} = \frac{20-0}{2} = 10 \text{ ms}^{-2}$

b) i) ~~Max speed = 30 ms⁻¹ need time. v = u + at~~

Max speed = $v = 30 \text{ ms}^{-1}$ need time. $v = u + at$

ii)

$t = \frac{v-u}{a} = \frac{30-0}{10} = 3 \text{s}$

so $s = \frac{u+v}{2} t = \frac{0+30}{2} \times 3$

$= 45 \text{m}$

c) $v = 30 \text{ ms}^{-1}$ $s = 450 \text{m}$ $t = ?$ $v = \frac{s}{t}$

$t = \frac{s}{v} = \frac{450}{30} = 15 \text{s}$

d) Antelope: $v = 22 \text{ ms}^{-1}$ $a = 10 \text{ ms}^{-2}$ $t = ?$

~~Area~~ $a = \frac{\Delta v}{t}$ $t = \frac{\Delta v}{a} = \frac{v-u}{a} = \frac{22-0}{10} = 2.2 \text{s}$

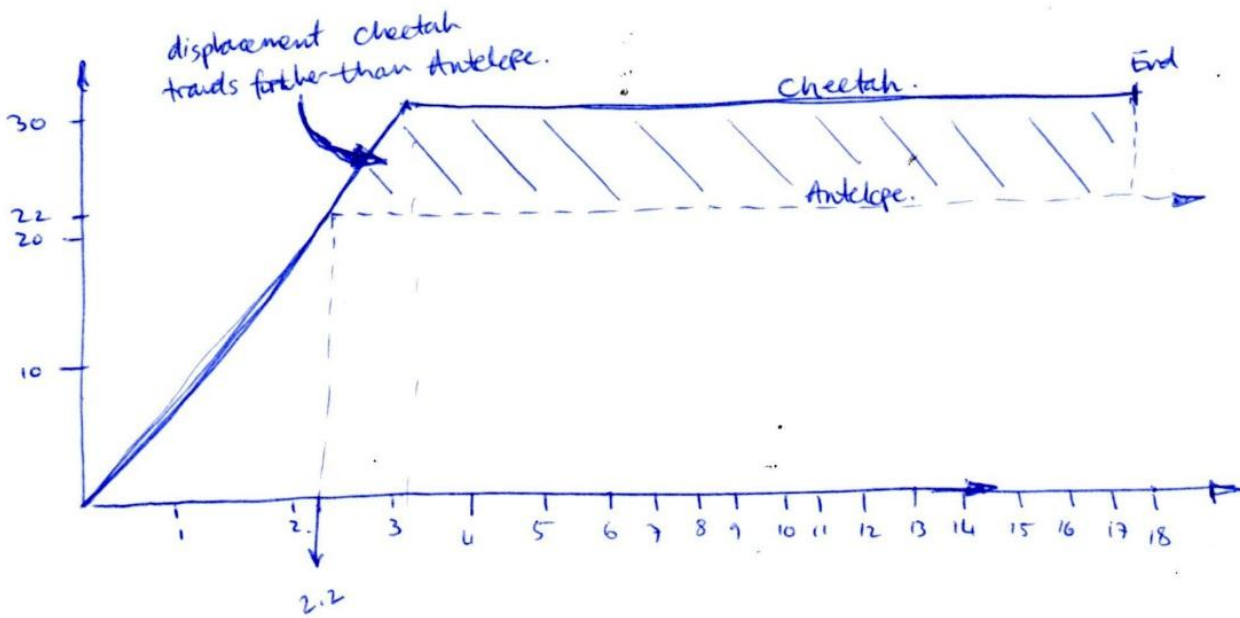
So antelope accelerates for 2.2s THEN travels at 22 ms^{-1} for $(15 - 2.2 =) 12.8 \text{s}$.

During acceleration: $s = \frac{u+v}{2} t = \frac{0+22}{2} \times 2.2 = 24.2 \text{m}$

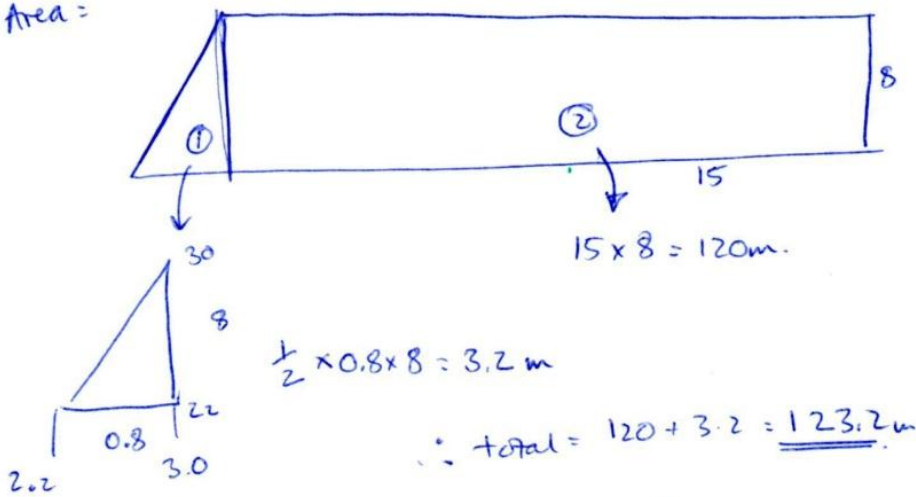
During const-velocity: $s = vt = 22 \times 12.8 = 281.6 \text{m}$

Total = 305.8m





So Area =



So, when a cheetah accelerates and runs (for 18 seconds) it travels 123.2m MORE than an antelope. This means the cheetah must give ~~the~~ antelope LESS than a 123.2m headstart if it wants to catch it.