- A car is travelling at a constant speed of ~~8~~ 7~~0~~ km/hr. Over the next ~~150~~ ⑯ km, the car constantly accelerates and reaches a speed of 80 km/hr. Find the acceleration.

Soln: Let a be the acceleration, $v(t)$ be the velocity at time t, $s(t)$ be the distance travelled in time t. where ~~$s(t)=$~~ time starts when acceleration starts.

So, $s(0)=0$; $v(0)=70$.

$$v(t) = \int a\, dt = at + C.$$

$70 = v(0) = C.$

Thus, $v(t) = at + 70$.

$$s(t) = \int v(t)\, dt = \frac{at^2}{2} + 70t + D.$$

$0 = s(0) = D.$

~~$\textcircled{s}(t) = \frac{at^2}{2} + \textcircled{D}$~~

$s(t) = \frac{at^2}{2} + 70t$.

At what time is $v(t) = 80$?

$80 = at + 70$

$\Rightarrow \dfrac{10}{a} = t$.

At this time, $s(t) = 150$.

$$150 = \frac{a}{2} \cdot \frac{100}{a^2} + 70 \cdot \frac{10}{a} = \frac{50}{a} + \frac{700}{a} = \frac{750}{a}$$

$$\Rightarrow a = \frac{750}{150} = 5.$$