

**Mathematics Questions by Topics**

Motion and Force

Question 23

Source: K13SM2Q12

**Question 23**

A car of mass  $m$  kg is travelling on a level roadway. The engine exerts a constant propulsive force of  $F$  newtons and the total resistance to the motion of the car is  $kv$  newtons, where  $k$  is positive constant and  $v$  is its speed in m/s. The car moves from rest, and travels a distance of  $D$  metres until it obtains a speed of  $V$  m/s, in a time of  $T$  seconds.



Five students stated some relationships between the constants,  $m$ ,  $V$ ,  $k$ ,  $F$ ,  $D$  and  $T$ .

Alan stated that  $mV = (F - kV)T$       Ben stated that  $2mD = (F - kV)T^2$

Colin stated that  $\frac{1}{2}mV^2 = (F - kV)D$       David stated that  $D = \int_0^V \frac{mv}{F - kv} dv$

Edward stated that  $T = \int_0^V \frac{m}{F - kv} dv$

Then

- A. Alan, Ben and Colin are all correct.
- B. Alan and Colin are both correct.
- C. Only Colin is correct.
- D. David and Edward are both correct.
- E. Only Edward is correct.