Answer on Question#49316 - Math - Calculus

A car is traveling at 20m/s. The brakes are applied, producing a constant deceleration of 4m/s2 for 3 seconds. Then the brakes are released and the car continues to move with constant velocity. How far has the car traveled

a) Three seconds after the brakes began to be applied,

b) five seconds after the brakes began to be applied

Solution:

a) The displacement of the car can be expressed in the following way

$$s = v_0 t + \frac{a \cdot t^2}{2}$$

where v_0 is the initial speed, a is the acceleration, and t is the time. Substituting $v_0 = 20\frac{\text{m}}{\text{s}}$, $a = -4\frac{\text{m}}{\text{s}^2}$ (car was decelerating), and $t = 3\text{s}$ we obtain

$$s = 42\ \text{m}$$

b) Firstly, we should define the final speed of the car (after the breaks were released). It is given by

$$v = v_0 + a \cdot t$$

Substituting $v_0 = 20\frac{\text{m}}{\text{s}}$, $a = -4\frac{\text{m}}{\text{s}^2}$, and $t = 3\text{s}$ we obtain

$$v = 8\frac{\text{m}}{\text{s}}$$

Traveling with this speed for 2s (time after the breaks were released) leads to the displacement of $s_1 = 16\ \text{m}$. So the total displacement of the car after the breaks began to be applied is given by

$$S = s + s_1 = 58\text{m}$$

Answer: a) 42m; b) 58m.