Answer on Question#38486 – Physics - Mechanics | Kinematics | Dynamics

A plane with a speed of 75m/s is going to travel along a runway of 25km, If it makes an acceleration of 1.3(m/s)/s, will it use the runway safely? Justify your answer.

Solution:

$a = 1.3\frac{m}{s^2} - \text{decceleration of the plane;}$

$V_0 = 75\frac{m}{s} - \text{initial velocity of the plane;}$

Equation of motion for the plane for first distance d:

$$d = V_0 t - \frac{at^2}{2} \qquad (1)$$

Rate equation for the plane for this distance ($V_1 = 0 - \text{velocity after time t}$):

$$V_1 = V_0 - at$$

$$V_0 - at = 0$$

$$t = \frac{V_0}{a} \qquad (2)$$

$(2)\text{in}(1)$:

$$d = V_0 \cdot \frac{V_0}{a} - \frac{a\left(\frac{V_0}{a}\right)^2}{2} = \frac{V_0^2}{2a} = \frac{\left(75\frac{m}{s}\right)^2}{2 \cdot 1.3\frac{m}{s^2}} = 2160\text{m}$$

Answer: plane will use the runway safely (travelled distance $2.16\text{km} < 25\text{km}$).