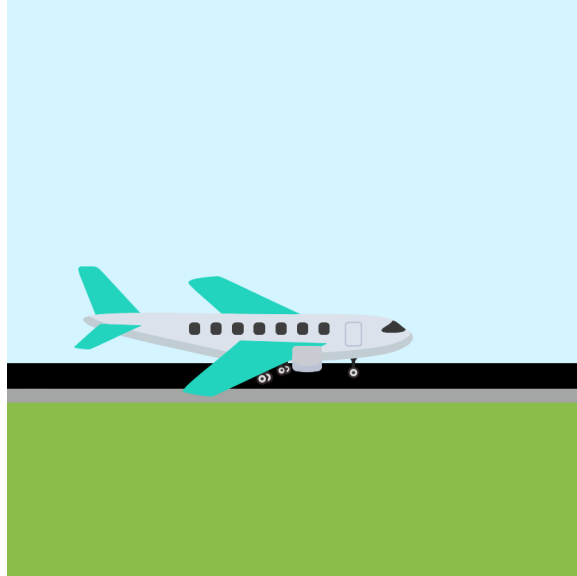


Acceleration of a Jet Transport



A jet transport with a landing speed of 270 km/h reduces its speed to 90 km/h with a negative thrust from its jet thrust reverses in a distance of $\Delta s = 625$ m along the runway with a constant deceleration. Compute the deceleration in m/s^2 of the jet.

Using known expressions (for arbitrary acceleration):

$$a = \frac{dv}{dt} \Rightarrow dt = \frac{dv}{a} \quad (1)$$

$$v = \frac{ds}{dt} \Rightarrow dt = \frac{ds}{v} \quad (2)$$

$$dt = \frac{dv}{a} = \frac{ds}{v} \Rightarrow v dv = a ds \quad (3)$$

$$\int_{v_0}^{v_1} v dv = \int_{s_0}^{s_1} a ds \quad (4)$$

Given:

Distance: $\Delta s = 625$ m

Initial velocity: $v_0 = 270 \text{ km/h} = 75 \text{ m/s}$

End velocity: $v_1 = 90 \text{ km/h} = 25 \text{ m/s}$

Solution:

Using Equation (4) for a constant acceleration a results in:

$$\int_{v_0}^{v_1} v \, dv = a \int_{s_0}^{s_1} ds \quad (5)$$

$$\left. \frac{1}{2} v^2 \right|_{v=v_0}^{v_1} = a s \Big|_{s=s_0}^{s_1} \quad (6)$$

$$\frac{1}{2}(v_1^2 - v_0^2) = a(s_1 - s_0) = a\Delta s \quad (7)$$

After substituting $\Delta s = 625$ m, $v_0 = 75$ m/s and $v_1 = 25$ m/s, this results in:

$$\frac{1}{2}(25^2 - 75^2) = a \cdot 625 \quad \Rightarrow \quad a = -4 \text{ m/s}^2 \quad (8)$$

Thus the acceleration is -4 m/s^2 . Meaning the deceleration, the final answer, becomes 4 m/s^2 .