Answer on Question#78929 - Physics - Other

A plane has a takeoff speed of 88.3 m/s and requires 1365 m to reach that speed. Determine the acceleration of the plane and the time required to reach this speed.

Solution:

The final and initial velocities v_f, v_i, acceleration a and distance d are related by the following expression

$$d = \frac{v_f^2 - v_i^2}{2a}$$

In our case $v_f = 88\ \text{m/s}$, $v_i = 0\ \text{m/s}$, $d = 1365\ \text{m}$, thus we have

$$a = \frac{v_f^2 - v_i^2}{2d} = \frac{\left(88\frac{\text{m}}{\text{s}}\right)^2 - \left(0\frac{\text{m}}{\text{s}}\right)^2}{2 \cdot 1365\ \text{m}} = 2.84\frac{\text{m}}{\text{s}^2}$$

The final and initial velocities v_f, v_i, acceleration a and time t are related by the following expression

$$v_f - v_i = at$$

Thus the time required to reach this speed:

$$t = \frac{v_f - v_i}{a} = \frac{88\frac{\text{m}}{\text{s}}}{2.84\frac{\text{m}}{\text{s}^2}} = 31\ \text{s}$$

Answer: acceleration: $2.84\frac{\text{m}}{\text{s}^2}$, time: 31 s.