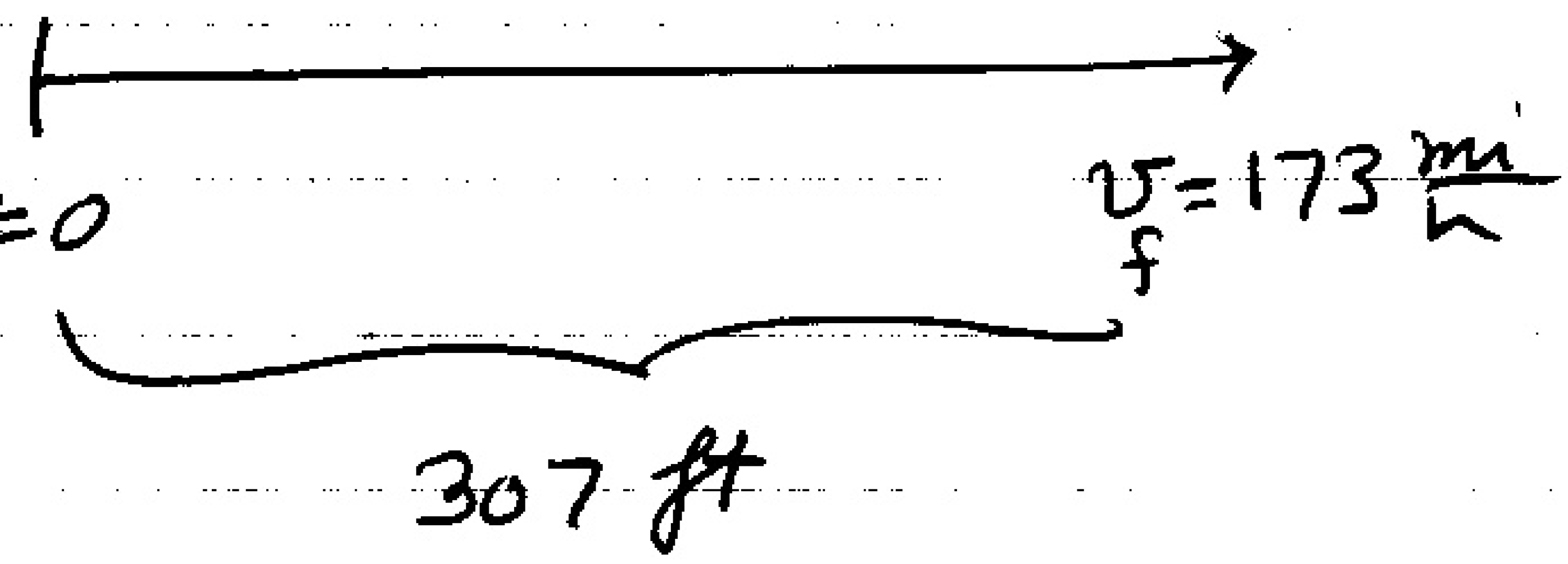
2.22

The aircraft undergoes constant acceleration over a known distance:



First, let's convert the quantities to MKS units

$$v_f = 173 \frac{mi}{hr}\left(\frac{1\,hr}{3600\,s}\right)\left(\frac{1609\,m}{1\,mi}\right) = 77.3 \frac{m}{s}$$

$$\Delta x = 307\,ft \left(\frac{0.3048\,m}{1\,ft}\right) = 93.5\,m$$

(a) Since the acceleration is constant, we can use the kinematic equations, and since we know the distance (but not the time) over which the acceleration occurred, it is simplest to use the "third" kinematic equation

$$v_f^2 = \cancelto{0}{v_0^2} + 2a\Delta x$$

Solving for a:

$$a = \frac{v_f^2}{2\Delta x} = \frac{(77.3 \frac{m}{s})^2}{2(93.5\,m)} = \boxed{31.9 \frac{m}{s^2}} \approx 3g$$

(b) Now, we want the time interval, so either of the first two kinematic equations may be used, but it is simplest to use the velocity equation

$\Delta v = at$ solve for t: $t = \frac{\Delta v}{a} = \frac{77.3 \frac{m}{s}}{31.9 \frac{m}{s^2}} = \boxed{2.42\,s}$

The displacement equation may be used in this case with equal ease because $v_0 = 0$. If this is not the case, a quadratic equation for the time interval must be solved.