71. (a) From Ch. 2, we have $v^2 = v_0^2 + 2a\Delta x$, where a may be interpreted as an average acceleration in cases where the acceleration is not uniform. With $v_0 = 0$, $v = 11000$ m/s and $\Delta x = 220$ m, we find $a = 2.75 \times 10^5\,\text{m/s}^2$. Therefore,

$$a = \left(\frac{2.75 \times 10^5\,\text{m/s}^2}{9.8\,\text{m/s}^2}\right) g = 2.8 \times 10^4 g$$

which is certainly enough to kill the passengers.

(b) Again using $v^2 = v_0^2 + 2a\Delta x$, we find

$$a = \frac{7000^2}{2(3500)} = 7000\,\text{m/s}^2 = 714g\ .$$

(c) Energy conservation gives the craft's speed v (in the absence of friction and other dissipative effects) at altitude $h = 700\,\text{km}$ after being launched from $R = 6.37 \times 10^6\,\text{m}$ (the surface of Earth) with speed $v_0 = 7000$ m/s. That altitude corresponds to a distance from Earth's center of $r = R + h = 7.07 \times 10^6\,\text{m}$.

$$\frac{1}{2}mv_0^2 - \frac{GMm}{R} = \frac{1}{2}mv^2 - \frac{GMm}{r}\ .$$

With $M = 5.98 \times 10^{24}\,\text{kg}$ (the mass of Earth) we find $v = 6.05 \times 10^3\,\text{m/s}$. But to orbit at that radius requires (by Eq. 14-41) $v' = \sqrt{GM/r} = 7.51 \times 10^3\,\text{m/s}$. The difference between these is $v' - v = 1.46 \times 10^3$ m/s, which presumably is accounted for by the action of the rocket engine.