4.1

a) $\begin{cases} x = A\omega t \\ y = A\sin\omega t \\ z = 0 \end{cases} \Rightarrow \begin{cases} v_x = A\omega \\ v_y = A\omega\cos\omega t \\ v_z = 0 \end{cases} \Rightarrow \begin{cases} a_x = 0 \\ a_y = -A\omega^2\sin\omega t \\ a_z = 0 \end{cases}$

b) $v^2 = A^2\omega^2(1+\cos^2\omega t)$ must be $< c^2$

but $1+\cos^2\omega t \in [1,2]$ $\forall t$

$\Rightarrow 2A^2\omega^2 < c^2 \Rightarrow A\omega < c/\sqrt{2}$.

c) Use eqs (4.4) but careful that the boost in the problem is along the z-axis. It's probably easier to ① relabel $z \to x$, $x \to y$, $y \to z$

② Apply (4.4) as it is since the boost is along the new x

③ relabel back $x \to z$ $y \to x$ $z \to y$

So:

① : $v_x = 0$ $\quad a_x = 0$

$v_y = A\omega$ $\quad a_y = 0$

$v_z = A\omega\cos\omega t$ $\quad a_z = -A\omega^2\sin\omega t$

(2) $a'_x = 0$ (since $a_x = 0$)

$a'_y = 0$ (since $a_y = 0$)

$$a'_z = \frac{a_z}{\gamma^2\left(1 - \frac{u v_x}{c^2}\right)} = \text{// } v_x = 0 \text{ , } \gamma = \frac{1}{\sqrt{1 - u^2/c^2}} \text{ //}$$

$$= -A\omega^2\left(1 - \frac{u^2}{c^2}\right)\sin\omega t$$

(3) transform back:

$$a'_x = 0$$

$$a'_y = -A\omega^2\left(1 - \frac{u^2}{c^2}\right)\sin\omega t$$

$$a'_z = 0 \text{ .}$$ //