2. a1) $\frac{\partial^2 w}{\partial t^2}$ where $w(x,t) = \sin(x+ct)$ $\quad \frac{d}{dx}\sin x = \cos x$ $\quad \frac{\partial^2 w}{\partial t^2} = c^2 \frac{\partial^2 w}{\partial x^2}$

$\frac{d}{dt}\left(\frac{d}{dt}\sin(x+ct)\right) = \frac{d}{dt}\cos(x+ct)\cdot c = -\sin(x+ct)\cdot c \cdot c = -c^2 \cdot \sin(x+ct)$

$\frac{d}{dx}\left(\frac{d}{dx}\sin(x+ct)\right) = \frac{d}{dx}\cos(x+ct) = -\sin(x+ct)\cdot 1 = -1^2 \cdot \sin(x+ct)$ $\Big\} =$ where $c = 1, -1$

2. a2) $v(x,t) = \sin(x+ct) + \cos(2x+2ct)$

$\frac{d}{dt}\left(\frac{d}{dt}\sin(x+ct) + \cos(2x+2ct)\right) = \frac{d}{dt}\left(c\cdot\cos(x+ct) - \sin(2x+2ct)\,2c\right) = c\frac{d}{dt}\cos(x+ct) - 2c\frac{d}{dt}\sin(2x+2ct)$

$= -c^2\left(\sin(x+ct) + 4\cos(2x+2ct)\right) \Rightarrow =$ for $c = 1, -1$

$\frac{d}{dx}\left(\frac{d}{dx}\sin(x+ct) + \cos(2x+2ct)\right) = \frac{d}{dx}\left(\cos(x+ct) - 2\sin(2x+2ct)\right) = -\sin(x+ct) - 4\cos(2x+2ct)$