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$w = w(x,t)$

a) ① $w(x,t) = \sin(x+ct)$

$$\frac{\partial w}{\partial x} = \cos(x+ct)$$

$$\frac{\partial^2 w}{\partial x^2} = -\sin(x+ct)$$

$$\frac{\partial w}{\partial t} = c \cdot \cos(x+ct)$$

$$\frac{\partial^2 w}{\partial t^2} = -c^2 \sin(x+ct)$$

$$\frac{\partial^2 w}{\partial t^2} = c^2 \frac{\partial^2 w}{\partial x^2}$$

$$-c^2 \cdot \sin(x+ct) = c^2 - \sin(x+ct) \quad \checkmark$$

② $r(x,t) = \sin(x+ct) + \cos(2x+2ct)$

$$\frac{\partial w}{\partial x} = \cos(x+ct) - 2\sin(2x+2ct)$$

$$\frac{\partial^2 w}{\partial x^2} = -\sin(x+ct) - 4\cos(2x+2ct)$$

$$\frac{\partial w}{\partial t} = c \cdot \cos(x+ct) - 2c \cdot \sin(2x+2ct)$$

$$\frac{\partial^2 w}{\partial t^2} = -c^2 \cdot \sin(x+ct) - 4c^2 \cos(2x+2ct)$$

$$\frac{\partial^2 w}{\partial t^2} \quad \frac{\partial^2 w}{\partial x^2}$$

$$\frac{\partial^2 w}{\partial t^2} = c^2 \frac{\partial^2 w}{\partial x^2}$$

$$-c^2 \cdot \left(\sin(x+ct) - 4\cos(2x+2ct)\right) = c^2(-\sin(x+ct) - 4\cos(2x+2ct)) \checkmark$$