1. $c = \lambda \cdot f = \lambda \cdot \frac{1}{T} = \frac{2.5\ \text{m}}{1.2\ \text{s}} = \underline{\underline{2.1\ \frac{\text{m}}{\text{s}}}}$

2. a) $\lambda = \frac{c}{f} = \frac{344\ \frac{\text{m}}{\text{s}}}{16\ \text{Hz}} = \underline{\underline{21.5\ \text{m}}}$ bis $\lambda = \frac{c}{f} = \frac{344\ \frac{\text{m}}{\text{s}}}{20'000\ \text{Hz}} = \underline{\underline{0.0172\ \text{m}}} = \underline{\underline{17.2\ \text{mm}}}$

   b) $\lambda = \frac{c}{f} = \frac{1480\ \frac{\text{m}}{\text{s}}}{16\ \text{Hz}} = \underline{\underline{92.5\ \text{m}}}$ bis $\lambda = \frac{c}{f} = \frac{1480\ \frac{\text{m}}{\text{s}}}{20'000\ \text{Hz}} = \underline{\underline{0.0740\ \text{m}}} = \underline{\underline{74.0\ \text{mm}}}$

3. a) $t = \frac{s}{c} = \frac{10'000\ \text{m}}{6'000\ \frac{\text{m}}{\text{s}}} = \underline{\underline{1.7\ \text{s}}}$

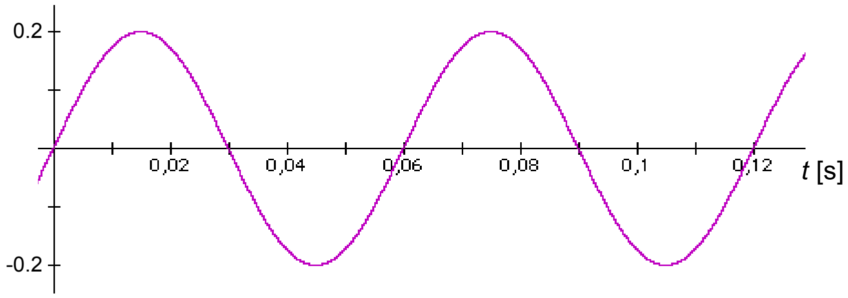
   b) $t = \frac{s}{c} = \frac{10'000\ \text{m}}{3'500\ \frac{\text{m}}{\text{s}}} = \underline{\underline{2.9\ \text{s}}}$

4. $s = c \cdot t = 222\ \frac{\text{m}}{\text{s}} \cdot 600\ \text{s} = 133'333\ \text{m} \approx \underline{\underline{130\ \text{km}}}$

5. a) $\omega = 100\ \text{s}^{-1}$, $f = \dfrac{\omega}{2\pi} = 15.9\ \text{Hz}$, $T = \dfrac{2\pi}{\omega} = 0.06\ \text{s}$, $\hat{y} = 0.2\ \text{m}$, $c = 5\ \frac{\text{m}}{\text{s}}$, $\lambda = \dfrac{c}{f} = 30\ \text{cm}$

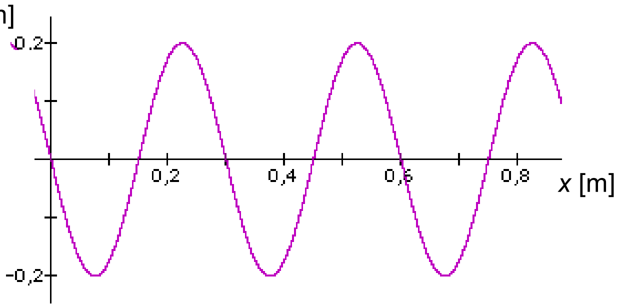
b) $y\,(x{=}0,t) = 0.20\ \text{m} \cdot \sin\,(100\ \text{s}^{-1} \cdot t)$

c) $y$ [m]




d) $y\,(x,\ t = 0) = 0.20\ \text{m} \cdot \sin\,(-\ 20\ \text{m}^{-1} \cdot x)$

e) $y$ [m]




f) Zum ersten Mal nach $\frac{1}{4}$ Periode, d.h. nach $t = 0.015$ s, danach alle 0.060 s: Zu den Zeiten $t = 0.075$ s, 0.135 s, etc.

g) $\frac{3}{4}$ Wellenlänge vom Punkt $x = 0$ entfernt, d.h. am Ort $x = 0.225$ m, danach alle 0.30 m an den Stellen $x = 0.525$ m, $x = 0.825$ m, etc.

h) $y(x = 1.0\ \text{m}, t = 2.0\ \text{s}) = 0.20\ \text{m} \cdot \sin\left[100\ \text{s}^{-1}\left(2.0\ \text{s}\ -\ \dfrac{1.0\ \text{m}}{5.0\ \frac{\text{m}}{\text{s}}}\right)\right] = \underline{\underline{-0.16\ \text{m}}}$

6. a) $\lambda = \dfrac{c}{f} = \dfrac{344\ \frac{\text{m}}{\text{s}}}{440\ \text{Hz}} = \underline{\underline{0.78\ \text{m}}} = \underline{\underline{78\ \text{cm}}}$

b) $y(x,t) = 0.002\ \text{m} \cdot \sin\left[2764.6\ \text{s}^{-1}\left(t\ -\ \dfrac{x}{344\ \frac{\text{m}}{\text{s}}}\right)\right]$

c) $y(x = 60\ \text{m}, t = 3.0\ \text{s}) = 2.00\ \text{mm} \cdot \sin\left[2764.6\ \text{s}^{-1}\left(2.27 \cdot 10^{-3}\ \text{s}\ -\ \dfrac{0.684\ \text{m}}{344\ \frac{\text{m}}{\text{s}}}\right)\right] = \underline{\underline{1.40\ \text{mm}}}$

7. $f = \frac{c}{\lambda} = \frac{26.7\ \frac{\text{cm}}{\text{s}}}{17.8\ \text{cm}} = 1.50\ \text{Hz}\quad \omega = 2\pi \cdot f = 9.425\ \text{s}^{-1}$

$$\frac{y(x,t)}{\hat{y}} = \sin\left[\omega \cdot \left(t - \frac{x}{c}\right)\right] \qquad \arcsin\left(\frac{y(x,t)}{\hat{y}}\right) = \omega \cdot \left(t - \frac{x}{c}\right)$$

$$\frac{\arcsin\left(\frac{y(x,t)}{\hat{y}}\right)}{\omega} = t - \frac{x}{c} \qquad t - \frac{\arcsin\left(\frac{y(x,t)}{\hat{y}}\right)}{\omega} = \frac{x}{c}$$

$$x = \left[t - \frac{\arcsin\left(\frac{y(x,t)}{\hat{y}}\right)}{2\pi f}\right] \cdot c = \left[0.24\ \text{s} - \frac{\arcsin\left(\frac{1.90\ \text{cm}}{5.39\ \text{cm}}\right)}{2 \cdot \pi \cdot 1.50\ \text{Hz}}\right] \cdot 0.267\ \frac{\text{m}}{\text{s}} = \underline{\underline{0.054\ \text{m}}} = \underline{\underline{5.4\ \text{cm}}}$$

8. $y(x,t) = \frac{\hat{y}}{4} = \hat{y} \cdot \sin\left[\omega \cdot \left(t - \frac{x}{c}\right)\right] \qquad \sin\left[\omega \cdot \left(t - \frac{x}{c}\right)\right] = \frac{1}{4}$

$$\arcsin\left(\frac{1}{4}\right) = 2\pi \cdot f \cdot \left(t - \frac{x}{c}\right) \qquad f = \frac{\arcsin\left(\frac{1}{4}\right)}{2\pi \cdot \left(t - \frac{x}{c}\right)} = \frac{\arcsin\left(\frac{1}{4}\right)}{2\pi \cdot \left(0.0080\ \text{s} - \frac{8.0\ \text{m}}{1'250\ \frac{\text{m}}{\text{s}}}\right)} = 25.13\ \text{Hz}$$

$$\lambda = \frac{c}{f} = \frac{1'250\ \frac{\text{m}}{\text{s}}}{25.13\ \text{Hz}} = \underline{\underline{50\ \text{m}}}$$