3) Hp.

$d = 2{,}52\ cm = 0{,}0252\ m$

$m_a = 873\ Kg$

$l = a2{,}6\ m$

$E = 200 \cdot 10^9\ N/m^2$

$\beta = 0{,}3$

Th.

a) $\Delta l = ?$

b) $\frac{\Delta r}{r}$ in $\% = ?$

a) $\sigma = \frac{F}{S} = E\varepsilon = E\frac{\Delta l}{l} \Rightarrow \frac{F_p}{S} = E\frac{\Delta l}{l}$

$$\frac{m_a g}{\pi \frac{d^2}{4}} = E\frac{\Delta l}{l} \Rightarrow \Delta l = \frac{m_a g l}{\pi \frac{d^2}{4} E} = \boxed{3{,}66 \cdot 10^{-3}\ m}$$

b) $\frac{\Delta r}{r} = -\nu \frac{\Delta l}{l} \Rightarrow \frac{\Delta r}{r} \cdot 100 = \boxed{0{,}0026\ \%}$

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5) Hp.

$d = 15 \cdot 10^{-3}\ m$

$F = 3{,}5\ KN$

$l_0 = 120 \cdot 10^{-3}\ m$

$\Delta l = 11 \cdot 10^{-3}\ m$

$\Delta d = -0{,}62 \cdot 10^{-3}\ m$

Th.

a) $E = ?$

b) $G = ?$

c) $\nu = ?$

a) $\sigma = \frac{F}{S} = E\varepsilon \Rightarrow \frac{F}{S} = E\frac{\Delta l}{l} \Rightarrow E = \frac{F}{S} \cdot \frac{l}{\Delta l} = \boxed{2{,}16 \cdot 10^8\ N/m^2}$

c) $\nu = -\frac{\Delta r}{r}\frac{l}{\Delta l} = \boxed{0{,}45}$

b) $G = \frac{E}{2(1+\nu)} = \boxed{7{,}45 \cdot 10^7\ N/m^2}$

9) Hp.

$A = 0,16\ m$

$\lambda = 2,1\ m$

$T = 1,8\ s$

$y(t=0s, x=0m) = 0,16\ m$

Th.

$\xi(x,t) = ?$

$$\xi(x,t) = A\sin(Kx - \omega t + \varphi) = A\sin\left(2\pi\left(\frac{x}{\lambda} - \frac{t}{T}\right) + \varphi\right)$$

$$\xi(0,0) = A\sin(\varphi) = y(0,0) \Longrightarrow \varphi = \arcsin\left(\frac{A}{y}\right) = \frac{\pi}{2}$$

$$\xi(x,t) = A\sin\left(2\pi\left(\frac{x}{\lambda} - \frac{t}{T}\right) + \frac{\pi}{2}\right) = \boxed{A\cos\left(2\pi\left(\frac{x}{\lambda} - \frac{t}{T}\right)\right)}$$

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11) Hp.

$f = 25\ Hz$

$\lambda = 0,24\ m$

$A = 0,30\ cm = 0,003\ m$

Th.

a) $v = ?$

b) $\xi(x,t)$ t.c. $A = 0,30\ cm = ?$ e $\varphi = 0$

a) $v = f\lambda = \boxed{6\ m/s}$

b) $\boxed{\xi(x,t) = A\sin\left(2\pi\left(\frac{x}{\lambda} - tf\right)\right)} = (0,003\ m)\sin\left(2\pi\left(\frac{x}{0,24\ m} - t\cdot(25\ s^{-1})\right)\right)$

13) Hp.

M massa uniforme

L lunghezza

Th.

a) Dimostrare che $v = \sqrt{gy}$ per onde trasversali.

b) Dimostrare $t = \sqrt{\frac{L}{g}}$ per percorre tutta la fune

c) a) e b) dipendono da M = ?

a) $v = \sqrt{\frac{T}{\mu}} = \sqrt{\frac{\mu y g}{\mu}} = \sqrt{yg}$ in quanto T non è costante

b) $v_{(y)} = \sqrt{yg} \Rightarrow \frac{dy}{dt} = \sqrt{gy}$

$$\Rightarrow \frac{dy}{\sqrt{gy}} = dt \Rightarrow \int_0^L \frac{dy}{\sqrt{gy}} = \int_0^t dt$$

$$t = \frac{2}{\sqrt{g}} \int_0^L \frac{1}{2\sqrt{y}} dy = \frac{2}{\sqrt{g}} \sqrt{y} \Big|_0^L = \frac{2\sqrt{L}}{\sqrt{g}}$$

$$\Rightarrow t = 2\sqrt{\frac{L}{g}}$$

c) No, non dipendono dalla massa (M).