4.1

Om man knuffar horisontellt en gång per period så är läge B bäst eftersom det är då gungans hastighet är horisontell.

4.2

$$s_1 = 4\sin(2\pi(0{,}2x - 3t))$$

$$s_2 = \frac{5}{2}\sin(7x + 3{,}5t)$$

$s_1 = 4\sin(0{,}4\pi x - 6\pi t)$

a) $f = \frac{1}{T}$ $\quad \omega = 2\pi \cdot f$

$\omega = -6\pi$ *

$\rightarrow f = \frac{\omega}{2\pi} = \frac{-6\pi}{2\pi} = \boxed{3\,Hz}$

frekvensen för

— " —

$$s_1 = 3\,Hz$$

$$s_2 = \frac{3{,}5}{2\pi}\,Hz$$

b) $k = \frac{2\pi}{\lambda} \Rightarrow \lambda = \frac{2\pi}{k}$

s_1: $\lambda = \frac{2\pi}{0{,}4\pi} = \boxed{5\,m}$

s_2: $\boxed{\lambda = \frac{2\pi}{7}}$

c) Perioden

$T = \frac{1}{f}$ $\quad s_1: T = \frac{1}{3} \approx \boxed{0,33}$

$s_2: T = \frac{1}{3,5/2\pi} = \frac{2\pi}{3,5} \approx \boxed{1,8}$

d) $s_1: \boxed{A = 4}$ $\quad s_2: A = \frac{1}{2,5} = \boxed{0,4}$

e) $v = f\lambda$

$s_1: v = 3 \cdot 5 = \boxed{15}$

$s_2: v = \frac{3,5}{2\pi} \cdot \frac{2\pi}{7} \approx \boxed{0,5}$

f) s_1 rör sig åt höger.

s_2 —— " —— vänster.

4.3

$P = 1000\,W$

$A = 0{,}04\,m^2$

$f = 2{,}45 \cdot 10^9\,Hz$

$P = \frac{E}{t}$

$v = c = 3 \cdot 10^8$

a) $\lambda = \frac{c}{f} = \boxed{12\,cm}$

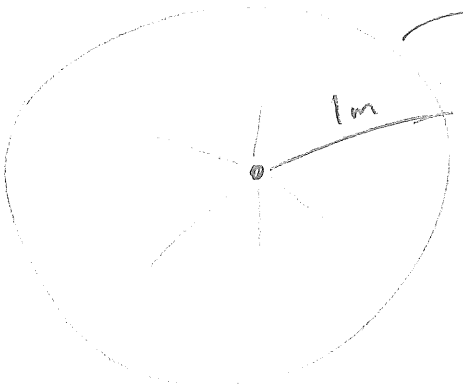
$T = \frac{1}{f} = \boxed{41\,ns}$

b) $E_c = \frac{P}{A} = \frac{1000}{0{,}04} = 400\,000\,W/m^2$

$$E_0 = \left(\frac{2E_c}{\varepsilon_0 c}\right)^{1/2} = \left(\frac{2 \cdot 400000}{\varepsilon_0 c}\right)^{1/2} =$$

4.4

a) P = 100W i 1m



Arean av ett klot = $4\pi r^2 = 4\pi$

$$I = \frac{P}{A} = \frac{100}{4\pi} = \boxed{7,96\ W/m^2}$$

b) $$E = \left(\frac{2I}{\varepsilon_0 c}\right)^{1/2} = \boxed{77,4}$$

$$B = \frac{E}{c} = \boxed{2,6 \cdot 10^{-7}}$$

4,5 $I = 1,40 \pm 0,06 \ W/m^2$

$$E_{max} = \left(\frac{2I}{\varepsilon c}\right)^{1/2} = 33,17$$

$$E_{min} = \left(\frac{2I}{\varepsilon c}\right)^{1/2} = 31,78$$

$\Rightarrow$ **$E = 32,5 \pm 0,7$**

4,6 a) c) och d) eftersom de beror på x och ut, se s. 133.

4.7 $s = A\sin\left(2\pi\left(\frac{t}{T} \pm \frac{x}{\lambda}\right) + \alpha\right)$ **$\lambda = 3,4$**

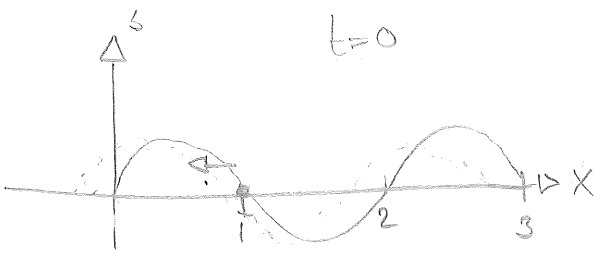
$x = 0 \Rightarrow s = A\sin\left(2\pi\frac{t}{T} + \alpha\right)$ **$A = 3$**

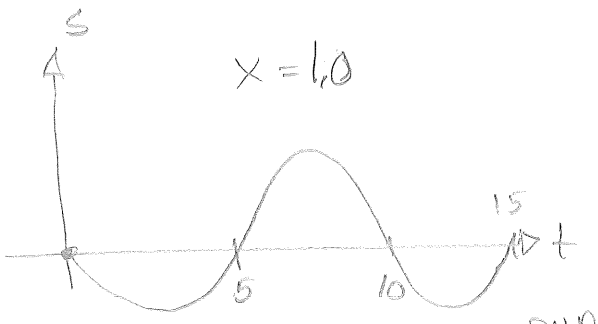
$\sin(\ ) = 0 \Rightarrow \alpha = -2\pi\frac{t}{T} = 0 + n\pi$, **$\alpha = 0$**
$t = 0 \Rightarrow$

$t = 5 \Rightarrow 3\sin\left(2\pi\left(\frac{5}{T}\right)\right) = 0$ **$T = 10$**

4.8

$$s(x,t) = A\sin\left(2\pi\left(\frac{t}{T} \pm \frac{x}{\lambda}\right) + \alpha\right)$$





$\alpha = 0 \quad \lambda = 2 \quad , T = 10 \quad , A = A$

$$s(x,t) = A\sin\left[2\pi\left(\frac{t}{10} \pm \frac{x}{2}\right)\right]$$

Hitta samma punkt (x), gå lite fram i tiden på högra grafen. Vänster

4.9

a)

$A = 0{,}15$
$\lambda = 6$
$T = 22$
$\alpha = 2$

$$s'_t = A \cdot 2\pi \cdot \frac{1}{T}\cos(\quad)$$

b) $$v = \lambda \cdot f = \lambda \cdot \frac{1}{T} = \frac{6}{22} = \boxed{0{,}27}$$

$$\frac{ds}{dt} = \omega A = 2\pi f \cdot A = 2\pi \cdot \frac{1}{T} \cdot A = \boxed{0{,}043}$$

4.10

$\lambda = 5$

$T = 2$

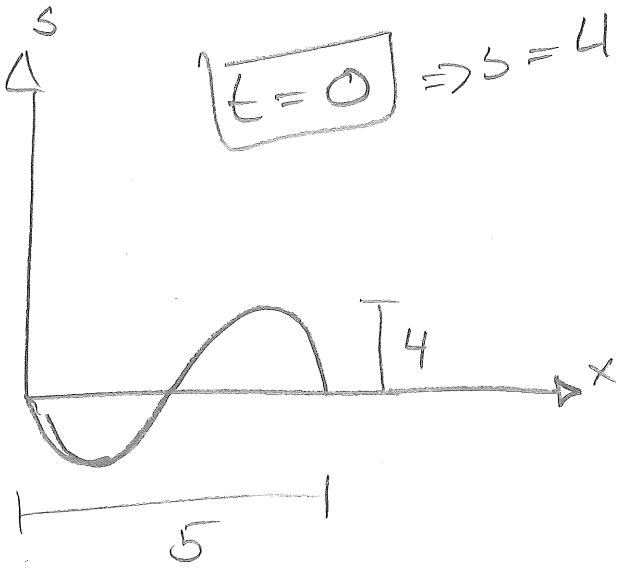
$\alpha = \pi$

$A = 4$

Vågen rör sig åt vänster, $-x$ riktn.

$$s = 4\sin\left(2\pi\left(\frac{t}{2} + \frac{x}{5}\right) + \pi\right)$$

$\boxed{t=0} \Rightarrow s = 4\sin\left(2\pi \cdot \frac{x}{5} + \pi\right)$



$x=0 \Rightarrow s = 4\sin\left(2\pi\frac{t}{2} + \pi\right)$