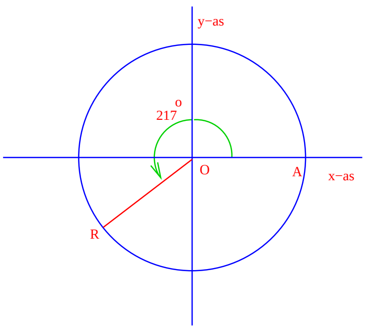
UITWERKINGEN VOOR HET VWO
A1B1 DEEL1

Hoofdstuk 5

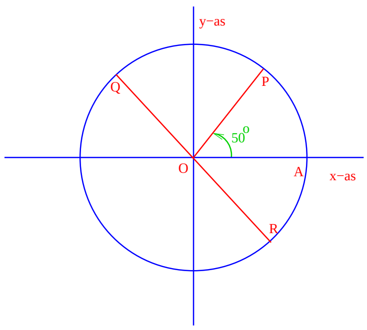
GONIOMETRISCHE FUNCTIES

KERN 1
PERIODIEKE VERSCHIJNSELEN

1a) $6\,seconden = \frac{1}{4}$ $van\ 24\,seconden$
een kwart $\left(\frac{1}{4}\right)$ van 360^o is 90^o
1b) driekwart $\left(\frac{3}{4}\right)$ van 360^o is 270^o $of\ -90^o$
1c) $\frac{5}{4}$ van 360^o is $450^o \xleftarrow{1\ keer\ rond\ +90^o}$
2a) $360^o - 30^o = 330^o$



2b) $217^o - 180^o = 37^o$
2c) derde kwadrant
2d) $360^o - 217^o = 143^o$
3b) $180^o - 50^o = 130^o$
3c) $\measuredangle AOR = -50^o$



4a) 8 sec
4b) $3sec, 11sec, 19sec, 27sec\,etc\,etc$

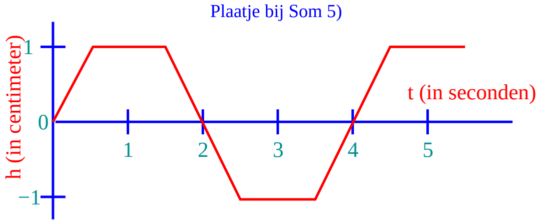
4c) 8 sec
4d) $h(t) = h(t+8)$

5a)
Periode: 4 sec
Amplitude: 1 cm
5b) $1\ per\ seconde \longrightarrow \frac{60}{8}\ per\ 8 \cdot \frac{60}{8} seconde$
$\Rightarrow\ 7,5\ per\ 60sec \longrightarrow 7,5/min$

5c)
Periode: 4 sec.
Amplitude: 1 cm
Frequentie: 15 per minuut

Plaatje bij Som 5)

5d)

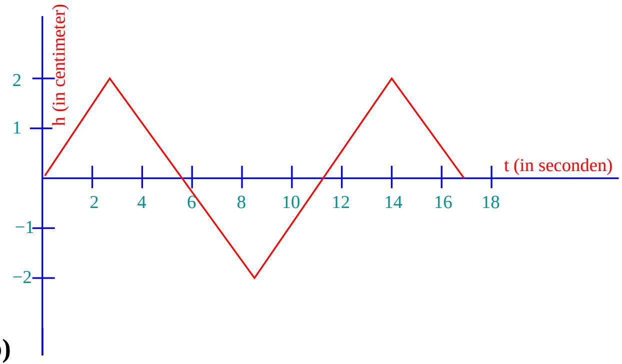


[1] *Deze samenvatting mag niet massaal op kosten van Schaersvoorde worden Uitgeprint!!!*

[2]  *werd gemaakt onder LinuX met LaTeX en LyX*

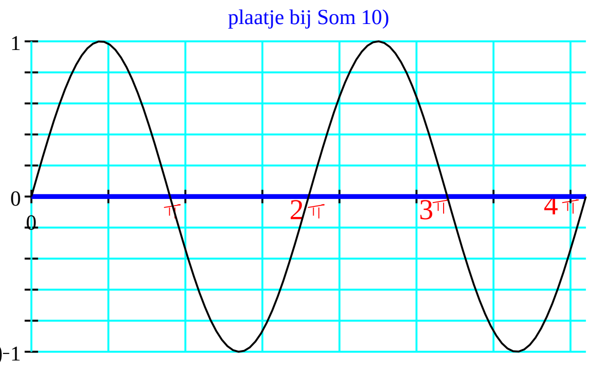
[3] *Typ&andere fouten&blunders graag Melden!*

6a) Frequentie$\longrightarrow$ 50 per seconde
Frequentie $\longrightarrow 50 \cdot 60 = 3000$ per minuut
6b) $Periode = \frac{1}{50} seconde \longrightarrow \frac{1}{3000} minuut$
7a) $\frac{1}{365} jaar$
7b) 365
8a) 2,8cm komt overeen met 1 second
2,2 tot 2,3 cm meet ik van top naar top
$\frac{2{,}2}{2{,}8} \simeq 0,79$ tot $\frac{2{,}3}{2{,}8} \simeq 0,82 \xrightarrow{Periode} 0,8\,seconde$
8b) 1 hartslag per 0,8 seconde
$\frac{60}{0{,}8} hartslagen/0,8sec \Rightarrow 75\,hartslagen/min$
9a)
$Van\ (2;0) \xrightarrow{Naar} (0;2) \Longrightarrow \sqrt{2^2+2^2} = \sqrt{8} = \sqrt{4\cdot 2} = \sqrt{4}\cdot\sqrt{2} = 2\sqrt{2}$
$Van\ (2;0) \longrightarrow (0;2) \longrightarrow (-2;0) \longrightarrow (-2;0) \Longrightarrow 4\cdot 2\sqrt{2} = 8\sqrt{2} \simeq 11,3sec$
9c)
Periode: 11,3 sec
Amplitude : 2cm



9b)

10a)
$$\left.\begin{array}{r} Omtrek \longrightarrow 2\pi\cdot 1 = 2\pi\,meter \\ 1\,m\,\text{sec} \end{array}\right\} \Rightarrow 2\pi\,sec$$



10b)

Kern 2
Een Nieuwe Hoekmaat

11a) 2π

11b)

na $\frac{1}{4} \cdot 2\pi = \frac{1}{2}\pi$ *sec. in T*

na $\frac{1}{2} \cdot 2\pi = \pi$ *sec. in U*

na $\frac{3}{4} \cdot 2\pi = 1\frac{1}{2}\pi$ *sec. in V*

na 2π *sec. in S*

11c)

$\frac{1}{2\pi} \cdot 360^o \simeq 57,5 \xleftarrow{na\ 1\ seconde}$

$\frac{4}{2\pi} \cdot 360^o \simeq 229,2 \xleftarrow{na\ 4\ seconde}$

$360^o \xleftarrow{na\ 2\pi\ seconde}$

12)

graden	0^o	30^o	45^o	60^o	90^o	120^o	180^o	270^o	360^o
radialen	0	$\frac{1}{6}\pi$	$\frac{1}{4}\pi$	$\frac{1}{3}\pi$	$\frac{1}{2}\pi$	$\frac{2}{3}\pi$	π	$1\frac{1}{2}\pi$	2π

13a)

graden	180^o		$57,3^o$
radialen	π	$\xrightarrow{\div\pi}$	1

$\xrightarrow{Dus} 57,3^o$

graden	180^o	$\xrightarrow{\div 180^o}$	1^o
radialen	π	$\xrightarrow{\div 180^o}$	$0,017$

$\xrightarrow{Dus} 0,017 rad$

14a)

graden	180^o	$\xrightarrow{\div 180^o}$	1^o	$\xrightarrow{*15}$	15^o
radialen	π	$\xrightarrow{\div 180^o}$	$0,017$		0,261

$\xrightarrow{Dus} 0,261 rad$

$Of\ \pi * \frac{15}{180} \simeq 0,261$

14b) $\pi * \frac{115}{180} \simeq 2,01\, rad$

14c) $\pi * \frac{10}{180} \simeq 0,17\, rad$

14b) $\pi * \frac{400}{180} \simeq 6,98\, rad$

14b) $\pi * \frac{40}{180} \simeq 0,698\, rad$

14b) $\pi * \frac{170}{180} \simeq 2,97\, rad$

14b) $\pi * \frac{65}{180} \simeq 1,13\, rad$

14b) $\pi * \frac{150}{180} \simeq 2,62\, rad$

15)

graden	180^o		$57,5^o$		60^o
radialen	π	$\xrightarrow{\div\pi}$	1	$\xrightarrow{*\frac{1}{3}\pi}$	$\frac{1}{3}\pi$

15a) $57,3^o$

15b) $180 * \frac{\frac{1}{3}\pi}{\pi} = \frac{180}{3} = 60^o$

15c) $180 * \frac{2,2}{\pi} \simeq 126,1^o$

15d) $180 * \frac{10}{\pi} \simeq 573,0^o$

15e) $180 * \frac{1\frac{1}{2}\pi}{\pi} = 270^o$

15f) $180 * \frac{0,7}{\pi} \simeq 40,1^o$

15g) $180 * \frac{3\pi}{\pi} = 540^o$

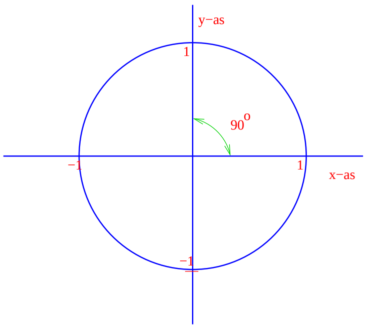
15h) $180 * \frac{1,5}{\pi} \simeq 85,9^o$

16a) $\sin x = \frac{PQ}{OP} = \frac{PQ}{1} = PQ = y_p$

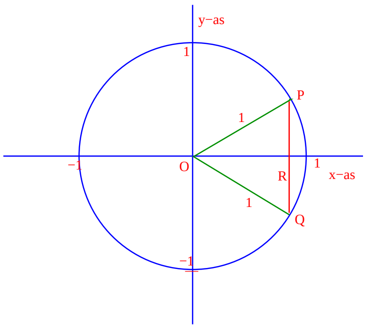
16b) $\cos x = \frac{OQ}{OP} = \frac{OQ}{1} = OQ = x_p$

17a) $\sin 90^o = 1$
17b) $\cos 180^o = -1$

17c) $\cos 270^o = 0$
17d) $\sin 360^o = 0$



17a)

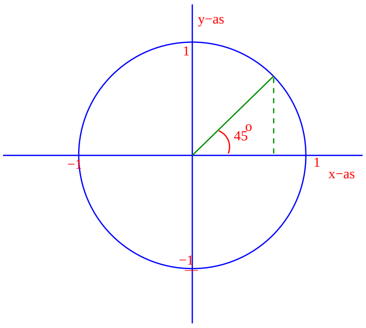


18)

18a) $\triangle OPQ \xrightarrow{gelijkzijdige\,driehoek} \measuredangle ROP = 30^o$
18b) $RP = \frac{1}{2}$
18c) $\sin 30^o = \frac{\frac{1}{2}}{1} = \frac{1}{2}$

18d) $\sin(-30^o) = -\frac{1}{2}$
18e) $\sin 150^o \overset{150^o = 180^o - 30^o}{=} \frac{1}{2}$
18f) $\sin 210^o \overset{210^o = 180^o + 30^o}{=} -\frac{1}{2}$

19a)



19b) $\sin 45^o = \frac{3{,}5}{5} \simeq 0,7$

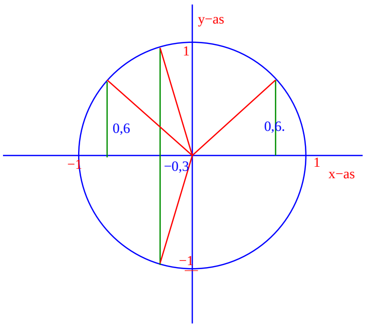
$\cos 45^o \simeq 0,7$

19d) $-45^o en - 135^o$

of $225^o (= 180^o + 45^o)\, en\, 315^o (= 360^o - 45^o)$

19e) 135^o *en* 225^o

20a) 37^o *en* $180^o - 37^o = 143^o$



20b) 107^o *en* -107^o

of $253^o (= 360^o - 107^o)$

21a) $\sin 1\frac{1}{2}\pi\, rad = -1$

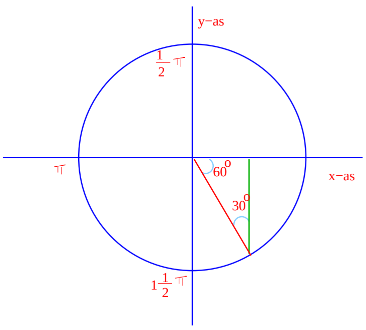
21b) $\cos \pi\, rad = -1$

21c) $\sin 2\pi\, rad = 0$

21d) $\cos -\frac{1}{2}\pi\, rad = 0$

21e) $\sin \frac{1}{6}\pi\, rad = \frac{1}{2}$

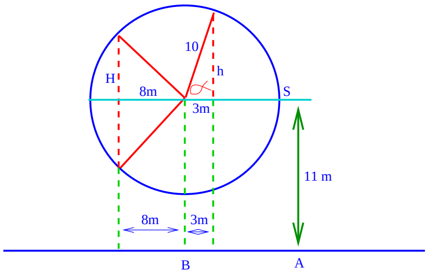
21a) $\cos 1\frac{2}{3}\pi\, rad = \frac{1}{2}$



22a) $\sin 2\,rad \simeq 0,91$
22b) $\cos 1,3\,rad \simeq 0,27$
22c) $\sin -0,9\,rad \simeq -0,78$

22d) $\cos 0,1\,rad \simeq 1,00$
22e) $\sin 4\,rad \simeq 0,91$
22f) $\cos -3,4\,rad \simeq -0,97$

23a) $\cos\alpha = \frac{3}{10} \Rightarrow \alpha \simeq 72,5^o$
23b) $\sin\alpha = \frac{h}{10} \Rightarrow h = 10\sin\alpha \Rightarrow$
$\Rightarrow h \simeq 9,5 meter$
$\Rightarrow 11 + 9,5 = 20,5$ meter boven de grond
23c) $\cos\beta = \frac{-8}{10} \Rightarrow \beta \simeq 143,1^o \Rightarrow$
$\Rightarrow H \simeq 10\sin 143,1^o \simeq 6 meter \Rightarrow$
$\Rightarrow 11 + 6 = 17 meter\ boven\ de\ grond$
$of\ \beta \simeq 216,9 \Rightarrow 11 - 6 = 5 meter\ boven\ de\ grond$

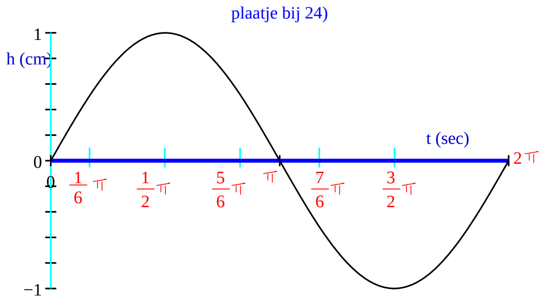


KERN 3
GRAFIEKEN

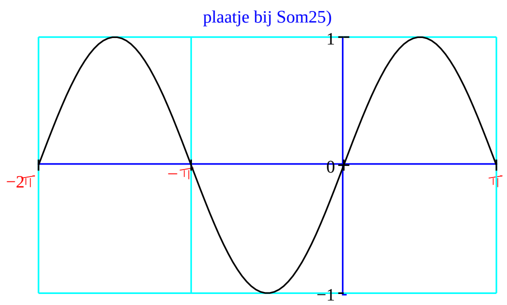
24a) $2\pi\ sec$
24b) $\alpha = 2\pi\, rad \quad h = 0m$
24c) $na\ \ 1\ \ seconde\ \ is\ \ \measuredangle\alpha\ \ 1\, rad\ \Rightarrow\ \sin\alpha = \frac{h}{1}\ \Rightarrow\ \sin 1 = h\ \Rightarrow\ h \simeq 0,84m$
24d)

α in graden	0^o	30^o	90^o	150^o	180^o	210^o	270^o	330^o	360^o
$t\ (s)$	0	$\frac{1}{6}\pi$	$\frac{1}{2}\pi$	$\frac{5}{6}\pi$	π	$1\frac{1}{6}\pi$	$1\frac{1}{2}\pi$	$1\frac{5}{6}\pi$	2π
$h\ (m)$	0	$\frac{1}{2}$	1	$\frac{1}{2}$	0	$-\frac{1}{2}$	-1	$-\frac{1}{2}$	0
α in radialen	0	$\frac{1}{6}\pi$	$\frac{1}{2}\pi$	$\frac{5}{6}\pi$	π	$1\frac{1}{6}\pi$	$1\frac{1}{2}\pi$	$1\frac{5}{6}\pi$	2π

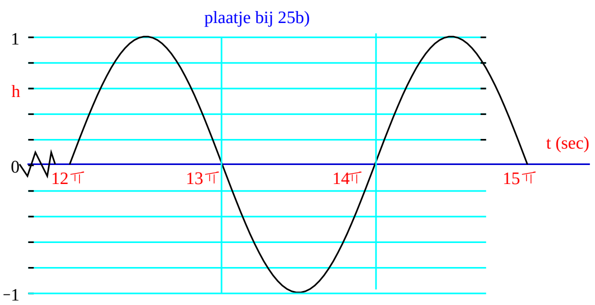
$\xrightarrow{bijvoorbeeld} \sin\frac{1}{6}\pi = \frac{h}{1} = h\ \Rightarrow\ h = \frac{1}{2}$



25a) $h(t) = \sin t\ [-2\pi\ 2\pi]$



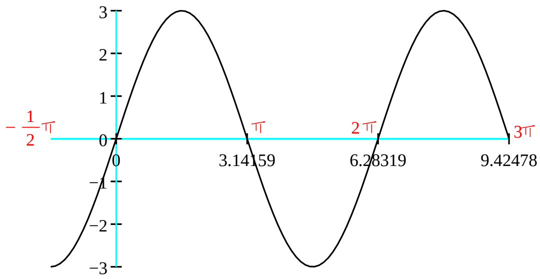
de periode van $h(t) = \sin t$ is 2π, dus op $[-2\pi;0]$ krijg je dezelfde grafiek als op $[0;2\pi]$
25b)



De grafiek op $[0;2\pi]$ zelfde als op $[2\pi;4\pi]$, $[4\pi;6\pi]$, $[6\pi;8\pi]$, $[8\pi;10\pi]$ en $[12\pi;14\pi]$
26a) $f(t) = 3\sin t$

$t\,in\,radialen$	$-\frac{1}{2}\pi$	$-\frac{1}{6}\pi$	0	$\frac{1}{6}\pi$	$\frac{1}{2}\pi$	$\frac{5}{6}\pi$	π	$1\frac{1}{6}\pi$	$1\frac{1}{2}\pi$	2π
$3\sin t$	-3	-1$\frac{1}{2}$	0	1$\frac{1}{2}$	3	1$\frac{1}{2}$	0	-1$\frac{1}{2}$	-3	0

plaatje bij 26a)



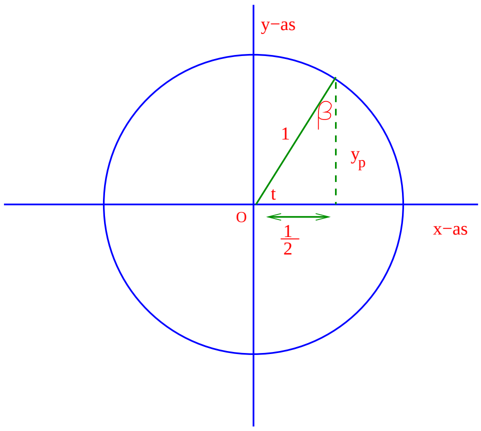
26b)
Periode: $2\pi \longrightarrow t$ loopt over de cirkel van $0\,tot\,2\pi$, waarna weer de zelfde cyclus
Amplitude: 3
$-1 \leqq \sin t \leqq 1 \;\Rightarrow\; -3 \leqq 3\sin t \leqq 3$
26c) $B_f : [-3;3]$
26d) $f(t) = 3\sin t$

$$\left.\begin{array}{l} f(t) = 1,5 \;\Rightarrow\; 3\sin t = 1,5 \;\Rightarrow\; \sin t = \frac{1}{2} \\ t \in [0;10] \end{array}\right\} \Rightarrow\; t = \tfrac{1}{6}\pi \bigvee t = \tfrac{5}{6}\pi \bigvee t = 2\tfrac{1}{6}\pi \bigvee t = 2\tfrac{5}{6}\pi$$

26e) Positief op $[0;\pi]$, $[2\pi;3\pi]$, $[4\pi;5\pi]$, $[6\pi;7\pi]$, $[8\pi;9\pi]$, $[10\pi;11\pi]$, $[12\pi;13\pi]$ $\Rightarrow$
$Negatief\ op\ \langle 11\pi;12\pi\rangle$

27a)

$t = \frac{1}{2}\pi$ en $1\frac{1}{2}\pi$



27b)

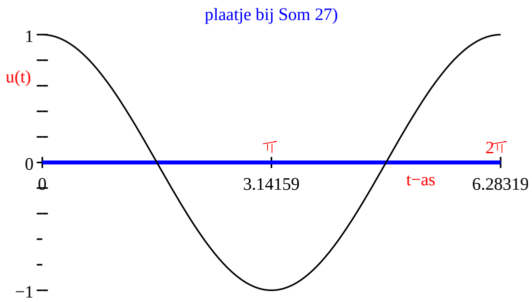
$Uitwijking\,1 \longrightarrow t = 0 \bigwedge t = \pi$

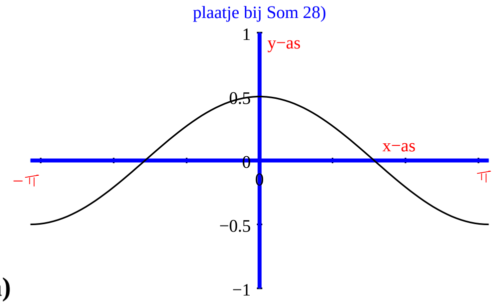
$Uitwijking\,\frac{1}{2} \longrightarrow t = \frac{1}{3}\pi \bigwedge t = 1\frac{2}{3}\pi$

$\downarrow\downarrow\downarrow$ *Toelichting* $\downarrow\downarrow\downarrow$

$$\sin\beta = \frac{\frac{1}{2}}{1} = \frac{1}{2} \;\Rightarrow\; \beta = \frac{1}{6}\pi \equiv 30^o \;\Rightarrow\; t = \pi - \frac{1}{2}\pi - \frac{1}{6}\pi \equiv 180^o - 90^o - 30^o \;\Rightarrow\; t = \frac{2}{6}\pi = \frac{1}{3}\pi \equiv 30^o \;\Rightarrow\; \cos t = \frac{1}{2} \;\Rightarrow\; t = \frac{1}{3}\pi$$

$t\,in\,radialen$	0	$\frac{1}{3}\pi$	$\frac{1}{2}\pi$	$\frac{2}{3}\pi$	π	$1\frac{1}{3}\pi$	$1\frac{1}{2}\pi$	$1\frac{2}{3}\pi$	2π
$u(t) = \cos t$	1	$\frac{1}{2}$	0	-$\frac{1}{2}$	-1	-$\frac{1}{2}$	0	$\frac{1}{2}$	1





28a)

$x\, in\, radialen$	$-\pi$	$-\frac{2}{3}\pi$	$-\frac{1}{2}\pi$	$-\frac{1}{3}\pi$	0	$\frac{1}{3}\pi$	$\frac{1}{2}\pi$	$\frac{2}{3}\pi$	π
$f(x) = 0,5 \cdot \cos t$	$-\frac{1}{2}$	$\frac{1}{4}$	0	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{1}{4}$	0	$-\frac{1}{4}$	$-\frac{1}{2}$

28b)

$$\left.\begin{array}{r} f(x) = \frac{1}{2} \Rightarrow x = 0\ (mod\ 2\pi) \\ x\ is\ kleinste\ waarde > 10 \\ stel\ 3\pi \simeq 9,4 \end{array}\right\} \Rightarrow x = 4\pi \simeq 12,6$$

$$mod\ 2\pi \xrightarrow{wil\ zeggen\ ''modulo\ 2\pi''} \left\{\begin{array}{c} x = 0\ \ is\ een\ oplossing \\ x = 2\pi\ \ is\ een\ oplossing \\ x = 4\pi\ \ is\ een\ oplossing \\ x = 6\pi\ \ is\ een\ oplossing \\ x = 8\pi\ \ is\ een\ oplossing \\ enz\, enz \end{array}\right.$$

28c)

$$\left.\begin{array}{r} f(x) = \frac{1}{2} \Rightarrow x = 0\ (mod\ 2\pi) \\ grootste\ waarde\ kleiner\ dan\ -10 \end{array}\right\} \Rightarrow x = -4\pi \simeq 12,6$$

28d) $f(x) = 0 \Rightarrow 0,5\cos x = 0 \Rightarrow \cos x = 0 \Rightarrow x = \frac{1}{2}\pi\ (mod\ 2\pi) \bigvee x = 1\frac{1}{2}\pi\ (mod\ 2\pi) \Rightarrow$

$$\left.\begin{array}{r} x = \frac{1}{2}\pi\ (mod\ \pi) \\ x \in [20;25] \end{array}\right\} \Rightarrow x = 6\frac{1}{2}\pi \bigvee x = 7\frac{1}{2}\pi \Rightarrow x \simeq 20,4 \bigvee x \simeq 23,6$$

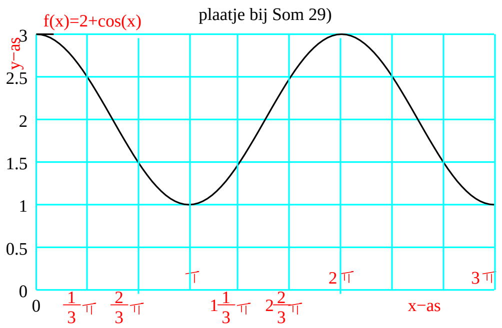
$6\pi \simeq 18,8$, $7\pi \simeq 22$, $8\pi \simeq 25,1$

29a) $f(x) = \cos x + 2 \quad x \in [0;3\pi]$

x	0	$\frac{1}{3}\pi$	$\frac{1}{2}\pi$	$\frac{2}{3}\pi$	π	$1\frac{1}{3}\pi$	$1\frac{1}{2}\pi$	$1\frac{2}{3}\pi$	2π
$\cos x$	1	$\frac{1}{2}$	0	$-\frac{1}{2}$	-1	$-\frac{1}{2}$	0	$\frac{1}{2}$	1
$\cos x + 2$	3	$2\frac{1}{2}$	2	$1\frac{1}{2}$	1	$1\frac{1}{2}$	2	$2\frac{1}{2}$	3

29b)
Amplitude: 1
Evenwichtslijn: $y = 2$

29c)
$f(x) = 2\frac{1}{2} \Rightarrow \cos x + 2 = 2\frac{1}{2} \Rightarrow \cos x = \frac{1}{2} \Rightarrow$
$\Rightarrow x = \frac{1}{3}\pi \bigvee x = 1\frac{2}{3}\pi \bigvee x = 2\frac{1}{3}\pi$



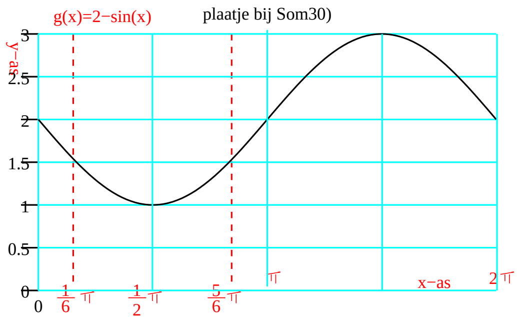
30a) $g(x) = 2 - \sin x \qquad x \in [0:2\pi]$

x	0	$\frac{1}{6}\pi$	$\frac{1}{2}\pi$	$\frac{5}{6}\pi$	π	$1\frac{1}{6}\pi$	$1\frac{1}{2}\pi$	$1\frac{5}{3}\pi$	2π
$\sin x$	0	$\frac{1}{2}$	1	$\frac{1}{2}$	0	-$\frac{1}{2}$	-1	$-\frac{1}{2}$	0
$2 - \sin x$	2	$1\frac{1}{2}$	1	$1\frac{1}{2}$	2	$2\frac{1}{2}$	3	$2\frac{1}{2}$	2

30b)

Amplitude: 1

Evenwichtslijn: $y = 2$



30c)

$g(x) = 2\frac{1}{2} \Rightarrow 2 - \sin x = 2\frac{1}{2} \Rightarrow \sin x = -\frac{1}{2} \Rightarrow$

$\Rightarrow x = 1\frac{1}{6}\pi \bigvee x = 1\frac{5}{6}\pi$

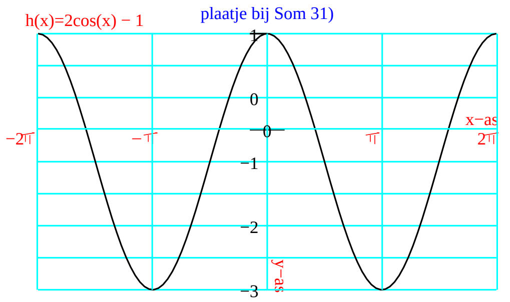
31a) $h(x) = 2\cos x - 1 \qquad x \in [-2\pi : 2\pi]$

x	-2π	-$1\frac{1}{2}\pi$	$-\pi$	$-\frac{1}{2}\pi$	0	$\frac{1}{3}\pi$	$\frac{1}{2}\pi$	$\frac{2}{3}\pi$	π	$1\frac{1}{3}\pi$	$1\frac{1}{2}\pi$	$1\frac{2}{3}\pi$
$\cos x$	1	0	-1	0	1	$\frac{1}{2}$	0	$-\frac{1}{2}$	-1	$-\frac{1}{2}$	0	$\frac{1}{2}$
$2\cos x - 1$	1	-1	-3	-1	1	0	-1	-2	-3	-2	-1	0

31b)

Amplitude: 2

Evenwichtslijn: $y = -1$



31c) De helling is 0 in:

$(-2\pi : 1)$, $(-\pi : -3)$, $(0; 1)$, $(\pi : -3)$

en $(2\pi : 1)$

$B_h = [-3; 1]$

32a)

$\xrightarrow{Na\ 1\ seconde} 2\ rad \simeq 115^o \xleftarrow{2*\frac{180}{\pi} \simeq 114{,}6}$

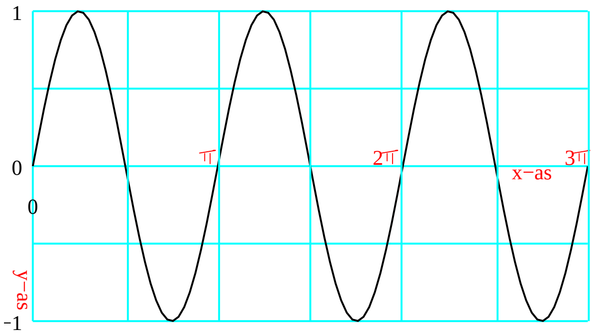
$\xrightarrow{Na\ \pi\ seconden} 2\pi\ rad\ = 360^o$

32b)

t	0	$\frac{1}{12}\pi$	$\frac{1}{4}\pi$	$\frac{5}{12}\pi$	$\frac{1}{2}\pi$	$\frac{7}{12}\pi$	$\frac{3}{4}\pi$	$\frac{11}{12}\pi$	π
$h(t)$	0	$\frac{1}{2}$	1	$\frac{1}{2}$	0	$-\frac{1}{2}$	-1	$-\frac{1}{2}$	0

32c) Periode:π *seconden*

plaatje bij Som32)



33a) $0 \leqq 4t \leqq 2\pi \;\Rightarrow\; 0 \leqq t \leqq \frac{1}{2}\pi \xrightarrow{Periode} \frac{1}{2}\pi$

33b) $0 \leqq \pi t \leqq 2\pi \;\Rightarrow\; 0 \leqq t \leqq 2 \xrightarrow{Periode} 2$

33c) $0 \leqq \frac{1}{2}t \leqq 2\pi \;\Rightarrow\; 0 \leqq t \leqq 4\pi \xrightarrow{Periode} 4\pi$

33d) $\xrightarrow{Periode} 2\pi$

33e) $0 \leqq \frac{1}{4}t \leqq 2\pi \;\Rightarrow\; 0 \leqq t \leqq 8\pi \xrightarrow{Periode} 8\pi$

33f) $0 \leqq 0,1t \leqq 2\pi \;\Rightarrow\; 0 \leqq t \leqq 20\pi \xrightarrow{Periode} 20\pi$

34)

$$f \Longrightarrow \begin{cases} evenwichtlijn & \rightarrow & y=\frac{1}{2} \\ amplitude & \rightarrow & 1 \\ periode & \rightarrow & 4\pi \end{cases}$$

$$g \Longrightarrow \begin{cases} evenwichtlijn & \rightarrow & y=-1 \\ amplitude & \rightarrow & 2 \\ periode & \rightarrow & 8\pi \end{cases}$$

$$h \Longrightarrow \begin{cases} evenwichtlijn & \rightarrow & y=-\frac{1}{2} \\ amplitude & \rightarrow & \frac{1}{2} \\ periode & \rightarrow & 1\frac{1}{3}\pi \end{cases}$$

35) $f(t) = \sin bt$

$0 \leqq bt \leqq 2\pi \;\Rightarrow\; 0 \leqq t \leqq \frac{2}{b}\pi \xleftarrow{is\ de\ periode}$

35a) $\frac{2}{b}\pi = 8\pi \;\Rightarrow\; b = \frac{2}{8} = \frac{1}{4}$

35b) $\frac{2}{b}\pi = \frac{1}{8}\pi \;\Rightarrow\; b = 16$

35c) $\frac{2}{b}\pi = 8 \;\Rightarrow\; \frac{2}{b} = \frac{8}{\pi} \;\Rightarrow\; b = \frac{2\pi}{8} = \frac{1}{4}\pi$

35d) $\frac{2}{b}\pi = \frac{1}{8} \;\Rightarrow\; 2\pi = \frac{1}{8}b \;\Rightarrow\; b = 16\pi$

35e) $\frac{2}{b}\pi = 12 \;\Rightarrow\; 2\pi = 12b \;\Rightarrow\; b = \frac{2}{12}\pi = \frac{1}{6}\pi$

35f) $\frac{2}{b}\pi = 365 \;\Rightarrow\; 2\pi = 365b \;\Rightarrow\; b = \frac{2}{265}\pi$

35g) $\frac{2}{b}\pi = 0,01\pi \;\Rightarrow\; 2\pi = 0,01\pi \cdot b \;\Rightarrow$

$\Rightarrow\; b = \frac{2}{0,01} = 200$

35h) $\frac{2}{b}\pi = 0,01 \;\Rightarrow\; 2\pi = 0,01b \;\Rightarrow$

$\Rightarrow\; b = \frac{2}{0,01}\pi = 200\pi$

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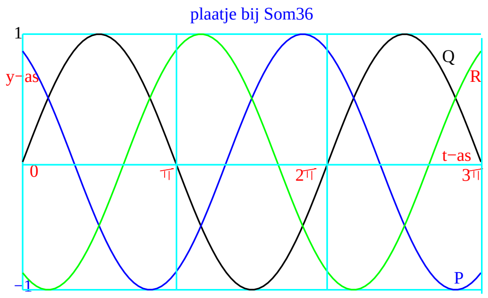
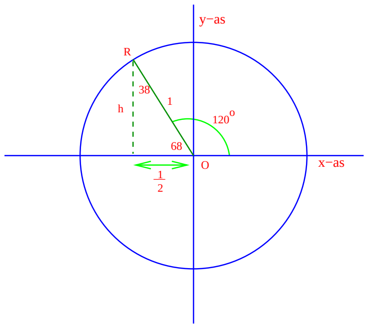
36)

t	0	$\frac{1}{6}\pi$	$\frac{1}{3}\pi$	$\frac{1}{2}\pi$	$\frac{2}{3}\pi$	π	$1\frac{1}{3}\pi$
P	0	$\frac{1}{2}$	$\frac{1}{2}\sqrt{3}$	1	$\frac{1}{2}\sqrt{3}$	0	$-\frac{1}{2}\sqrt{3}$
Q	$-\frac{1}{2}\sqrt{3}$	-1	$-\frac{1}{2}\sqrt{3}$	$-\frac{1}{2}$	0	$\frac{1}{2}\sqrt{3}$	$\frac{1}{2}\sqrt{3}$
R	$\frac{1}{2}\sqrt{3}$	$\frac{1}{2}$	0	$-\frac{1}{2}$	$-\frac{1}{2}\sqrt{3}$	$-\frac{1}{2}\sqrt{3}$	0

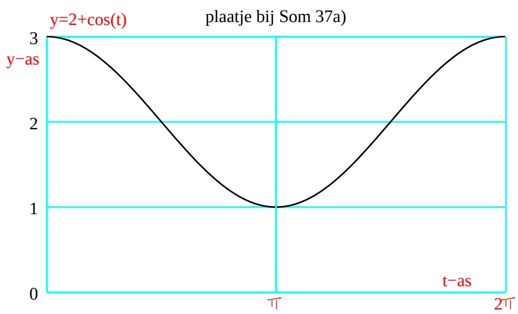




$$\sin 30^o = \sin\frac{1}{6}\pi = \frac{1}{2} \Rightarrow h = \sqrt{1^2 - \left(\frac{1}{2}\right)^2} \Rightarrow h = \sqrt{\frac{3}{4}} \Rightarrow h = \frac{\sqrt{3}}{\sqrt{4}} \Rightarrow h = \frac{1}{2}\sqrt{3} \xrightarrow{Dus} \sin 60^o = \frac{h}{1} = h \Rightarrow \sin 60^o = \frac{1}{2}\sqrt{3}$$

37a)

$$y = 2 + \cos t \longrightarrow \begin{cases} t \in [0;2\pi] & & \\ periode: & 1 & op\ [0:2\pi]\ \frac{1}{2\pi} per\, 1 \\ amplitude: & 1 & \\ evenwichtslijn: & y=2 & \\ verschuiving & 2\, omhoog & \begin{pmatrix} 0 \\ 2 \end{pmatrix} \end{cases}$$



37b)

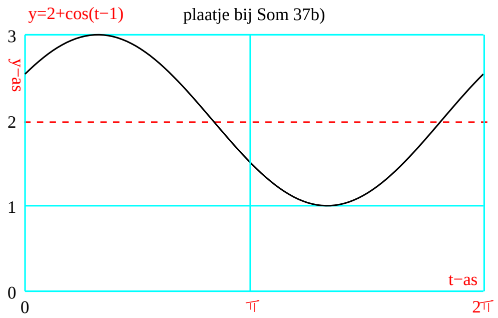
$$y = 2 + \cos(t-1) \longrightarrow \begin{cases} frequentie & \frac{1}{2\pi}\ per\ eenheid\ 1 & \\ periode: & 0 \leqq (t-1) \leqq 2\pi \Leftrightarrow 1 \leqq t \leqq (2\pi+1) \xrightarrow{periode\ is} & 2\pi + 1 - 1 = 2\pi \\ amplitude: & 1 & \\ evenwichtslijn: & y=2 & \\ verschuiving^* & 1 \longrightarrow rechts \\ & 2 \longrightarrow omhoog & \begin{pmatrix} 1 \\ 2 \end{pmatrix} \end{cases}$$

$verschuiving^{*}: als\ t = 1 \Rightarrow$

$\Rightarrow \cos(t-1) = \cos 0 \xleftarrow{is\ 1\ naar\ rechts}$

$t = 0 \Rightarrow y = 2 + \cos(-1) \simeq 2,5$

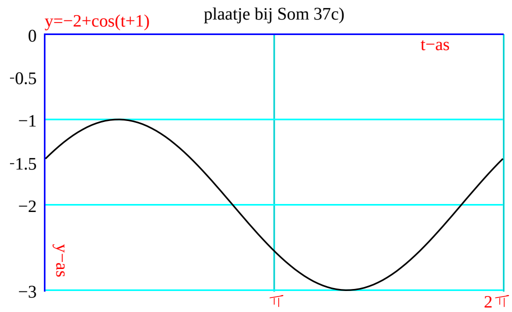
$t = 2\pi \Rightarrow y = 2\cos(2\pi - 1) \simeq 2,5$



37c)

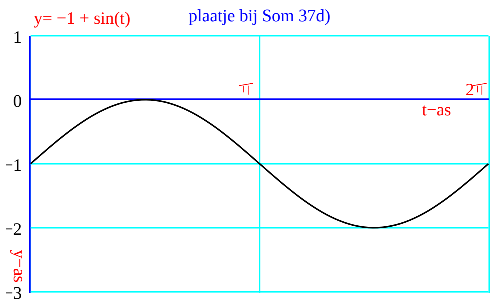
$$y = -2 + \cos(t+1) \longrightarrow \begin{cases} t \in [0; 2\pi] & \\ periode: & 2\pi \\ amplitude: & 1 \\ evenwichtslijn: & y = -2 \\ verschuiving & \begin{matrix} 1 \longrightarrow rechts \\ 2 \longrightarrow omlaag \end{matrix} \quad \begin{pmatrix} -1 \\ -2 \end{pmatrix} \end{cases}$$

t	0	$\frac{1}{2}\pi$
$-2 + \cos(t+1)$	-1,5	-2,8



37d)

$$y = \sin(t) - 1 \rightarrow \begin{cases} frequentie: & \frac{1}{2\pi} \\ periode: & 2\pi \\ amplitude: & 1 \\ evenwichtslijn: & y = -1 \\ verschuiving & 1 \rightarrow omlaag \\ t \in [0; 2\pi] & \end{cases}$$



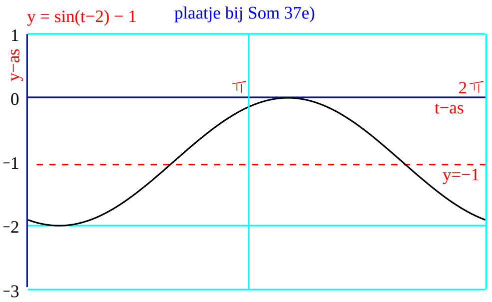
37e)

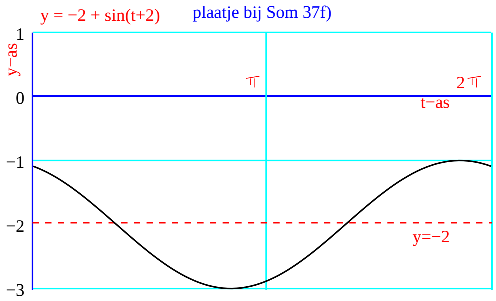
$$y = \sin(t-2) - 1 \longrightarrow \begin{cases} frequentie & \frac{1}{2\pi}\ per\ eenheid\ 1 \\ periode: & 0 \leqq (t-2) \leqq 2\pi \Leftrightarrow 2 \leqq t \leqq (2\pi + 2) \xrightarrow{periode\ is} \quad 2\pi \\ amplitude: & 1 \\ evenwichtslijn: & y = -1 \\ verschuiving^{*} & \begin{matrix} 2 \longrightarrow rechts \\ 1 \longrightarrow omlaag \end{matrix} \quad \begin{pmatrix} 2 \\ -1 \end{pmatrix} \end{cases}$$

$verschuiving^{*}: als\ t = 2 \Rightarrow$

$\Rightarrow \sin(2-2) = \sin 0 \xleftarrow{is\ 2\ naar\ rechts\ \&\ 1\ naar\ beneden}$

t	0	$\frac{1}{2}\pi$	π
$\sin(t-2) - 1$	-1,9	-1,4	-0,09





37f)

$$y=\sin(t+2)-2\rightarrow\begin{cases}\textit{frequentie}: & \frac{1}{2\pi}\\ \textit{periode}: & 2\pi\\ \textit{amplitude}: & 1\\ \textit{evenwichtslijn}: & y=-2\\ \textit{verschuiving} & \begin{pmatrix}-2\\-2\end{pmatrix}\\ t\in[0;2\pi] & \end{cases}$$

t	0	$\frac{1}{2}\pi$	π	$1\frac{1}{2}\pi$	2π
$\sin(t+2)-2$	-1,1	-2,4	-2,9	-1,6	-1,1

38a)

$$y=-2+2\cos(t)\longrightarrow\begin{cases}\textit{frequentie}: & \frac{1}{2\pi}\\ \textit{periode}: & 2\pi\\ \textit{amplitude}: & 2\\ \textit{evenwichtslijn}: & y=-2\end{cases}$$

38b)

$$y=-2+2\cos(3\cdot t)\longrightarrow\begin{cases}\textit{frequentie}: & \frac{1}{\frac{2}{3}\pi}\cdot 1=\frac{1}{\frac{2}{3}\pi}\cdot\frac{3}{3}=\frac{3}{2\pi}\\ \textit{periode}: & 0\leqq 3\cdot t\leqq 2\pi\Leftrightarrow 0\leqq t\leqq\frac{2}{3}\pi\xrightarrow{\textit{periode is}}\frac{2}{3}\pi\\ \textit{amplitude}: & 2\\ \textit{evenwichtslijn}: & y=-2\end{cases}$$

38c)

$$y=3-2\cos(t)\longrightarrow\begin{cases}\textit{frequentie}: & \frac{1}{2\pi}\\ \textit{periode}: & 2\pi\\ \textit{amplitude}: & 2\\ \textit{evenwichtslijn}: & y=3\end{cases}$$

38d)

$$y=3-2\cos(\tfrac{1}{2}t)\longrightarrow\begin{cases}\textit{frequentie}: & \frac{1}{4\pi}\\ \textit{periode}: & 0\leqq\frac{1}{2}t\leqq 2\pi\Leftrightarrow 0\leqq t\leqq 4\pi\xrightarrow{\textit{periode is}}4\pi\\ \textit{amplitude}: & 2\\ \textit{evenwichtslijn}: & y=3\end{cases}$$

38e)

$$y=2-2\sin(t)\longrightarrow\begin{cases}\textit{frequentie}: & \frac{1}{2\pi}\\ \textit{periode}: & 2\pi\\ \textit{amplitude}: & 3\\ \textit{evenwichtslijn}: & y=2\end{cases}$$

38f)

$$y=2-3\sin(2t)\longrightarrow\begin{cases}\textit{frequentie}: & \frac{1}{\pi}\\ \textit{periode}: & 0\leqq 2t\leqq 2\pi\Leftrightarrow 0\leqq t\leqq\pi\xrightarrow{\textit{periode is}}\pi\\ \textit{amplitude}: & 3\\ \textit{evenwichtslijn}: & y=-2\end{cases}$$

38g)

$$y=-1+2\sin(t)\longrightarrow\begin{cases}\textit{frequentie}: & \frac{1}{2\pi}\\ \textit{periode}: & 2\pi\\ \textit{amplitude}: & 2\\ \textit{evenwichtslijn}: & y=-1\end{cases}$$

38h)

$$y=-1+2\sin(3t)\longrightarrow\begin{cases}frequentie: & \frac{2}{2\pi}\\ periode: & 0\leqq 3t\leqq 2\pi \Leftrightarrow 0\leqq t\leqq \frac{2}{3}\pi \xrightarrow{periode\ is} \frac{2}{3}\pi\\ amplitude: & 2\\ evenwichtslijn: & y=-1\end{cases}$$

39a) $y=3+2\sin(bt)\longrightarrow\left\{\begin{matrix}0\leqq t\leqq 0,5\pi\\ 0\leqq bt\leqq 2\pi\end{matrix}\right\}\Rightarrow \frac{2}{b}=0,5\Rightarrow b=4\xrightarrow{Dus} y=3+2\sin(4t)$

39b) $\boxed{Algemene\ Formule\ y=a+d\cos(bt)}$

$$y=a+d\cos(bt)\Rightarrow\begin{cases}(0;2)\\ periode:2\longrightarrow 0\leqq bt\leqq 2\pi\Rightarrow 0\leqq t\leqq \frac{2\pi}{b}\longrightarrow \frac{2\pi}{b}=2\Rightarrow b=\pi\longrightarrow\\ amplitude:2\longrightarrow a=2\end{cases}$$

$$\longrightarrow\left.\begin{matrix}y=a+2\cos\pi t\\ (0;2)\end{matrix}\right\}\Rightarrow 2=a+2\cos 0\Rightarrow 2=a+2\Rightarrow a=0\xrightarrow{Dus} y=2\cos\pi t$$

39c) $\boxed{Algemene\ Formule\ y=a+c\sin b(t+d)}$

$$\left.\begin{matrix}evenwichtslijn: & y=1,5\Longrightarrow a=1,5\\ periode: & 2\pi\Longrightarrow b=1\\ verschuiving: & 2\ naar\ Rechts\Longrightarrow d=-2\end{matrix}\right\}\xrightarrow{y=a+c\sin b(t+d)\ \ Dus} y=1,5+\sin(t-2)$$

40) $f(t)=3\sin\frac{1}{4}\pi t+2\ D_f:[0;\rightarrow\rangle$

40a) Evenwichtslijn: $y=2$

40b)

$f\left(\frac{2}{3}\right)=3\sin\frac{1}{4}\pi\cdot\frac{2}{3}+2=3\sin\frac{1}{6}\pi+2=1\frac{1}{2}+2=3\frac{1}{2}$

$f\left(3\frac{1}{3}\right)=3\sin\frac{1}{4}\pi\cdot 3\frac{1}{3}+2=3\sin\frac{5}{6}\pi+2=1\frac{1}{2}+2=3\frac{1}{2}$

40c) Periode: $0\leqq\frac{1}{4}\pi t\leqq 2\pi\Rightarrow 0\leqq t\leqq 8$

40d) $2=3\sin\frac{1}{4}\pi t+2\Rightarrow 3\sin\frac{1}{4}\pi t=0\Rightarrow \sin\frac{1}{4}\pi t=0\Rightarrow \sin\frac{1}{4}\pi t=\sin(0+k\pi)\Rightarrow$

$\Rightarrow \frac{1}{4}\pi t=0+k\pi\Rightarrow \pi t=0+4k\pi\Rightarrow t=0+4k$

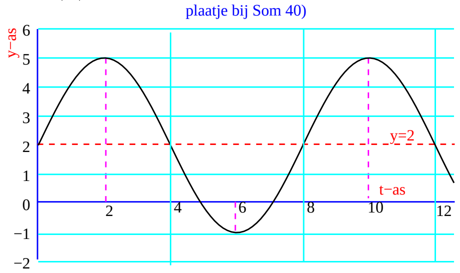
Snijden in evenwichtslijn: $(0;2)$, $(4;2)$, $(8;2)$, $(12;2)$ etc etc

40e) Amplitude : 3

40f) Uitwijking is maximaal als $\sin\frac{1}{4}\pi t$ maximaal of minimaal is

$$\xrightarrow{\sin\frac{1}{4}\pi t\ maximaal}\left\|\begin{matrix}\sin\frac{1}{4}\pi t=1 & \vee & \sin\frac{1}{4}\pi t=-1\Rightarrow\\ \Rightarrow\sin\frac{1}{4}\pi t=\sin(\frac{1}{2}\pi+2k\pi) & \vee & \sin\frac{1}{4}\pi t=\sin(1\frac{1}{2}\pi+2k\pi)\Rightarrow\\ \Rightarrow\frac{1}{4}\pi t=\frac{1}{2}\pi+2k\pi & \vee & \frac{1}{4}\pi t=1\frac{1}{2}\pi+2k\pi\Rightarrow\\ \Rightarrow\pi t=2\pi+8k\pi & \vee & \pi t=6\pi+8k\pi\Rightarrow\\ \Rightarrow t=2+8k & \vee & t=6+8kR\\ \Rightarrow t=2,10,18\,etc & & t=6,14,22\,etc\\ t=2\Rightarrow f(2)=3\cdot 1+2=5 & & t=6\Rightarrow f(6)=3\cdot -1+2=-1\end{matrix}\right\|$$

plaatje bij Som 40)



41A) $f(t)=2\sin\frac{1}{2}t-1$

41Aa) evenwichtslijn: $y=-1$

41Ac) Periode: $0\leqq\frac{1}{2}t\leqq 2\pi\Rightarrow 0\leqq t\leqq 4\pi\xrightarrow{Periode\ is} 4\pi$

41Ad) $2\sin\frac{1}{2}t-1=-1\Rightarrow 2\sin\frac{1}{2}t=0\Rightarrow \sin\frac{1}{2}t=0\Rightarrow \sin\frac{1}{2}t=\sin(0+k\pi)\Rightarrow \frac{1}{2}t=0+k\pi$

$\Rightarrow t=0+2k\pi\xrightarrow{Dus}(0;-1)$, $(2\pi;-1)$, $(4\pi;-1)$ etc etc

41Ae) Amplitude : 2

41Af)

De uitwijking is Maximaal als:

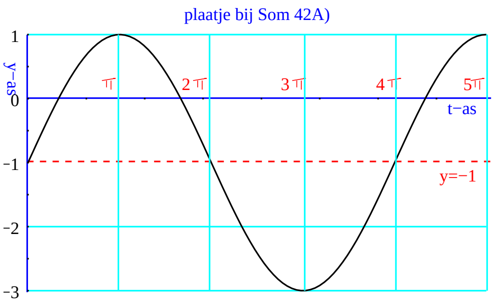
$$\xrightarrow{\sin\frac{1}{2}t\ maximaal}\left\|\begin{array}{ccc} \sin\frac{1}{2}t=1=\sin(\frac{1}{2}\pi+2k\pi) & \bigvee & \sin\frac{1}{2}t=-1=\sin(1\frac{1}{2}\pi+2k\pi)\ \Rightarrow \\ \Rightarrow\ \frac{1}{2}t=\frac{1}{2}\pi+2k\pi & \bigvee & \frac{1}{2}t=1\frac{1}{2}\pi+2k\pi\ \Rightarrow \\ \Rightarrow\ t=\pi+4k\pi & \bigvee & t=3\pi+4k\pi\ \Rightarrow \\ (\pi;1)\ ,\ (5\pi;1)\ ,\ (9\pi;1)\ etc & \bigwedge & (3\pi;-3)\ ,\ (7\pi;-3)\ ,\ (11\pi;-3)\ etc \end{array}\right\|$$

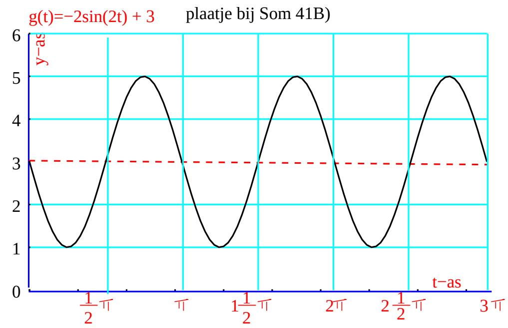
$\sin\frac{1}{6}\pi=\frac{1}{2}$

$\longrightarrow t=\frac{1}{3}\pi\ \Rightarrow\ f(\frac{1}{3}\pi)=2\sin\frac{1}{2}\cdot\frac{1}{3}\pi-1\ \Rightarrow\ f(\frac{1}{3}\pi)=2\cdot\sin\frac{1}{6}\pi-1\ \Rightarrow\ f(\frac{1}{3}\pi)=2\cdot\frac{1}{2}-1=0$

$\longrightarrow t=1\frac{2}{3}\pi\ \Rightarrow\ f(1\frac{2}{3}\pi)=2\sin\frac{1}{2}\cdot\frac{5}{3}\pi-1\ \Rightarrow\ f(1\frac{2}{3}\pi)=2\cdot\sin\frac{5}{6}\pi-1\ \Rightarrow\ f(\frac{1}{3}\pi)=2\cdot\frac{1}{2}-1=0$

$\longrightarrow t=2\frac{1}{3}\pi\ \Rightarrow\ f(2\frac{1}{3}\pi)=2\sin\frac{1}{2}\cdot\frac{7}{3}\pi-1\ \Rightarrow\ f(2\frac{1}{3}\pi)=2\cdot\sin\frac{7}{6}\pi-1\ \Rightarrow\ f(2\frac{1}{3}\pi)=2\cdot-\frac{1}{2}-1=-2$





41B) $g(t)=-2\sin(2t)+3$

41Ba) evenwichtslijn: $y=3$

41Bc) Periode: $0\leqq 2t\leqq 2\pi\ \Rightarrow\ 0\leqq t\leqq\pi\xrightarrow{Periode\ is}\pi$

41Bd) $-2\sin 2t+3=3\ \Rightarrow\ -2\sin 2t=0\ \Rightarrow\ \sin 2t=0\ \Rightarrow\ \sin 2t=\sin(0+k\pi)\ \Rightarrow\ 2t=0+k\pi\ \Rightarrow$

$\Rightarrow\ t=0+\frac{1}{2}k\pi\xrightarrow{Dus}(0;3)\ ,\ (\frac{1}{2}\pi;3)\ ,\ (\pi;3)\ ,\ (1\frac{1}{2}\pi;3)$ etc etc

41Be) Amplitude is 2

41Bf) Uitwijking maximaal, als $\sin 2t=1=\sin(\frac{1}{2}\pi+2k\pi)\ \bigvee\ \sin 2t=-1=\sin(1\frac{1}{2}\pi+2k\pi)\ \Rightarrow$

$$\xrightarrow{\sin 2t\ maximaal}\left\|\begin{array}{ccc} \Rightarrow\ 2t=\frac{1}{2}\pi+2k\pi & \bigvee & 2t=1\frac{1}{2}\pi+2k\pi\ \Rightarrow \\ \Rightarrow\ t=\frac{1}{4}\pi+k\pi & \bigvee & t=\frac{3}{4}\pi+k\pi\ \Rightarrow \\ \Rightarrow\ g(\frac{1}{4}\pi)=-2\cdot\sin(2\cdot\frac{1}{4}\pi)+3 & \bigvee & g(\frac{3}{4}\pi)=-2\cdot\sin(2\cdot\frac{3}{4}\pi)+3\ \Rightarrow \\ \Rightarrow\ g(\frac{1}{4}\pi)=-2\cdot 1+3 & \bigvee & g(\frac{5}{4}\pi)=-2\cdot-1+3\ \Rightarrow \\ \Rightarrow\ g(\frac{1}{4}\pi)=+1 & \bigvee & g(\frac{5}{4}\pi)=5\ \Rightarrow \\ (\frac{1}{4}\pi;1)\ ,\ (1\frac{1}{4}\pi;1)\ etc & & (\frac{3}{4}\pi;5)\ ,\ (1\frac{3}{4}\pi;5)\ etc \end{array}\right\|$$

41C) $h(x)=\frac{1}{2}\sin\pi x$

41Ca) Evenwichtslijn: $y=0$

41Cb)

41Cc) Periode: $0\leqq\pi x\leqq 2\pi\ \Rightarrow\ 0\leqq x\leqq 4\xrightarrow{Periode\ is}2$

41Cd) $\frac{1}{2}\sin\pi x=0\ \Rightarrow\ \sin\pi x=0=\sin(0+k\pi)\ \Rightarrow\ x\pi=0+k\pi\ \Rightarrow\ x=0+k\ \Rightarrow$

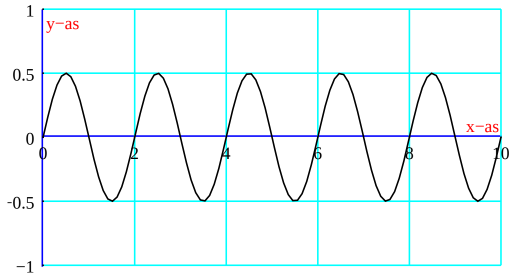
$\xrightarrow{Dus}(0;0)\ ,\ (1;0)\ ,\ (2;0)\ ,\ (3;0)$ enz enz

41Ce) Amplitude is $\frac{1}{2}$

41Cf) Maximaal: $\sin\pi x=1=\sin(\frac{1}{2}\pi+2k\pi)\ \bigvee\ \sin\pi x=-1=\sin(1\frac{1}{2}\pi+2k\pi)\ \Rightarrow$

$\pi x=\frac{1}{2}\pi+2k\pi\ \bigvee\ \pi x=1\frac{1}{2}\pi+2k\pi\Rightarrow\ x=\frac{1}{2}+2k\ \bigvee\ x=1\frac{1}{2}+2k$

Dus $(\frac{1}{2};\frac{1}{2})\ ,\ (2\frac{1}{2};\frac{1}{2})$ etc etc $(1\frac{1}{2};-\frac{1}{2})\ ,\ (3\frac{1}{2};-\frac{1}{2})$ etc etc plaatje bij Som41C



41D) $k(x) = \pi - 2\sin 1\frac{1}{2}x$

41Da) Evenwichtslijn: $y = \pi$

41Dc) $Periode: 0 \leqq 1\frac{1}{2}x \leqq 2\pi \Rightarrow 0 \leqq x \leqq \frac{4}{3}\pi \xrightarrow{Periode\ is} 1\frac{1}{3}\pi$

41Dd) $\pi - 2\sin 1\frac{1}{2}x = \pi \Rightarrow -2\sin 1\frac{1}{2}x = 0 \Rightarrow \sin 1\frac{1}{2}x = 0 = \sin(0 + k\pi) \Rightarrow 1\frac{1}{2}x = 0 + k\pi$

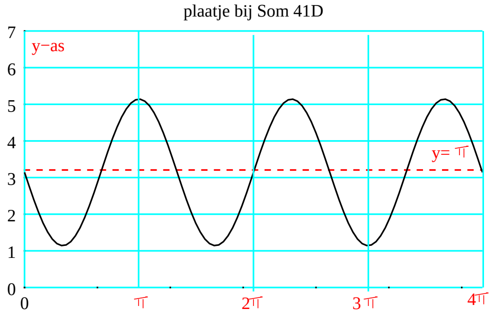
Dus $(0;\pi)$, $(\frac{2}{3}\pi;\pi)$ etc etc $(1\frac{1}{3}\pi;\pi)$, $(2\pi;\pi)$ etc etc

41D3) Amplitude is 2

41Df) Maximale uitwijking als: $\sin 1\frac{1}{2}x = 1 = \sin(\frac{1}{2}\pi + 2k\pi) \vee \sin 1\frac{1}{2} = -1 = \sin(1\frac{1}{2}\pi + 2k\pi) \Rightarrow$

$$\xrightarrow{\sin 1\frac{1}{2}x\ maximaal} \left\| \begin{array}{ccc} 1\frac{1}{2}x = \frac{1}{2}\pi + 2k\pi & \vee & 1\frac{1}{2} = 1\frac{1}{2}\pi + 2k\pi \Rightarrow \\ \Rightarrow x = \frac{1}{3}\pi + 1\frac{1}{3}k\pi & \vee & x = \pi + k\pi \Rightarrow \\ x = \frac{1}{3}\pi & & x = \pi \\ \Rightarrow k(\frac{1}{3}\pi) = \pi - 2\cdot\sin(1\frac{1}{2}\cdot\frac{1}{3}\pi) & \vee & g(\pi) = \pi - 2\cdot\sin(\pi\cdot 1\frac{1}{2}\pi) \Rightarrow \\ \Rightarrow k(\frac{1}{3}\pi) = \pi - 2\cdot\sin\frac{1}{2}\pi & \vee & k(\pi) = \pi - 2\sin 1\frac{1}{2}\pi \Rightarrow \\ \Rightarrow k(\frac{1}{3}\pi) = \pi - 2 & \vee & g(\pi) = \pi + 2 \Rightarrow \\ (\frac{1}{3}\pi;\pi-2)\ ,\ (1\frac{2}{3}\pi;\pi-2)\ etc & & (\pi;\pi+2)\ ,\ (2\frac{1}{3}\pi;\pi+2)\ etc \end{array} \right\|$$

plaatje bij Som 41D



42)

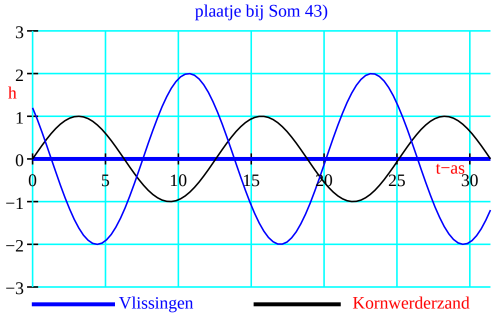
IV heeft de kleinste amplitude ⇒ 4

I heeft de kleinste periode ⇒ 3 $0 \leqq bt \leqq 2\pi \Rightarrow 0 \leqq t \leqq \frac{2\pi}{b} \xleftarrow{hoe\ groter\ b,\ des\ te\ kleiner\ de\ Periode}$

II heeft de grootste periode ⇒ 1

III 2

plaatje bij Som 43)



43a)

t	0	π	2π	3π	4π	2	2,5	4	8	16
Kornwerderzand h	0	1	0	-1	0	0,84	0,6	0,91	-0,76	0,99
Vlissingen t	-5	$\pi - 5$	$2\pi - 5$	$3\pi - 5$	$4\pi - 5$	-3		-1	3	11

43b) III $h = 2\sin\frac{1}{2}(t+5)$

$2 \xrightarrow{betekend} Amplitude$

$(t+5) \xrightarrow{betekend} 5\,uur\ eerder$: als $t=-5$ dan dez zelfde hoogte als in Kornwerderzand op $t=0$

43c) $-1m\ of\ -0.13m$

Bereken:

$1,4 = 2\sin\frac{1}{2}(t+5) \Rightarrow 0,7 = \sin\frac{1}{2}(t+5) \Rightarrow$

$\Rightarrow \sin\frac{1}{2}(t+5) \simeq \sin 0,7754\ of\ \sin\frac{1}{2}(t+5) \simeq \sin(\pi - 0,7754) \Rightarrow$

$\Rightarrow \frac{1}{2}(t+5) \simeq 0,7754 + 2k\pi\ of\ \frac{1}{2}(t+5) \simeq 2,366 + 2k\pi \Rightarrow$

$\Rightarrow t+5 \simeq 1,5508 + k\pi\ of\ t+5 \simeq 4,7324 + k\pi \Rightarrow$

$\Rightarrow t \simeq -3,4492 + 4k\pi\ of\ t \simeq -0,2676 + 4k\pi$

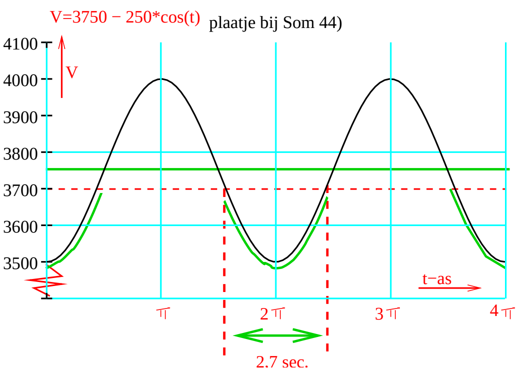
$\Rightarrow \sin(\frac{1}{2}\cdot -3,4492) \simeq -0,988\ of\ \sin(\frac{1}{2}\cdot -0,2676) \Rightarrow h \simeq -1\ of\ h \simeq -0,13$

44) $V = 3760 - 250\cos t$ Waarbij t de tijd is uitgedrukt in seconden en V het volume in cm^3

44a) De Perode is 2π seconden $\Rightarrow$ $frequentie\ per\ seconde \longrightarrow \frac{1}{2\pi} \Rightarrow frequentie\ per\ minuut \longrightarrow \frac{60}{2\pi}$

44b)

t	0	$\frac{1}{3}\pi$	$\frac{1}{2}\pi$	$\frac{2}{3}\pi$	π	$1\frac{1}{3}\pi$	$1\frac{1}{2}\pi$	$1\frac{2}{3}\pi$	2π
V	3500	3625	3750	3875	4000	3875	3750	3625	3500



44c)

$3cm \Longleftrightarrow \pi$

$\frac{3}{\pi}cm \Longleftrightarrow 1 \Rightarrow 2,8\cdot\frac{3}{\pi} \simeq 2,7\,seconden$

$3700 - 2750 - 250\cos(t) \Rightarrow 250\cos(t) = 50 \Rightarrow \cos(t) = 0,2 \Rightarrow$

$\cos(t) \simeq \cos(1,37 + 2k\pi)\ of\ \cos(t) \simeq \cos(-1,37 + 2k\pi) \Rightarrow$

$\Rightarrow t \simeq 1,37 + 2k\pi\ of\ t \simeq -1,37 + 2k\pi \Rightarrow$

$\Rightarrow t \simeq 1,37 \bigvee t \simeq 7,7\ of\ t \simeq 4,9 \bigvee t \simeq 11,2$

$7,7 - 4,9 \simeq 2,8\,sec.$

45) $r = 28 + 17\sin 2\pi t$ Waarin r is de hoogte t.o.v. wegdek,
t de tijd in seconde

45a)

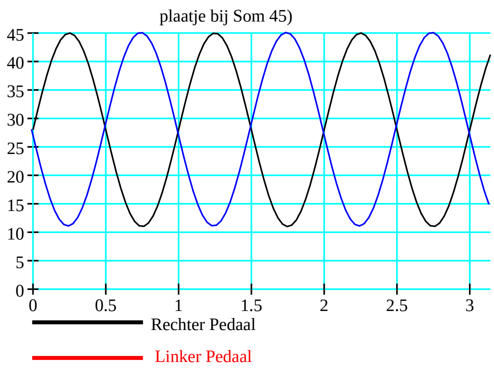
Amplitude: $17 \longrightarrow$ maximaal 17 cm onder en boven de trapas

Evenwichtslijn: $28 \longrightarrow$ de trapas ligt 28cm boven het wegdek

$0 \leq 2\pi t \leq 2\pi \Rightarrow 0 \leq t \leq 1 \xrightarrow{Periode\ is} 1$

t	0	$\frac{1}{12}$	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{3}{4}$
r	28	36,5	45	28	11

45b)



45c) $l = 28 - 17\sin 2\pi t$

45d) $28 + 17\sin 2\pi t - (28 - 17\sin 2\pi t) = 6 \Rightarrow 28 + 17\sin 2\pi t - 28 + 17\sin 2\pi t = 6 \Rightarrow$

$\Rightarrow 34\sin 2\pi t = 6 \Rightarrow \sin 2\pi t = \frac{6}{34} \simeq 0,176$

$\longrightarrow \sin 2\pi t = \sin(\frac{6}{34} + 2k\pi) \bigvee \sin(\pi - \frac{6}{34} + 2k\pi) \Rightarrow 2\pi t = 2k\pi + \frac{6}{34} \bigvee 2\pi t = \pi - \frac{6}{34} + 2k\pi \Rightarrow$

$\Rightarrow t \simeq 0,028 + k \bigvee t \simeq 0,472 + k \Rightarrow \begin{cases} t \simeq 0,028 \bigvee t \simeq 1,028\ etc\ etc \\ t \simeq 0,472 \bigvee t \simeq 1,472\ etc\ etc \end{cases}$

In 1 periode: $t \simeq 0,028\ of\ t \simeq 0,472$

$28 + 17\sin 2\pi t - (28 - 17\sin 2\pi t) = -6 \Rightarrow 34\sin 2\pi t = -6 \Rightarrow \sin 2\pi t = -\frac{6}{34} \simeq -0,1774 \Rightarrow$

$\Rightarrow \sin 2\pi t \simeq \sin(-0,1774 + 2k\pi) \bigvee \sin 2\pi t \simeq \sin(\pi - -0,1774 + 2k\pi) \Rightarrow$

$2\pi t \simeq -0,1774 + 2k\pi \bigvee 2\pi t \simeq 3,319 + 2k\pi \Rightarrow t \simeq -0,028 + k \bigvee t \simeq 0,528 + k$

In 1 periode $t \simeq 0,972 \xleftarrow{0,972=-0,028+1} \quad of \quad t \simeq 0,528$
Hoogte verschil minder dan $6cm \longrightarrow$
$0,028+(0,528-0,472)+(1-0,972)=0,028+0,056+0,028=0,112$
Of bereken van uit een heel precies getekende grafiek: $\left\langle \begin{array}{c} 28+3=32 \\ 28-3=25 \end{array} \right\rangle \xleftarrow{Hier\ Aflezen}$

45e) Periode is $1\,sec. \xrightarrow{Dus\ldots\ldots} 5^{meter}/_{seconde} \Rightarrow 5*3600^{meter}/_{uur} \Rightarrow 18^{kilometer}/_{uur}$

Kern 5
Doorwerking

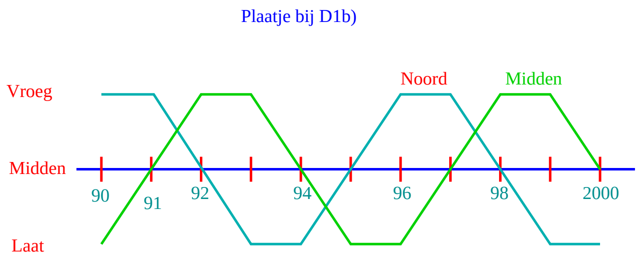
D1a) laat

D1b)

Noord is vroeg: 1990-1991

Midden is vroeg: 1992-1993 (2 jaar later)

In 1988: Midden



D1c) $p = 6$ (periode is 6)

D2a)

$$\left.\begin{array}{r} Amplitude = 8 \\ Evenwichtsstand:\ 10 - 1,5 = 8,5 \end{array}\right\} \xrightarrow{Dus\ formule\,(2)} h(t) = 8,5 + 8\sin(0,1\pi t)$$

D2b) $h(0) = 8,5 + 8\sin(0,1\pi \cdot 0) \Rightarrow h(0) = 8,5 + 0 \Rightarrow h(0) = 8,5$

Periode: $0 \leqq 0,1\pi t \leqq 2\pi \Rightarrow 0 \leqq t \leqq 20 \xleftarrow{de\ Periode\ is} 20\,seconden$

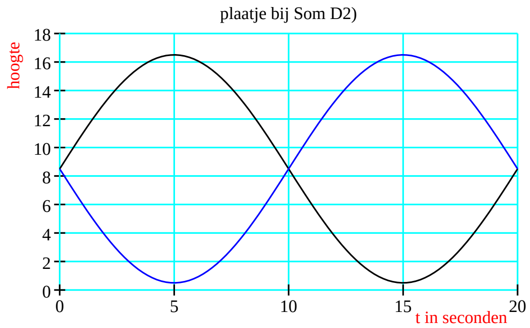
D2c) $t = 12 \Rightarrow h(12) = 8,5 + 8\sin(0,1\pi 12) \simeq 3,8\,meter$

t	0	10	20
h	8,5	8,5	8,5

t	0	15
h	16,5	0,5

t	$\frac{10}{6}$	$\frac{50}{6}$
h	12,5	12,5

t	$\frac{70}{6}$	$\frac{110}{6}$
h	4,5	4,5



D2e) $Q:\ h(t) = 8,5 - 8\sin(0,1\pi t)$

D3a) 2,7,11,14 juni
D3b) 7 dagen
D3d) $4 = 1,5\sin 0,375t$ $0 \leqq 0,375t \leqq 2\pi$
$\frac{2\pi}{0,375} \simeq 16,8$ dagen