

Calculations with Waves

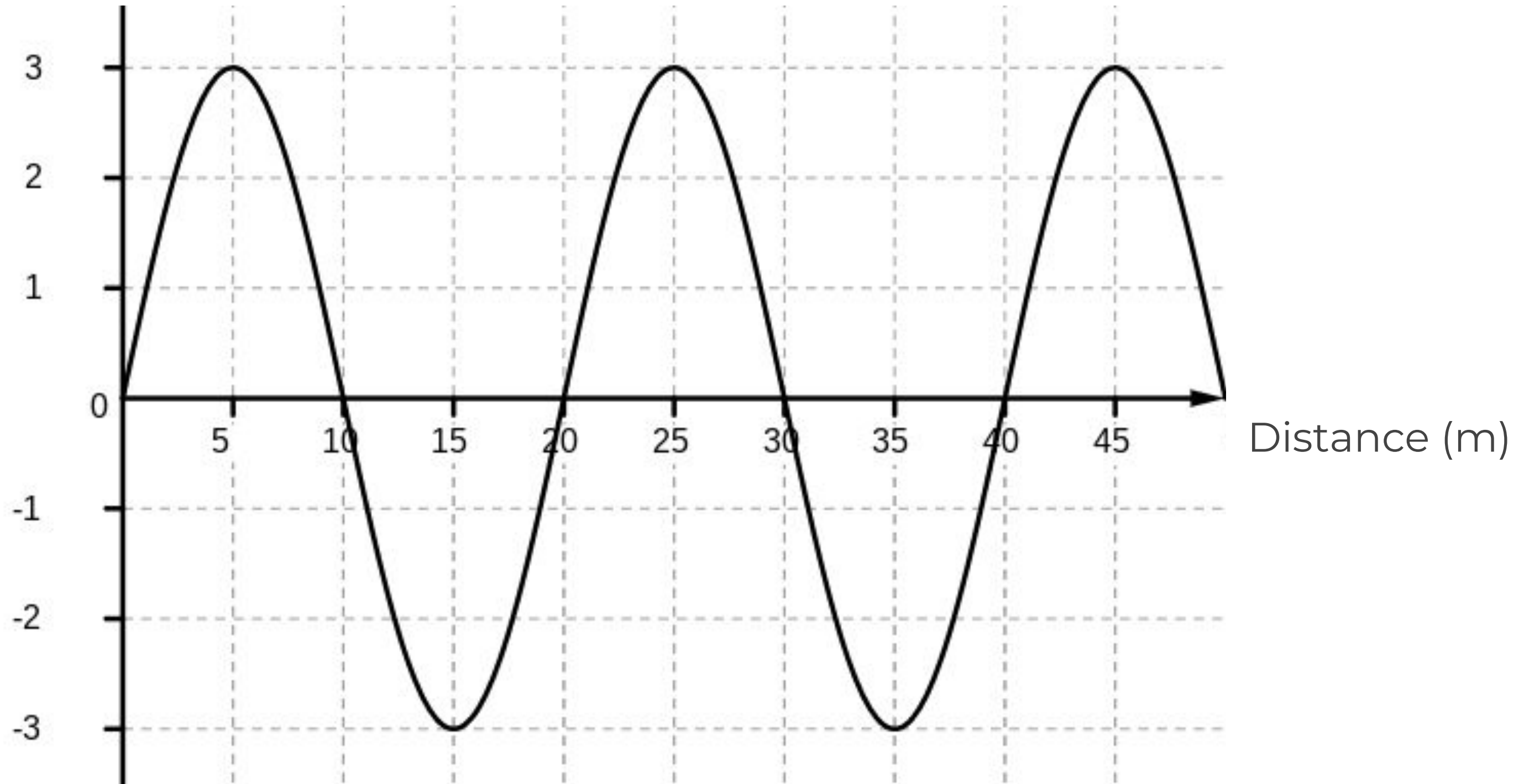
Combined Science - Physics - Key stage 4 - Waves

Mr Benyohai



Measuring wavelength and amplitude

Displacement (m)

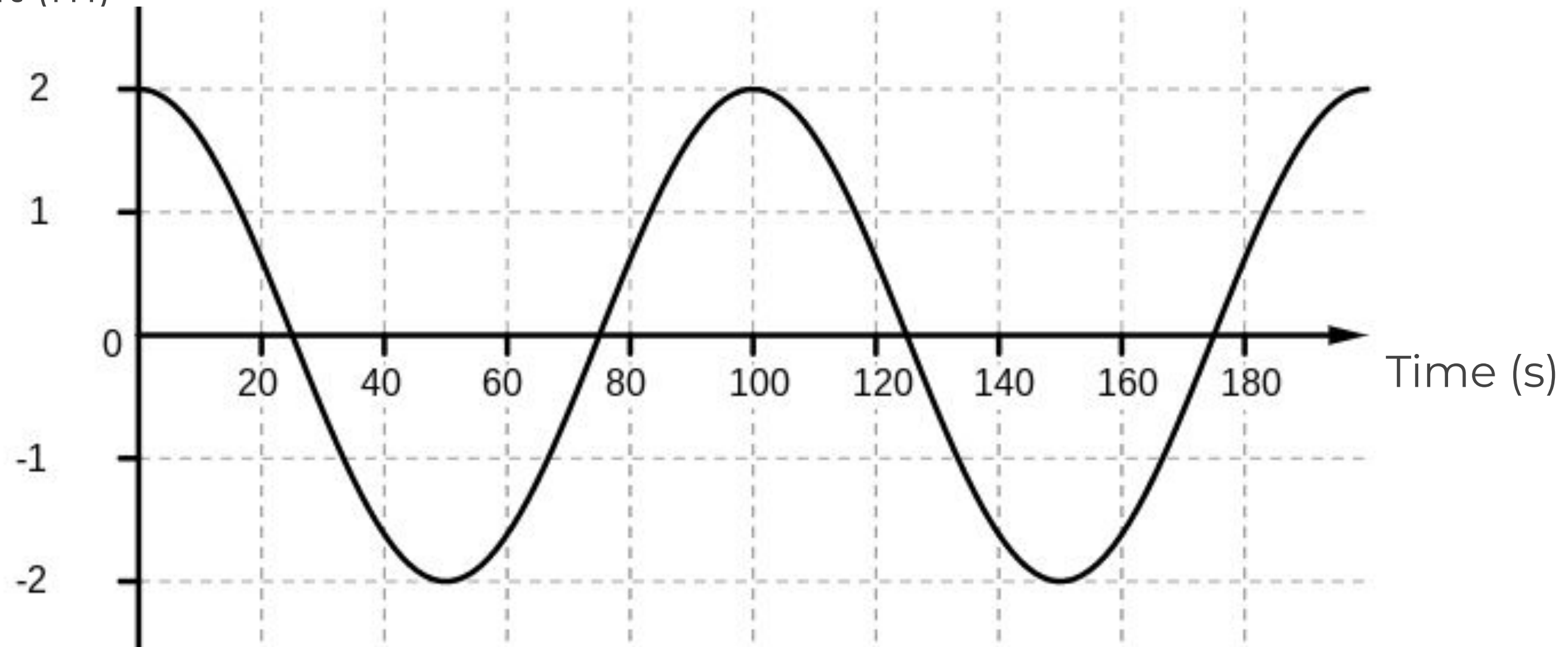


Credit: Mr Benyohai



Measuring period

Displacement (m)



Credit: Mr Benyohai



The relationship between period and frequency

$$T = \frac{1}{f}$$

Symbol	Quantity	Units	Unit Symbol
T			
f			



Worked example

Calculate the period when the frequency is 4 Hz



Shared example

	A water wave has a frequency of 0.5 Hz. Calculate the period.	A water wave has a frequency of 12 mHz. Calculate the period.
V alues		
E quation		
S ubstitute		
R earrange		
A nswer		
U nits		



Independent practice

1. Calculate the time period when the frequency is:

a. 4 Hz

b. 25 Hz

c. 5000 Hz

d. 3×10^3 Hz

e. 2 kHz

f. 3.45 kHz

g. 0.5 MHz

h. 150 mHz

i. 0.2 Hz

j. 14.3×10^{-6} Hz



Worked example

Calculate the frequency when the period is 2 minutes



Shared example

	A water wave has a period of 0.5 μ s. Calculate the frequency.	A water wave has a period of 0.1 ms. Calculate the frequency.
V alues		
E quation		
S ubstitute		
R earrange		
A nswer		
U nits		



Independent practice

1. Calculate the frequency when the time period is:

a. 0.5 seconds

b. 7 seconds

c. 0.01 seconds

d. 5 milliseconds

e. $34.5\ \mu\text{s}$

f. 2 ns

g. 1 minute

h. 30 minutes

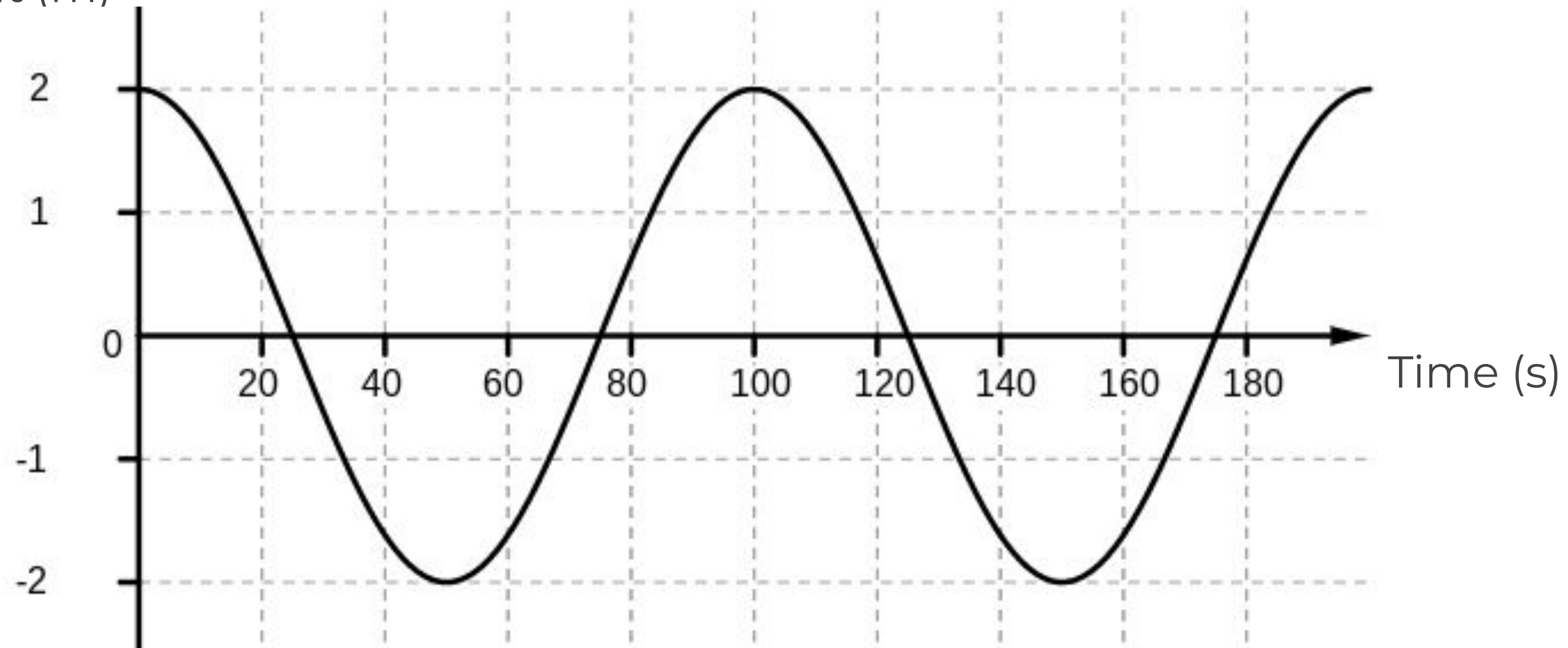
i. 2 hours

j. 2 minutes 25 seconds



Measuring period and calculating frequency

Displacement (m)



Credit: Mr Benyohai



Calculating wave speed

$$v = f \times \lambda$$

Symbol	Quantity	Units	Unit Symbol
v			
f			
λ			



Worked example

A wave generator with a frequency of 50 Hz produces water waves with a wavelength of 20 cm. What is the wave speed?



Shared example

	If a wave has a frequency of 5 Hz and has a wavelength of 2 m, what is the wave speed?	A generator with a frequency of 50 Hz produces water waves with a wavelength of 3 m. What is the wave speed?
V alues		
E quation		
S ubstitute		
R earrange		
A nswer		
U nits		



Independent practice

1. What is the wave speed if:
 - a. $f = 5 \text{ Hz}$, $\lambda = 1 \text{ m}$
 - b. $f = 6 \text{ Hz}$, $\lambda = 0.25 \text{ m}$
 - c. $f = 13 \text{ kHz}$, $\lambda = 25 \text{ m}$
2. A sound wave in steel with a frequency of 500 Hz and a wavelength of 3.0 metres. What is its speed?
3. a ripple on a pond with a frequency of 2 Hz and a wavelength of 0.4 metres. What is the wave speed?
4. A radio wave with a wavelength of 30 m and a frequency of 10,000,000 hertz. What is the wave speed?



Worked example

Sound has a speed of 330 m/s. Calculate the wavelength of the sound from a siren with a frequency of 3400 Hz.



Shared example

	A sound wave of wavelength 10 metres travelling at 340 metres per second in air. What is its frequency?	A wave on a slinky spring with a frequency of 0.9 mHz travelling at 3 m/s. What is its wavelength?
V alues		
E quation		
S ubstitute		
R earrange		
A nswer		
U nits		



Independent practice

1. What is the frequency if:
 - a. $v = 2 \text{ m/s}$, $\lambda = 1 \text{ m}$
 - b. $v = 4 \text{ km/s}$, $\lambda = 3 \text{ m}$
 - c. $v = 6 \text{ cm/s}$, $\lambda = 50 \text{ cm}$
2. What is the wavelength if:
 - a. $v = 2 \text{ m/s}$, $f = 4 \text{ Hz}$
 - b. $v = 34 \text{ mm/s}$, $f = 40 \text{ Hz}$
 - c. $v = 12 \text{ cm/s}$, $f = 25 \text{ MHz}$
3. A train whistle has a frequency of 2 kHz and the speed of sound is 330 m/s . What is its wavelength?
4. A radio station has a wavelength of 1500 m . The speed of radio waves is $300\,000\,000 \text{ m/s}$. What is the frequency of the radio transmissions?

