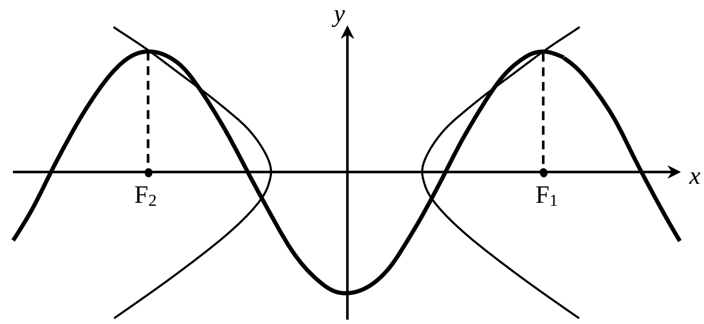
1 A hyperbola and a trigonometric function are drawn on the same Cartesian plane. The equation of the hyperbola is

$$\frac{x^2}{25} - \frac{y^2}{144} = 1.$$

The foci of the hyperbola are directly below two of the maxima of the trigonometric function.
What equation describes the trigonometric function?



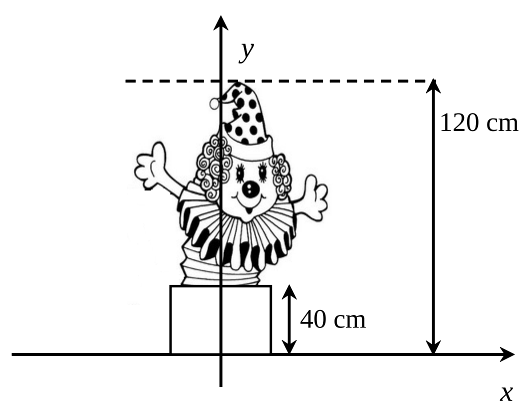
2 During an experiment, the intensity i*(t)* of the electric current of a device as a function of time *t* elapsed since the beginning of the experiment is given by: $i(t) = 6 \sin\left(\frac{\pi t}{12} + \frac{2\pi}{3}\right) + 6$ where t is expressed in seconds.

The device emits a sound signal each time the current's intensity is equal to 9. The experiment lasts 120 seconds.
How many sound signals does the device emit during the experiment?

3 A fountain in a shopping centre has a single jet of water. The height of the jet of water varies according to a sinusoidal function. Joel notes that, in exactly one minute, the jet goes from a minimum height of 1 m to a maximum height of 5 m and back to 1 m.
At 13:00, the jet of water is at a height of 1 m.
What will be the height of the jet of water when the clock reads 13:12:40? (13 hours, 12 minutes, 40 seconds)

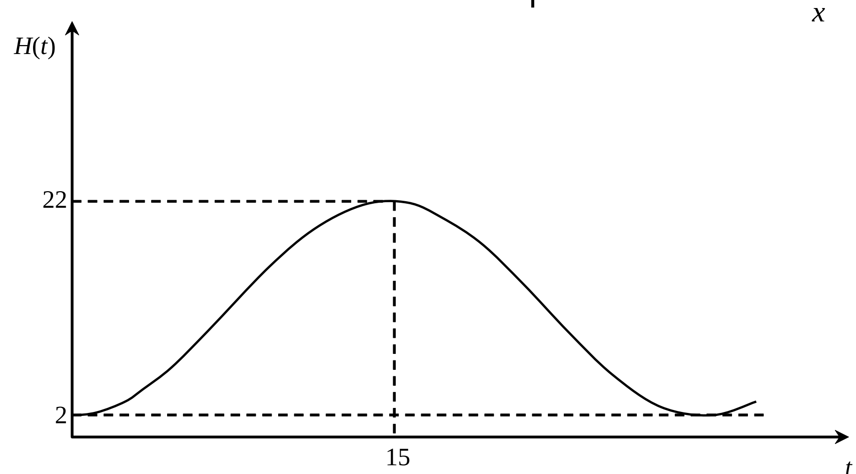
4 The depth of water at the port of St. Marie-Elise varies according to the tides. A sinusoidal function can be used to predict water depth. At low tide, the depth of the water is 9.2 m. At high tide, it is 18.2 m. The time between two low tides is 12 hours and 30 minutes.
In order for an oil tanker to dock safely, the depth of water must be at least 14.5 m.
For how many hours can an oil tanker dock safely between two consecutive low tides?

5 The diagram depicts the head of a Jack-in-a-box used in the display window of a department store. The head is connected to a motor, and its up-and-down movement follows a sinusoidal curve. The head is compressed to 40 cm at $t = 0$ and it reaches a maximum height of 120 cm. It bounces with a frequency of 10 cycles per minute.
At what height is the head, 5 seconds after it is released?

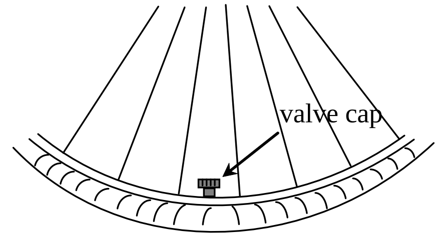


6 Tom's ride on the Ferris wheel at *La Ronde* can be described by the graph of the sinusoidal function shown below.
The graph represents the height of Tom's seat above the ground, in metres, as a function of the time, *t*, in seconds.
The distance between the minimum and maximum heights of Tom's seat is 20 metres.
Tom's seat reaches its first maximum height 15 seconds after the Ferris wheel begins to turn.

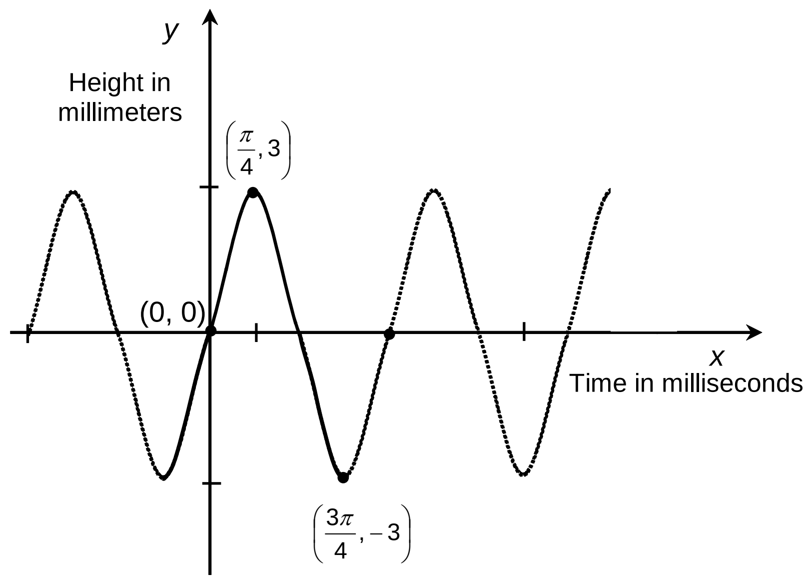
Assuming that Tom's seat started from rest at the bottom of the Ferris wheel, **how many metres above ground is Tom's seat 20 seconds after the Ferris wheel begins to turn**?



7 Sara is riding her bicycle. The front wheel makes a complete turn in 2 seconds.
The diameter of the front wheel, including the tire, is 46 cm.
The thickness of the tire is 4 cm.
Moreover, the valve cap is 4 cm away from the tire rim.
When the wheel starts moving, the cap is at its shortest distance from the ground.
At what times, during the first 4 seconds of the ride, will the valve cap be at 33 cm from the ground?



8 A vibration of a guitar string is described by a sinusoidal movement whose graph is shown at right.
What is the height of the guitar string at 3.2 milliseconds?



9 A cuckoo clock uses a pendulum to keep time. The movement of the pendulum can be described by a sinusoidal function.
The length of the pendulum is 31 cm. At its lowest point, the pendulum is 1.5 m from the ground.
The pendulum starts its movement at t_1.
The interior angle between t_2 and t_3 is 90° and it takes the pendulum 0.875 second to go from t_2 to t_3.
What is the height of the pendulum relative to the ground after 1 hour?