Trig Functions Word Problems Worksheet 2 (with answers)

1. At a seaport, the depth of the water h metres at time t hours during a certain day is given by this formula.

$$h = 1.8 \sin 2\pi \frac{(t - 4.00)}{12.4} + 3.1$$

a) Calculate the depth of the water at 5 A.M. and at 12 noon.
b) What is the maximum depth of the water? When does it occur?

2. The equation below gives the depth of the water h metres at an ocean port at any time t hours during a certain day.

$$h = 2.5 \sin 2\pi \frac{(t - 1.5)}{12.4} + 4.3$$

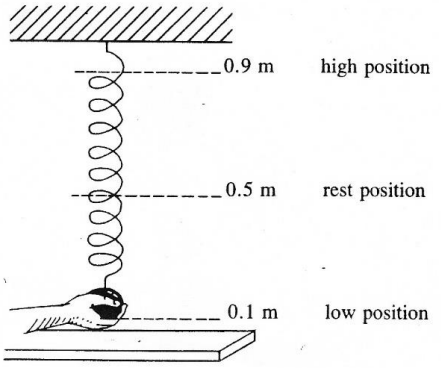
Calculate the approximate depth of the water at 9:30 A.M.

3. Tidal forces are greatest when the Earth, the sun, and the moon are in line. When this occurs at the Annapolis Tidal Generating Station, the water has a maximum depth of 9.6 m at 4:30 A.M. and a minimum depth of 0.4 m 6.2 h later.
a) Write an equation for the depth of the water at any time t.
b) Calculate the depth of the water at 9:30 A.M. and at 6:45 P.M.

4. Write an equation for the volume of air in the lungs during deep breathing, when the variation is from 1000 mL to 5000 mL. Assume that the period is 10 s.

5. The twin towers of the World Trade Center in New York were once the tallest buildings in the world. During a strong wind, the top of each tower swings back and forth as much as 80 cm, with a period of 10 s.
a) Draw a graph showing the departure of the top of one of the buildings from the normal position as a function of time, for 20 s.
b) Write an equation for the function in part a).

6. A certain mass is supported by a spring so that it is at rest 0.5 m above a table top. The mass is pulled down 0.4 m and released at time $t = 0$, creating a periodic up and down motion, called *simple harmonic motion*. It takes 1.2 s for the mass to return to the low position each time.
a) Draw a graph showing the height of the mass above the table top as a function of time for the first 2.0 s.
b) Write an equation for the function in part a).
c) Use your equation to determine the height of the mass above the table top after:
i) 0.3 s ii) 0.7 s iii) 1.2 s.

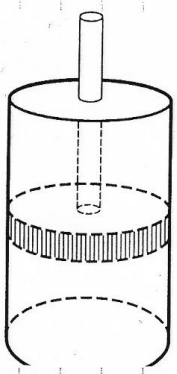


Answers: 1) a) ~3.97 m ~1.72 m b) 4.9 m @ 7.06 am 7:30 pm
2) 2.3 m 3) $y = 4.6 \cos \frac{2\pi}{12.4}(t - 4.5) + 5$ b) 1.2 m, 7.7 m
4) $y = 2000 \sin \frac{\pi}{5}(t) + 3000$ 5) b) $y = 80 \sin \frac{\pi}{5} x$ 6) $y = .4 \cos \frac{2\pi}{1.2}(x - .6) +$
$y = .4 \sin \frac{2\pi}{1.2}(x - .3) +$

Trig Functions Word Problems Worksheet 2 (with answers)

(7) ✓ A piston in an engine moves up and down in the cylinder, as shown in the diagram. The height h centimetres of the piston at time t seconds is given by this formula.

$h = 20 \sin \frac{2\pi t}{0.05} + 20$



a) State the piston's:
   i) maximum height
   ii) minimum height
   iii) period.

b) If the piston operates for exactly one hour, how many complete cycles does it make?

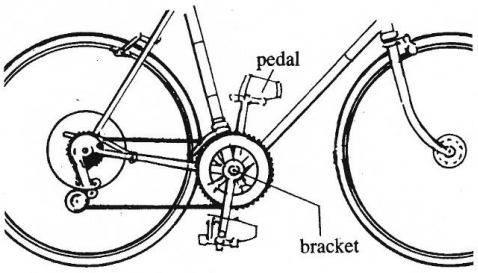
(8) ✓ **A Ferris wheel has a radius of 25 m, and its centre is 26 m above the ground. It rotates once every 50 s. Suppose you get on at the bottom at $t = 0$.**

a) Draw a graph showing how your height above the ground changes during the first two minutes.

b) Write an equation for the function in part a).

c) Use your equation to determine how high you will be above the ground after:
   i) 10 s ii) 20 s iii) 40 s iv) 60 s.

(9) ✓ The pedals of a bicycle are mounted on a bracket whose centre is 29.0 cm above the ground. Each pedal is 16.5 cm from the bracket. Assume that the bicycle is pedaled at the rate of 12 cycles per minute.

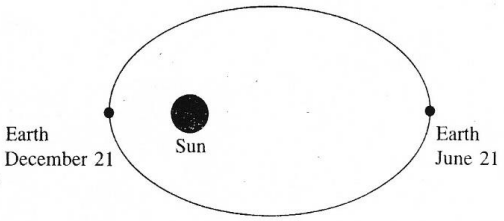


a) Draw a graph showing the height of a pedal above the ground for the first few cycles. Assume that the pedal starts at the topmost position at $t = 0$.

b) Write an equation for the function in part a).

c) Use your equation to determine the height of the pedal after:
   i) 5 s ii) 12 s iii) 18 s.

(10) ✓ On December 21 each year, the sun is closest to the Earth, at approximately 147.2 million kilometres. On June 21 the sun is at its greatest distance, approximately 152.2 million kilometres.



a) Express the distance d from the Earth to the sun as a sinusoidal function of the number of the day of the year.

b) Use the function to calculate the approximate distance from the Earth to the sun on:
   i) March 1 ii) April 30 iii) September 2.

©

(11) On the nth day of the year, the number of hours of daylight at Seattle is given by this formula.

$h = 3.98 \sin 2\pi \frac{(n - 80)}{365} + 12.16$

a) About how many hours of daylight should there be today?

b) On what dates should there be about 10 h of daylight?

(11) a) b) Feb 16, Oct 23.

(10) a) $y = 2.5 \cos \frac{2\pi}{365}(x - 172) + 149.7$
b) i) 148.8 ii) 151.3 iii) 150.5

(9) b) $y = 16.5 \cos \frac{2\pi}{5} x + 29$
c) i) 45.5 cm ii) 15.7 cm

7 a) i 40 cm ii 0 cm iii .05 seconds b) 72000

(8) b) $y = 25 \cos \frac{2\pi}{50}(x - 25) + 26$
c) i. 18 m ii. 46 m iii 18 m iv. 18 m