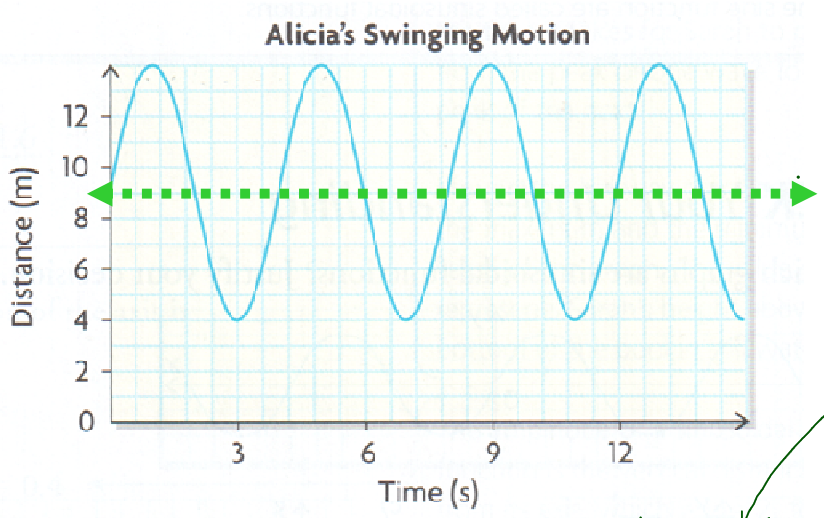
# 5.6 - Applications of Trig Functions

Ex 1 Alicia was swinging back and forth in front of a motion detector. Her distance from the detector was modeled by the following graph:




$\frac{\text{Max}+\text{min}}{2} = \frac{14+4}{2}$

- What is the equation of the axis? $d = 9$ Counting

Algebraically:

- What is the amplitude? 5 Counting

Algebraically: $\frac{14-4}{2}$

- What is the period of the function approx 4
- How close did Alicia get to the motion detector? 4m
- At t=8 sec would it be safe to run between Alicia and the motion detector?
  - Yes
  - She's approx. 9m away
  - She's moving away

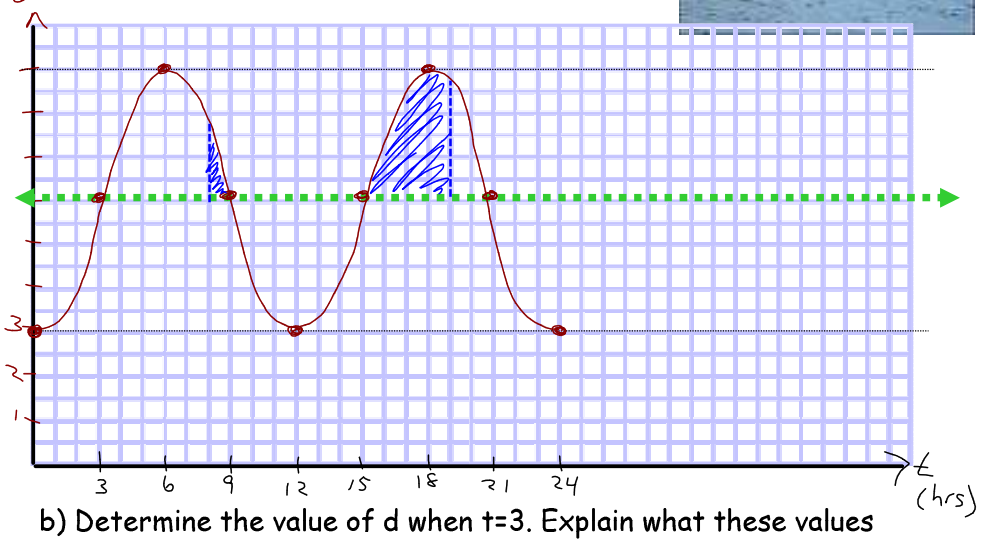
Note: She's never closer than 4m
∴ Always safe

May 9-8:07 AM

Ex2. The depth of the water in a harbour fluctuates because of the tide and is modeled by the equation d = -3cos(30t) + 6 , where d represents the depth of the water in metres, and t represents the number of hours after midnight. (ie. t=0 means midnight, t=3 means 3 A.M. etc)

a) Graph the relation for 24 hours

per = 360/30 = 12 spaced 12/4 = 3 a = 3 c = 6 Max = 6+3 Min = 6-3




b) Determine the value of d when t=3. Explain what these values represent.

With graph: d = 6

With equation:

$d = -3\cos(30 \cdot 3) + 6$

$= 6$

c) Determine the maximum depth of the water

Max = c + /a/ Min = c - /a/

Max = 6+3 = 9

∴ Max depth is 9m

d) Surfing is allowed between 8 A.M. and 7 P.M., but only when the depth of the water is 6 metres or more. For how many hours each day is surfing allowed? Explain.

Between 8-9am → 1hr

3-7pm → 4 hr

5hr

∴ Surfing is allowed for 5 hrs.

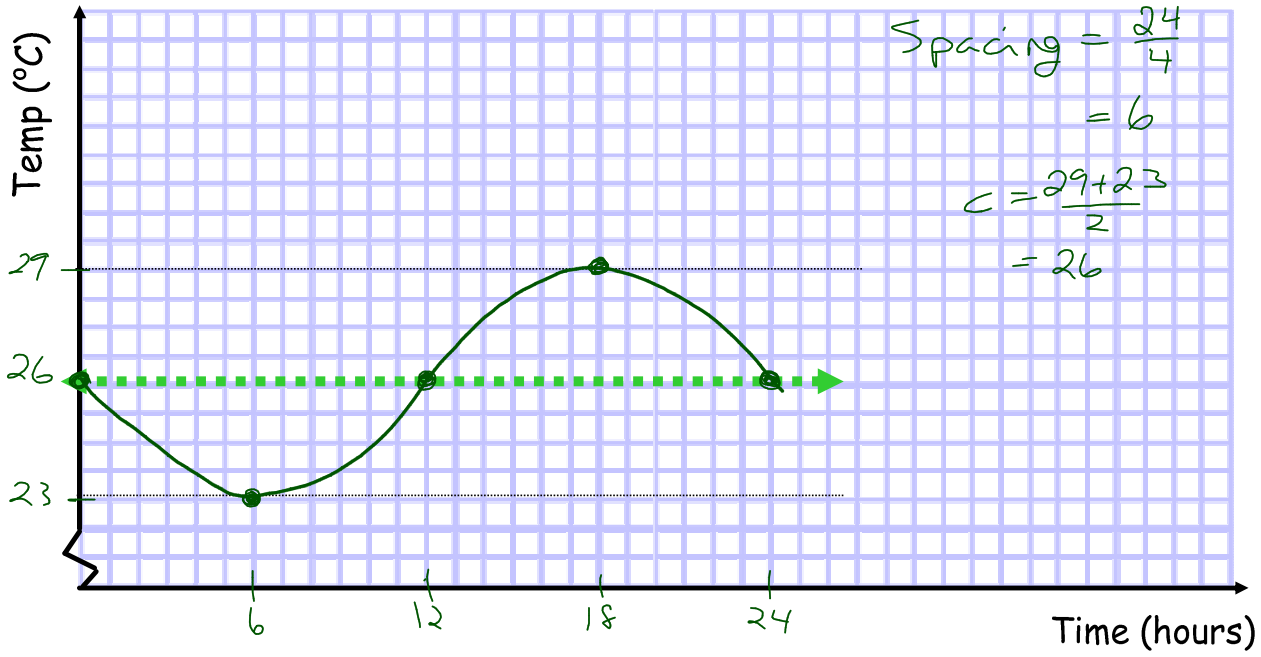
May 4-5:44 PM

Ex3. The temperature of a solar-heated pool changes throughout a sunny day and is modeled by a trigonometric relation. The temperature ranges from 23°C at 6 A.M. to 29°C at 6 P.M.

lowest - highest => 12 hrs
∴ period = 24 hr

$a = \frac{29-23}{2} = 3$

a) Graph the relation for a 24 hour period starting at midnight (t=0).




b) Determine the equation of a sine function for the given graph.

Find k

$k = \frac{360}{24} = 15$

$T = -3\sin(15t) + 26$

c) The pool is comfortable for swimming when the temperature is at least 23°C. The pool is open from 6 A.M. to 11 P.M. every day. How many hours of comfortable swimming are available on a sunny day?

- Always at least 23°C
- 11pm → 23
- → 23 - 6 = 17 hrs

∴ 17 hours of comfortable swimming

Ex4. The rodent population in a region varies approximately according to the equation $r(t) = 1200 + 300\sin 90t$, where t is the number of years since 1970 and r is the number of rodents.

a) Find the maximum and minimum number of rodents.

$c = 1200$

$a = 300$

Max $= 1200 + 300$
$= 1500$

Min $= 1200 - 300$
$= 900$

b) What is the period of the function?

$\frac{360}{90} = 4$

$\therefore$ 4 years

c) How many rodents could be expected in 2010?

$t = 2010 - 1970$
$= 40$

$r(40) = 1200 + 300\sin(90 \cdot 40)$
$= 1200$

$\therefore$ Population will be 1200

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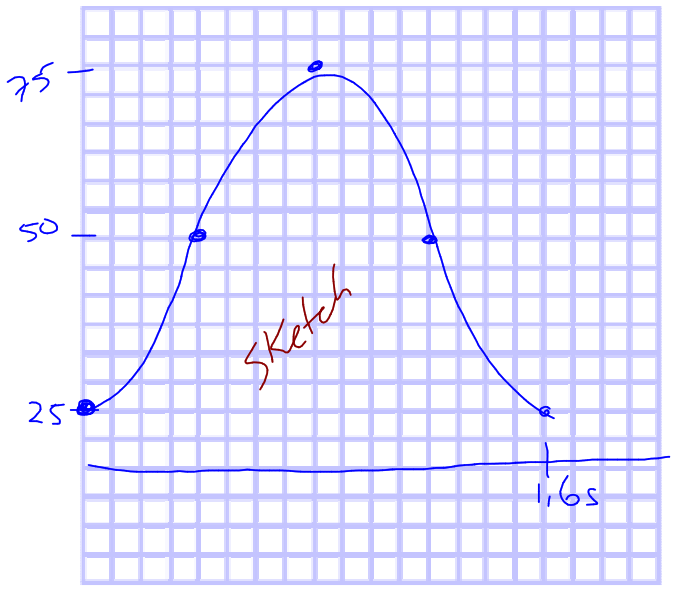
Ex5. A weight is supported by a spring. The weight rests 50 cm above a tabletop. The weight is pulled down 25 cm and released at time t=0. This creates a periodic up-and-down motion. It takes 1.6 s for the weight to return to the low position each time. Determine an equation for the sinusoidal function.




Max = 50+25
= 75

Min = 50−25
= 25

$c = 50$

$a = 25$

period = 1.6s

$k = \frac{360}{1.6}$

$= 225$

∴ an equation is

$h = -25\cos(225t) + 50$

Ex6. A ferris wheel has a radius of 7 m. The centre of the wheel is 8m above the ground. The Ferris wheel rotates at a constant speed of 15°/s. There is only one red seat on the Ferris wheel.

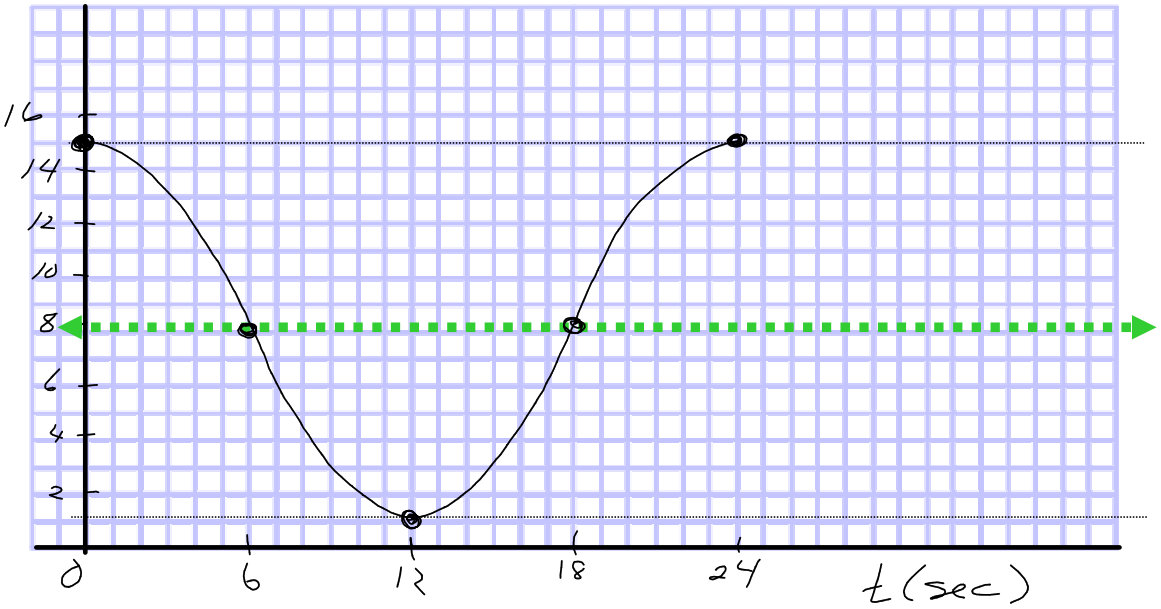
Period = $\frac{360}{15}$ $= 24$s

Scale = $\frac{24}{4}$ $= 6$s

a) Graph one rotation of the wheel if the red seat starts at the maximum height.

Max $= 8+7$ $= 15$

Min $= 8-7$ $= 1$




b) Determine an equation of a cosine function which describes the height of the red seat, where h is the height in metres and t is the time in seconds.

$h = 7\cos(15t) + 8$

c) Determine an equation of a sine function which describes the height of the red seat where h is the height in metres and t is the time in seconds.

$h = 7\sin[15(t+6)] + 8$

May 4-5:58 PM

# Homework

5.5 - p. 376 #13, 15-19

5.6 - p. 389 #12-16, 19, 21