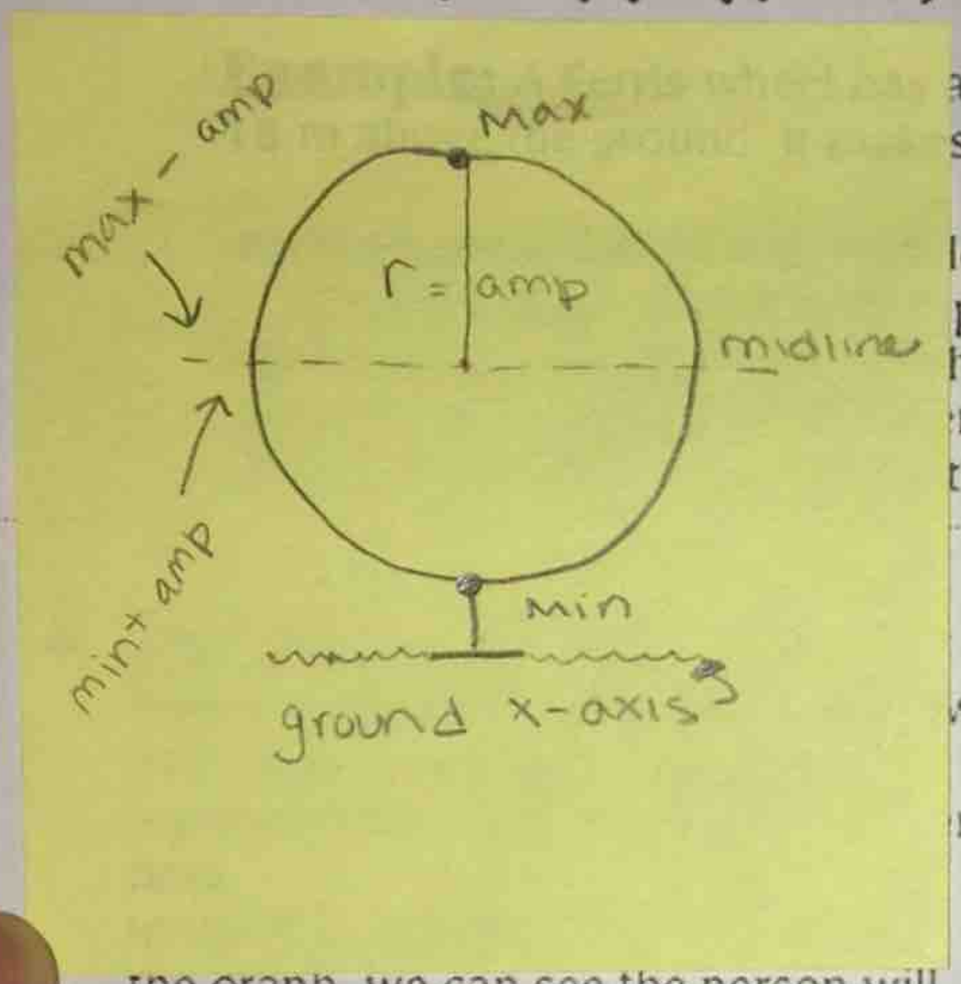
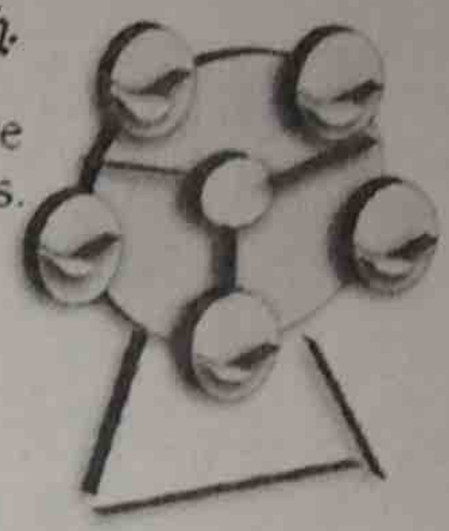
7.10 Applications of Trigonometry (Part 1)

SWBAT analyze real-life situations to create trigonometric functions and graph them on the coordinate plane.

One of the most common application questions for graphing trigonometric functions involves Ferris wheels, since the up and down motion of a rider follows the shape of a sine or cosine graph.



a diameter of 30 m, with the centre
s one complete rotation every 60 s.

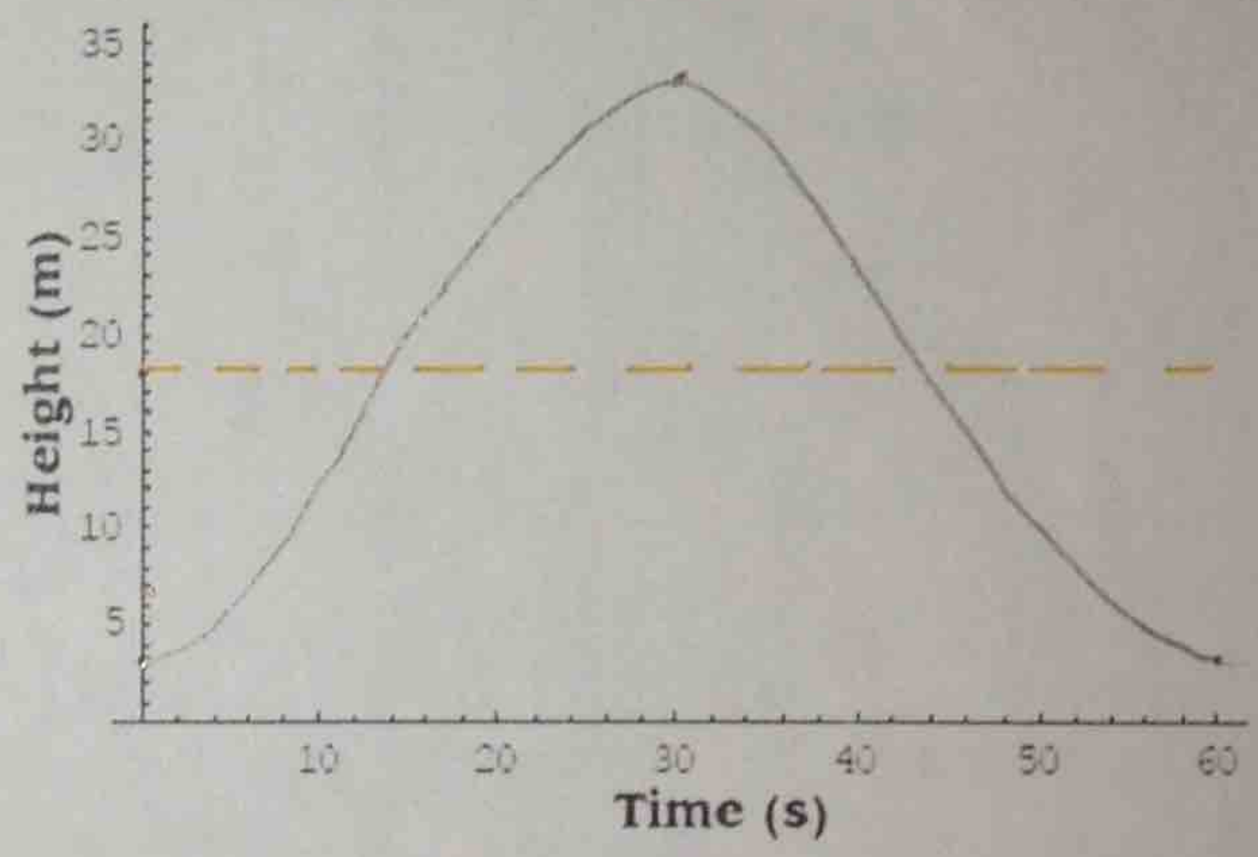


lete cycle, assuming
point.
he graph.
r at 52 seconds?
t 20 m?

w

r

the graph, we can see the person will go up from 3 m to 33 m in 30 seconds. In the second half, the person will go back down to 3 m.



b. ***a-value:*** $\frac{33-3}{2} = \frac{30}{2} = 15$

$= -15$

b-value: The period is 60 s, so:

$\frac{2\pi}{60} = \frac{\pi}{30}$

starts low.

c-value: There is none in the cosine pattern.

d-value: $K = 18$

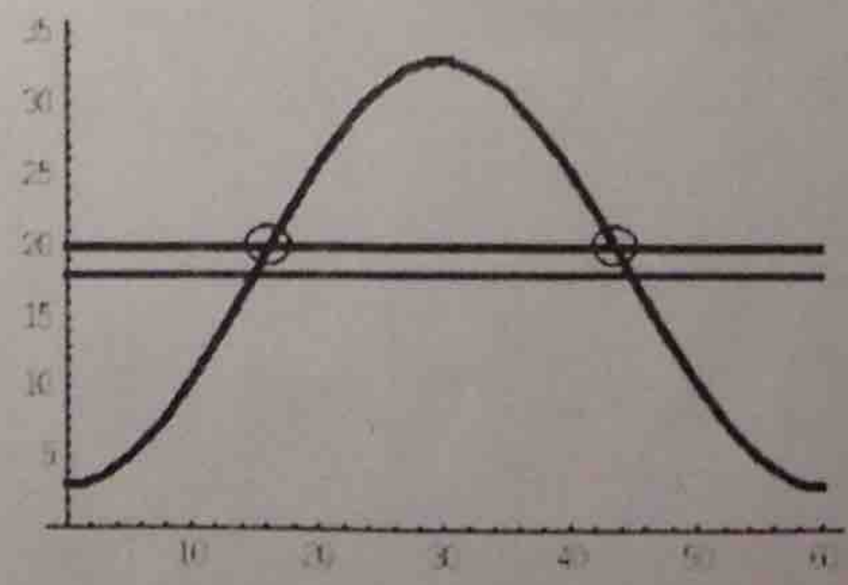
midline $= 18$

c. ***Method 1:*** Plug 52 s in for time in either the cosine equation. Simplify and calculate with your TI-83 in radian mode

height = 7.96

Method 2: Put your calculator in radian mode and graph either the cosine function.
2^{nd} Trace → Value → x = 52
This will calculate the height directly from the graph.

d. To find the times the rider is at 20 m, graph a horizontal line in your TI-83 at y = 20, then find the points of intersection.



16.3 sec & 43.7 sec

Equation of the Ferris Wheel:

$Y = -15 \cos \frac{\pi}{30} \theta + 18$

In some Ferris wheel questions, you will be given the rotational speed in units of revolutions per second or revolutions per minute. You can use these values to find the period as follows:

Example: A Ferris wheel rotates at 4 rev/min. What is the period in minutes & seconds?

Think of it this way: there are 60 seconds in a minute. If it completes four revolutions, each one must take only 15 seconds. Thus, the period is 15 s.

$\frac{60}{4} = 15$ s

Conversion Reminder:
Minutes → Seconds: Multiply by 60
Seconds → Minutes: Divide by 60

max = 72
min = 2

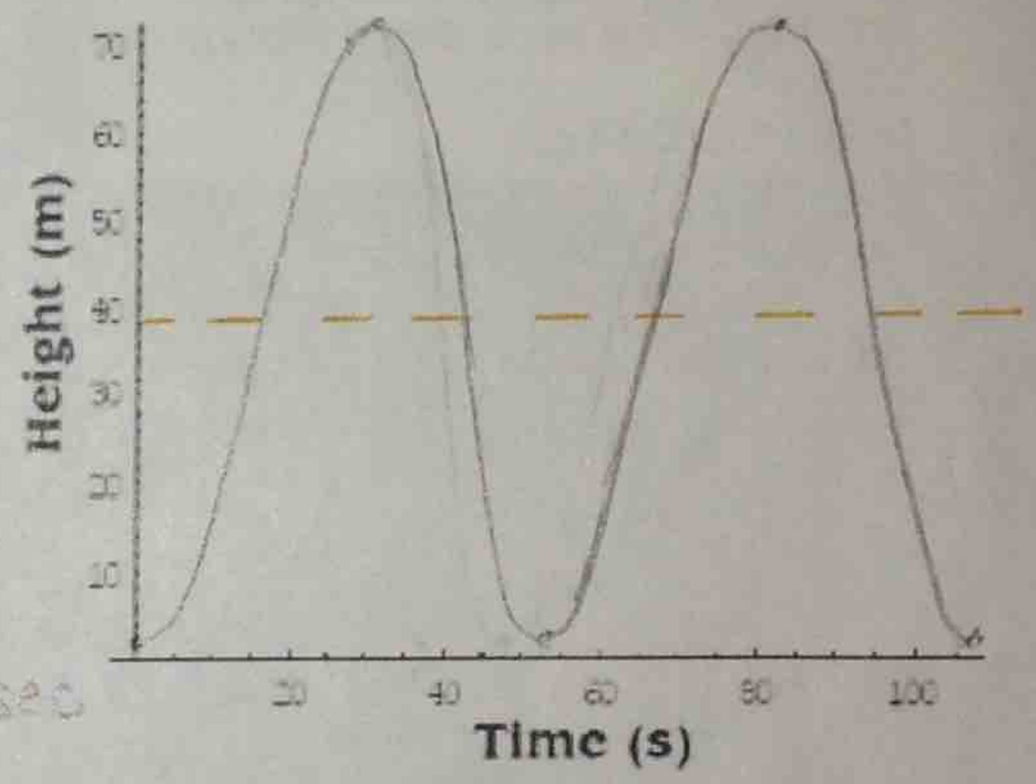
Ferris Wheel Questions

1. A Ferris wheel has a radius of 35 m and starts 2 m above the ground. It rotates once every 53 seconds. = period

a) Determine the cosine equation of the graph, if the rider gets on at the lowest point.

amp $= \frac{70}{2} = 35$ midline $= \frac{74}{2} = 37$ $b = \frac{2\pi}{53}$ $y = -35\cos\frac{2\pi}{53}\theta + 37$

b) Sketch two complete cycles of a graph representing the height of a rider above the ground, assuming the rider gets on the Ferris wheel at the lowest point.



c) What is the height of the rider at 81 seconds?

height = 50.76 m

d) At what time does the rider first reach a height of 51 m?

16.7 sec, 36.3 sec, 69.7 sec, 89.3 sec

2. A Ferris wheel makes 4 revolutions in one minute. The diameter of the Ferris wheel is 28 m, and a rider boards from a platform at a height of 30 m above the ground. The ride lasts 30 seconds.

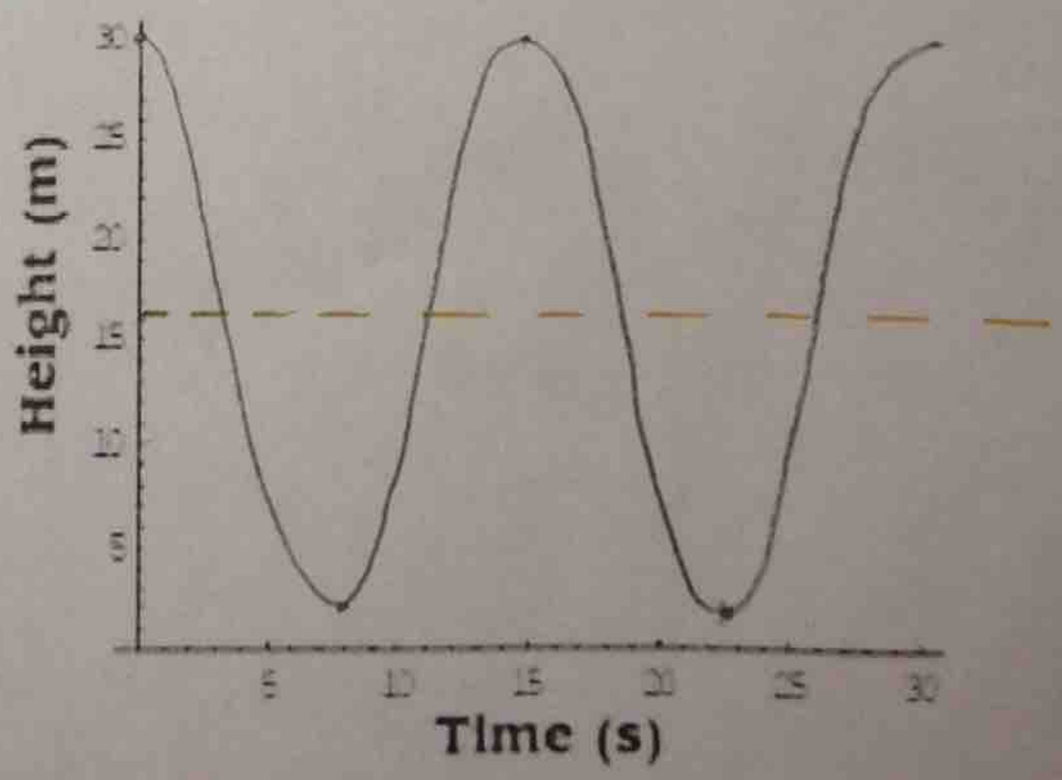
a) Determine the cosine equation. (*Hint*: Think about where the rider is starting in this question.) $P = \frac{60}{4} = 15$ sec

mid $= \frac{30+2}{2} = 16$

$y = 14\cos\frac{2\pi}{15}\theta + 16$

b) Sketch the graph for the complete ride.

$\frac{15}{2} = 7.5$ ← time at first low point



c) At what times is the rider at a height of 20 m?

3.06 sec, 11.94 sec,

18.06 sec, 26.94 sec