

FERRIS WHEEL NUMBERS

GRADE LEVEL(S) 2-12

LESSON OBJECTIVE

Students will use and understand comparison in terms of quantity and measurement: greatest, capacity, maximum, fractional amounts, rate of speed and circumference.

BACKGROUND/PRIOR KNOWLEDGE NEEDED

- Estimation and number sense, rate, and circumference
- California Math Council (cmc.org) and National Council of Teachers of Mathematics (nctm.org) online resources
- Statistics from “Santa Monica Pier—A Century on the Last Great Pleasure Pier” by James Harris

EDUCATION STANDARDS

CA 2nd Grade: Number Sense 4.0 Students understand that fractions and decimals may refer to parts of a set and parts of a whole.

CA 3rd Grade: Number Sense 2.1 Solve simple problems involving a functional relationship between two quantities (e.g. find the total cost of multiple items given the cost per unit).

CA 4th Grade: Mathematical Reasoning 2.2 Apply strategies and results from simpler problems to more complex problems.

CA 5th Grade: Number Sense 1.0 Students compute with very large and very small numbers, positive integers, decimals, and fractions and understand the relationship between decimals, fractions, and percents. They understand the relative magnitudes of numbers.

CA 6th Grade: All of the above Standards and Measurement and Geometry 1.1 Understand the concept of a constant such as π ; know the formula for the circumference of a circle.

CA 7th Grade: Measurement and Geometry 1.3 Use measures expressed as rates (e.g., speed, density) and measures expressed as products (e.g., person-days) to solve problems; check the units of the solutions; and use dimensional analysis to check the reasonableness of the answer.

CA Algebra I: 5.0 Students solve multistep problems, including word problems involving linear equations and linear inequalities in one variable and provide justification for each step.

CA Geometry: 8.0 Students know, derive, and solve problems involving the perimeter, circumference, area, volume, lateral area, and surface area of common geometric figures.

MATERIALS NEEDED

Lesson is tailored by working backwards from the Data Collection and Analysis Questions sheets. The analysis questions sheet needs to be tailored to the grade level and standard addressed and thereby made age/grade appropriate.

MOTIVATION

Students visit the pier and collect the pertinent numbers related to the Ferris Wheel.

DIRECT INSTRUCTION

- Students will be put in teams of 2 to 3 students.
- The class will visit the pier to collect the data needed for their class's follow up analysis/problem solving.
- Frontloading of lessons depends on grade level and standard as do the analysis questions.



Data Collection

1. How much does it cost to ride the Ferris wheel?
2. Time how many seconds it takes the Ferris wheel to make one revolution. (How long does it take the wheel to go around once?)
3. Time the duration of the Ferris wheel ride in seconds.
4. Time how many seconds there are between rides. In other words, how long does it take passengers to get off and new ones to board?
5. Estimate the height of the Ferris wheel in feet.
6. How many cars (also known as gondolas) does the Ferris wheel have?
7. What is the maximum number of people allowed to ride in a car?
8. Estimate how many lights are used to light up the Ferris wheel at night.

**Answer Key
Data Collection**

1. How much does it cost to ride the Ferris wheel?
\$5 if paying with tickets. (There is an all day pass option but we'll ignore that.)
2. Time how many seconds it takes the Ferris wheel to make one revolution. (How long does it take the wheel to go around once?)
32 seconds
3. Time the duration of the Ferris wheel ride in seconds.
It normally goes around six times so around 192 seconds.
4. Time how many seconds there are between rides. In other words, how long does it take passengers to get off and new ones to board?
Answers will vary. 5 minutes?
5. Estimate the height of the Ferris wheel in feet.
Correct answer is 90 feet.
6. How many cars (also known as gondolas) does the Ferris wheel have?
20 cars
7. What is the maximum number of people allowed to ride in a car?
6 people
8. Estimate how many lights are used to light up the Ferris wheel at night.
**Correct answer is 160,000 energy efficient LEDs (light emitting diodes)
FYI - old wheel had 5392 ordinary bulbs.**

Ferris Wheel Analysis Questions

1. What is the greatest number of people that can ride the Ferris wheel at once?
2. What is the greatest amount of money the Ferris wheel can generate for one ride?
3. If one-quarter of the seats are empty, how many seats are occupied?
4. If forty percent of the seats are empty, how many seats are occupied?
5. If half the seats are empty, and the others are two-thirds filled, how many people are riding on the Ferris wheel?
6. What is the diameter of the Ferris wheel? What is its circumference?
7. How fast do the passengers on the Ferris wheel travel? Express your answer in feet per second.
8. How fast do the passengers travel in miles per hour? (1 mile = 5280 feet)
9. What is the maximum number of times the Ferris wheel can run in one hour?
10. The new Ferris wheel was purchased for \$1.5 million. If it ran at full capacity five times per hour for ten hours each day, how long would it take the Ferris wheel to pay for itself? (Ignore operating costs in arriving at your answer.)

Answer Key
Ferris Wheel Analysis Questions

1. What is the greatest number of people that can ride the Ferris wheel at once?

$$20 \times 6 = \boxed{120 \text{ people}}$$

2. What is the greatest amount of money the Ferris wheel can generate for one ride?

$$120 \times \$5 = \boxed{\$600}$$

3. If one-quarter of the seats are empty, how many seats are occupied?

$$\frac{1}{4} \times 20 = 5 \text{ empty seats, } 20 - 5 = \boxed{15 \text{ seats}} \quad (\text{or } \frac{3}{4} \times 20 = 15)$$

4. If forty percent of the seats are empty, how many seats are occupied?

$$.4 \times 20 = 8 \text{ empty seats, } 20 - 8 = \boxed{12 \text{ seats}} \quad (\text{or } .6 \times 20 = 12)$$

5. If half the seats are empty, and the others are two-thirds filled, how many people are riding on the Ferris wheel?

$$10 \text{ seats} \times 6 \text{ people} = 60 \text{ people, } \frac{2}{3} (60) = \boxed{40 \text{ people}}$$

6. What is the diameter of the Ferris wheel? What is its circumference?

$$\text{Diameter} = \text{height of wheel} = \boxed{90 \text{ ft}} \quad C = \pi d \quad (\text{or } 2\pi r) = 90 \times 3.14 = \boxed{283 \text{ ft}}$$

7. How fast do the passengers on the Ferris wheel travel? Express your answer in feet per second.

$$\text{Speed} = \text{distance} / \text{time} = 283 \text{ ft} / 32 \text{ s} = \boxed{8.8 \text{ ft/s}}$$

8. How fast do the passengers travel in miles per hour? (1 mile = 5280 feet)

$$283 \text{ ft} / 5280 \text{ ft} = 0.056 \text{ mi, } 32 \text{ s} / 3600 \text{ s} = .0089 \text{ hr, speed} = .056 / .0089 = \boxed{6.3 \text{ mph}}$$

9. What is the maximum number of times the Ferris wheel can run in one hour?

$$\text{Total time} = \text{ride duration} + \text{loading time} = 3 \text{ min} + 5 \text{ min} = 8 \text{ min} \\ 60 \text{ min} / 8 \text{ min} = \boxed{7.5 \text{ times}}$$

10. The new Ferris wheel was purchased for \$1.5 million. If it ran at full capacity five times per hour for ten hours each day, how long would it take the Ferris wheel to pay for itself? (Ignore operating costs in arriving at your answer.)

$$\text{\$600 per ride} \times 5 \text{ rides per hour} \times 10 \text{ hours} = \text{\$30,000 per day}$$

$$\text{\$1,500,000} / \text{\$30,000} = \boxed{50 \text{ days}}$$