

# Calculating Time Spent on Different Modes (for 5th & 6th graders)

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## Problem Description

Sam's family (2 adults and 2 kids) is having a family reunion in Disneyland. About how long will it take Sam's family from (city, state pulled at random from a hat or [app](#)) to arrive at Disneyland in Anaheim, California if they traveled by \_\_\_\_\_.

- Also discuss which is most direct route
- Personal vehicles will need to stop for bathroom/food breaks vs trains
- May encounter other obstacles more likely to slow vehicles (poor weather, fatigue of driver, road blockages, congestion, etc.)
- 7 suggested originating cities for students to do the calculations
  - Albuquerque, NM
  - Portland, OR
  - Seattle, WA
  - Salt Lake City, UT
  - Phoenix, AZ
  - Denver, CO
  - Helena, MT

# U.S. Map Showing Origin and Destination Cities



# 5 & 6th Grades Activity

## Calculation Table

Team (city, state):						
	Car (sedan)	Electric Car (sedan)	Bus	Electric Train	High Speed Rail	Passenger plane
	Average miles per fuel tank: 400	Average miles per charge: 250	Average miles per tank: 500	Average miles:	Average miles per trip:	Average miles per trip:
<b>Average Number of Passengers</b>	4	4	50	150	900	100
<b>Miles to Anaheim, CA using mode of transit</b>						
 Disneyland						
<b>Additional stops (i.e. restroom, food, sleep, etc.) and estimated time</b>						
<b>Average speed</b>	70mph	60mph	70mph	90mph	150mph	575mph
<b>Carbon output</b>	404 grams of CO <sub>2</sub> per mile	0	2,680 grams of CO <sub>2</sub> per mile	67 grams of CO <sub>2</sub> per mile	0	900 grams of CO <sub>2</sub> per mile
<b>Carbon output per Sam's family member</b>	117,261 g CO <sub>2</sub> or 117 kg CO <sub>2</sub> per mile					
<b>Estimated total travel time</b>						

## How to Solve the Problems

### Miles to Disneyland in Anaheim, CA using mode of transit

Research how far your assigned city is from Anaheim, CA. You can use Google Maps to calculate the distance from the originating city to the destination.

### Additional stops and estimated time

Discuss with your group how many times along the way Sam and his family have to stop for restroom, meal, and sleep breaks. How long will each stop take? And how will the stops affect the total travel time?

### Carbon output per Sam's family member

$$\frac{(\text{Carbon output of transportation mode} \times \text{miles traveled})}{\text{Average number of passengers}} = \text{Carbon output per passenger per mile}$$

$$\text{For example, Seattle to Anaheim by Car} = \frac{(404 \text{ g} \times 1161 \text{ mile})}{4} = 117,261 \text{ g CO}_2 \text{ per mile per passenger OR } 117 \text{ kg CO}_2 \text{ per mile per passenger}$$

To determine which transportation option is the most efficient, look for the **lowest number of carbon output per passenger per mile**.

## Further Discussion

What if the bus, train or plane was mostly empty? What if the bus, train or plane carried the same amount of people? Then which would be more efficient?