MATHCOUNTS® Problem of the Week Archive

Summer Thrill Rides – July 17, 2023

Problems & Solutions

Over the summer millions of people around the world visit amusement parks. Previously heralded as the "World's Largest Amusement Park," Cedar Point Amusement Park in Sandusky, Ohio earned that title. At one time, Cedar Point had 72 rides, 16 of which were roller coasters. What percent of Cedar Point's rides were *not* roller coasters? Express your answer as a decimal to the nearest tenth.

*Since 16/72 of the rides at Cedar Point were roller coasters, it follows that $1 - 16/72 \approx 0.778$ = **77.8**% of the rides were not.*

The GateKeeper is one of the tallest, fastest, longest wing roller coasters in the world. GateKeeper climbs a record 170 feet (tallest inversion of any roller coaster) and reaches a maximum speed of 67 mi/h. The entire 4164-foot ride takes an unbelievable 2 minutes 20 seconds to complete. What is the average rate of speed for GateKeeper, in miles per hour? Express your answer to the nearest whole number.

*First, let's convert 2 minutes 20 seconds to $2 \times 60 + 20 = 120 + 20 = 140$ seconds. Recall that 1 mile = 5280 feet and 1 hour = 3600 seconds. Therefore, to go 4164 feet in 140 seconds, GateKeeper travels an average of just $(4164 \div 5280) \div (140 \div 3600) = (347/440) \times (180/7) = 3123/154 \approx$ **20** mi/h.*

Since standing in line for rides can take up a great deal of time at some amusement parks, serious riders find it necessary to have a good plan of action to make the best use of time. Say Matt is interested in riding only roller coasters, but he has only enough time to ride 12 of the 16 roller coasters at Cedar Point. How many combinations of 12 roller coasters are there, assuming Matt wouldn't ride any roller coaster multiple times?

*There are $16 \times 15 \times 14 \times 13 \times 12 \times 11 \times 10 \times 9 \times 8 \times 7 \times 6 \times 5$ combinations of 12 different rides chosen from the 16 roller coasters at Cedar Point. Each of these combinations can be arranged in 12! different orders. We divide to remove the duplicates and see that there are $(16 \times 15 \times 14 \times 13 \times 12 \times 11 \times 10 \times 9 \times 8 \times 7 \times 6 \times 5)/(12 \times 11 \times 10 \times 9 \times 8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1) = (16 \times 15 \times 14 \times 13)/(4 \times 3 \times 2 \times 1) =$ **1820** combinations of 12 roller coasters Matt could ride.*

*We get the same result using the formula ${}_nC_r = n!/(r!\,(n-r)!)$ to calculate ${}_{16}C_{12} = 16!/(12! \times 4!) =$ **1820** combinations.*

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