MATHCOUNTS® Problem of the Week Archive

MATHCOUNTS Competition Season Approaches – January 29, 2024

Problems & Solutions

The Sprint Round of the MATHCOUNTS Chapter Competition has 30 questions and students are given 40 minutes to complete the round. Though it isn't expected that most students will finish all 30 questions, what is the average time a student can spend on each of the 30 questions, in minutes:seconds per question?

The 40-minute time limit is equivalent to 40 × 60 = 2400 seconds. Dividing this time equally among the 30 questions yields 2400 ÷ 30 = 80 seconds per question. This is one minute (60 seconds) and 20 seconds, or ***1:20****.*

Some chapters will hold a Countdown Round for the highest-scoring 25% of the students at the competition or the top 10 students at the competition, whichever is fewer students. What is the greatest number of students at a competition for which "25% of the students (to the nearest whole number)" is fewer students than "the top 10 students?"

We can first figure out when 25% of the students is equal to 10 students. Let x be the number of students in the competition. Then we are solving 0.25x = 10 or (1/4)x = 10. Multiplying both sides by 4 (or dividing both sides by 0.25) tells us x = 40. Now we know that if there are 40 students at the competition, taking the top 25% or the top 10 will both result in 10 students participating in the Countdown Round. It's true that 0.25(39) < 10, but 0.25(39) = 9.75, which is still 10 students when rounded to the nearest whole number. We can also see that 0.25(38) = 9.5, which is again 10 when rounded to the nearest whole number. It's not until our total number of students reaches ***37*** *that the number of students (9, rounded to the nearest whole number) when taking the top 25% is fewer students than if we take the top 10 students.*

MATHCOUNTS competitions are very different from tests students take in class. For a MATHCOUNTS competition, a score of 23 out of 46 (or 50%) is absolutely fantastic! The Target Round of a MATHCOUNTS competition has four pairs of problems. If we're told that a student answered exactly half of the Target Round questions correctly, and answered one question in each of the pairs of questions correctly, how many different combinations of questions could she have answered correctly? (One combination is questions #1, 3, 5 and 7.)

We could try to list them all out or use the Counting Principle. We know there are four pairs of questions, she answered four questions correctly, and she answered one question correctly in each pair of questions. That means that in the first pair of questions, there are two options. She either got #1 or #2 correct. When considering the second pair of questions, she either got #3 or #4 correct, and what she did on the first pair has no bearing on the second pair. So, there are 2 options for the first pair and 2 options for the second pair, which makes a total of 2 × 2 = 4 combinations so far (#1 and #3 correct, #1 and #4 correct, #2 and #3 correct, #2 and #4 correct). Now the third pair of questions has 2 options, again *neither of which is dependent on what happened with the first two pairs of questions. So now we're up to $2 \times 2 \times 2 = 8$ combinations. You can see that we can take the four combinations listed previously, and add #5 to each of them and then add #6 to each of them, thus doubling the number of combinations. Finally, we have our fourth pair of questions, which gives us another two options. We now have a total of $2 \times 2 \times 2 \times 2 =$* ***16*** *possible combinations of questions our competitor could have answered correctly if she answered exactly four questions correctly with one correct answer in each pair of questions.*

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