MATHCOUNTS® Problem of the Week Archive

Planning for Next Year – May 20, 2024

Problems & Solutions

Kyra's school building this year was overcrowded due to a lot of new registered students. Classroom space was a real issue. In looking ahead to next year, the administration figures that if teachers did not stay in their classrooms during their planning/off periods and allow other teachers to come in to use the room, it might free up space and the administration could hire more teachers. This year each teacher teaches 5 class periods per day, but the school day is 7 full class periods long. If there are 43 teachers in the school, what is the fewest number of classrooms that are needed, assuming any teacher can teach in any classroom during any period of the day and there are no other scheduling restrictions?

If there are 43 teachers and they are each teaching for 5 class periods, that is 43 × 5 = 215 classes being taught. The school day lasts for 7 class periods, so each room can be used for 7 classes. That means that with perfect scheduling, the 215 classes being taught would need 215 ÷ 7 = 30.7 or ***31*** *classrooms.*

As the administration looks ahead to next year, Kyra is concentrating on finishing up this year well. Students at her school receive 4 quarter grades, a mid-term exam grade and a final exam grade for each class. The quarter grades are all weighted equally, the mid-term exam grade is double the weight of a quarter grade, and the final exam grade is four times the weight of a quarter grade. What fraction of the final course grade is the final exam grade? Express your answer as a common fraction.

The grades are Q, Q, Q, Q, M, F, but each one is not worth 1/6 of the final grade. Since the mid-term exam is worth double a quarter grade, let's replace M with two Qs. We'll underline the Qs so that we remember where they came from. Now, we have Q, Q, Q, Q, Q, Q, F. The final exam grade is worth four times a quarter grade, so let's replace the F with four Qs, but this time, we'll make them un-italicized: Q, Q, Q, Q, Q, Q, Q, Q, Q, Q. Rather than dealing with six scores that had different weights, we now have 10 scores that are all weighted the same. Four of them are representing the final exam grade, so that grade is worth 4/10 or ***2/5*** *of the final course grade.*

Knowing that the final course grade is determined in the manner described above, Kyra can figure out what grade she needs to earn on the final exam to earn at least a 90% for her final course grade. These are her other grades she has earned so far: Q1 = 92%, Q2 = 85%, Q3 = 88%, Q4 = 84%, and mid-term exam = 89%. What is the least whole percent she must earn on the final exam?

Using our solution from the previous problem, we can fill in some numbers. Rather than working with Q, Q, Q, Q, Q, Q, Q, Q, Q, Q, Q, Q, we have 92, 85, 88, 84, 89, 89, Q, Q, Q, Q. We want the average of these 10 scores to be at least 90, so we have the equation (92 + 85 + 88 + 84 + 89 + 89 + Q + Q + Q + Q) ÷ 10 ≥ 90, which simplifies to 527 + 4Q ≥ 900, which further simplifies to 4Q ≥ 373. Dividing both sides by 4, we see that Q ≥ 93.25 or 94, to the nearest whole number that would put the average above 90. Kyra must therefore earn a ***94****% on her final exam to earn a 90% for the final course grade.*

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