MATHCOUNTS® Problem of the Week Archive

Tax Day – April 8, 2024

Problems & Solutions

Next Monday, April 15, is Tax Day!

It is estimated that the total time Americans will spend on taxes this year is 6.5 billion hours! According to the White House budget office, tax work accounts for approximately 70% of the paperwork burden of the federal government. If 6.5 billion hours is 70% of the total time spent on federal government paperwork, how many hours are equivalent to 50% of the total time spent on federal government paperwork? Express your answer as a whole number of hours rounded to the nearest million.

*We are told the 6.5 billion hours is 70% of x, and we need to find 50% of x. We can either take the time to determine the value of x, or we can skip that step altogether using the following proportion: 6.5/0.7 = y/0.5. If we set the cross-products equal, we have 0.7y = 0.5(6.5) or 0.7y = 3.25. Dividing both sides by 0.7 yields y = 4.6428571429. Remember that this is really 46,428,571,429 hours, or **46,429,000,000** hours, rounded to the nearest million.*

Say that 1.1 billion of the total hours is spent by people filing the most basic tax return. If it is estimated that the average filer of this basic tax return spends approximately 13 hours, 48 minutes, how many filers are in this "most basic tax return" category? Express your answer to the nearest hundred thousand.

*We need to figure out how many different filers each spend 13 hours, 48 minutes in order to reach the total of 1.1 billion hours. To do this, we can divide the total by the part. However, before doing this, we need to figure out how 13 hours, 48 minutes can be represented in just hours. There are 60 minutes in an hour, so 48 minutes is 48 ÷ 60 = 0.8 hours. This means 13 hours, 48 minutes is equivalent to 13.8 hours. Now, we can calculate that there are 1,100,000,000 ÷ 13.8 = 79,710,144.927536 or **79,700,000** filers in this category, to the nearest hundred thousand.*

In order to reduce the burden of the time spent on taxes, the IRS created the Office of Taxpayer Burden Reduction in early 2002. In its first five years, it shaved a total of about 200 million hours from tax paperwork. It would make sense that the office's first year in existence may have led to the most improvement. Let's assume that in its first year, it shaved 80 million hours, but the remainder of the 200 million hours was spread equally over the next four years and will continue at this same rate into the future. How many total hours would we have expected to be shaved by the end of its eighth year in existence? If y represents the total number of shaved hours and x is the total number of years the office has been in existence, what equation in the form $y = mx + b$ represents this situation for $x \geq 1$?

*If the first year accounted for 80 million hours, then there were still 200 – 80 = 120 million hours left. We are told that these hours were equally spread over the next four years, which is 120 ÷ 4 = 30 million each year. At the end of these five years, the total was 200 million. If we give the office three more years, that would be an additional 3(30) = 90 million hours, for a total of **290 million** hours at the end of eight years. In order to come up with an equation that represents this situation, it might be easiest to look at some*

data points. (For this, we won't use millions, but just the number of millions of hours.) We know that the points (1, 80), (2, 110), (3, 140), (4, 170), and (5, 200) should be generated from our equation, as well as (8, 290). After the first year, the y-value increases by 30 every time the x-value increases by 1. We also know, though, that we start off with 80 in the first year. So, how do we account for this? Something like y = 30x + 80 looks like it might work, since it accounts for the initial 80 and every time we increase x by 1, we'll increase our total by 30. But check what happens if x = 1. We get y = 30(1) + 80 = 110, and that's 30 too much. If we're going to have to include one 30 during the first year, then we're going to have to take 30 out of the 80. Let's try y = 30x + 50. Though we never had the number 50 mentioned anywhere in the problem, this helps our situation when x = 1, and every time we increase x by 1, our y-value will go up by 30 as we need. This is it: **y = 30x + 50**.

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