MATH DOESN'T SUCK

Solution Guide – Chapter 9

Complex Fractions

Doing the Math from p. 101

2) $\dfrac{\frac{5}{2}}{\frac{10}{12}} = ?$

Since the numerator and denominator are already improper fractions (tall & skinny!), this complex fraction is ready for the "means and extremes method. So we can go ahead and multiply:

the *extremes (the very top and very bottom)* $5 \times 12 = 60$ for the new numerator,
and the *means (the "middle" terms)* $2 \times 10 = 20$ for the new denominator:

So: $\dfrac{\frac{5}{2}}{\frac{10}{12}} = \dfrac{60}{20}$

Now, we reduce and see that we can divide top and bottom by 20: $\dfrac{60}{20} = \dfrac{60 \div \mathbf{20}}{20 \div \mathbf{20}} = \dfrac{3}{1} = 3$

Done!

Answer: $\dfrac{\frac{5}{2}}{\frac{10}{12}} = \mathbf{3}$

3) $\dfrac{1\frac{1}{2}}{3} = ?$

First rewrite the top and bottom into improper fractions. $\dfrac{1\frac{1}{2}}{3} = \dfrac{\frac{3}{2}}{\frac{3}{1}}$ and now we can multiply the *extremes*, $3 \times 1 = 3$ for the numerator, and the *means* $2 \times 3 = 6$ for the denominator.

So $\dfrac{1\frac{1}{2}}{3} = \dfrac{3}{6}$, and don't forget to reduce! $\dfrac{3}{6} = \dfrac{3 \div \mathbf{3}}{6 \div \mathbf{3}} = \dfrac{1}{2}$

Answer: $\dfrac{1\frac{1}{2}}{3} = \mathbf{\dfrac{1}{2}}$

4) $\dfrac{\frac{9}{28}}{\frac{3}{7}} = ?$

Because the numbers are kinda big, I'll wait to multiply out the new numerator and denominator, and hope that we can cancel before multiplying.

Extremes: 9×7 and the *means*: 28×3 would give us, before multiplying: $\dfrac{9 \times 7}{28 \times 3}$

And look, we can cancel a "3" and a "7" from top and bottom, before even multiplying them out: $\dfrac{^{3}\cancel{9} \times \cancel{7}^{1}}{^{4}\cancel{28} \times \cancel{3}^{1}} = \dfrac{3 \times 1}{4 \times 1} = \dfrac{3}{4}$. That worked out nicely!

Answer: $\dfrac{\frac{9}{28}}{\frac{3}{7}} = \mathbf{\dfrac{3}{4}}$

Doing the Math from p. 108

2) $\dfrac{\frac{2}{5}-\frac{1}{3}}{\frac{1}{30}}+2=?$

Notice this problem asks us to add a big complex fraction + "2." It might be easy to forget to add the 2, after we're done simplifying the fraction, so let's make a mental note not to forget!

Alright, first let's tackle the numerator of the complex fraction.

Aiming for the LCD of 15, and using some copycat fractions to do so, we can convert the entire numerator, $\frac{2}{5}-\frac{1}{3}$ into:

$$\frac{2}{5}-\frac{1}{3}=\frac{2\times\mathbf{3}}{5\times\mathbf{3}}-\frac{1\times\mathbf{5}}{3\times\mathbf{5}}=\frac{6}{15}-\frac{5}{15}=\frac{1}{15}$$

So now the complex fraction looks like: $\dfrac{\frac{1}{15}}{\frac{1}{30}}$.

Since the top and bottom are both improper fractions (tall and skinny!) we can multiply the *extremes*, $30\times 1=30$ for our numerator, and the *means* $15\times 1=15$ for our denominator, telling us that indeed $\dfrac{\frac{1}{15}}{\frac{1}{30}}=\frac{30}{15}$. We can divide top and bottom by 15 to reduce it: $\frac{30}{15}=\frac{30\div\mathbf{15}}{15\div\mathbf{15}}=\frac{2}{1}=2$. But remember the problem wanted us to add the complex fraction to 2. So our problem becomes 2 + 2 = 4. ☺

Answer: $\dfrac{\frac{2}{5}-\frac{1}{3}}{\frac{1}{30}}+2=\mathbf{4}$

3) $\dfrac{\frac{3}{4}+\frac{1}{4}\div\frac{1}{3}}{\frac{1}{2}-\frac{1}{6}}$ Let's tackle the numerator first, which is of course: $\frac{3}{4}+\frac{1}{4}\div\frac{1}{3}$

Following order of operations, we should divide *before* we add, so let's do that, remembering the fraction division from p.56 in the book: $\frac{1}{4}\div\frac{1}{3}=\frac{1}{4}\times\frac{3}{1}=\frac{3}{4}$. Now our

numerator becomes $\frac{3}{4}+\frac{3}{4}=\frac{6}{4}$, which reduces to $\frac{3}{2}$. So our new numerator is $\mathbf{\frac{3}{2}}$. (pant, pant!)

Now, let's move on to tackling the denominator: $\frac{1}{2}-\frac{1}{6}$. To attain an LCD of 6, we can multiply top and bottom by 3, and rewrite $\frac{1}{2}=\frac{1\times\mathbf{3}}{2\times\mathbf{3}}=\frac{3}{6}$. And now we can subtract them: $\frac{3}{6}-\frac{1}{6}=\frac{2}{6}$. This is our new denominator, but notice that it reduces, too! $\frac{2}{6}=\mathbf{\frac{1}{3}}$

So, our big fraction becomes: $\frac{\frac{3}{2}}{\frac{1}{3}}$.

That's looking much better, isn't it? We're almost done…Now we can multiply the *extremes*, $3\times3=9$, for the numerator, and the *means*, $2\times1=2$, for the denominator. Our fraction simplifies to: $\frac{9}{2}$. Since 9 and 2 don't share any common factors, it's reduced, and we're done!

Answer: $\frac{\frac{3}{4}+\frac{1}{4}\div\frac{1}{3}}{\frac{1}{2}-\frac{1}{6}}=\mathbf{\frac{9}{2}}$

4) $\frac{2\frac{1}{5}+\frac{1}{2}}{\frac{5}{4}\div\frac{1}{9}-\frac{9}{4}}+\frac{1}{5}=$

First things first—let's focus on the <u>numerator</u> of the big scary fraction: $2\frac{1}{5}+\frac{1}{2}$. We'll convert the mixed number to an improper fraction, and then do fraction addition after we find the LCD. Using the MAD face method (see p.45 for review), we find that $2\frac{1}{5}=\frac{11}{5}$. Using 10 as the LCD to rewrite $\frac{11}{5}$ and $\frac{1}{2}$, as $\frac{22}{10}$ and $\frac{5}{10}$, we can add them together to get $\mathbf{\frac{27}{10}}$, which is our big fraction's numerator.

Now we'll look at the denominator of the big fraction: $\frac{5}{4} \div \frac{1}{9} - \frac{9}{4}$. Following the order of operations, we'll do the division first, and get $\frac{5}{4} \div \frac{1}{9} = \frac{5}{4} \times \frac{9}{1} = \frac{45}{4}$. Now we'll do the subtraction and get that $\frac{45}{4} - \frac{9}{4} = \mathbf{\frac{36}{4}}$. This is our new denominator.

So our big scary fraction now looks like: $\frac{\mathbf{27}}{\frac{\mathbf{10}}{\mathbf{36}}}$. Using the means and extremes method, we can simplify this to: $\frac{27 \times 4}{10 \times 36}$. Before we multiply out these big numbers, though, we should do some serious canceling. We can cancel a "9" from the top and bottom: $\frac{27^{3} \times 4}{10 \times 36^{4}} = \frac{3 \times 4}{10 \times 4}$, and now we can certainly cancel a "4" the top and bottom, to get $\frac{3}{10}$.

So that's our big scary fraction, boiled down to $\frac{3}{10}$. But we're not quite done, because, if you look back at the original problem, you'll see that we had to *add* this big scary fraction to $\frac{1}{5}$, so: $\frac{3}{10} + \frac{1}{5}$. Let's use the LCD of 10, to rewrite $\frac{1}{5}$:

$\frac{1}{5} = \frac{1 \times \mathbf{2}}{5 \times \mathbf{2}} = \frac{2}{10}$.

And our big problem is now: $\frac{3}{10} + \frac{2}{10}$, which is pretty easy:

$= \frac{5}{10} = \frac{1}{2}$.

Answer: $\frac{2\frac{1}{5} + \frac{1}{2}}{\frac{5}{4} \div \frac{1}{9} - \frac{9}{4}} + \frac{1}{5} = \mathbf{\frac{1}{2}}$

Phew!