Are memorizing formulas well and good arithmetic skills essential to become a good theoretical physicist or a good mathematician?

When I took quantum mechanics, a student asked the professor what the relation between $\hbar$ and h was. I could tell the answer right away. It is given by $\hbar = \dfrac{h}{2\pi}$. I memorized this formula by heart. However, he could not tell the answer right away, but he began to figure it out himself. As $E = hf = \hbar\omega$, and $\omega = 2\pi f$, we have $hf = \hbar(2\pi f)$. So, he concluded $\hbar = \dfrac{h}{2\pi}$. I was refreshingly surprised. One of the most world renowned physicists could not tell off top of his head such a simple formula that I memorized by heart!

Indeed in his memoir, Breakthrough prize winner, late string theorist Polchinski wrote[1]

> Indeed, I have always felt that I did not have an especially good memory. In one of my first classes in college, the instructor told us that you do not need a good memory to do physics, because you can derive everything from first principles.

It seems that many physics professors share this view. Many physics professors whose classes I took gave us chances to bring "cheat sheet" on which we could write physics formulas for the final exams; not only would it give a opportunity to review what we have learned by writing out important formulas, but also it would free us from memorizing too complicated formulas. Some of them even allowed to bring class notes or textbooks. I cannot imagine that would happen for a history class or a foreign language class. It seems that memory plays less important roles in physics than in history or in foreign language.

Memorizing formulas well is not the only skill that are not essential to become a good theoretical physicist.

Mandelbrot, a renowned mathematician, who received Wolf Prize for physics (the most renowned physics prize after Nobel Prize and Breakthrough Prize) admitted that he had hard time multiplying as he had never learned multiplication table.

This is not the only isolated case. Poincaré, a very-renowned mathematician in 19th and 20th century, wrote in his book "Science and method" that Gauss (a very-renowned mathematician in 18th and 19th century) had been very good at calculation, but there were exceptions to this rule that mathematicians must be good at calculation. Then, he went on to say that he cannot call them exceptions, because "the exceptions would be more numerous than the cases of conformity with the rule." He wrote, "on the contrary, it was Gauss who

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[1]Memories of a Theoretical Physicist, arxiv.org/abs/1708.09093

was an exception." Then, he went on to say, as for himself, he was "absolutely incapable of doing an addition sum without a mistake."

Memorizing formulas well and good arithmetic skills are not essential skills to become a good theoretical physicist or good mathematicians. I am sorry that Korean SAT physics and math tests do not provide formulas on the exam, but students are required to memorize them by themselves. In conclusion, you should never be discouraged of your dream to become a good mathematician or good theoretical physicist, simply because you are not good at arithmetics.