Shifting the variance

We know that
\[ \mathbb{E}[aX + c] = a\mathbb{E}[X] + c \]

What happens with variance?
i.e., What is \( \text{Var}(aX + c) \)? What is \( \text{Var}(aX) \)?

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Your music teacher requires you to play a 1000 note song without mistake. You have been practicing, so you have probability of 0.999 of getting each note correct (independent of the others). If you mess up a single note, you must start over and play from the beginning. Let $X$ be the number of times you have to play the song from the start. What is $\mathbb{E}[X]$?
Activity

More generally, run independent trials with probability $p$. How many trials do you need for $r$ successes?

What’s the pmf?
What’s the expectation and variance? (hint: linearity)

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