Предложенный метод решения можно обобщить.:

В нулевом периоде на счете z_0 денег. В конце 1-го года на счет кладут $A, в конце 2 года $B и так далее, вкладывая $A в конце каждого нечетного года и $B в конце каждого четного года. Сколько денег будет на счете после вклада с номером N? Ставка интереса r.

Решение получается, если условия задачи записать через разностное уравнение

$$z_n = (1+r)z_{n-1} + (A+B)/2 + (-1)^{n-1}(A-B)/2 .$$

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From My Experience of Teaching Mathematics

During few last years, the AUCA has developed a greater diversity in the students' enrollment and a new curricula, which introduced additional mathematical courses. Students from more than twenty countries with different backgrounds and levels in mathematics are enrolling in mathematics in greater numbers that in the past. This paper is raising the issue of how to make mathematics more exciting and enjoyable and what are the challenges in teaching mathematics; how to encourage students for effective participation in math classes in spite of their prior experience. This paper will highlight in brief the various aspects of communications and pedagogy; the way of teaching mathematics based on my experience with several tasks which I offer to the students in my class. It is clear to those of us who meet such a kind of material that is done with an intention to help our students to see both that the mathematics is a useful tool and a fine mental discipline, as well as that a hard work can be prepared in a fun and interesting way. With the purpose to increase mathematical knowledge of students, many standard textbooks have been published in different languages. There are many diverse educational systems, methodological and technical approaches to present information. The AUCA faculty members have the access to the Internet in order to prepare lectures and make them more attractive and diverse. The question is how a faculty should present mathematical manipulation and theoretical material without losing students or creating an aversion to the subject.

In the XVI century two main problems - the slope of the tangent line and the calculation of the area under the curve - were in the center of mathematical discussions. The problems were solved by English mathematician Sir Isaak Newton and German scholar Gottfried Wilhelm von Leibniz. Newton introduced a concept known as the *limit*; Leibniz used another term called *the infinitesimal*. Students can find many historical notes and stories about Newton, Leibniz and George Cantor in the contemporary mathematical textbooks.There are several definitions of a limit of sequences (each depends on area where limits will be applied), of infinitely large and infinitely small numbers, of a limit of functions. It will be useful for students first to understand the main idea on intuitive level and then try to understand exact definitions. The "Infinity" symbolically was represented as ∞ with the idea of "without end". In the set theory the class of natural numbers or positive integers is the example of infinite collection. The property of positive integers is that after each integer there follows a next one, so that there is no last integer. .

In order to explain the nature of infinity to his pupils David Hilbert developed a story about a hotel with an infinite number of rooms:

"Imagine a hypothetical hotel with an infinite number of rooms. One day a new guest arrives and is disappointed to learn that, despite the hotel's infinite size, it has no vacancies. Fortunately the clerk (Hilbert) has a solution. He simply asks each of the guests to move to the next room: the guest in room 1 moves to room 2, the guest in room 2 to room 3, and so on. This allows the new arrival to slip into the newly vacant room (1). So far, so good.

The following night, however, Hilbert is presented with a more challenging problem - the arrival of an infinitely large number of new guests. Hilbert, delighted by the prospect of infinitely more hotel bills, once again has a solution. He simply asks each guest to move to the room whose number is twice that of his or her current room: the guest in room 1 moves to room 2, the guest in room 2 moves to room 4, and so on. Everyone still has a room but an infinite number of rooms (all the odd ones and then some) have been vacated for the new arrivals!" .

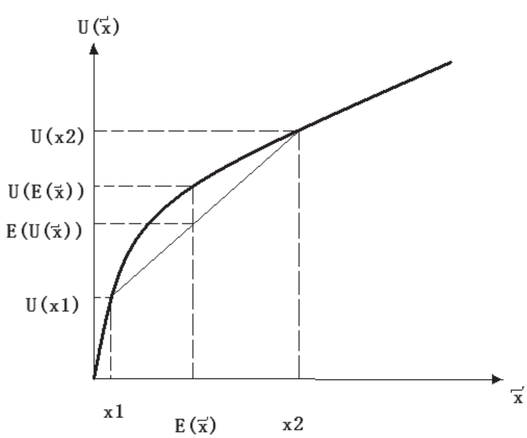
This example is helpful in the class; students like to modify and develop such stories with new contents and details; they can learn the interesting property of an infinite set: that an infinite set can be mapped (in a one-to-one correspondence) onto an infinite subset of itself.

The classical way to give the definition of limit of a function is on the base of ε-δ language: Let f be a function defined on an open interval containing the point a, except possibly at a itself. We say $\lim_{x \to a} f(x) = L$ if, for every arbitrary small and preassigned $\varepsilon \succ 0$, there exist $\delta \succ 0$ such that for every x satisfying $0 \prec |x-a| \prec \delta$ we have $|f(x)-L| \prec \varepsilon$. This definition is very important. Definition contains many symbols and estimations which are complicated for the students. Those who are majoring in mathematics came to clearness through the years of study. Teaching calculus to the students, who are not majoring in mathematics, often does not require exact definition and concentrate on understanding its meaning. We may use numerical (sequences of numbers, neighborhoods of a), graphical, and algebraic approaches. We may say: "the limit of *f* as *x* approaches a number *a* is *L* if when *x* gets arbitrary way close to *a, f(x)* gets close to *L*." From the mathematical point it is vague and the word "close" could raise many questions, so the last sentence can not be a real definition, but first information could be given on mentioned above informal way. In addition, we can use real-world examples and business cases to explain to students how to use quantitative concepts and techniques.

Students have very different needs and expectations of their study. We should always keep in mind students' motivation and additional knowledge in their future field that helps to attract students. There are numerous numbers of interesting models in Microeconomics [4] and Finance for the students majoring in Business and Economics [5], or the psychological tests for rationality and decision making [6], and the armament drive models with difference equations for the students majoring in Political Sciences [7]. "Give me a firm place to stand and I will move the world"- said Archimedes of Syracuse. We all learn differently and everyone has her/his own experience to understand a new material. Students can not predict their future and do not know when and how they will apply their knowledge, but in each topic we can find some tasks and problems where we can rely on students knowledge. For instance, we can discuss continuous compounding in financial mathematics and be guided by their knowledge of a limit of function; also a risk estimation will be offered on the base of differential calculus and statistics. Students will effectively learn if they find connections between what they already know and a new content to which they're exposed. We should give to our students "a firm place to stand". The opening of a lecture should facilitate these connections by helping students to exercise their prior knowledge. For instance, according to curricula, students have already learned the basics of the utility theory and statistics. So, let just remind at the beginning the basics of the utility theory and von Neumann-Morgenstern' system as the alternatives consisting of probabilistic consequences. In case of necessity we can discuss in class the axioms and draw the utility curves to reach visual and intuitive understanding. [8] Let's apply the expected utility structure to the lottery tickets supply. For instance, you have received as a gift one lottery ticket with guaranteed income W_0=\$44. Assume that your utility function for lottery is $U(x)=\sqrt{x}$. You have chance to win \$100 with probability 0.6 and lose \$19 with probability 0.4. How much you would like to be paid if you decide to sell the ticket?

Solution. For this lottery ticket expected result is

$$E\left[\bar{x}\right]=100\cdot 0.6+19\cdot 0.4=52.4$$



Picture 1.

Expected utility of possessing the lottery ticket and guaranteed income is equal to:

$$E[U(W_0+\overline{x})]=\sqrt{144}\cdot 0.6+\sqrt{25}\cdot 0.4=7.2+2=9.2$$

Equivalent income W^*, which has the same utility 9.2, is:

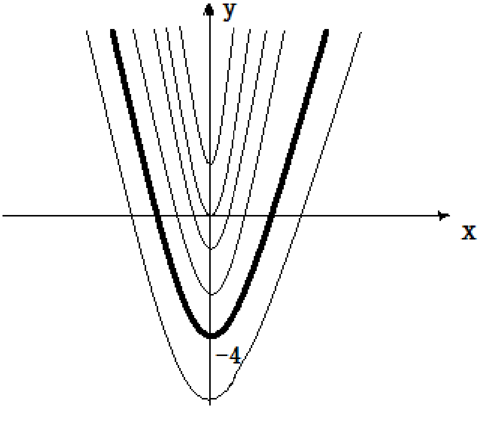
$\sqrt{W^*}$ =9.2, then W^*=9.2 ^{2} =84.64.

Then risk- premium will be $\pi=W_0+E[\overline{x}]-U^{-1}(E[U(W_0+\overline{x})])$ =44+52.4–84.64=11.76.

So, according to our calculations, you will agree to sell the lottery ticket if at least 52.4–11.7=40.64 dollars will be offered.

The following result using the mathematical analysis tools will be obtained: the first derivative of the utility function $U(x)=\sqrt{x}$ is positive, the second derivative is negative; that is the expected utility of wealth is less then the utility of the expected value of wealth and our player is a risk aversion vendor.

I usually start a new topic with a simple concept and then step by step augment a complexity of the problem. Solving the separable differential equations is a launching pad to learn the theory of the differential equations. Unfortunately the Differential Equations course is not offered at AUCA and students meet a short description of these equations with some applications in other courses. That is why it is useful to give a simple case of equations with the detailed explanations. Solving the differential equations $\frac{dy}{dx}=2\cdot x$ we can find an infinite number of solutions as $y=x^2+C$, where C is an arbitrary constant. Each choice of C produces a solution. If the initial condition y(2)=0 is given, we can mark out one bold type curve which passes the point (2;0) and find the particular solution $y^*=x^2-4$.

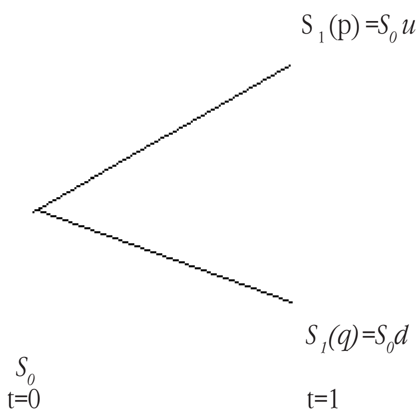


Picture 2.

We can solve in a similar way the differential equations of natural growth and decay $\frac{dy}{dx} = k \cdot y \;\; (y \succ 0)$, where k is a nonzero constant. It arises in biology, ecology, physics, chemistry, and economic forecasting.

Next strategy is to expose students to new and outstanding achievements in sciences. In 1990 Harry Markowitz, William Sharpe and Merton Miller were awarded with Nobel Prize in Economics, and in 1997 Fisher Black and Myron Scholes were awarded with Nobel Prize in Economics. It become evident that a new scientific discipline named "Theory of Finance" was recognized. This theory attempts to understand how financial markets work, how they can be regulated.

The following one-period no-arbitrage binomial stock-model could be offered to MBA students. [4], [8] In this model the price per share S_0 is going up with probability *p* and down with probability *q*.



Picture 3.

We assume the value of a stock price for both outcomes at time one is known, but it is unknown at time zero. Two positive numbers *u* and *d* are defined as up factor and down factors:

$$u = \frac{S_1(p)}{S_0}, \quad d = \frac{S_1(q)}{S_0}.$$

We assume also $d \prec u$ and introduce the interest rate *r*. One dollar invested at time zero will yield *1+r* dollars at time one. And we need one more assumption: there is no arbitrage; otherwise, wealth will be generated from nothing in such a model. If a strike price of the European call option is known, initial wealth is given, and number of shares we are going to buy is also known, we can evaluate our portfolio at time one in case of both outcomes. Multi-period binomial model could be offered to the students for the firsthand acquaintance with stock market model, and the MBA students can go further and discuss a hedging strategy and the continuous-time models.

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Коммуникативный метод: за и против

Идея коммуникативности в практике преподавания иностранных языков в Советском Союзе стала приобретать популярность еще в 50-х гг. XX века. Был выдвинут принцип коммуникативности обучения, а также говорилось о коммуникативном подходе к обучению. В конце 60-х гг. Е. И. Пассовым был разработан коммуникативный метод, который впоследствии стал довольно популярен. Зарубежные методисты тоже активно развивали идею коммуникативного обучения (Communicative Approach, Communicative Language Teaching). Однако наряду с единодушным признанием многих достоинств коммуникативного метода существует значительная критика некоторых его аспектов, как у нас (А. А. Леонтьев, Б. В. Беляев, М. К. Кабардов, П. В. Сысоев), так и на Западе (Stephen B. Ryan, Bayram Pekoz, R. Ellis, N. Spada, P. Lightbown). Методисты либо отвергают коммуникативный метод и ищут ему более эффективную замену, либо возвращаются к идее смешанного или комбинированного метода и пытаются разными способами улучшить коммуникативный метод за счет внедрения в него компонентов из других методов. Основным их аргументом является утверждение, что коммуникативный метод пригоден лишь для развития беглости речи и не уделяет достаточного внимания усвоению грамматики.

П. В. Сысоев пишет, что коммуникативный метод позволяет учащимся говорить непринужденно, но не гарантирует грамотности их высказываний (52). Род Эллис в своей работе демонстрирует, что многие воспринимают коммуникативный метод как отход от грамматики в сторону исключительно содержательной стороны речи (44). У