a place of mind

FACULTY OF EDUCATION

Department of
Curriculum and Pedagogy

Mathematics
Finance: Compound Interest

Science and Mathematics
Education Research Group

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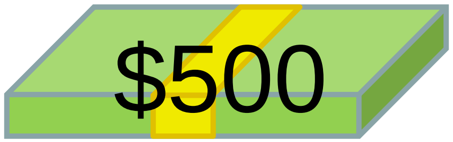
Compound Interest

+5% +5%

Compound Interest I

For your birthday, you received $500 from your friends and family. Being the smart individual that you are, you decided to bank your money in a high interest savings account, which has 10% interest over the course of a year. If the interest is calculated once a year, how much money do you have in your bank by your next birthday (excluding the money you get on that birthday)?

A. $450
B. $500
C. $550
D. $600
E. $1,000,000



+10%

Solution

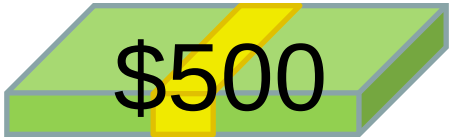
Answer: C

Justification: Because the interest is only calculated once a year, and it is 10% a year, by the end of the year you will have an additional $10\%\times500=\$50$, which means in total you will have \$550.

Compound Interest II

Instead of giving you 10% interest every year, the bank decides to give you 5% interest every half year. If you initially had $500, how much money would you have after 6 months has gone by?

A. $500
B. $525
C. $550
D. $575
E. $600



+5%

Solution

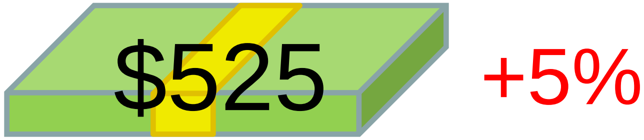
Answer: B

Justification: Since the bank gives you 5% every half a year, and half a year has gone by, you get 100%+5% of your money, which is $525.

Compound Interest III

Consider the same situation as the last question, except this time a year has passed instead of 6 months. How much money do you have at the end of the year?

A. $500
B. $525
C. $534.75
D. $551.25
E. $575



Solution

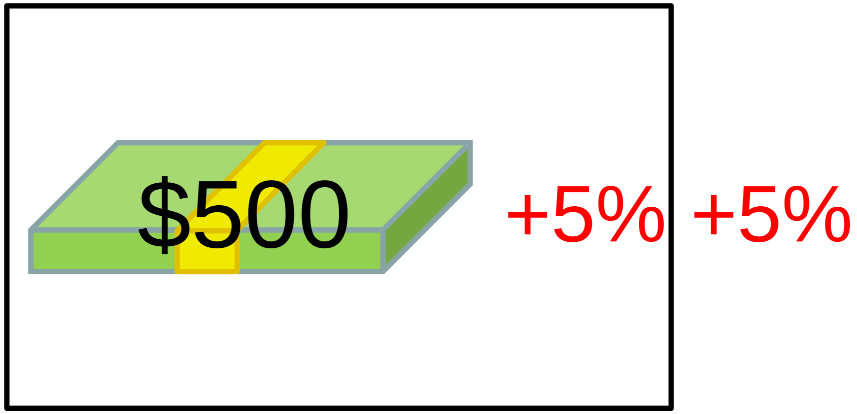
Answer: D

Justification: We know from the last question that you have \$525 at the end of 6 months. So after another 6 months have passed, you get 105% of what you have after the first 6 months, which is \$525. By the end of the year you will have $105\% \times 525 = \$551.25$. The interest here has been compounded twice, so you will have $105\% \times 105\%$ of your original money. This is 10% interest per year compounded biannually, which means 5% is applied the first half year, and 5% is applied in the second year. This does not mean that you will have 10% at the end.

Compound Interest IV

You store $500 in a bank with 10% interest per year, compounded every 6 months (twice a year). How much money do you have by the end of the year?

A. $500
B. $525
C. $534.75
D. $551.25
E. $575



Solution

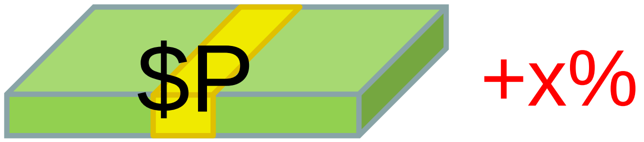
Answer: D

Justification: This is the same question as question 3, except worded differently. The general equation is 500(100%+10%/2)(100%+10%/2).

Compound Interest V

You store P dollars in a bank with r% interest per year, compounded twice a year. How much money do you have by the end of 6 months? Note that 100%=1, so B could also be written as P(100%+r/4).

A. P(1-r/2)
B. P(1+r/4)
C. P(1+r/2)
D. P(1+r)
E. None of the above



Solution

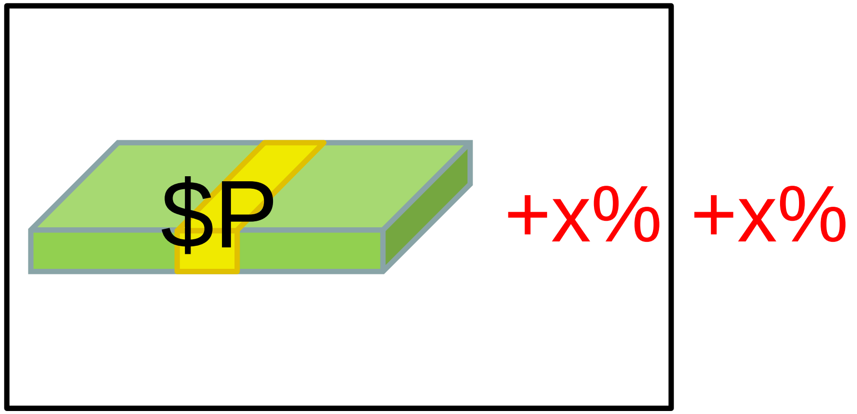
Answer: C

Justification: As half of the year has gone by, you get half of the interest per year added to your total, or 1+r/2. Multiply this by your original amount of money to get the amount of money you have after 6 months.

Compound Interest VI

You store P dollars in a bank with r% interest per year, compounded twice a year. How much money do you have by the end of the year? Note that $(1+r)^2=(1+r)(1+r)$.

A. $P(1-r/2)(1+r/2)$
B. $P(1+r/2)$
C. $P(1+r/2)^2$
D. $P(1+r)(1+r/2)$
E. None of the above



Solution

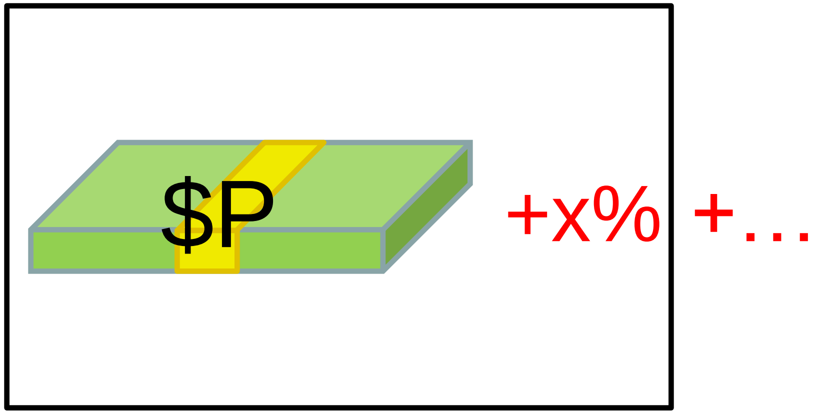
Answer: C

Justification: When half of the year had passed you had $P(1+r/2)$ money. After another 6 months, you would have 100% plus half of the interest rate (10%) applied to what you had after the first 6 months. Therefore the answer is $P(1+r/2)\times(1+r/2)=P(1+r/2)^2$.

Compound Interest VII

You store P dollars in a bank with r% interest per year, compounded n times a year. How much money do you have by the end of t years?

A. $P(1+r/n)^{nt}$
B. $P(1+r/2)^{2t}$
C. $P(1+r/n)^{n}$
D. $P(1+r)^{n}$
E. None of the above



Solution

Answer: A

Justification: The answer to question 5 was $P(1+r/2)^2$. That was for compounded twice a year. If we wanted to compound n times a year, each time would have a r/n percent increase. Since it is n times a year for t years, there is nt of such increases. Thus, our original savings are increased by $(1+r/n)^{nt}$, and $P(1+r/n)^{nt}$ is our final answer.