

Continuous Compounding

$$\text{continuous growth rate} = e^r$$

$$A = P(e^r)^t$$

1. Jamie invests \$2,500 in an account paying 3% interest compounded continuously. How much money, to the nearest cent, will she have after 4 years?
2. To have \$10,000 in an account earning 4% continuously for 6 years, how much must be deposited now?
3. You invest money at 5.5% interest compounded continuously. How long will it take for your investment to grow to \$15,000 if you start with \$9,000?
4. A population grows continuously. After some time, it increases from 2000 to 3000 at a rate of 4% per year. How long does it take for the population to reach 3000?
5. Lee deposits \$1,800 at a continuous rate of 2.5% per year and wants it to grow to \$3,600. How long will it take for his investment to double?
6. How long does it take for a quantity to increase by 25% at 3% continuous growth?
7. A bacterial culture starts with 800 bacteria and grows continuously at 1.2% per hour. How long will it take for the population to **triple**?
8. A sum of \$4,000 grows to \$4,600 in 5 years under continuous compounding. What annual interest rate is being applied (to the nearest hundredth of a percent)?
9. An investment grows from \$3,500 to \$4,375 over 3 years under continuous compounding. Find the annual rate of growth (to the nearest hundredth of a percent).
10. A value grows from \$5,000 to \$5,900 over 4.5 years. Find the continuous rate.

Key idea: All conversions are based on matching growth: continuous growth rate = e^r

$$e^r = \left(1 + \frac{r}{n}\right)^n$$

11. A bank offers an interest rate of 5% compounded annually.
 - a) What is the one-year growth factor?
 - b) What continuous rate produces the same growth?
12. Convert 5% compounded semi-annually to a continuous rate.

13. A bank offers a nominal interest rate of 3% compounded monthly. What is the equivalent annual rate if interest were compounded continuously?
14. An account pays 4.5% interest compounded quarterly. Determine the continuous compound rate that yields the same one-year growth (to the nearest hundredth of a percent).
15. To match a continuous rate of 3% per year, what nominal annual rate compounded semi-annually should a financial institution quote (to the nearest hundredth of a percent)?
16. If an investment grows at 3.2% per year compounded continuously, what nominal rate compounded daily (365 days/year) gives the same annual increase (to the nearest thousandth of a percent)?
17. A continuously compounded interest rate of 2.1% is advertised by a credit union. What is the effective annual yield (to the nearest thousandth of a percent)?
18. Compare two savings options over one year: Option A pays 3.5% compounded continuously; Option B pays 3.6% compounded quarterly. Which yields a higher amount on an initial \$5,000 deposit, and by how much?