

Sec 41

-Exponential Applications-

- population growth and loss
- depreciation (vehicles, equipment)
- appreciation (inflation, salary)
- radioactive decay
- decay of medicinal substances in the body
- account growth (money invested in savings, cds)

The equation $P = 7.6(1.0109)^t$ models the world's present population, in billions, where t is years since 2018. What is the world population today; what will it be in 2025?

$$\text{Let } t = 7$$

$$P = 7.6(1.0109)^7$$

$$P \approx 8.199$$

Pop ≈ 8.199 billion

8,199,000,000
people

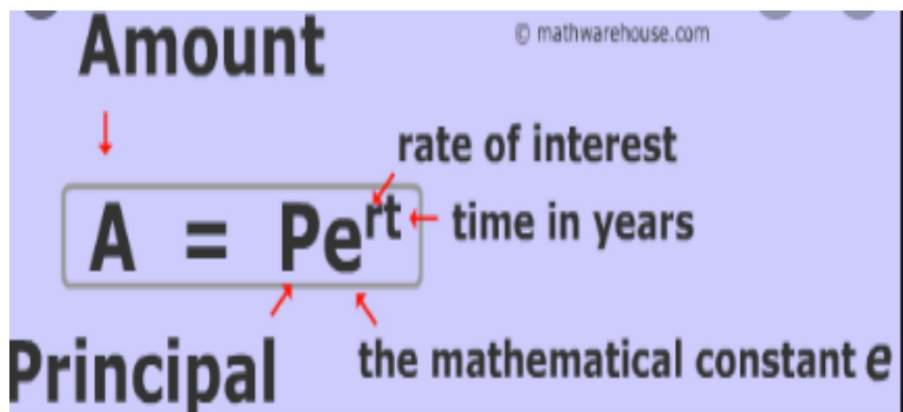
If your home is worth \$250,000 and the inflation rate is 2.5%, how much will your home be worth in 15 years?

Use the model

$S = C(1+r)^t$, where C is the current value, r is the inflation rate and S is the value after t years.

$$\begin{aligned} S &= C(1+r)^t \\ &= 250,000(1.025)^{15} \\ &\approx \$362,074 \end{aligned}$$

For the scenario on the next screen we will use the Pert formula.



The diagram shows the formula $A = Pe^{rt}$ enclosed in a box. Red arrows point from labels to the variables: 'Amount' points to 'A', 'Principal' points to 'P', 'rate of interest' points to 'r', 'time in years' points to 't', and 'the mathematical constant e' points to 'e'. A copyright notice '© mathwarehouse.com' is visible in the top right corner of the diagram.

It calculates the amount of money accumulated if it's compounded continuously.

We'll also use the compound interest formula.

The diagram shows the compound interest formula $A = P(1 + \frac{r}{n})^{nt}$ enclosed in a rounded rectangle. Red arrows point from descriptive labels to the variables in the formula: 'Amount' points to 'A', 'Principal' points to 'P', 'rate of interest' points to 'r', 'number of times per year, interest is compounded' points to 'n', and 'time in years' points to 't'. The variable 'nt' is also present in the formula.

$$A = P(1 + \frac{r}{n})^{nt}$$

Amount

rate of interest

time in years

Principal

number of times per year, interest is compounded

It obtains the later amount if interest is compounded more than once a year, but not continuously.

You are investing \$8000 for 6 years. One account pays 7%, compounded monthly. The other pays 6.85%, compounded continuously. Which is the better investment?

$$A = P \left(1 + \frac{r}{n}\right)^{nt}$$

$$= 8000 \left(1 + \frac{.07}{12}\right)^{12(6)}$$

$$\approx \$12,160.8$$

↑ 7% monthly pays more

$$A = Pe^{rt}$$
$$= 8000e^{.0685(6)}$$

$$12066.6$$

annually- 1
 semi-annually- 2
 quarterly- 4
 monthly- 12
 daily- 365
 continuously-

Amount

$$A = P \left(1 + \frac{r}{n} \right)^{nt}$$

↓ rate of interest
 time in years
 Principal
 number of times per year, interest is compounded

Amount

$$A = Pe^{rt}$$

↓ rate of interest
 time in years
 Principal
 the mathematical constant e

© meta-financial.com

various "n" values

Suggested Practice
Sec 4.1
page 453

53,55,65,66,67,73

- 53. a. \$13,116.51
b. \$13,140.67
c. \$13,157.04
d. \$13,165.31**
- 55. 7%, monthly**
- 65. a. 574 million
b. 1148 million
or 1,148,000,000
or 1.1 trillion**

**66. $f(80) = 157.49$
so, no, not safe in 2066**

67. \$832,744

- 73. a. 100%
b. 68.5%
c. 30.8%
d. 20%**

