



The Exponential Function



1. Solve the following exponential equations:

(a) $e^x = 10$

(b) $e^x = 25$

(c) $e^{3x} = 150$

(d) $e^{7x} = 675$

(e) $5e^x = 30$

(f) $4e^{2x} = 32$

(g) $17e^{0.8x} = 124$

(h) $12e^{x+1} = 50$

(i) $0.75e^{2x-5} = 56$

(j) $5 + e^x = 24$

(k) $12 + 8e^{5x} = 17$

(l) $15 + 10e^{0.35x-2} = 100$

(m) $21 + 0.7e^{5x+9} = 1245$

2. A €100 investment gains value by continuously compounding at a rate of 4% annually. Create a model in the form $V = Ae^{rt}$, where V is the value of the investment (€), and t is time in years.

(a) How much will the investment be after 5 years?

(b) How long will it take the investment to double?

3. A laptop bought at the end of 2015 for €1,100 depreciates continuously in value at a rate of 25% a year. Assuming this can be modeled by the exponential function;

(a) What will the laptop be worth at the end of 2017?

(b) During what year will the price of the laptop drop below €400

4. An investment of €505 gains value from continuously compounding interest at a rate of $3\frac{1}{2}\%$.

(a) What will the investment be worth after 5 years?

(b) When will it be worth over €1000?





5. In the year 2000, the population of the world was 6.070 Billion ; in 2015, it was 7.3 Billion.

Use this information to create a model in the form $Y = Ae^{rt}$, where Y represents the population in Billions, and t is time in years.

Assuming a model of exponential growth estimate the global population in

- (a) 2020
 - (b) 2050
 - (c) When will the world population reach 10 Billion?
6. A car was bought three years ago for €25,000. It is now valued at €15,000. Assuming that the value is depreciating exponentially, estimate the value one year from now to the nearest euro.
7. A new born baby gains weight at a rate proportional to its weight during the first weeks of it's life. A baby weighing 3.6kg at birth weighs 3.72kg after one week.
- (a) Estimate its weight at three weeks.
 - (b) After how many weeks will the baby weigh 5kg?
8. The value of a piece of equipment is declining exponentially according to a function of the form

$$V = V_0 e^{-rt}$$

where V equals the value of the equipment in euro and t equals the age of the equipment in years. When the equipment was 3 years old, its value was €520,000. When it was 7 years old, its value was €130,000.

- (a) What will the equipment be worth when it is 10 years old?
9. An online dating app had 2.5 million users at the end of 2012, and 6.5 million users at the end of 2015. We want to model this growth.
- (a) Assuming the growth is exponential, create an exponential model in the form $Y = Ae^{rt}$, where Y is the number of users (in millions) and t is time in years.
 - (b) Using this model, how many users will the dating app have at the end of 2016?
 - (c) Using this model, by the end of what year do we expect the dating app to have over 20 million users?
10. A Petri dish initially contains a sample of 500 cells. The number of cells doubles in three hours. Using a model of exponential growth.
- (a) Find a formula for the number N of cells present t hours after the initial time.
 - (b) How many cells will there be after 5 hours?
 - (c) How long does it take the number of cells to reach 10000?

