When finding approximate solutions, round all answers to the nearest tenth of a unit. When rounding very small numbers, like 0.006865..., keep three digits after the zeroes, *e.g.* 0.00687.

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1. A population of 180 rabbits was re-introduced to Rouge Park in 2014. Careful observations of other similar populations indicate that their numbers double every 1.5 years.

   (a) What will the rabbit population be in the year 2020?
   (b) How long does it take for the population to reach 1000?

2. A bacterial culture doubles in numbers every 4.5 hours. At 6 AM, a new culture was started with 1200 bacteria.

   (a) What will the bacteria population be at 3 PM?
   (b) What is the bacteria population after 2 days?

3. The population of a Toronto suburb is growing at a rate of 3.8% per year. Its population in 2016 is 875,000.

   (a) What will the population be in 2025?
   (b) How long will it take for the population to grow to 2 million?

4. A healthy wolf population grows at a rate of 2.2% per year. The last time they were counted was in 2004, and the estimate was 650 wolves.

   (a) What would a healthy population be in 2016?
   (b) What is the minimum number of wolves that would make a healthy population in 2020?

5. The UN estimates the global human population is 7.4 billion in 2016, and forecasts an increase to 11.2 billion in 2100. If we assume an exponential growth model, what is the annual growth rate? How many years does it take for the population to double?

6. Carbon-14, a common isotope found in organic material, experiences radioactive decay with a half-life of 5730 years.

   (a) How long does it take for an initial mass of 5 micro-grams (μg) of carbon-14 to decay to 0.8 μg.
   (b) How much carbon-14 will remain after 50,000 years? Express your answer as a percentage of the original amount.

7. The value of a computer decreases (depreciates) at a rate of 12% per year.

   (a) If you buy a computer for $1800, what will it be worth in 5 years?

   (b) How long does it take for the computer's value to decrease to 25% of its original price?

8. In a particular lake in Muskoka the intensity of light underwater decreases by 6.5% every metre during the daytime.

   (a) What is the intensity of light at 10 m depth?

   (b) If the maximum depth of the lake is 15 m, would you need lighting if you wanted to dive to the bottom? Assume that you need artificial light when there is less than 40% of normal daylight.

9. The colour in a pair of blue jeans fades by 0.5% of its original colour every time they are washed.

   (a) How many washes does it take for the jeans to fade to 50% of their original colour?

   (b) If they are washed once a week, how many years does it take for the jeans to fade to 50% of their original colour?

10. An investment of $2000 earns interest at 3.5% per year, compounded annually.

    (a) How much is the investment worth after five years?

    (b) How long does it take for the investment to reach $3000?

11. An investment of $5000 earns interest at 4.8% per year, compounded quarterly.

    (a) How much is the investment worth after five years?

    (b) How long does it take for the investment to reach $7500?

    (c) How much would you have to invest to in order to have $8000 in 3 years?