

# DIGITLE – AB CALCULUS

## Puzzle 132 – Growth



**Directions:** The first 5 problems have single digit answers. The 6<sup>th</sup> problem has a 5-digit answer (counting leading zeros if present). You have a choice: solve the easier single-digit answer problems or tackle the more difficult 5-digit answer. Once you have done that, attempt to solve the puzzle by entering the following url on your computer, tablet, or phone:

<https://mastermathmentor.com/mmm/digitle.ashx>.

The correct puzzle answer will be the digits of your answer(s) scrambled. Use the following interpretation. You get 6 tries.

**Green :**

the digit is in the answer and is in the correct spot.

**Grey :**

the digit is not in the answer.

**Yellow:**

the digit is in the answer but is not in the correct spot.

### Single Digit Answers:

- 1) A radioactive element has a half-life of 200 years. What whole number percentage of it will be remaining in 1,125 years?
- 2) The Giulianos have a baby boy and invest money for him in a special certificate of deposit that is guaranteed to get 14% interest annually if it is not withdrawn until maturity. To the nearest year, how long will it take until its value has doubled?
- 3) The differential equation that models the statement “the rate of change of  $y$  with respect to  $t$  is proportional to the product of  $t$  and  $1 - y$ .” If when  $t = 0$ ,  $y = 10$ , what is the constant of integration  $C$ ?
- 4) After a rainstorm, a circular puddle is formed having a radius of 3 feet. When the sun comes out afterwards, the radius decreases at a rate proportional to the square root of its radius with the constant of proportionality being  $-1/3$ ,  $t$  measured in minutes. How long will it take the radius of the puddle to be 2 feet, 1 inch?
- 5) The rate of change of the percent of people  $P(t)$  getting a flu inoculation in a population is directly proportional to  $100 - P(t)$  where  $t$  is the time in weeks. At the start of flu season ( $t = 0$ ), 25% had already been inoculated and 4 weeks later, 50% had been inoculated. From that time, approximately how many more weeks will it take for 75% of the population to be inoculated?

### 5-Digit Answer:

- 6) You win a lottery and win \$3,000 a month for the rest of your life. You are afraid of banks, so you put the money in a fireproof vault in your house. Each month, you spend 5.2% of the money you have saved. Let  $M$  be the amount of money that you saved, and  $t$  be the number of months that you have been receiving the money. The differential equation that describes this situation is  $\frac{dM}{dt} = 3000 - 0.052M$ . Solve the DEQ, assuming there was no money in the vault at time  $t = 0$  and determine how much money you will have saved if you live forever.