CLASS QUIZ: JANUARY 5: EXPONENTIAL GROWTH

MATH 153, SECTION 55 (VIPUL NAIK)

Your name (print clearly in capital letters): _____

(1) A species of unicellular micro-organisms doubles in number every one hour at room temperature and remains constant when placed in a refrigerator. Given that the initial number of micro-organisms in a dish is N_0, and the dish is kept at room temperature for A hours and in a refrigerator for B hours, what is the **total number** of micro-organisms at **the end**? (5 points)
(A) $N_0 \cdot 2^{A-B}$
(B) $N_0 \cdot 2^{A+B}$
(C) $N_0 \cdot 2^{AB}$
(D) $N_0 \cdot 2^{A}$
(E) $N_0 \cdot 2^{B}$

Your answer: _____

(2) The population in the island of Androgynesia as a function of time is believed to be an exponential function. On January 1, 1984, the population was measured to be $3 * 10^5$ with a measurement error of up to 10^5 on either side, i.e., the population was measured to be between $2 * 10^5$ and $4 * 10^5$. On January 1, 1998, the population was measured to be $1.2 * 10^6$ with a measurememt error of up to $4 * 10^5$ on either side, i.e., the population was measured to be between $8 * 10^5$ and $1.6 * 10^6$. If the population is an exponential function of time (i.e., the increment in population per year is a fixed proportion of the population that year), what is the **range of possible values** of the population measured on January 1, 2012?
(A) Between $3.2 * 10^6$ and $6.4 * 10^6$
(B) Between $3.2 * 10^6$ and $1.28 * 10^7$
(C) Between $1.6 * 10^6$ and $3.2 * 10^6$
(D) Between $1.6 * 10^6$ and $6.4 * 10^6$
(E) Between $1.6 * 10^6$ and $1.28 * 10^7$

Your answer: _____

(3) A radioactive substance has a half-life of 3 years. **Determine the integer** n such that 90% of the substance decays within somewhere between $n - (1/2)$ and $n + (1/2)$ years.
(A) 5
(B) 10
(C) 15
(D) 20
(E) 25

Your answer: _____

(4) A, B, and C are three species of unicellular micro-organisms. Under specified conditions, species A doubles in number every 2 hours, species B triples in number every 3 hours, and species C quadruples (i.e., becomes 4 times) in number every 4 hours. Assume that they start off in the same quantities at the beginning. What can we say about their relative rates of growth?
(A) They are all growing at the same rate.
(B) Species A is growing fastest, species C is growing slowest, and species B is growing at an intermediate rate.
(C) Species A is growing slowest, species C is growing fastest, and species B is growing at an intermediate rate.
(D) Species A and C are both growing at the same rate, which is faster than the rate at which species B is growing.
(E) Species A and C are both growing at the same rate, which is slower than the rate at which species B is growing.

Your answer: _____

(5) A species of bacteria doubles in number every hour. It takes 9 hours for a given initial quantity of this species to fill up a petri dish volume. How many hours from the start did the species occup half the petri dish volume (assume that the volume occupied is proportional to the quantity)?
(A) 1 hour from the beginning
(B) 3 hours from the beginning
(C) 4.5 hours from the beginning
(D) 6 hours from the beginning
(E) 8 hours from the beginning

Your answer: _____

(6) Suppose the populations in two countries A and B are growing exponentially at possibly different rates. Which of the following statements is **false**?
(A) If the initial population of A is more, and the exponential population growth rate of A is greater, then the population of A will always be greater than that of B.
(B) If the initial population of A is more, and the exponential population growth rate of B is greater, then the population of B will eventually overtake the population of A.
(C) If the initial population of A is more, and the exponential population growth rates of A and B are equal, then the populations of A and B will eventually become equal.
(D) All of the above.
(E) None of the above.

Your answer: _____