A∞Ω
MATH@TD

Formula reminders

$A(t) = A_0(1+r)^t$

$A(t) = A_0(1-r)^t$

$A(t) = A_0\left(\frac{1}{2}\right)^{t/h}$

$A(t) = A_0(2)^{t/D}$

MCR3U

Name:_____

11 U4 - Exponential Functions: Test

K ____/12 C ____/5 A ___/16

Written Solutions: Provide clear solutions to the following 10 problems. You will receive a ***Communications grade, out of 3*** for how well your math is presented.

1. Evaluate. Express your answer in rational form. **(#1-3 - 2pts each) K ___/6**

$$9^{-2} \div \left(\frac{9^1}{9^{-4}}\right)^{-1}$$

2. Simplify the expression. Express your answer with positive exponents.

$$\frac{a^5 b^{-3}}{(a^2 b^{-3})^4}$$

3. Simplify the expression. Express your answer with positive exponents.

$$\left(\frac{\left(x^{-2}\right)^5\left(y^3\right)}{(x)^3\left(y^{-4}\right)^4}\right)^{-2}$$

4. State all transformations applied to "construct" the function $y = -3\left(2^{x+6}\right) - 1$. **K ___/2**

5. In 2021, a sum of $10,000 is invested at a rate of 5.4% per year for 10 years. What is the value of the investment when it matures (at the end of 10 years)? **A ___/3**

6. The population of a city has grown at an annual rate of approximately 1.6%. The current population is 125,500 people.
   Write an exponential function which will describe the town's population over time. **A ___/2**
   How long will it take for its population of 125,500 people to grow to 251,000 at this growth rate? **A ___/3**

7. A cup of delicious tea was left to cool in a room whose temperature was 20°C. The temperature of the tea changes (cools) according to the function $T(t) = 95\left(\frac{1}{2}\right)^{\frac{t}{60}} + 20$, where t is in minutes. Determine the temperature of the liquid after:
   i) 90 minutes, ii) 3 hours **K ___/2**

   Explain the meaning of the y-intercept and the horizontal asymptote in the context of this problem. **C ___/2**

8. A car loses its value each month after it is purchased. Its value as a function of time, in months, is modelled by $V(m) = 28500(0.945)^m$.
   What is the rate of depreciation? (the decay rate) **K ___/1**
   What is the value of the car after 10 months? **K ___/1**
   In which month after it is purchased does the car's value fall below $10,000? **A ___/2**

9. A 450*g* sample of plutonium-238 has a half-life of 88 years. Determine a function describing this situation. How long will it take for this sample to decay to 100*g*? **A ___/3**

10. The doubling time for a certain type of bacteria is 6 h. A bacteria population in a person's lungs begins at 3000 bacteria. Determine a function that describes number of bacterium after *t* hours. **A ___/1**
Without medical intervention a human might die if ther are one million bacteria in their body. How long does the patient have to get the medical attention they need? **A ___/2**