

Units 8, 9, and 10 Exam Review

Exponential Functions, Growth, & Decay

Simplifying exponent expressions

- *Multiplying* – add exponents, multiply coefficients
- *Dividing* – subtract exponents, divide coefficients
- *Power to a power* – multiply exponents, raise coefficients to exponent power
- *Raised to the zero power* – always simplifies to 1!
- *Negative exponent* – base and exponent need to move to the other side of the fraction

$$\frac{(5x^2)^2(y^7z^5)^4}{25x^4y^{28}z^{20}} \quad \frac{4^{-2}h^{-4}j^3}{j^3} \quad \frac{10fg^{-5}h^0}{h^{-2}}$$

$$= \frac{25x^4y^{28}z^{20}}{25x^4y^{28}z^{20}} \quad = \frac{1}{16h^4} \quad = \frac{10fh^2}{g^5}$$

Arithmetic vs. Geometric patterns

- Arithmetic sequence – common difference (d) that is added or subtracted
 - Subtract previous number in sequence to find common difference (d is slope)
 - Linear functions
 - *Explicit form:* $y = mx + b$
- Geometric sequence – common ratio (r) that is multiplied (can be a decimal/fraction that appears like it is dividing)
 - Divide by previous number in sequence to find common ratio
 - Exponential functions
 - *Next = Now* $\times r$, *Explicit form:* $y = a(r)^x$
- Start number in a table is always when the independent or x-value is equal to zero!! (b for linear and a for exp. are start numbers)

2, 6, 18, 54, 162, ...
geometric $r=3$
 $a_n = 3 \cdot a_{n-1}$
exponential

4, 8, 12, 16, ...
arithmetic $d=4$
 $a_n = a_{n-1} + 4$
linear

1	2	3	4	5	6
12	36	108	324	972	2916

Growth & Decline/Decay: $y = a(1 \pm r)^x$

- Always start with 100%
 - If growing, add change to original 100%, write as decimal for common ratio
 - Amount of growth is the amount over 100%
 - If decaying, subtract change from original 100%, write as decimal for common ratio
 - Amount of decay is the amount less than 100%
- If you are given two values one year apart, find the common ratio between them by dividing
- Example: The population of a town grows exponentially each year. The population 1 year ago was 8,000. Today the population is 9280.

- A) What is the common ratio? $9280 \div 8000 = 1.16$
- B) By what percentage is the population growing each year? 16%
- C) What will the population be in 4 years? $9280(1.16)^4 = 16803$
- D) How many years will it take the population to reach 30,000? 8 years

Half Life

- Amount of time it takes for substance to decrease by $\frac{1}{2}$
- The number of times that the half life occurs within a time span is the exponent value
- **The common ratio is always $\frac{1}{2}$ (or 0.5).**
- Example: An exponentially decaying radioactive ore originally weighs 30 grams and has a half-life of 100 years. How much of the ore will be left in 400 years? Write an exponential decay function in order to find the solution.

Function: $y = 30\left(\frac{1}{2}\right)^4$
 Amount remaining: 1.875 grams

Compound Interest:

Formula: $A = P\left(1 + \frac{r}{n}\right)^{nt}$

A → S in the account at the end of the time period P – Principal (initial amount of money)

r – The percent rate the money is growing by (changed to a decimal!)

n – The number of times the money is being compounded per year t – The total amount of time in years

More Vocabulary: (n)

Annually – Once per year (n = 1)

Semi-Annually – Twice per year (n = 2)

Quarterly – Four times per year (n = 4)

Monthly – Twelve times per year (n = 12)