

3.1: Experimenting With Exponents

Date: _____

Topic: Arithmetic and Geometric Patterns

The sequences below exemplify either a linear (arithmetic) or exponential (geometric) pattern. Answer the following:

- i. Determine which type of sequence each pattern represents.
- ii. Fill in the missing table values.
- iii. Write an explicit equation for the pattern represented in the table. Pay special attention to the term number.

1.

Term	0	1	2	3	4	5	6	7
Value	2	4	8	16	32			

i. Type: _____ | ii. Equation: _____

2.

Term	7	8	9	10	11	12	13	14
Value	66	50	34	18				

i. Type: _____ | ii. Equation: _____

3.

Term	0	1	2	3	4	5	6	7
Value	-3	9	-27	81				

i. Type: _____ | ii. Equation: _____

4.

Term	-4	-3	-2	-1	0	1	2	3
Value	160	80	40	20				

i. Type: _____ | ii. Equation: _____

5.

Term	2	4	6	8	10	12	14	16
Value	-9	-1	7	15				

i. Type: _____ | ii. Equation: _____

Topic: Simplifying exponential expressions

Review of Exponent Properties		New Exponent Properties	
• Product of Powers:	$a^m \cdot a^n = a^{m+n}$	Rational Exponents	
• Quotient of Powers:	$\frac{a^m}{a^n} = a^{m-n}$	• Square Root:	$b^{\frac{1}{2}} = \sqrt{b}$
• Power to Power:	$(a^m)^n = a^{m \cdot n}$	• Cubed Root:	$b^{\frac{1}{3}} = \sqrt[3]{b}$
• Power of Product:	$(a \cdot b)^m = a^m \cdot b^m$	• Any Root:	$b^{\frac{1}{n}} = \sqrt[n]{b}$
• Negative Exponents:	$a^{-m} = \frac{1}{a^m}$	• Power & Root:	$b^{\frac{m}{n}} = \sqrt[n]{b^m}$
• Power of One:	$a^1 = a$		
• Zero Property:	$a^0 = 1$		

Simplify the following expressions using the exponent rules and relationships provided in the table above, write your answers in exponential form. (For example: $2^2 \cdot 2^5 = 2^{2+5} = 2^7$ **NOT** 128)

6. $3^2 \cdot 3^5$	7. $\frac{5^3}{5^2}$	8. 2^{-5}
9. 17^0	10. $\frac{7^5}{7^2} \cdot \frac{7^3}{7^4}$	11. $\frac{3^{-2} \cdot 3^5}{3^7}$
12. $p^2 \cdot p^{-2}$	13. $\frac{x^{-4}}{x^2}$	14. $\frac{x^5 \cdot y^2 \cdot x^{-1}}{x^{-3} \cdot y^3}$
15. $\frac{2 \cdot x^2 \cdot y^5 \cdot x^{-1}}{2^3 \cdot x^{-5} \cdot y^2}$	16. $\left(\frac{3^{-8} \cdot x^3 \cdot 2 \cdot y}{3 \cdot x^7 \cdot 2^5 \cdot y^9}\right)^0$	17. $\left(\frac{2 \cdot x^{-1} \cdot y^2}{x^3 \cdot 2^3 \cdot y^3}\right)^3$

Simplify each radical expression, below, completely. Write your answer in simplest radical form. Meaning, DO NOT USE A CALCULATOR.

18. $\sqrt{81}$

19. $\sqrt{121}$

20. $\sqrt{8}$

21. $\sqrt{27}$

Fill in the geometric tables of values below by:

- i. finding the *exact* factor used to move between the whole number values (a).
- ii. finding the *exact* factor used to move between each column of the table (b).

22.

x	0	$\frac{1}{2}$	1	$\frac{3}{2}$	2
y	4		16		

i. Factor between whole numbers (a): _____

ii. Factor between each column (b): _____

23.

x	0	$\frac{1}{3}$	$\frac{2}{3}$	1	$\frac{4}{3}$
y	4			8	

i. Factor between whole numbers (a): _____

ii. Factor between each column (b): _____

24.

x	0	$\frac{1}{2}$	1	$\frac{3}{2}$	2
y	5		15		

i. Factor between whole numbers (a): _____

ii. Factor between each column (b): _____

Evaluate each function below. Write your answer as an exact value – no decimals. REALISTICALLY, YOU SHOULD BE ABLE TO EVALUATE EACH FUNCTION WITHOUT USING A CALCULATOR.

25. $f(x) = 2x - 7$

a) Find $f(-3)$

b) Find $f\left(\frac{1}{2}\right)$

25. $g(x) = 3^x(2)$

a) Find $g(-4)$

b) Find $g\left(\frac{1}{2}\right)$

27. $k(x) = 210(1.08)^x$

a) Find $k(-1)$

b) Find $k\left(\frac{1}{2}\right)$

28. $h(x) = x^2 + x - 6$

a) Find $h(-5)$

b) Find $h\left(\frac{1}{2}\right)$

29. $m(x) = -5x + 9$

a) Find $m(-7)$

b) Find $m\left(\frac{1}{2}\right)$

30. $p(x) = 5^x(2)$

a) Find $p(-2)$

b) Find $p\left(\frac{1}{2}\right)$