

3.3: Experimenting with Exponents

Topic: Understanding and Using Exponent Rules

1. Fill in the table below using the information provided.

Exponential Form	List of Prime Factors	Standard Form
a. 5^3		
b.	$7 \cdot 7 \cdot 7 \cdot 7 \cdot 7 \cdot 7 \cdot 7$	
c. 2^{10}		
d.		81
e.	$11 \cdot 11 \cdot 11 \cdot 11 \cdot 11$	
f.		625

For the following problems, provide three other equivalent forms of the exponential expression using exponent rules. The first one has been done as an example for you.

	Product of Powers	Power to Power	Quotient of Powers
EXAMPLE: 2^{10}	$2^7 \cdot 2^3$	$(2^2)^5$	$\frac{2^{15}}{2^5}$
2. 3^7			
3. 3^{-8}			
4. $7^{\frac{1}{3}}$			
5. 5^1			
6. $\frac{1}{3^3}$			

Determine whether all three expressions in each problem below are equivalent. Justify your answer.

7.	$5(3^{x-1})$	$15(3^{x-2})$	$\frac{3}{5}(3^x)$
8.	$64(2^{-x})$	$\frac{64}{2^x}$	$64\left(\frac{1}{2}\right)^{-x}$
9.	$30(-1.05^x)^{-1}$	$-30\left(1.05^{-\frac{1}{7}}\right)^{-7x}$	$30\left(-1.05^{\frac{x}{2}}\right)^{-2}$

Simplify each of the exponential expressions below. Your answer should be in simplest exponential form.

10. $\frac{44a^5b^{12}c^0}{32a^8b^9c^{-1}}$	11. $9^{\frac{3}{2}}s^{\frac{6}{2}}t^{\frac{1}{2}}$
12. $9^{\frac{2}{3}} \cdot 9^{\frac{4}{3}}$	13. $\left(\frac{32x^{13}}{243y^{20}}\right)^{\frac{1}{5}}$
14. $25^{\frac{7}{6}}27^{\frac{5}{9}}$	15. $81^{\frac{1}{4}}a^{\frac{10}{6}}b^{\frac{2}{3}}$

Simplify each of the radical expressions below. Your answer should be in simplest standard form.

16. $\sqrt[3]{27a^5b^2}$	17. $\sqrt[3]{5^7 \cdot 3^5}$
18. $\sqrt{9t} \cdot \sqrt[3]{729} \cdot \sqrt[6]{s^{12}}$	19. $\sqrt[5]{\frac{3^7 \cdot 81}{27^{-3}}}$
20. $\sqrt[5]{\frac{32x^{13} \cdot y^{-20}}{243}}$	21. $\frac{\sqrt[3]{1331} \cdot \sqrt{(b^3c)^2}}{2\sqrt{(2a^4)^4}}$

22. Match the six exponential expressions from 10-15 to their six equivalent radical expressions from 16-21.

23. Show that the following expressions are equivalent by converting the first form to the second form.

Exponential Form → Radical Form	Radical Form → Exponential Form
a. $(16b)^{-\frac{1}{4}} \cdot (9b^{\frac{1}{2}})^{\frac{3}{2}} = \frac{27\sqrt{b}}{2}$	b. $\sqrt[3]{15u^2v} \cdot \sqrt[3]{75u^5v^8} = 5(3^{\frac{2}{3}}u^{\frac{7}{3}}v^3)$

Simplify. Your answer should contain only positive exponents.

24.
$$\frac{(x^2y^{-4})^5}{xy^5 \cdot 2x^4y^4}$$

25.
$$\frac{2x^{-3}y^5}{(-2y^4 \cdot 2x^5y^{-4})^{-1}}$$

26.
$$\left(\frac{2x^{-1}y^4}{-2x^{-5}y^5 \cdot y} \right)^{-3}$$

27.
$$-\frac{2x^{-5}y^{-3} \cdot -x^4y^4}{(2y^{-3})^3}$$

28.
$$\frac{x^{-4}y^3 \cdot 2x^2y^4}{(-x^5y^3)^5}$$

29.
$$-\frac{2x^0y^0 \cdot -x^{-5}}{(-x^5)^0}$$