9.3 DIVISION USING EXPONENTS

Division with exponents can be done using the **QUOTIENT PROPERTY RULE.** This rule tells us to **subtract** the exponents when dividing numbers or letters that have the same base and keep the base the same. [$x^a \div x^b = x^{a-b}$]

EXAMPLES:

1. $8^{12} \div 8^3 = 8^{12-3} = 8^9$
2. $x^{15} \div x^{12} = x^{15-12} = x^3$
3. $(x^6 y^5) \div (x^4 y^2) = x^{6-4} y^{5-2} = x^2 y^3$
4. $(a^3 b^{-4} c^4) \div (a^{-2} b^2 c^2) = a^{(3)-(-2)} b^{(-4)-(2)} c^{(4)-(2)} = a^5 b^{-6} c^2$
5. $\dfrac{21 x^3 y^7 z^2}{24 x^4 y^3 z} = \left(\frac{21}{24}\right) x^{3-4} y^{7-3} z^{2-1} = \frac{7}{8} x^{-1} y^4 z^1$

A. Perform the following divisions using the Quotient Property Rule and leave your answers in simplest exponential form.

1. $x^5 \div x^2 = x^3$
2. $y^3 \div y^2 = y$
3. $z^7 \div z^6 = z^1$
4. $b^7 \div b^9 = b^{-2}$
5. $s^6 \div s^3 = s^3$
6. $x^{-7} \div x^{14} = x^{-7-14} = x^{-21}$
7. $x^5 \div x^9 = x^{-4}$
8. $x^6 \div x = x^5$
9. $y^{10} \div y^5 = y^5$
10. $x^0 \div x^{-5} = x^5$
11. $x^1 \div x^{12} = x^{-11}$
12. $x^1 \div x^{-12} = x^{1-(-12)} = x^{1+12} = x^{13}$
13. $y^0 \div y^0 = 1$
14. $c^8 \div c^8 = 1$
15. $x^{-12} \div x^{-16}$ x^4

B. Simplify the following using the Quotient Property Rule and leave your answers in simplest exponential form.

1. $\dfrac{x^3 y^4}{x^2 y^2} = x^1 y^2$
2. $\dfrac{18 x^8 y^5}{6 x^6 y^3} = 3x^2 y^2$
3. $\dfrac{x^{-4} b^7}{x^{11} b^{-8}} = x^{-15} y^1 = \dfrac{y}{x^{15}}$
4. $\dfrac{a^{-5} b^6 c^{-2}}{c^7 b^8} = a^{-5} b^{-2} c^{-9} = \dfrac{1}{a^5 b^2 c^9}$
5. $\dfrac{a b^{14} c^{-30}}{a^{12} b^{32} c^{15}} = a^{-11} b^{-18} c^{-45} = \dfrac{1}{a^{11} b^{18} c^{45}}$
6. $\dfrac{(x^7)(x^3)(x^{-5})}{(x^6)(x^{-5})} = \dfrac{x^5}{x^1} = x^4$
7. $\dfrac{20 a^{11} b^{-8} c^{15} b^{10} a^{-8}}{25 a^5 c^7 b^{-5} c^{15}} = \dfrac{4}{5} a^{-2} b^7 c^{-7} = \dfrac{4b^7}{5a^2 c^7}$
8. $\dfrac{a^{15} a^{-3} a^{17}}{a^{16} a^{-3}} = \dfrac{a^{29}}{a^{13}} = a^{16}$
9. $\dfrac{24 a^{10} b^{13} a^{-6} c^{12} b^{19} c^{-2}}{36 a^4 c^7 a^{12} b^{-12} c^{12}} = \dfrac{2 a^{-12} b^{44} c^{-6}}{3} = \dfrac{2b^{44}}{3a^{12} c^6}$
10. $\dfrac{a^4 b^3 a^{-7} b^{14}}{a^1 b^{10}}$ $a^{-4} b^7 = \dfrac{b^7}{a^4}$
11. $\dfrac{x^0 y^0 z^0}{y^0 z^0 x^0} = 1$
12. $\dfrac{25 r^{-13} s^{11} r^9 t^2 p^6 s^{-24}}{35 t^{10} p^{-2} s^8 q^{-14}} = \dfrac{5 r^{-4} s^{-21} t^{-8} p^8}{7 q^{-14}} = \dfrac{5 p^8 q^{14}}{7 r^4 s^{21} t^8}$