Practice Test: Factorization and Exponents

FMP10 **Factorization and Exponents Practice Test** Name: ______________

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1. Using a tree diagram, determine the prime factorization of 1080. [2]

1080
10 108
2 5 4 27
2 2 3 9
3 3

$1080 = 2^3 \cdot 3^3 \cdot 5$

2. Determine the greatest common factor (GCF) of each set of numbers. [4]

a) 36 and 54

36: 6 6; 2 3 2 3
54: 6 9; 2 3 3 3

$GCF = 2 \cdot 3^2 = 18$

b) 24, 84, and 108

24: 4 6; 2 2 2 3
84: 4 21; 2 2 3 7
108: 4 27; 2 2 3 3 3

$GCF = 2^2 \cdot 3 = 12$

3. Determine the lowest common multiple (LCM) of each set of numbers. [4]

a) 15 and 21

15: 3 5
21: 3 7

$LCM = 3 \cdot 5 \cdot 7 = 105$

b) 12, 18, and 44

12: 4 3; 2 2
18: 6 3; 2 3
44: 4 11; 2 2

$LCM = 2^2 \cdot 3^2 \cdot 11 = 396$

4. Use prime factorization to determine if 3375 is a perfect square, a perfect cube, neither, or both. Explain how you know. (*Hint: What is the exponent of each prime factor?*) [2]

3375
5 675
25 27
5 5 3 3 3

$3375 = 3^3 \cdot 5^3 = (3 \cdot 5)^3$

3375 is a perfect cube since each exponent is divisible by 3.

$2^6 \cdot 7^6 \rightarrow (2^3 \cdot 7^3)^2$ ∴ perfect square

$\rightarrow (2^2 \cdot 7^2)^3$ ∴ perfect cube

$3^4 \cdot 5^2 \rightarrow (3^2 \cdot 5)^2$ ∴ perfect square

$3^2 \cdot 5^3 \rightarrow$ neither

perfect square ⇒ each exponent is divisible by 2

5. Use prime factorization to determine the square root of 576. [2]

$\sqrt{81}$

$81 = 9^2$

$\sqrt{81} = 9$

576
4 144
2 2 12 12
4 3 4 3

$576 = 2^6 \cdot 3^2$

$= (2^3 \cdot 3)^2$

$\therefore \sqrt{576} = 2^3 \cdot 3$

$= 24$

$\sqrt{81} = 9$

4 3 4 3

2 2 2 2

$= 24$

divisible by 2

6. Write as a single power (if applicable), and then evaluate. [4]

a) $(-2)^2 \times (-2)^3 = (-2)^5$
$= -32$

b) $3^8 \div 3^4 = 3^4$
$= 81$

c) $-7^0 = -1$

d) $(10^2)^4 = 10^8$
$= 100000000$

7. Use the exponent laws to simplify. [5]

a) $x^8 \times x^5 = x^{13}$

b) $a^{12} \div a^3 = a^9$

c) $(-4y)^2 = 16y^2$

d) $(z^3)^6 = z^{18}$

e) $p^0 = 1$

8. Simplify. [8]

a) $-6a^4 \times a^5 \times -3a = 18a^{10}$

b) $(-4n^2t^7)^3 = -64n^6t^{21}$

$(-4)^3$

c) $\frac{-18c^4}{-9c} = 2c^3$

d) $(5x^4y^2) \div (x^3y^2) = 5xy^0$
$= 5x$

e) $\frac{15(p^2qr^2)^5}{3(p^5q^2r^5)} = \frac{15p^{10}q^5r^{10}}{3p^5q^2r^5}$
$= 5p^5q^3r^5$

f) $\left(\frac{5y^4 \times 4x^8}{10x^5}\right)^4 = \left(\frac{20x^8y^4}{10x^5}\right)^4$
$= (2x^3y^4)^4$
$= 16x^{12}y^{16}$

9. Simplify each expression, using only positive exponents. [6]

a) $x^{-4} = \frac{1}{x^4}$

b) $\left(\frac{k}{2}\right)^{-3} = \left(\frac{2}{k}\right)^3 = \frac{8}{k^3}$

c) $5n^{-3} = 5 \cdot \frac{1}{n^3} = \frac{5}{n^3}$

$(5n)^{-3} = \frac{1}{(5n)^3}$

d) $(-6z)^{-2} = \frac{1}{(-6z)^2} = \frac{1}{36z^2}$

10. Simplify each expression, using only positive exponents. [7]

a) $a^{-6}a^{-4}$
$= a^{-10}$
$= \frac{1}{a^{10}}$

b) $(-3x^{-5}\underbrace{y^0}_{=1}z^4)^{-4}$
$= \frac{1}{(-3x^{-5}z^4)^4}$
$= \frac{1}{81x^{-20}z^{16}}$
$= \frac{x^{20}}{81z^{16}}$

c) $\left(\frac{16x^3}{8xy^{-2}}\right)^{-2}$
$= \left(\frac{2x^2}{y^{-2}}\right)^{-2}$
$= (2x^2y^2)^{-2}$
$= \frac{1}{(2x^2y^2)^2}$
$= \frac{1}{4x^4y^4}$

d) $\frac{\overset{16}{\cancel{64}}a^3b^2}{\underset{1}{\cancel{4}}a^{-2}b^{-2}} \times \frac{\overset{2}{\cancel{6}}a^{-3}}{\underset{-1}{\cancel{-3}}b^{-2}}$
$= 16a^5b^4 \times -\frac{2a^{-3}}{b^{-2}}$
$= 16a^5b^4 \times -\frac{2b^2}{a^3}$
$= -\frac{32a^5b^6}{a^3}$
$= -32a^2b^6$

$$= \frac{\cdot}{4x^4y^4}$$