[redacted] KEY [redacted]

L04 – 4.3 Rational Exponents

Part 1 – Review of Exponent Laws

	Exponent Law	
	Note that a and b are rational or variable bases and m and n are integral exponents.	
1	Product of Powers	$(a^m)(a^n) = a^{m+n}$
2	Quotient of Powers	$\frac{a^m}{a^n} = a^{m-n}, a \neq 0$
3	Power of a Power	$(a^m)^n = a^{mn}$
4	Power of a Product	$(ab)^m = (a^m)(b^m)$
5	Power of a Quotient	$\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}, b \neq 0$
6	Zero Exponent	$a^0 = 1, a \neq 0$

Q1: $(x^5)(x^3) =$

x^{5+3}

x^8

Q2: $(x^3)^4 =$

$x^{(3)(4)}$

x^{12}

Q3: $\frac{x^8}{x^6} =$

x^{8-6}

x^2

Part 2 – Fractions

Q4: $5 + 3 =$ 8

Q5: $\frac{5}{2} + \frac{3}{2} =$ $\frac{8}{2} = 4$

Q6: $(3)(4) =$ 12

Q7: $\left(\frac{3}{2}\right)\left(\frac{4}{3}\right) =$ $\frac{12}{6} = 2$

Q8: $8 - 6 =$ 2

Q9: $\frac{8}{7} - \frac{6}{7} =$ $\frac{2}{7}$

KEY

Part 3 – Exponent Laws with Fractions

Q10: $(x^5)(x^3) =$ x^{5+3}

$= x^8$

Q11: $\left(x^{\frac{5}{2}}\right)\left(x^{\frac{3}{2}}\right) =$ $x^{\frac{5}{2}+\frac{3}{2}}$

$= x^{\frac{8}{2}}$

$= x^4$

Q12: $(x^3)^4 =$ $x^{(3)(4)}$

$= x^{12}$

Q13: $\left(x^{\frac{3}{2}}\right)^{\frac{4}{3}} =$ $x^{\left(\frac{3}{2}\right)\left(\frac{4}{3}\right)}$

$= x^{\frac{12}{6}}$

$= x^2$

Q14: $\frac{x^8}{x^6} =$ x^{8-6}

$= x^2$

Q15: $\frac{x^{\frac{8}{7}}}{x^{\frac{6}{7}}} =$ $x^{\frac{8}{7}-\frac{6}{7}}$

$= x^{2/7}$

Part 4 – Rational Exponents – What Does It Mean?

Q16: $\left(9^{\frac{1}{2}}\right)\left(9^{\frac{1}{2}}\right) =$ $9^{\frac{1}{2}+\frac{1}{2}} = 9^1$

But wait!?

$(3)(3) = 9$

Also

$(\sqrt{9})(\sqrt{9}) = 9$

So

$9^{\frac{1}{2}} = \sqrt{9} = 3$

Q17: $\left(8^{\frac{1}{3}}\right)\left(8^{\frac{1}{3}}\right)\left(8^{\frac{1}{3}}\right) =$ $8^{\frac{1}{3}+\frac{1}{3}+\frac{1}{3}} = 8^1$

But wait!?

$(2)(2)(2) = 8$

Also

$(\sqrt[3]{8})(\sqrt[3]{8})(\sqrt[3]{8}) = 8$

So

$8^{\frac{1}{3}} = \sqrt[3]{8} = 2$

Confirm the values of $9^{\frac{1}{2}}$ *and* $8^{\frac{1}{3}}$ *using your calculator.*

Key

Part 5 – Exponents to Radicals

Q18: Write $x^{\frac{3}{2}}$ as an entire radical.

Option #1

$x^{3/2} = (x^3)^{1/2} = \sqrt{x^3}$

Option #2

$x^{3/2} = (x^{1/2})^3 = (\sqrt{x})^3$

Q19: Write $y^{\frac{3}{5}}$ as an entire radical.

Option #1

$y^{3/5} = (y^3)^{1/5} = \sqrt[5]{y^3}$

Option #2

$y^{3/5} = (y^{1/5})^3 = (\sqrt[5]{y})^3$

Part 6 – Rational Exponents with Numerical Response

Q20: The expression $\dfrac{\left(x^{\frac{2}{3}}\right)\left(x^{\frac{4}{3}}\right)}{\left(x^{\frac{1}{2}}\right)^{-\frac{1}{3}}}$ simplifies to $x^{\frac{ab}{c}}$, where ***a, b,*** and ***c*** are ___, ___, and ___.

*(Record your **three digit** answer in the Numerical Response boxes below)*

1	3	6	

$$\frac{(x^{\frac{2}{3}})(x^{\frac{4}{3}})}{(x^{1/2})^{-1/3}} = \frac{x^{\frac{2}{3}+\frac{4}{3}}}{x^{(1/2)(-1/3)}} = \frac{x^{6/3}}{x^{-1/6}} = \frac{x^2}{x^{-1/6}}$$

$$= \frac{(x^2)(x^{1/6})}{1} = x^{12/6 + 1/6} = \boxed{x^{13/6}}$$

so $ab = 13$
$c = 6$

KEY

Part 7 – Harder Practice

Q21: Use the exponent laws to **simplify** each expression.

$\left(x^{\frac{1}{2}}\right)\left(x^{\frac{7}{2}}\right) = x^{1/2+7/2} = x^{8/2} = x^{4}$

$\left(\frac{5x^3}{20x}\right)^{\frac{1}{2}} = \left(\frac{x^2}{4}\right)^{1/2} = \frac{(x^2)^{1/2}}{(4)^{1/2}} = \frac{x}{2}$

$\left(\frac{x^{\frac{1}{4}}}{16x^{\frac{3}{4}}}\right)^{\frac{1}{2}} = \left(\frac{1}{16x^{1/2}}\right)^{1/2} = \frac{1}{(16)^{1/2}(x^{1/2})^{1/2}}$

$= \frac{1}{4x^{1/4}}$

$\left(x^{\frac{1}{3}}y^{\frac{4}{5}}\right)^{0}\left(x^{\frac{1}{3}}\right)^{6} = (1)(x^{1/3})^{6}$

$= x^{6/3}$

$= x^{2}$

Simplify first, then evaluate.

$\frac{5^{-2}}{125^{\frac{1}{3}}} = \frac{5^{-2}}{(5^3)^{1/3}} = \frac{5^{-2}}{5^1} = \frac{1}{5^3} = \frac{1}{125}$

$(4^3)\left(4^{\frac{3}{2}}\right) = 4^{3+3/2} = 4^{6/2+3/2} = 4^{9/2}$

$\left(8^{\frac{2}{3}}\right)\left(16^{\frac{3}{2}}\right) = (2^3)^{2/3}\cdot(2^4)^{3/2}$

$= (2^2)\cdot(2^6)$

$= 2^8$

$\frac{\left(\left(9^{\frac{1}{2}}\right)\left(9^{\frac{1}{3}}\right)\right)^2}{27^{\frac{2}{3}}} = \frac{\left[(3^2)^{1/2}(3^2)^{1/3}\right]^2}{(3^3)^{2/3}} = \frac{\left[3\cdot 3^{2/3}\right]^2}{3^2}$

$= \frac{\left[3^{5/3}\right]^2}{3^2} = \frac{3^{10/3}}{3^{6/3}} = 3^{4/3}$

Practice P. 180 #1, 2, 3, 4, 5