

HW 9-1

Quiz Friday on Days 1 & 2

1. $8x^{18}y^9$

6. $\frac{3x}{16}$

2. x^{3a+1}

7. $80b^{12}$

3. $\frac{16x^6}{9y^4}$

8. 3^6

4. 1000

9. 32

5. $162y^8$

10. 400

11. $2^8 = 256$

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Name _____ Alg 2 HW 9-1

Simplify each expression. No calculators!

1. $(2x^6y^3)^3 = 2^3 x^{18} y^9 = 8x^{18}y^9$

2. $x^{2a} \cdot x^{a+1} = x^{2a+a+1} = x^{3a+1}$

3. $\left(\frac{4x^3}{3y^2}\right)^2 = \frac{4^2 x^6}{3^2 y^4} = \frac{16x^6}{9y^4}$

4. $2^3 \cdot 5^3 = (2 \cdot 5)^3 = 10^3 = 1000$

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5. $2(3x^0y^2)^4 = 2 \cdot (3^4y^8) = 2 \cdot 81y^8 = 162y^8$

6. $\frac{3x^5}{(2x)^4} = \frac{3x^5}{16x^4} = \frac{3x}{16}$

7. If $x = 5a^4$ and $a = 2b^3$ express x in terms of b .

$x = 5(\underbrace{2b^3}_{\downarrow})^4 = 5 \cdot 16b^{12} = 80b^{12}$

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8. Express 9^3 as a power of 3.

$9 = 3^2 \quad (3^2)^3 = 3^6$

9. Divide 8^3 by 2^4

$(2^3)^3 \div 2^4 = \frac{2^9}{2^4} = 2^5 = 32$

$(ab)^n = a^n b^n$

10. Using the power rule evaluate 25 times 16.

$5^2 \cdot 4^2 = (5 \cdot 4)^2 = 20^2 = 400$

11. Use the powers of 2 to help you perform the calculation of $\frac{2^7 \cdot 2^5}{16}$

$\frac{2^7 \cdot 2^5}{2^4} = \frac{2^{12}}{2^4} = 2^8 = 256$
 2^{7+5-4}

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	2	3	4	5
2	4	8	16	32
3	9	27	81	243
4	16	64	256	X
5	25	125	625	X

Negative and Fractional Exponents

$$\frac{4^5}{4^4} = 4^1 = 4$$

$$\frac{4^4}{4^5} = 4^{4-5} = 4^{-1}$$

$$\frac{4^0}{4^1} = 4^{-1} = \frac{1}{4}$$

Handwritten notes and diagrams:

- Diagram showing 4^5 as 4 multiplied by itself 5 times, with 4 terms crossed out to leave 1, resulting in 4^1 .
- Diagram showing 4^4 as 4 multiplied by itself 4 times, with 4 terms crossed out to leave 1, resulting in 4^0 .
- Diagram showing 4^{-1} as 4^{4-5} , with 4 terms crossed out to leave 1, resulting in 4^{-1} .
- Diagram showing 4^{-1} as 4^{1-2} , with 4 terms crossed out to leave 1, resulting in 4^{-1} .
- Diagram showing 4^{-1} as 4^{1-2} , with 4 terms crossed out to leave 1, resulting in 4^{-1} .
- Diagram showing 4^{-1} as 4^{1-2} , with 4 terms crossed out to leave 1, resulting in 4^{-1} .

Negative and Fractional Exponents

$$4^{-1} = \frac{1}{4}$$

PEMDAS

Unit 9 Day 2

Negative Exponent →

Rule:

$$x^{-1} = \left(\frac{1}{x}\right)^1 = \frac{1}{x}$$

reciprocate
the base

$$= \frac{1}{x}$$

$$x^{-n} = \left(\frac{1}{x}\right)^n = \frac{1^n}{x^n} = \frac{1}{x^n}$$

Examples:

a. $3^{-1} = \frac{1}{3}$

b. $2 \cdot 3^{-1} = 2 \left(\frac{1}{3}\right) = \frac{2}{3}$

a. $3^{-2} = \left(\frac{1}{3}\right)^2 = \frac{1}{9}$

b. $-5^{-2} = -(5)^{-2} = -\left(\frac{1}{5}\right)^2$
 $\neq (-5)^{-2} = -\frac{1}{25}$

$$\frac{1}{x^{-n}} = x^{-n}$$

$$a. \quad \frac{1}{3^{-2}} = 3^2 = 9$$

$$b. \quad \frac{3}{2^{-3}} = 3 \cdot 2^3 = \cancel{4}^3 3 \cdot 8 = 24$$

$$\left(\frac{x}{y}\right)^{-n} = \left(\frac{y}{x}\right)^n = \frac{y^n}{x^n}$$

$$a. \quad \left(\frac{2}{3}\right)^{-2} = \left(\frac{3}{2}\right)^2 = \frac{9}{4}$$

$$b. \quad \left(\frac{5}{4}\right)^{-3} = \left(\frac{4}{5}\right)^3 = \frac{64}{125}$$

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Simplify each expression leaving only positive exponents. Assume all variables are nonzero.

$$1. \quad 5^{-2} = \frac{1}{5^2} = \frac{1}{25}$$

$$2. \quad (-2)^{-2} = \left(\frac{1}{-2}\right)^2 = \frac{1}{4}$$

$$3. \quad \left(-\frac{3}{2}\right)^{-3} = \left(-\frac{2}{3}\right)^3 = -\frac{8}{27}$$

$$4. \quad \frac{y^{-3}}{x^{-4}} = \frac{x^4}{y^3}$$

$$5. \quad (3x)^{-3} = \left(\frac{1}{3x}\right)^3 = \frac{1}{27x^3}$$

$$6. \quad \frac{(4x)^{-3}}{3x^{-2}} = \frac{x^2}{3(4x)^3} = \frac{x^2}{3(64x^3)} = \frac{x^2}{192x^3} = \frac{1}{192x}$$

$$7. \quad 2^{-5} \cdot 2^3 \cdot 2^4 = 2^{-5+3+4} = 2^{-5+7} = 2^2 = 4$$

$$8. \quad \left(\frac{3x^2}{2x^{-3}}\right)^{-2} = \left(\frac{3x^2x^3}{2}\right)^{-2} = \left(\frac{3x^5}{2}\right)^{-2} = \left(\frac{2}{3x^5}\right)^2 = \frac{4}{9x^{10}}$$

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Fractional Exponents →

$$\sqrt[n]{x}$$

n = indexx = radicand

$$\sqrt{x} = x^{1/2} \rightarrow \text{index}$$

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

$$\sqrt[3]{x} = x^{1/3}$$

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

$$\sqrt[n]{x} = x^{1/n}$$

$$243^{1/5} = \sqrt[5]{243} = 3$$

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Write using exponents:

9. $\sqrt[4]{2a}$

$$(2a)^{1/4}$$

$$\sqrt{9} = 3 \quad \text{b/c } 3^2 = 9$$

10. $x\sqrt{y} = xy^{1/2}$

Write using a radical sign:

11. $y^{1/5}$

$$\sqrt[5]{y}$$

12. $(3x)^{1/4} = \sqrt[4]{3x}$

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Evaluate. (No calculators!)

13. $81^{\frac{1}{4}} = \sqrt[4]{81} = 3$

14. $27^{\frac{1}{3}} = \sqrt[3]{27} = 3$

15. $100^{-\frac{1}{2}} = \left(\frac{1}{100}\right)^{\frac{1}{2}} = \sqrt{\frac{1}{100}} = \frac{1}{10}$

16. $(-8)^{\frac{1}{3}} = \sqrt[3]{-8} = -2$

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17. $(-27)^{-\frac{1}{3}} = \left(\frac{1}{-27}\right)^{\frac{1}{3}} = \sqrt[3]{\frac{1}{-27}} = -\frac{1}{3}$

18. $\left(\frac{4}{49}\right)^{\frac{1}{2}} = \sqrt{\frac{4}{49}} = \frac{2}{7}$

19. $\left(\frac{16}{25}\right)^{-\frac{1}{2}} = \left(\frac{25}{16}\right)^{\frac{1}{2}} = \frac{5}{4}$

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20. Use the properties of exponents to rewrite the expression with positive exponents.

$$f(x) = \frac{9}{(2x)^{-3}} = \frac{9(2x)^3}{1} = 9(8x^3) = 72x^3 \rightarrow \boxed{f(x) = 72x^3}$$

Find the value of $f\left(-\frac{1}{3}\right) = 72\left(-\frac{1}{3}\right)^3 = 72\left(-\frac{1}{27}\right) = -\frac{72}{27} = -\frac{9(8)}{9(3)}$

$$\boxed{-\frac{8}{3}}$$

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Do you recall how to add, subtract and multiply fractions?

$$\frac{1}{5} + \frac{2}{5} = \frac{3}{5}$$

$$\frac{3}{1} \cdot \frac{2}{5} = \frac{6}{5}$$

↓ no common denominator needed

$$\frac{4}{7} \left(\frac{1}{3} - \frac{3}{4} \right) = \frac{4}{7} \left(\frac{4}{12} - \frac{9}{12} \right) = \frac{4}{7} \left(-\frac{5}{12} \right) = -\frac{20}{84} = -\frac{5}{21}$$

no common denominator needed for multiplication

$$\frac{5}{9} - \left(\frac{1}{3} - \frac{3}{9} \right) = \frac{5}{9} - \frac{5-3}{9} = \frac{5}{9} - \frac{2}{9} = \frac{3}{9} = \frac{1}{3}$$

21. Use the properties of exponents to evaluate the following expressions

a. $x^{\frac{1}{2}} \cdot x^{\frac{1}{8}}$

$$x^{\frac{1}{2}} \left(\frac{1}{2} \right) + \frac{1}{8}$$

$$x^{\frac{4}{8} + \frac{1}{8}} = x^{\frac{5}{8}}$$

b. $\frac{x^{\frac{1}{3}}}{x^{\frac{1}{6}}} - \frac{1}{6}$

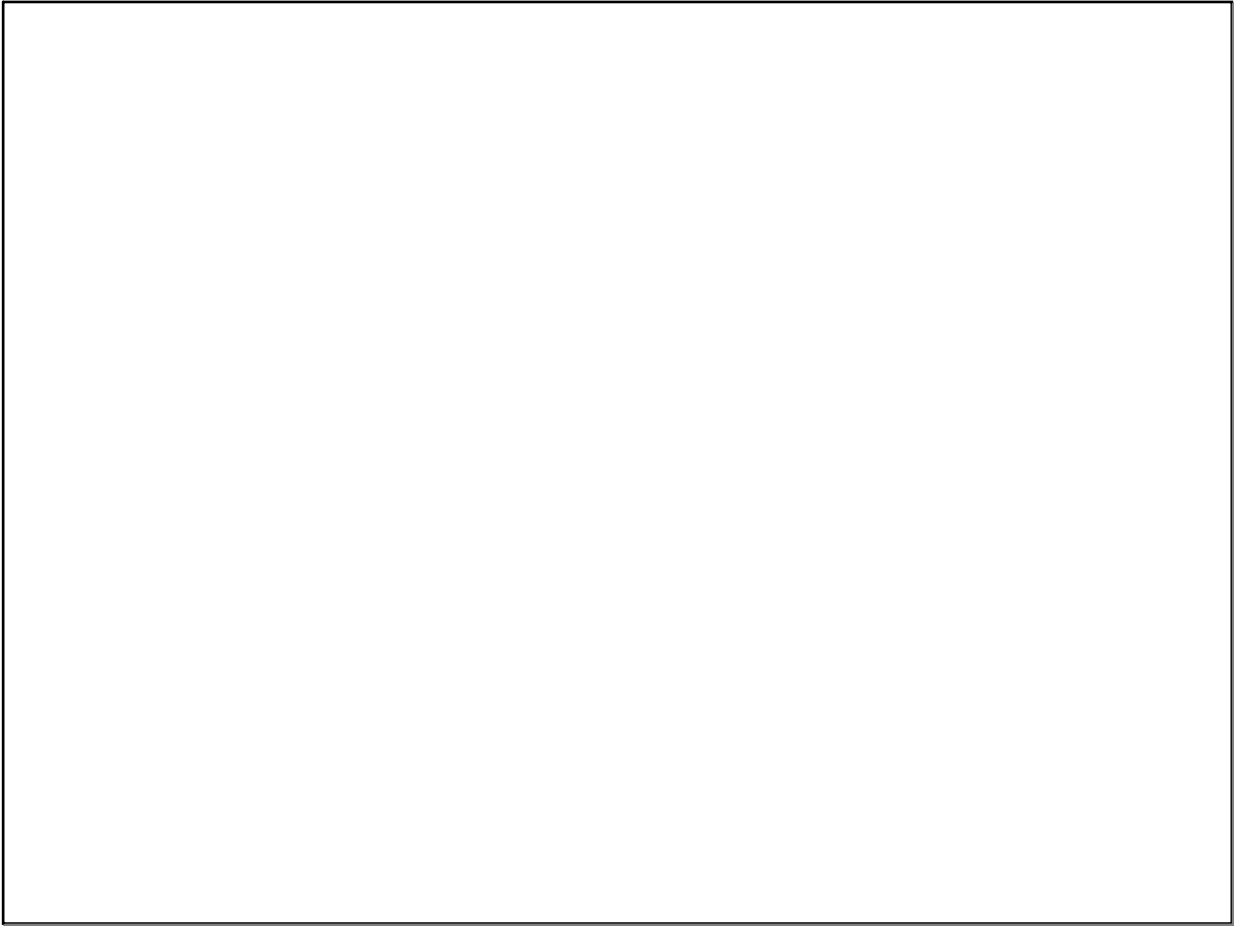
$$= x^{\frac{1}{3} - \frac{1}{6}} - \frac{1}{6}$$

$$= x^{\frac{2}{6} - \frac{1}{6}}$$

$$= x^{\frac{1}{6}}$$

c. $\left(x^{\frac{1}{6}}\right)^6 = x^1 = x$

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