Math 10-C Exponents & Radicals Assignment List **Name: _____**

C1: Prime Factorization

- Eratosthenes' Sieve
- Prime Factorization Practice

C2: Perfect Squares & Square Roots

- Text pg. 64: 3, 12, 13
- Quizlet - Perfect Squares & Square Roots (http://quizlet.com/_bkzdc)

C3: Perfect Cubes & Cube Roots

- Text pg. 64: 4, 16, 17
- Quizlet - Perfect Cubes & Cube Roots (http://quizlet.com/_bkywk)

C4: Entire & Mixed Radicals

- Entire & Mixed Radicals Investigation
- Radicals Worksheet
- Text pg. 76: 4abc, 5abcd
- Text. pg. 64: 20, 18, 24
- Exponents & Radicals Quiz C1-C4

C5: Exponents with Rational Bases

- Basic Exponents Review
- Investigate Negative Exponents
- Powers with Rational Bases Assignment
- Exponents & Radicals Quiz (Rational Bases)

C6: Exponents with Variables Bases

- Powers with Variables Bases Assignment
- Text pg. 68: 11, 15, 16

C7: Number Systems & Ordering

- In class questions.

Exponents & Radicals Chapter Review Assignment

ERATOSTHENES' SIEVE...

Is one technique to sort prime and composite numbers. Primes can be isolated by crossing out a series of multiples, starting with the multiples of 2.

- **Cross out 1, which only has 1 factor, itself.**
- **Cross out all even numbers HIGHER than 2.** (example 4, 6...)
- **Cross out multiples of 3: these multiples have digits which add up to equal three or a multiple of three.** (example: 111's digits add to 3, so its is divisible by 3)
- **Cross out multiples of 5: these end in 0 or 5.**
- **Cross out the multiples of 7.**

1 f	2 z	3 i	4 k	5 g	6 m	7 b	8 w	9 x	10 a
11 o	12 v	13 a	14 c	15 q	16 n	17 s	18 d	19 e	20 j
21 f	22 e	23 s	24 t	25 u	26 h	27 r	28 q	29 e	30 l
31 a	32 s	33 a	34 y	35 r	36 a	37 o	38 g	39 r	40 z
41 i	42 t	43 n	44 p	45 c	46 v	47 g	48 a	49 b	50 w
51 k	52 s	53 h	54 u	55 t	56 y	57 h	58 d	59 e	60 g
61 a	62 i	63 v	64 j	65 r	66 a	67 o	68 s	69 f	70 g
71 n	72 x	73 e	74 t	75 n	76 c	77 y	78 q	79 s	80 h
81 p	82 j	83 e	84 v	85 d	86 r	87 j	88 q	89 d	90 h
91 n	92 b	93 p	94 s	95 w	96 t	97 o	98 g	99 e	100 l

If you have "sifted the sieve" correctly, only the prime numbers will remain.

The following words are unique because they are the only ones in English with the triple letter combinations indicated. Use the clues given to find them.

- **Check your work by placing the letters found with each prime number in SEQUENCE.**
- **Start with the first letter of the first word, then complete the first word, and so on.**

		G	Z	A						wavy
		O	K	C						sets of shelves
		S	Y	G						flexible
			D	P	H					listening devices
T	U	X								dinner jacket

M10C – Divisibility Rules **Name:** _____

The rules listed in the table below help us determine whether a number is divisible by each of the numbers from 2 to 11. Note that 0 is divisible by all positive numbers.

Divisible by	Test	Example
2	The ones digit is even.	46 is divisible by 2 since 6 is even.
3	The sum of all the digits is divisible by 3.	153 is divisible by 3 since $1+5+3 = 9$, which is divisible by 3.
4	The last two digits are divisible by 4.	820 is divisible by 4 since 20 is divisible by 4.
5	The ones digit is 0 or 5.	795 is divisible by 5 since its last digit is 5.
6	The number is divisible by 2 and 3.	258 is divisible by 6 since 8 is even so it is divisible by 2 and $2+5+8 = 15$ which is divisible by 3.
7	Subtract twice the ones digit from the rest of the number, until you get a small number that is divisible by 7.	672 is divisible by 7 since $2 \times 2 = 4$ and $67 - 4 = 63$, which is divisible by 7.
8	The last three digits are divisible by 8.	4816 is divisible by 8 since 816 is divisible by 8.
9	The sum of all the digits is divisible by 9.	567 is divisible by 9 since $5+6+7 = 18$ which is divisible by 9.
10	The ones digit is 0.	270 is divisible by 10 since the ones digit is 0.

Divisibility Practice – using the rules above, check off each of the numbers from 2 to 10 that each number is divisible by.

	2	3	4	5	6	7	8	9	10
702									
268									
371									
344									
316									
282									
207									
342									
1420									

M10C – Prime Factorization Practice Name: _____

Complete the following problems on a separate piece of paper.

Prime Factorization Strategies

1. Choose a prime factorization strategy (birthday cake or factor tree) to find the prime factorization of the following numbers.

   a) 84 b) 120 c) 172

   d) 100 e) 96 f) 351

Problem Solving

2. Ms. Timson wants to split her Grade 9 math class of 36 students into groups for an upcoming assignment. List all the possibilities of groups, each with the same number of students, that Ms. Timson can divide her class into so that no students are left without a group.

3. The volume of a cereal box is 1925 cm^3. What are the different possible dimensions of the cereal box if each dimension must be greater than 1 cm? (Note: The volume of a rectangular box is length × width × height.)

4. The product of three different positive integers is 144. What is the maximum possible sum of these three integers?

5. The four digit number 43__ is divisible by 3, 4 and 5. What are the last two digits?

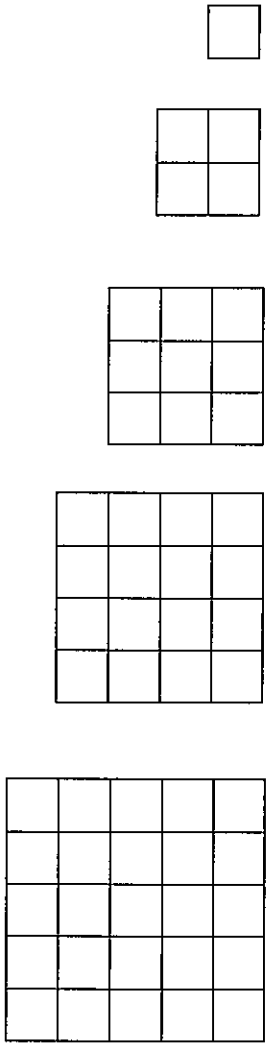
Challenge

6. The digits 1; 2; 3; 4; 5 and 6 are each used once to compose a six digit number *abcdef*, such that the three digit number *abc* is divisible by 4, *bcd* is divisible by 5, *cde* is divisible by 3 and *def* is divisible by 11. Determine all possible assignments of the digits to the letters.

Math 10-C Entire & Mixed Radicals Investigation **Name:** _____

1. Complete the table below given the information provided.

   Each of the small squares below has an area of 2. The first one is completed for you.



Total Area	**Side Length** (written as an entire radical)	**Side Length** (written as a multiple of $\sqrt{2}$)
2 units^2	$\sqrt{2}$	$1\sqrt{2}$

Looking at the completed table we can see that there are two different ways to represent the 'Side Length'. Try to describe the relationship between the two side length columns (hint: think factors). If you need more help seeing the relationship continue to the next page...

If the following are true ... ***(verify with a calculator if you'd like)***

$\sqrt{8} = \sqrt{4} \cdot \sqrt{2} = 2\sqrt{2}$ $\sqrt{12} = \sqrt{4} \cdot \sqrt{3} = 2\sqrt{3}$ $\sqrt{24} = \sqrt{4} \cdot \sqrt{6} = 2\sqrt{6}$

$\sqrt{18} = \sqrt{9} \cdot \sqrt{2} = 3\sqrt{2}$ $\sqrt{27} = \sqrt{9} \cdot \sqrt{3} = 3\sqrt{3}$ $\sqrt{63} = \sqrt{9} \cdot \sqrt{7} = 3\sqrt{7}$

$\sqrt{32} = \sqrt{16} \cdot \sqrt{2} = 4\sqrt{2}$

then answer these...

$\sqrt{50} =$ $\sqrt{20} =$ $\sqrt{200} =$

$\sqrt{72} =$ $\sqrt{45} =$ $\sqrt{300} =$

$\sqrt{98} =$ $\sqrt{500} =$

Radicals Worksheet **Name:** _____

Evaluate the Perfect Squares

1^2 2^2 3^2 4^2 5^2 6^2 7^2 8^2 9^2 10^2 11^2 12^2 13^2 14^2 15^2

1. Simplify the following.

$\sqrt{1}$ $\sqrt{4}$ $\sqrt{9}$ $\sqrt{16}$ $\sqrt{25}$ $\sqrt{36}$

$\sqrt{144}$ $\sqrt{\frac{4}{9}}$ $\sqrt{\frac{9}{100}}$ $\sqrt{\frac{9}{36}}$ $\sqrt{\frac{25}{100}}$ $\sqrt{\frac{900}{100}}$

2. Find the value of the following.

$\sqrt{49}$ $2\sqrt{16}$ $25\sqrt{4}$ $\sqrt{9}+\sqrt{36}$ $5\sqrt{4}+10\sqrt{9}$

3. Convert the following entire radicals to mixed radicals in simplest form.

$\sqrt{12}$ $\sqrt{27}$ $\sqrt{32}$ $\sqrt{60}$ $\sqrt{72}$ $\sqrt{242}$

4. Simplify the following.

$\sqrt{200}$ $\sqrt{36}$ $\sqrt{45}$ $\sqrt{49}$ $\sqrt{64}$ $\sqrt{108}$

5. Simplify the following.

$\sqrt{18}$ $5\sqrt{24}$ $\sqrt{15}$ $4\sqrt{20}$

$6\sqrt{16}$ $7\sqrt{17}$ $8\sqrt{18}$ $10\sqrt{98}$

$\sqrt{18}$ $5\sqrt{24}$ $\sqrt{32}$ $\sqrt{200}$

6. Convert the following radicals to mixed radicals in simplest form.

$3\sqrt{12}$ $2\sqrt{32}$ $5\sqrt{24}$ $6\sqrt{98}$ $4\sqrt{200}$ $8\sqrt{18}$

7. Simplify the following.

$4\sqrt{8}$ $2\sqrt{16}$ $16\sqrt{18}$ $32\sqrt{9}$ $25\sqrt{25}$ $4\sqrt{1}$

8. Simplify the following.

$4\sqrt{4}$ $2\sqrt{81}$ $9\sqrt{25}$ $3\sqrt{9}$ $100\sqrt{2 \bullet 18}$ $\sqrt{16\sqrt{16}}$

9. Convert the following mixed radicals to entire radicals.

$3\sqrt{2}$ $2\sqrt{3}$ $5\sqrt{6}$ $6\sqrt{7}$ $4\sqrt{10}$ $2\sqrt{11}$

Evaluate the Perfect Cubes

1^3 2^3 3^3 4^3 5^3 6^3 7^3 8^3 9^3 10^3

1. Evaluate the following.

$\sqrt[3]{1}$ $\sqrt[3]{-8}$ $\sqrt[3]{27}$ $\sqrt[3]{\frac{27}{8}}$ $\sqrt[3]{\frac{1000}{125}}$ $\sqrt[3]{\frac{10}{270}}$

2. Simplify the following. (mixed radical in simplest form where possible)

$\sqrt[3]{16}$ $\sqrt[3]{54}$ $\sqrt[3]{48}$ $5\sqrt[3]{2000}$

3. Convert the following mixed radicals to entire radicals.

$2\sqrt[3]{3}$ $3\sqrt[3]{2}$ $2\sqrt[3]{4}$ $5\sqrt[3]{10}$

4. Simplify the following. (mixed radical in simplest form where possible)

$2\sqrt[3]{16}$ $\sqrt[3]{216}$ $4\sqrt[3]{8}$ $3\sqrt[3]{8000}$

Radicals & Variables (Challenge!)

1. Simplify the following.

$\sqrt{x^2}$ $\sqrt{x^4}$ $\sqrt{x^6}$ $\sqrt{x^{10}y^8}$ $\sqrt{16x^{16}}$ $\sqrt{36x^8}$

2. Simplify the following. (mixed radical in simplest form where possible)

$\sqrt{x^3}$ $\sqrt{x^5}$ $\sqrt{x^7}$ $\sqrt{x^{15}}$ $\sqrt{9x^9}$ $\sqrt{18x^7}$

$\sqrt{12x^3y^6}$ $\sqrt{50x^{11}y^5}$ $\sqrt{36x^{16}y^9}$

3. Simplify the following. (mixed radical in simplest form where possible)

$\sqrt[3]{8x^3}$ $\sqrt[3]{16x^{12}}$ $3\sqrt[3]{16x^{10}}$ $\sqrt[3]{27x^8y^4}$

4. The square root of large numbers

$\sqrt{720}$ $\sqrt{1944}$ $\sqrt{3375}$

M10C Quiz – Exponents & Radicals C1-C4 **Name:** _____

Evaluate each of the following and record on the Numerical Response Answer Sheet provided:

1. $\sqrt{81}$

2. $\sqrt[3]{64}$

3. $\dfrac{\sqrt{144}}{36^{\frac{1}{2}}}$

4. $\dfrac{\sqrt{100}}{\sqrt[3]{8}}$

Express each entire radical as a mixed radical in simplest form. Your final answer should be in the form $a\sqrt{b}$ or $a\sqrt[3]{b}$. For each question please record the value of a followed by the value of b on the Numerical Response Answer Sheet provided.

5. $\sqrt{50}$

6. $\sqrt{20}$

7. $3\sqrt{27}$

8. $\sqrt{48}$

9. $\sqrt[3]{32}$

10. $2\sqrt[3]{54}$

Express each mixed radical as an entire radical. Your final answer should be in the form $\sqrt{b}$ or $\sqrt[3]{b}$. For each question please record the value of b on the Numerical Response Answer Sheet provided.

11. $5\sqrt{10}$

12. $2\sqrt[3]{5}$

Math 10-C Basic Exponents Review **Name:** _____

The Meaning of an Exponent

$2^3 = 2 \bullet 2 \bullet 2 = 8$

as a power (exponential form) | as a product (3 factors of the base 2) | standard form

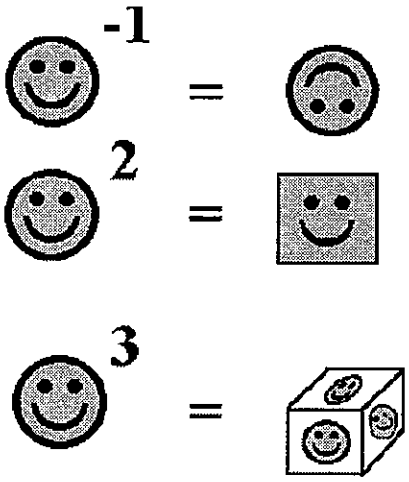
3^2 4^3 5^2 7^2 12^2

$= 3 \bullet 3$
$= 9$

Just as -7 means $-1 \bullet 7$ so does -2^3 mean $-1 \bullet 2^3$ and so $-1 \bullet 2 \bullet 2 \bullet 2 = -8$

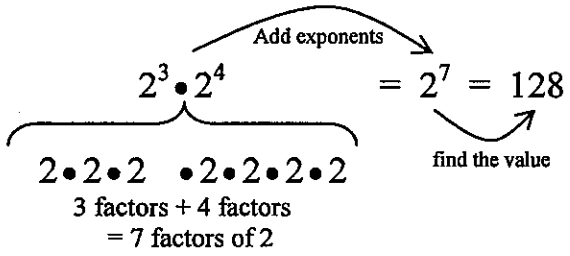
-3^2 -4^3 -5^2 -7^2 -12^2

$= -1 \bullet 3 \bullet 3$
$= -9$

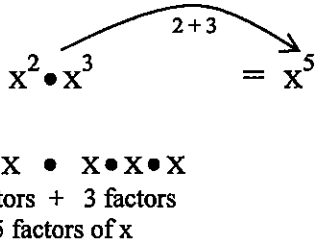


The Product Rule

Numbers as powers



Variables



In general: Add exponents $x^m \bullet x^n = x^{m+n}$

Simplify the following

$2^2 \bullet 2^4$ $3^5 \bullet 3^4$ $4^{12} \bullet 4^4$ $5^3 \bullet 5^2 \bullet 5^1$

$x^2 \bullet x^4$ $y^2 \bullet y^4$ $x^2 \bullet x^4 \bullet x^5$ $x \bullet x \bullet x^3$

Multiple variables

$x^2y \bullet x^2y^2$

$x \bullet x \bullet y \bullet x \bullet x \bullet y \bullet y$

$= x^4y^3$

Numbers and Variables

$3x^2 \bullet 2x^3$

$3 \bullet x \bullet x \bullet 2 \bullet x \bullet x \bullet x$

$= 6x^5$

Simplify the following

$xy^2 \bullet xy^4$ $xy^2 \bullet x^4y$ $2x^2 \bullet 3x^4$ $2x^2 \bullet 2x^4$

$2x^2y \bullet 3xy^4$ $2x^2y \bullet 3xy^4 \bullet 4x^3y^5$ $-y^2 \bullet -y$ $-2x^2 \bullet 2x^4 \bullet -2x^4$

$(x^2y^2)(x^5y^4)$ $(x^7y^2)(x^3y^8)$ $(2xy^2)(4xy)$ $(3x^5y)(5x^3y)$

The Quotient Rule

$$x^5 \div x^2 = \frac{x^5}{x^2} = \frac{x \bullet x \bullet x \bullet x \bullet x}{x \bullet x} = x^3$$

(subtract exponents: $5-2$)

$$x^5 y^3 \div x^2 y = \frac{x^5 y^3}{x^2 y} = \frac{x \bullet x \bullet x \bullet x \bullet x \bullet y \bullet y \bullet y}{x \bullet x \bullet y} = x^3 y^2$$

(subtract exponents: $5-2$ $\quad 3-1$)

In general: $x^m \div x^n = x^{m-n}$	$x^a y^b \div x^c y^d = x^{a-c} y^{b-d}$

Simplify the following

$x^5 \div x^2$	$y^7 \div y^4$	$x^5y^8 \div xy^2$	$x^6y^2 \div xy$
$\frac{x^7}{x^3}$	$\frac{x^{25}}{x^5}$	$\frac{x^6y^4}{x^3y^2}$	$\frac{x^6y^4}{xy}$
$\frac{10x^4}{2x^3}$	$\frac{12x^{12}}{2x^2}$	$\frac{30x^2y^4}{15xy^3}$	$\frac{45x^{10}y^6}{9x^8y}$
$\frac{4x^4}{12x^3}$	$\frac{4x^{12}}{14x^2}$	$\frac{18x^2y^4}{12xy^3}$	$\frac{1200x^{100}y^{60}}{500x^{99}y^{59}}$
$12x^4 \div 2x^2$	$2x^7 \div 10x^2$	$-12x^2y^6 \div 3xy^4$	$12x^2y^3 \div -24xy^2$

THE WORLD OF BRACKETS

Recall: the exponent relates to the variable or number it is directly beside

$2xy^3 = 2 \bullet x \bullet y \bullet y \bullet y$

And $-2xy^3 = -1 \bullet 2 \bullet x \bullet y \bullet y \bullet y$

The ONLY way the exponent relates to MORE than the variable or number it is directly beside is with . . . BRACKETS!

$(2xy)^3 = (2xy)(2xy)(2xy) = 8x^3y^3$

$2(xy)^3 = 2(xy)(xy)(xy) = 2x^3y^3$

$(-2xy)^3 = (-2xy)(-2xy)(-2xy) = -8x^3y^3$

SO:

$\left(\frac{2}{3}\right)^2 \qquad (x^3)^2 \qquad (x^7)^2 \qquad (x^3y)^2 \qquad (3x^3y)^2$

$= \left(\frac{2}{3}\right)\left(\frac{2}{3}\right)$

$= \left(\frac{4}{9}\right)$

The Power Rule

When a power is raised to an exponent, we multiply exponents.

$(x^m)^n = x^{mn} \qquad (x^a y^b)^c = x^{ac} y^{bc} \qquad \left(\frac{x^a}{y^b}\right)^c = \frac{x^{ac}}{y^{bc}}$

Simplify the following

$(x^2)^3 \qquad (x^4)^5 \qquad (x^2y^3)^3 \qquad (x^5y)^6$

$(2^2)^3 \qquad (2x^4)^3 \qquad \left(\frac{x^2}{y^3}\right)^3 \qquad \left(\frac{x^5}{y^2}\right)^7$

$4(xy^4)^2 \qquad \left(\frac{2^3}{5}\right)^2 \qquad \left(\frac{3x^2}{2y^3}\right)^3 \qquad \left(\frac{12xy^3}{6z^2}\right)^3$

Math 10-C Investigate Negative Exponents **Name:** _____

Complete the chart by dividing each row by 2.

Exponential Form	Expanded Form	Value
2^3	$2 \cdot 2 \cdot 2$	8

Complete the chart by dividing each row by 3.

Exponential Form	Expanded Form	Value
3^2	$3 \cdot 3$	9

Based on the patterns in the previous charts, please determine the value of the following:

4^{-1}	4^{-2}	4^{-3}
5^{-1}	5^{-2}	5^{-3}
6^{-1}	6^{-2}	6^{-3}

8^{-2}	7^{-2}	10^{-3}
12^{-1}	2^{-4}	9^{-2}
7^{-3}	144^{-1}	10^{-4}

M10-C Exponents and Radicals
C5 - Powers with Rational Bases Assignment **Name:** _____

Complete the following assignment on a separate sheet of paper.

1. Write the following expressions using radicals and then evaluate.

a) $16^{\frac{1}{2}}$ b) $100^{\frac{1}{2}}$ c) $8^{\frac{1}{3}}$ d) $64^{\frac{1}{3}}$

e) $(-8)^{\frac{1}{3}}$ f) $\left(\frac{1}{4}\right)^{\frac{1}{2}}$ g) $\left(\frac{49}{144}\right)^{\frac{1}{2}}$ h) $\left(\frac{8}{27}\right)^{\frac{1}{3}}$

2. Write the following expressions as radicals in simplest form.

a) $50^{\frac{1}{2}}$ b) $48^{\frac{1}{2}}$ c) $500^{\frac{1}{2}}$ d) $16^{\frac{1}{3}}$ e) $81^{\frac{1}{3}}$ f) $(-40)^{\frac{1}{3}}$

3. Evaluate each power without using a calculator.

a) $9^{\frac{3}{2}}$ b) $64^{\frac{2}{3}}$ c) $(-27)^{\frac{4}{3}}$ d) $\left(\frac{27}{8}\right)^{\frac{2}{3}}$ e) $\left(-\frac{27}{64}\right)^{\frac{2}{3}}$ f) $\left(\frac{4}{25}\right)^{\frac{3}{2}}$

4. Evaluate each power without using a calculator. Exponent laws may prove useful.

a) $3^{\frac{1}{2}} \cdot 3^{\frac{3}{2}}$ b) $\sqrt[3]{7} \cdot 7^{\frac{2}{3}}$ c) $\dfrac{8^{\frac{5}{2}}}{8^{\frac{1}{2}}}$ d) $\dfrac{4^{\frac{5}{6}}}{4^{\frac{1}{3}}}$ e) $\left(5^{\frac{2}{3}}\right)^{3}$ f) $\left(3^{\frac{3}{4}}\right)^{\frac{4}{3}}$

g) $\left(2^{6} \cdot 3^{2}\right)^{\frac{1}{2}}$ h) $\left(\sqrt{3} \cdot \sqrt[3]{2}\right)^{6}$ i) $\left(\dfrac{6^{4}}{2^{2}}\right)^{\frac{1}{2}}$ j) $\left(\dfrac{3^{\frac{1}{2}}}{\sqrt[4]{5}}\right)^{8}$ k) $\left(5^{\frac{1}{6}} \cdot 5^{\frac{1}{3}}\right)^{6}$ l) $\sqrt{\left(\dfrac{2^{5} \cdot 3^{3}}{2^{3} \cdot 3}\right)}$

5. Evaluate without using a calculator.

a) 3^{-2} b) 2^{-4} c) $6 \cdot 3^{-2}$ d) $(-7)^{-2}$ e) $\dfrac{1}{2^{-3}}$

f) $\dfrac{1}{4^{-2}}$ g) $\dfrac{3}{4^{-2}}$ h) $\dfrac{3^{-2}}{2^{-3}}$ i) $\left(\frac{1}{2}\right)^{-2}$ j) $\left(-\frac{2}{3}\right)^{-3}$

6. Evaluate each power without using a calculator. Exponent laws may prove useful.

a) $8^5 \cdot 8^{-3}$ b) $5^{-2} \cdot 5^{-1}$ c) $2^{-3} \cdot 3^2$ d) $\frac{7^2}{7^{-1}}$ e) $\frac{3^{-5}}{3^{-2}}$ f) $\left(2^{-2}\right)^2$

g) $\left(3^2\right)^{-1}$ h) $\left(2^{-3} \cdot 5\right)^{-2}$ i) $\left(\frac{1}{5^{-2}}\right)^{-1}$ j) $\left(\frac{4^{-1}}{3^{-2}}\right)^{-2}$ k) $\left(\frac{6^2 \cdot 6^{-5}}{6^{-4}}\right)^{-2}$ l) $\left(\frac{3^{-2} \cdot 4^{-3}}{3 \cdot 4^{-4}}\right)^{-1}$

7. Evaluate without using a calculator.

a) $16^{-\frac{1}{2}}$ b) $49^{-\frac{1}{2}}$ c) $(-8)^{-\frac{1}{3}}$ d) $125^{-\frac{1}{3}}$ e) $\frac{1}{9^{-\frac{1}{2}}}$

f) $\frac{5}{64^{-\frac{1}{3}}}$ g) $\left(\frac{1}{81}\right)^{-\frac{1}{2}}$ h) $\left(\frac{25}{144}\right)^{-\frac{1}{2}}$ i) $\left(\frac{343}{216}\right)^{-\frac{1}{3}}$ j) $\frac{36^{-\frac{1}{2}}}{27^{-\frac{1}{3}}}$

8. Evaluate without using a calculator.

a) $9^{-\frac{3}{2}}$ b) $27^{-\frac{4}{3}}$ c) $\frac{1}{4^{-\frac{5}{2}}}$ d) $\frac{-2}{216^{-\frac{2}{3}}}$ e) $\left(-\frac{8}{27}\right)^{-\frac{2}{3}}$ f) $\left(\frac{81}{16}\right)^{\frac{-3}{4}}$

9. Evaluate each power without using a calculator. Exponent laws may prove useful.

a) $4^2 \cdot 4^{-\frac{3}{2}}$ b) $9^{-\frac{1}{4}} \cdot 9^{-\frac{1}{4}}$ c) $\frac{5^{-\frac{1}{2}}}{5^{\frac{1}{2}}}$ d) $\frac{16^{-1}}{16^{-\frac{5}{4}}}$ e) $\left(6^{-\frac{2}{7}}\right)^7$

f) $\left(2^{\frac{1}{2}} \cdot 3^{\frac{1}{4}}\right)^{-8}$ g) $\left(\frac{1}{144^{-\frac{1}{4}}}\right)^2$ h) $\left(\frac{4^{-6}}{3^{-9}}\right)^{\frac{1}{3}}$ i) $\left(\frac{5^6 \cdot 5^{-9}}{5^3}\right)^{\frac{1}{3}}$ j) $\left(\frac{6^{-1} \cdot 2^{\frac{1}{3}}}{6^{-\frac{1}{2}} \cdot 2^{-\frac{1}{2}}}\right)^{-6}$

k) $\frac{5^{-2}}{125^{\frac{1}{3}}}$ l) $\left(8^{\frac{2}{3}}\right)\left(16^{\frac{3}{2}}\right)$

10. Evaluate without using a calculator.

a) 4^0 b) $\frac{1}{6^0}$ c) $2 \cdot 5^0$ d) $\left(\frac{35}{41}\right)^0$ e) $\left(\frac{4^2 \cdot 4^{-\frac{3}{2}}}{5^{\frac{2}{5}} \cdot 7^{-5}}\right)^0$

M10C Exponents & Radicals Quiz (Rational Bases)

Name: _____

Date: _____

1. $81^{\frac{1}{2}} =$ _____

2. $\left(\frac{16}{49}\right)^{\frac{1}{2}} =$ _____

3. $125^{\frac{1}{3}} =$ _____

4. $\left(\frac{27}{8}\right)^{\frac{1}{3}} =$ _____

5. $27^{\frac{2}{3}} =$ _____

6. $2^{\frac{1}{2}} \cdot 2^{\frac{5}{2}} =$ _____

7. $\frac{5^{\frac{4}{3}}}{5^{\frac{1}{3}}} =$ _____

8. $\left(\sqrt[3]{7}\right)^{3} =$ _____

9. $\left(9^{\frac{1}{4}}\right)^{2} =$ _____

10. $\left(3^{\frac{1}{3}} \cdot 3^{\frac{1}{6}}\right)^{6} =$ _____

11. $5^{-2} =$ _____

12. $(-5)^{-2} =$ _____

13. $4 \cdot 2^{-3} =$ _____

14. $\frac{1}{3^{-2}} =$ _____

15. $\left(\frac{3}{4}\right)^{-3} =$ _____

16. $10^{-2} \cdot 10^{4} =$ _____

17. $\frac{3^{-2}}{3^{-5}} =$ _____

18. $\left(4^{-1}\right)^{3} =$ _____

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

20. $\left(\frac{6^{-5} \cdot 6^{-3}}{6^{-7}}\right)^{-2} =$ _____

21. $16^{-\frac{1}{2}} =$ _____

22. $(64)^{-\frac{1}{3}} =$ _____

23. $\frac{1}{121^{-\frac{1}{2}}} =$ _____

24. $\left(\frac{36}{49}\right)^{-\frac{1}{2}} =$ _____

25. $9^{-\frac{3}{2}} =$ _____

M10C C6 - Powers with Variables Bases Assignment **Name:** _____

Solve the following on a separate sheet of paper.

1. Write each expression with positive exponents. Simplify where possible.

a) c^{-4} b) $(-x)^{-2}$ c) $3x^{-3}$ d) $4m^3n^{-2}$ e) $-5x^{-3}y^{-2}$

f) $\frac{1}{a^{-3}}$ g) $\frac{3}{x^{-4}}$ h) $\frac{a^{-2}}{b^{-5}}$ i) $\left(\frac{x}{y^2}\right)^{-5}$ j) $\left(-\frac{2a}{b}\right)^{-3}$

2. Simplify each expression. State the answer using positive exponents.

a) $c^{-4}\cdot c^{-3}$ b) $\frac{m^3}{m^{-6}}$ c) $\left(a^{-3}\right)^2$ d) $(4xy^{-3})^{-2}$ e) $-4x(5x)^3$

f) $\left(\frac{m^{-2}}{n^{-4}}\right)^{-3}$ g) $(2xy^2)(3x^{-1}y^0)$ h) $(-3m^2n)(-4m^4n^{-2})$ i) $\left(\frac{mn^3}{m^2n}\right)^2$

j) $\left(\frac{6a^{-3}b^5}{4a^2b^3}\right)^{-3}$ k) $\frac{x^3y^{-2}}{(xy^4)(x^5y^2)}$

3. Simplify each expression. State the answer using positive exponents.

a) $a^{\frac{3}{2}}\cdot a^{\frac{5}{2}}$ b) $x^{\frac{1}{2}}\cdot\left(\sqrt{x}\right)^7$ c) $3m^2m^{\frac{1}{4}}$ d) $\frac{x^{\frac{1}{4}}}{x^{-\frac{3}{4}}}$ e) $\frac{y^{\frac{7}{3}}}{\sqrt[3]{y}}$

f) $\left(c^{\frac{3}{5}}\right)^5$ g) $\left(\sqrt[3]{x^2}\,y^{\frac{4}{3}}\right)^3$ h) $\left(\frac{25c^6}{16b^4}\right)^{\frac{1}{2}}$ i) $\left(\frac{5x^3}{20x}\right)^{\frac{1}{2}}$ j) $\sqrt{\left(\frac{a^9b^4}{a^7b^0}\right)}$

4. Simplify each expression. State the answer using positive exponents.

a) $c^{-\frac{1}{5}}\cdot c^{\frac{6}{5}}$ b) $\frac{m^{\frac{1}{3}}}{m^{-\frac{5}{6}}}$ c) $\left(a^{\frac{1}{9}}\right)^{-3}$ d) $\left(x^{\frac{1}{4}}y^{-\frac{1}{3}}\right)^{-12}$ e) $\frac{\left(x^3\right)^{-\frac{1}{2}}}{\left(x^{\frac{5}{2}}\right)^{\frac{1}{5}}}$

5. Simplify each expression. State the answer using positive exponents.

a) x^0 b) $\frac{3}{b^0}$ c) $\left(\frac{2x^3y^2}{15xy^{-3}}\right)^0$ d) $x^0\cdot\left(-8x^{-6}\right)^{\frac{1}{3}}$

Math 10 C - *Exponents & Radicals Chapter Review*

1. Determine whether each of the following numbers is a perfect square, a perfect cube, both, or neither. Justify your choices mathematically.

   (a) 729 (b) 625

2. Identify whether the following are mixed or entire radicals, then change it to the other form.

   (a) $\sqrt{48}$ (b) $4\sqrt[3]{2}$ (c) $\sqrt{80}$

   (d) $\sqrt[3]{72}$ (e) $12\sqrt{3}$ (f) $25\sqrt{2}$

3. Determine the exact value without using a calculator.

   (a) $\left(\frac{9}{16}\right)^{\frac{1}{2}}$ b) $\left(\frac{216}{125}\right)^{\frac{1}{3}}$ (c) $49^{\frac{3}{2}}$ (d) $\left(\frac{81}{16}\right)^{\frac{-3}{4}}$ (e) $\left(\frac{8}{27}\right)^{\frac{-2}{3}}$

4. Write each expression using radicals.

   (a) $4^{\frac{1}{5}}$ (b) $4^{\frac{3}{2}}$ (c) $3^{\frac{-1}{3}}$ (d) $2^{\frac{5}{6}}$

5. Evaluate without using a calculator. Leave each answer as a rational number.

   (a) $\left(3^{-2}\right)^{\frac{-5}{2}}$ (b) $\left(125^{\frac{-1}{3}}\right)^{2}$ (c) $(4)\left(4^{\frac{3}{2}}\right)$

   (d) $(7^{3})^{\frac{2}{3}}$ (e) $\left(\frac{3}{2}\right)^{\frac{3}{2}}\cdot\left(\frac{3}{2}\right)^{\frac{1}{2}}$ (f) $\left[\frac{3^{2}}{(-3)^{4}}\right]^{\frac{1}{2}}$

6. Use the laws of exponents to simplify the following. Express your final answer using positive exponents only.

   (a) $\left(a^{2}b\right)\left(a^{3}b^{2}\right)$ (b) $\left(-4p^{3}q^{2}\right)^{3}$ (c) $\frac{a^{5}b^{3}}{a^{2}b^{2}}$

   (d) $\left(\frac{x^{2}}{z^{3}}\right)^{-2}$ (e) $\left(m^{-3}\right)\left(m^{-1}\right)$ (f) $p^{-1}\cdot p^{7}\cdot p^{-6}$

   (g) $b^{-8}\div b^{-3}$ (h) $\left(x^{-2}\right)^{3}$ (i) $\left(x^{-1}y^{2}\right)^{-1}$

   (j) $\left(a^{-2}b^{4}\right)\left(a^{2}b^{-5}\right)$ (k) $\frac{\left(x^{-2}\right)^{3}}{\left(x^{3}\right)^{-2}}$ (l) $\frac{\left(2x^{2}y^{2}\right)^{-1}}{\left(2x^{2}y\right)^{-2}}$

   (m) $\left(\frac{2x^{-3}y^{-2}}{3x^{-2}y^{3}}\right)^{-2}$ (n) $\left(\frac{12x^{5}y^{3}z^{4}}{18x^{4}y^{3}z^{-2}}\right)^{2}$

7. Use the exponent laws to simplify each expression.

(a) $\left(x^{\frac{1}{2}}\right)\left(x^{\frac{7}{2}}\right)$ (b) $\left(3m^{\frac{1}{2}}\right)\left(m^{\frac{1}{4}}\right)$ (c) $\left(\frac{5x^3}{20x}\right)^{\frac{1}{2}}$ (d) $\left(x^{\frac{2}{3}}y^{\frac{4}{3}}\right)^3$

8. Simplify each expression. State the answer using positive exponents.

(a) $\left(y^{-2}\right)\left(y^{\frac{5}{2}}\right)$ (b) $\left(-8x^{-6}\right)^{\frac{1}{3}}$ (c) $\left(\frac{x^2y}{y^{-2}}\right)^{-2}$

(d) $\left(\frac{x^{\frac{1}{4}}}{16x^{\frac{3}{4}}}\right)^{\frac{1}{2}}$ (e) $\left(\frac{r^4s^{-1}}{s^{-4}r^{-2}}\right)^{-\frac{2}{3}}$

9. Express each radical as a power and simplify.

(a) $\sqrt{(9x)^3}$ (b) $\sqrt{\left(4x^2\right)^3}$ (c) $\sqrt[3]{64x^6}$ (d) $\sqrt[4]{x^0y^2}$

10. The growth of 1000 bacterium cells in a lab can be modelled using the expression $N = 1000(4)^{\frac{h}{40}}$, where N is the number of bacteria after h hours.
    (a) What does the value 4 in the expression tell you?
    (b) How many bacteria are there after 40 h?
    (c) How many bacteria are there after 20 h?
    (d) How many bacteria were there 80 hours ago?
    (e) What situation does $h = 0$ indicate?

11. Identify the following numbers as either rational or irrational.

(a) $\sqrt{4}$ (b) $\sqrt{3}$ (c) $\sqrt{\frac{4}{9}}$ (d) $\sqrt{20}$

12. Name the sets of numbers to which each number belongs.

(a) $\sqrt{25}$ (b) 0.090909... (c) $-\sqrt{7}$ (d) $\sqrt{\frac{4}{9}}$ (e) 2.75 (f) -3

13. Order each set of numbers from least to greatest. Describe the method you used.

(a) $\sqrt{35}, \frac{5}{3}, \sqrt[3]{45}, \sqrt{21}$ (b) $4\sqrt{5},\ 2\sqrt{13}, \sqrt{60}, 6\sqrt{2}$

23