Name:

UNIT 2 LEARNING GUIDE – EXPONENTS

INSTRUCTIONS:

Using a pencil, complete the following questions as you work through the related lessons. Show ALL of your work as is explained in the lessons. Do your best and always ask questions if there is anything that you don't understand.

2.1 EXPONENTS

1. Rewrite the following using digits.

   Ex. Base: 3 Exponent: 5 3^5

   a. Base: 7 Exponent: 4

   b. Base: 9 Exponent: 3

   c. Four to the power of one

   d. Base: 5 Exponent: 10

   e. Twenty squared

   f. Two cubed

   g. Base: 12 Exponent: 6

   h. Base: 45 Exponent: 2

   i. Seven to the power of eight

2. Expand.

   Ex. 5^6

   $5 \times 5 \times 5 \times 5 \times 5 \times 5$

   a. 2^4

   b. 7^2

   c. 9^8

   d. 25^1

   e. 3^5

3. Evaluate the following using your calculator.

   Ex. 4^6

   4096

   a. 2^8

   b. 5^5

   c. 9^3

   d. 25^4

   e. 3^4

4. Insert $>$, $<$, or $=$ to make each statement true.

Ex. $2^6 > 6^2$

a. 3^3 ___ 27

b. 7^3 ___ 12^2

c. 20^3 ___ 10^4

d. 4^2 ___ 2^4

e. 10^1 ___ 5^2

f. 8^3 ___ 500

g. 50 ___ 25^2

h. 2^6 ___ 8^2

5. Complete the table.

Perfect Squares		
Exponent	Expanded	Perfect Square
1^2		
	2×2	4
		9
	4×4	
5^2		
		36
	7×7	
		64
9^2		
	10×10	
		121
12^2		

6. Circle the perfect squares.

$\mathbf{-9}$	$\mathbf{30^2}$	$\mathbf{400}$	$\mathbf{10}$	$\mathbf{2.5^2}$	$\mathbf{64}$
$\mathbf{3}$	$\mathbf{11^2}$	$\mathbf{\frac{1^2}{2}}$	$\mathbf{-100}$	$\mathbf{625}$	$\mathbf{36.1}$

2.2 BEDMAS

1. Solve. *Reminder: Always use the Order of Operations (BEDMAS) when solving a problem.*

Ex. $8^2 - 2^5$

$\mathbf{64 - 32}$

$\mathbf{32}$

a. $3^4 - 2^3$

b. 4×7^2

c. $3^3 + \frac{18}{2}$

d. $(17 + 6) - 5^2$

e. $\frac{10^2}{2^2}$

2. Follow the steps to solve each problem. *Reminder: After each operation that you complete, rewrite what remains in the problem.*

	Ex. $4 \times (12 - 9)^3 - 7^2$	a. $(31 - 23)^2 - 5^3 \times 3$	b. $\frac{15}{3} \times \frac{(44-9)}{-5} + 2^4$
Step 1: Brackets	$\mathbf{4 \times 3^3 - 7^2}$		
Step 2: Exponents	$\mathbf{4 \times 27 - 49}$		
Step 3: Division & Multiplication	$\mathbf{108 - 49}$		
Step 4: Addition & Subtraction	$\mathbf{59}$		

3. Solve.

a. $(9 - 2)^2 + \frac{16}{8}$

b. $\frac{81}{9} \times (3 - 2)^5$

c. $(8 + 5 \times 5) - \left(\frac{36}{6}\right)^2$

d. $4 \times \frac{95}{5} - 8 \times (9 - 2)^2$

4. Solve. *<u>Reminder</u>: Treat numbers that are in the numerator and denominator of a fraction as though they are in brackets.*

a. $\frac{5^3-25}{2\times5}$

c. $\frac{100-4^3}{6}\times(8-3)$

b. $\frac{18+(4+2)^2}{11-2}$

d. $(49-57)\times\frac{4^2}{17-8\times2}$

e. $(63\div9)^2+\frac{5^2}{16-11}\times4$

f. $2+[9+(9-4)^2]\times2$

2.3 Square Roots of Perfect Squares

1. Follow the steps to find the square root of each number.

	Question: "What is the square root of ___?"	**Step 1:** Find 2 identical numbers that have a product equal to the number in the square root sign.	**Step 2:** Use one of the numbers from Step 1. **Answer**	How to say the answer.
Ex.	$\sqrt{121}$	11×11	11	***"11 is the square root of 121."***
a.	$\sqrt{49}$			
b.	$\sqrt{100}$			
c.	$\sqrt{4}$			
d.	$\sqrt{144}$			
e.	$\sqrt{81}$			

2. Write out the following using mathematical symbols.

Ex. The square root of 36 is 6.

$\sqrt{36} = 6$

a. The square root of 9 is 3.

b. The square root of 64 is 8.

c. 8 squared is 64.

d. 12 squared is 144.

e. The square root of 196 is 14.

3. Evaluate without a calculator.

Ex. $\sqrt{25}$ ***5***

a. $\sqrt{16}$

b. $\sqrt{64}$

c. $\sqrt{81}$

d. $\sqrt{1}$

e. $\sqrt{144}$

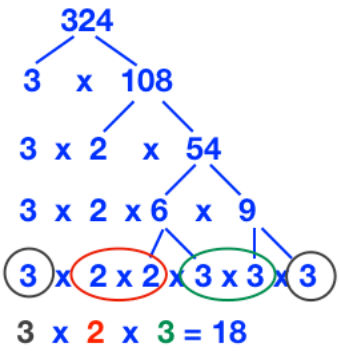
f. $\sqrt{36}$

g. $\sqrt{100}$

h. $\sqrt{121}$

4. Use prime factorization to find the square root of the perfect squares below.

Ex. $\sqrt{324}$ *= 18*



a. $\sqrt{256}$

b. $\sqrt{484}$

c. $\sqrt{1225}$

5. Look at the factors of each number to determine whether or not it is a perfect square. If the number is a perfect square, circle the factor that is its square root.

   a. **128:** 1, 2, 4, 8, 16, 32, 64, 128 Perfect Square? **Yes** **No**

   b. **332:** 1, 2, 4, 83, 166, 332 Perfect Square? **Yes** **No**

   c. **625:** 1, 5, 25, 125, 625 Perfect Square? **Yes** **No**

   d. **171:** 1, 3, 9, 19, 57, 171 Perfect Square? **Yes** **No**

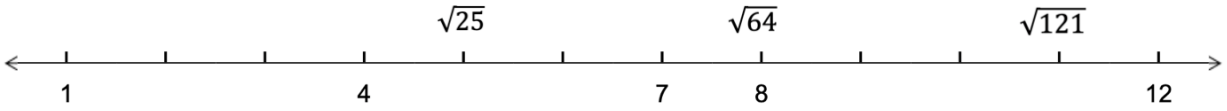
   e. **361:** 1, 19, 361 Perfect Square? **Yes** **No**

   f. **729:** 1, 3, 9, 27, 81, 243, 729 Perfect Square? **Yes** **No**

6. In your own words, explain why numbers that are perfect squares have an odd number of factors?

2.4 Square Roots of Whole Numbers

1. Fill in the missing information on the number line.



2. Determine between which two whole numbers each square root lies. *Hint: Use the number line above to help you.*

Ex. $\sqrt{105}$

Between 10 & 11

a. $\sqrt{57}$

b. $\sqrt{20}$

c. $\sqrt{2}$

d. $\sqrt{34}$

e. $\sqrt{139}$

3. Determine between which two square roots of perfect squares each number lies. *Hint: Use the number line above to help you.*

Ex. 6.6

Between the $\sqrt{36}$ & $\sqrt{49}$

a. 2.1

b. 7.4

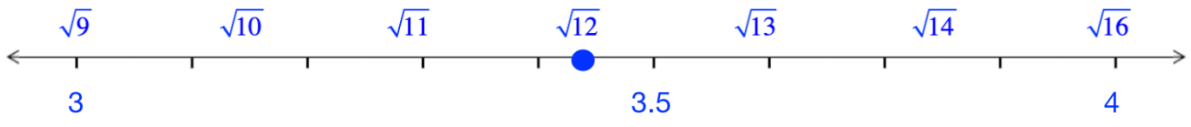
c. 9.3

d. 4.9

e. 1.5

4. Use a number line to estimate the value of each square root to the nearest tenth. Use the "approximately equals" sign (≈) to show that the value is not exact. *Reminder: Place all of the square roots that are between the perfect squares on the number line (with equal spacing), then use this as a guide to estimate the value of the square root.*

Ex. $\sqrt{12}$



$\sqrt{12} \approx 3.4$

a. $\sqrt{46}$

b. $\sqrt{21}$

c. $\sqrt{126}$

d. $\sqrt{29}$

5. Use your answers from Question 4 to find the square root of each number to 2 decimal places. Do not use a calculator. *Hint: Find this method in the* Examples #1 *page of the lesson* Square Roots of Whole Numbers.

Ex. $\sqrt{12}$

On the number line, the answer looks to be between 3.4 and 3.5.

$3.4 \times 3.4 = 11.56$

$3.5 \times 3.5 = 12.15$ *The answer is between 3.4 and 3.5, but closer to 3.5*

$3.46 \times 3.46 = 11.97$

$3.47 \times 3.47 = 12.04$ *The answer is between 3.46 and 3.47. but is closest to 3.46*

$\boldsymbol{\sqrt{12} = 3.46}$

a. $\sqrt{46}$

b. $\sqrt{21}$

c. $\sqrt{126}$

6. Use your calculator to evaluate. Round your answer to **2 decimal places**.

Ex. $\sqrt{88}$ ***= 9.38***

b. $\sqrt{96}$

d. $\sqrt{75}$

a. $\sqrt{2}$

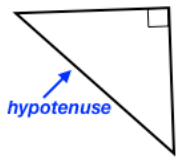
c. $\sqrt{500}$

e. $\sqrt{20\,000}$

2.5 Pythagorean Theorem

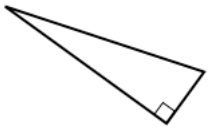
1. State whether each triangle is a right triangle or not. For each right triangle, identify the hypotenuse. *Reminder: The hypotenuse is the side opposite the right angle.*

Ex.



This is a right triangle.

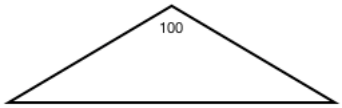
b.



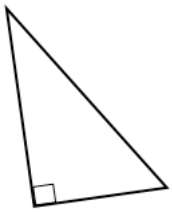
d.

a.

c.

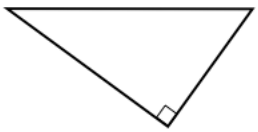


e.

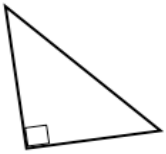


2. Label the sides of the triangles with the letters ***a***, ***b***, and ***c***. *Reminder: The hypotenuse must be labelled "**c**".*

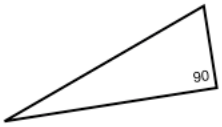
a.



b.



c.

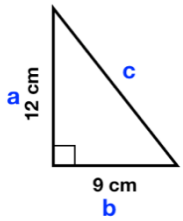


3. Using numbers 1 – 5, order the steps used to determine the length of a side of a right triangle using Pythagoras' Theorem.

_____	Write out the formula: $a^2 + b^2 = c^2$
_____	Add the unit of measure to your answer
_____	Replace the variables a, b, and/or c with known values
Step 1	Label the sides of the triangle a, b, and c
_____	Calculate

4. Follow the steps to calculate the length of the hypotenuse.

Ex.



Step 1: Label sides.

Step 2: $a^2 + b^2 = c^2$

Step 3: $12^2 + 9^2 = c^2$

Step 4: $144 + 81 = c^2$

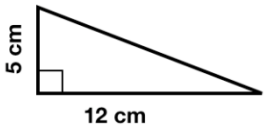
$225 = c^2$

$\sqrt{225} = c$

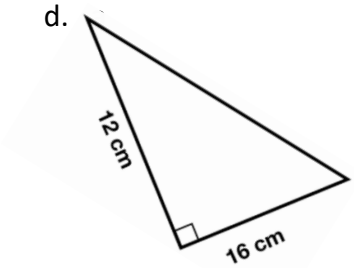
$15 = c$

Step 5: $c = 15\ cm$

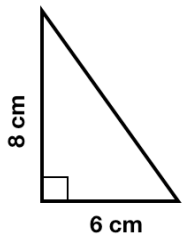
b.



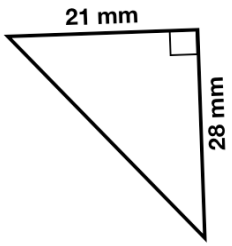
d.



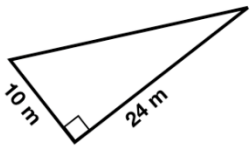
a.



c.

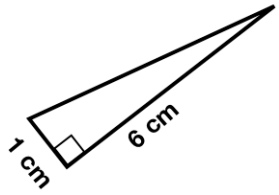


e.

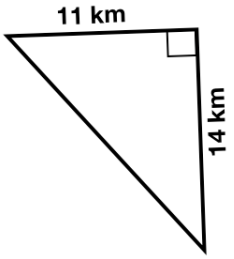


5. Calculate the length of the hypotenuse. Round your answer to the nearest hundredth. *<u>Reminder</u>: Always write out the formula at the start of your calculations. Don't forget to add the unit of measure to your answer.*

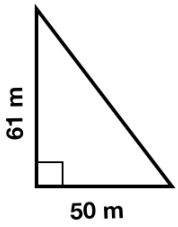
a.



b.

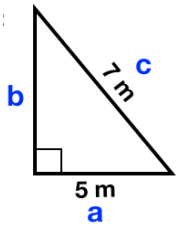


c.

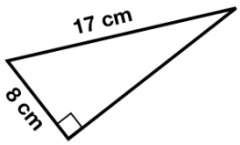


6. Calculate the length of the unknown side. Round your answers to the nearest tenth.

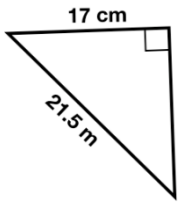
Ex.



a.



b.



Step 1: Label sides.

Step 2: $\boldsymbol{a^2 + b^2 = c^2}$

Step 3: $\boldsymbol{5^2 + b^2 = 7^2}$

Step 4: $\boldsymbol{25 + b^2 = 49}$

$\boldsymbol{-24 \quad -24}$

$\boldsymbol{b^2 = 24}$

$\boldsymbol{b = \sqrt{24}}$

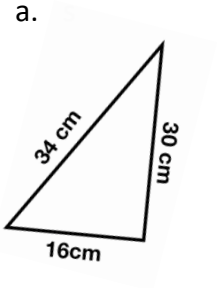
$\boldsymbol{b = 4.90}$

Step 5: $\boldsymbol{b = 4.9\ m}$

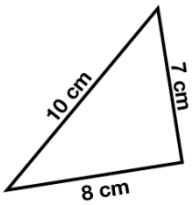
7. Which triangle in Question #6 is a Pythagorean triple? Why?

8. Use the Pythagorean Theorem to determine whether each triangle is a right triangle. *Reminder: After substituting in the values for* $a, b, \& c$, *if* $a^2 + b^2 = c^2$, then you know that a triangle is a right triangle.

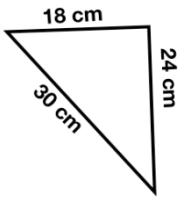
a.



b.



c.



9. Use the Pythagorean Theorem to solve the problems below. Round your answers to the nearest tenth. *Hint Draw a diagram of the problem as a first step to solving.*
   a. What is the height of computer screen that has a diagonal measurement of 22 inches and a width of 12 inches?

   b. A door jamb has a height of 2.08 m, a width of 1.05 m and a diagonal measurement of 2.33 m. Are the corners of the door jamb square (ie. $90°$)?

   c. After take-off from the airport, a plane travels for in a straight trajectory until it reaches its cruising altitude of 11 000 metres (11 km). At this point, it is directly over a town that is 200km from the airport. Calculate the actual distance traveled by the plane.

2.6 Cubes & Cube Roots

1. Circle the perfect cubes.

-27	30^3	8	216	-9^3	64
3	4.1^3	$\frac{1^3}{2}$	1000	125	36

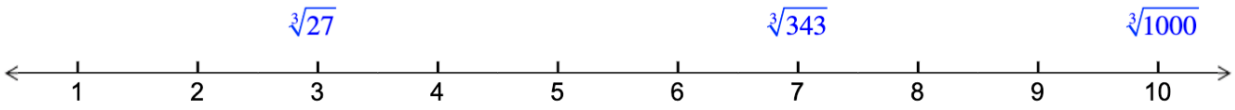
2. Complete the table.

Perfect Cubes		
Exponent	Expanded	Perfect Cube
1^3		
	$2 \times 2 \times 2$	8
		27
	$4 \times 4 \times 4$	
5^3		
		216
	$10 \times 10 \times 10$	

3. Follow the steps to find the cube root of each number.

	Question: "What is the cube root of ___?"	**Step 1:** Find 3 identical numbers that have a product equal to the number in the cube root sign.	**Step 2:** Use one of the numbers from Step 1. **Answer**	How to say the answer.
Ex.	$\sqrt[3]{125}$	$5 \times 5 \times 5$	5	***"5 is the cube root of 125."***
a.	$\sqrt[3]{64}$			
b.	$\sqrt[3]{729}$			
c.	$\sqrt[3]{343}$			
d.	$\sqrt[3]{512}$			

4. Fill in the number line below.



5. Estimate the cube root of the following numbers. Write your answers using 1 decimal point. *Hint: Use the number line above to help with your estimations.*

Ex. $\sqrt[3]{24}$ $\approx$ **2.9**

a. $\sqrt[3]{45}$

b. $\sqrt[3]{143}$

c. $\sqrt[3]{6}$

d. $\sqrt[3]{120}$

e. $\sqrt[3]{946}$

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

g. $\sqrt[3]{280}$

h. $\sqrt[3]{530}$

6. Evaluate using your calculator. Round your answers to the nearest hundredth.

Ex. $\sqrt[3]{50}$ ***3.68***

a. $\sqrt[3]{400}$

b. $\sqrt[3]{16}$

c. $\sqrt[3]{100}$

d. $\sqrt[3]{1100}$

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

f. $\sqrt[3]{15\,625}$

g. $\sqrt[3]{36}$

h. $\sqrt[3]{125\,000}$

2.7 Exponent Laws

1. Expand, then simplify. Leave your answers in exponential form. *Reminder: A number without an exponent is the same as that number having an exponent of 1.*

Ex. $4^2 \times 4^5$

$(4 \times 4) \times (4 \times 4 \times 4 \times 4 \times 4)$

$4 \times 4 \times 4 \times 4 \times 4 \times 4 \times 4$

4^7

a. $7^4 \times 7^2$

b. $2^6 \times 2^3$

c. $5^4 \times 5$

2. Simplify. Leave your answers in exponential form. *Reminder: To multiply terms with exponents, you can add the exponents if the terms have the **same base**.*

Ex. $6^4 \times 6^3$

$6^{4+3} = 6^7$

a. $8^7 \times 8^2$

b. $3^5 \times 3^5 \times 3^2$

c. $9^3 \times 9$

d. $15^2 \times 15^6$

e. $\left(\frac{1}{3}\right)^4 \times \left(\frac{1}{3}\right)^3$

3. Expand, then simplify. Leave your answers in exponential form.

Ex. $4^5 \div 4^3$

$\frac{4 \times 4 \times 4 \times 4 \times 4}{4 \times 4 \times 4} = 4^2$

a. $10^7 \div 10^6$

b. $\frac{6^6}{6^2}$

c. $14^6 \div 14^6$

4. Simplify. Leave your answers in exponential form. *Reminder: To divide terms with exponents, you can subtract the exponents if the terms have the **same base**.*

Ex. $2^8 \div 2^2$

$2^{8-2} = 2^6$

a. $25^{10} \div 25^7$

b. $\frac{6^9}{6^5}$

c. $3^2 \div 3^6$

d. $7^3 \div 7$

e. $\frac{4^{16}}{4^{15}}$

5. Match each expression with its simplified form.

a.	$7^{14} \div 7^{11}$	____	$7^{10} \times 5^5$
b.	$7^2 \times 7^5 \times 7^2$	____	7^3
c.	$7^4 \times 7^6 \times 5^2 \times 5^3$	____	$(-7)^4$
d.	$7^7 \div 7^0$	____	$7^8 \times 5^7$
e.	$(-7)^9 \div (-7)^5$	____	7^9
f.	$7^4 \times 7^6 \times 7^2 \times 5^3$	____	7^5
g.	$7 \times 7^3 \times 7$	____	$7^{12} \times 5^3$
h.	$5^4 \times 7^6 \times 7^2 \times 5^3$	____	7^7

6. Simplify.

a. $x^{10} \times x^3$

b. $n^5 \times n^6$

c. $a \times a \times a \times a$

d. $y^{12} \div y^8$

e. $\frac{m^7}{m^2}$

f. $\frac{f^6}{f}$

7. Simplify the expressions as much as possible.

a. $x^2y^3x^5y^7$

b. $a^4b^3a^5b^2$

c. $(x^5y^3)(x^2y^4)$

d. $\frac{y^9z^4}{y^6z^3}$

e. $\frac{r^5s^7t^3}{r^2s^3t}$

f. $\frac{a^8b^4c^2}{a^4b^3}$

8. Simplify the expressions. *<u>Reminder</u>: We can evaluate a number with an exponent, but not a variable with an exponent, unless we know the value of that exponent.*

a. $\frac{3^3x^5y^2}{x^2}$

b. $\frac{d^4x^5fd^7}{d^6x^2}$

c. $\frac{h^2w^8}{5^2w^3hwd}$

d. $\frac{2^5a^6b^3}{a^2b^2a^2}$

e. $\frac{x^5y^2x^4z^8}{x^2z^3z^2}$

f. $\frac{8m^{10}n^9}{4m^6n}$

2.8 Exponent Laws 2

1. Simplify. *Reminder: The exponent outside of the brackets is applied to everything in the brackets.*

Ex. $(2y^5)^3$

$\mathbf{2^3 = 8}$

$\mathbf{(y^5)^3 = y^{5\times 3} = y^{15}}$

$\mathbf{8y^{15}}$

a. $(x^4)^5$

b. $(a^2b^3)^5$

c. $(d^6e^2f^4)^4$

d. $(2n^3)^6$

e. $(5x^7)^2$

f. $(3a^2b)^3$

g. $(4f^2gh^{10})^4$

2. Circle the expressions that are equal to 1. *Reminder: Any number or variable to the power of 1 is equal to 0.*

a. $\mathbf{7^0}$ b. $\mathbf{(2y)^0}$ c. $\mathbf{x^4x^0}$ d. $\mathbf{2y^0}$ e. $\mathbf{475^0}$

f. $\mathbf{0^4}$ g. $\mathbf{5a^03b^2}$ h. $\mathbf{h^0}$ i. $\mathbf{(9n^5)^0}$ j. $\mathbf{(9n^0)^5}$

3. Expand, then evaluate. *Reminder: Don't forget to use the rules for multiplying negative numbers:* $(-)(-) = (+),\ (-)(+) = (-)$

Ex. $\mathbf{-2^3}$

$\mathbf{-(2\times 2\times 2) = -8}$

a. $\mathbf{(-2)^3}$

b. $\mathbf{-2^4}$

c. $\mathbf{(-2)^4}$

d. $\mathbf{(-2x)^5}$

e. $\mathbf{(-2x)^6}$

4. Determine whether the product will be positive or negative and circle your answer. You do not have to evaluate the expressions. *Reminder: When the negative sign is not inside brackets, the exponent does not affect the negative.*

a. $(-2)^3$ **POS NEG**

b. $(-2)^4$ **POS NEG**

c. -2^2 **POS NEG**

d. $-(2x)^2$ **POS NEG**

e. $-2x^0$ **POS NEG**

f. $-(2x)^7$ **POS NEG**

g. $(-2x^5)^2$ **POS NEG**

h. $(-2x^5)^3$ **POS NEG**

5. Simplify and evaluate.

a. $(d^6e^2)^2(de^3)^5$

b. $(x^2y^2z^2)^5(x^6y)^3$

c. $(5m^4n^2)^3(m^2n^0)^4$

d. $(2a^2b^2)^4(6a^6b^2)^0(-3a^3)^3$

6. Simplify in order to remove the negative exponents. Leave you answers in exponent form. *Reminder: A negative exponent can be removed by taking the reciprocal (ie. opposite) of that number.*

Ex. 6^{-2} $\frac{1}{6^2}$

a. 4^{-6}

b. y^{-3}

c. $(5x)^{-4}$

d. $5x^{-4}$

e. $3^{-8}y^2$

7. Simplify in order to remove the negative exponents. Leave you answers in exponent form.

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

b. $\frac{1}{x^{-2}}$

c. $\frac{5}{y^{-6}}$

d. $\frac{3^{-4}}{2^{-2}}$ e. $\frac{x^{-2}}{y^{-8}}$ f. $\frac{3^3}{3^{-2}}$

8. Simplify. Answer in exponent form and with no negative exponents. *Reminder: The rules of multiplying negative and positive numbers applies to exponents as well.*

a. $(4^2)^{-3}$ c. $(x^{-5})^0$ e. $(99^{-9})^9$

b. $(4^{-2})^{-3}$ d. $(17^0)^{-6}$ f. $(2y^{-2})^3$

9. Expand. Do not simplify.

Ex. $(3r+1)^2$
$(\mathbf{3r+1})(\mathbf{3r+1})$

a. $(-4t+5)^2$ c. $(3a+2b-6)^3$

b. $(x-3)^4$ d. $(6m^2n)^4$

e. $(-2x^2+5x+4)^2$

10. Use all of the skills you have learned so far to simplify the following expressions as much as possible. Answer without negative exponents.

a. $(a^6)^3(a^3)^{-4}$ b. $\frac{(9y)^{-2}}{(40y^5)^0}$

UNIT 2 – ANSWER KEY

SECTION 2.1

1. a. 7^4 b. 9^3 c. 4^1 d. 5^{10} e. 20^2 f. 2^3 g. 12^6 h. 45^2 i. 7^8
2. a. $2 \times 2 \times 2 \times 2$ b. 7×7 c. $9 \times 9 \times 9 \times 9 \times 9 \times 9 \times 9 \times 9$ d. 25 e. $3 \times 3 \times 3 \times 3 \times 3$
3. a. 256 b. 3125 c. 729 d. 390 625 e. 81
4. a. $=$ b. $>$ c. $<$ d. $=$ e. $<$ f. $>$ g. $<$ h. $=$
5.

Perfect Squares		
Exponent	Expanded	Perfect Square
1^2	1×1	1
2^2	2×2	4
3^2	3×3	9
4^2	4×4	16
5^2	5×5	25
6^2	6×6	36
7^2	7×7	49
8^2	8×8	64
9^2	9×9	81
10^2	10×10	100
11^2	11×11	121
12^2	12×12	144

6. $30^2,\ 400,\ 64,\ 11^2,\ 625$

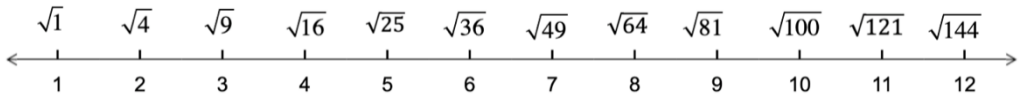
SECTION 2.2

1. a. 73 b. 196 c. 36 d. -2 e. 25
2. a. -311 b. -19
3. a. 51 b. 9 c. -3 d. -316
4. a. 10 b. 6 c. 30 d. -128 e. 69 f. 70

SECTION 2.3

1. a. 7 b. 10 c. 2 d. 12 e. 9
2. a. $\sqrt{9} = 3$ b. $\sqrt{64} = 8$ c. $8^2 = 64$ d. $12^2 = 144$ e. $\sqrt{196} = 14$
3. a. 4 b. 8 c. 9 d. 1 e. 12 f. 6 g. 10 h. 11
4. a. 16 b. 22 c. 35
5. a. No b. No c. Yes, 25 d. No e. Yes, 19 f. Yes, 27
6. Because the factor pair of a perfect square is a repeat of itself, therefore you only see one of that number in the list of factors, turning the list of factors pairs into a odd number.

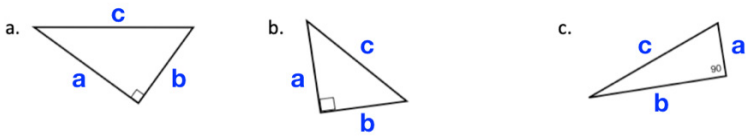
SECTION 2.4

1. 

2. a. 7 & 8 b. 4 & 5 c. 1 & 2 d. 5 & 6 e. 11 & 12
3. a. $\sqrt{4}$ & $\sqrt{9}$ b. $\sqrt{49}$ & $\sqrt{64}$ c. $\sqrt{81}$ & $\sqrt{100}$ d. $\sqrt{16}$ & $\sqrt{25}$ e. $\sqrt{1}$ & $\sqrt{4}$
4. a. ≈ 6.8 b. ≈ 4.6 c. ≈ 11.2 d. ≈ 5.4
5. a. 6.78 b. 4.58 c. 11.22
6. a. 1.41 b. 9.8 c. 22.36 d. 8.66 e. 141.42

SECTION 2.5

1. a. Yes b. Yes c. No d. No e. Yes
2. Note: **a** & **b** can be switched places, but **c** must always be the longest side.



3. 2, 5, 3, 1, 4
4. a. 10 cm b. 13 cm c. 35 mm d. 20 cm e. 26 m
5. a. 6.08 cm b. 17.80 km c. 78.87 m

6. a. 15 cm b. 13.2 cm
7. 6.a. Because all of its sides are positive integers.
8. a. Yes b. No c. Yes
9. a. 18.4 in b. Yes, the corners are square. This is because the triangles formed by the diagonal are right triangles (as proven by Pythagoras' Theorem), which means the angles in the corners of the door jamb are $90°$. c. 200.3 km

SECTION 2.6

1. $30^3,\ 8,\ 216,\ 64,\ 1000,\ 125$
2.

Perfect Cubes		
Exponent	Expanded	Perfect Cube
1^3	$1 \times 1 \times 1$	1
2^3	$2 \times 2 \times 2$	8
3^3	$3 \times 3 \times 3$	27
4^3	$4 \times 4 \times 4$	64
5^3	$5 \times 5 \times 5$	125
6^3	$6 \times 6 \times 6$	216
10^3	$10 \times 10 \times 10$	1000

3. a. 4 b. 9 c. 7 d. 8
4. $\sqrt[3]{1},\ \sqrt[3]{8},\ \sqrt[3]{27},\ \sqrt[3]{64},\ \sqrt[3]{125},\ \sqrt[3]{216},\ \sqrt[3]{343},\ \sqrt[3]{512},\ \sqrt[3]{729},\ \sqrt[3]{1000}$
5. Note: Answers +/- 0.1 from the stated answer are considered accurate estimations.
   a. ≈ 3.6 b. ≈ 5.2 c. ≈ 1.8 d. ≈ 4.9 e. ≈ 9.8 f. ≈ 1.3 g. ≈ 6.5 h. ≈ 8.1
6. a. 7.37 b. 2.52 c. 4.64 d. 10.32 e. 1.26 f. 25 g. 3.3 h. 50

SECTION 2.7

1. a. 7^6 b. 2^9 c. 5^5
2. a. 8^9 b. 3^{12} c. 9^4 d. 15^8 e. $\left(\frac{1}{3}\right)^7$
3. a. 10^1 *or* 10 b. 6^4 c. 14^0
4. a. 25^3 b. 6^4 c. 3^{-4} d. 7^2 e. 4^1 *or* 4
5. c, a, e, h, b, g, f, d

6. a. x^{13} b. n^{11} c. a^4 d. y^4 e. m^5 f. f^5
7. a. x^7y^{10} b. a^9b^5 c. x^7y^7 d. y^3z e. $r^3s^4t^2$ f. a^4bc^2
8. a. $27x^3y^2$ b. d^5x^3f c. $\frac{hw^4}{25d}$ d. $32a^2b$ e. $x^7y^2z^3$ f. $2m^4n^8$

SECTION 2.8

1. a. x^{20} b. $a^{10}b^{15}$ c. $d^{24}e^8f^{16}$ d. $64n^{16}$ e. $25x^{14}$ f. $27a^6b^3$ g. $256f^8g^4h^{40}$
2. a, b, e, h, i
3. a. -8 b. -16 c. 16 d. $-32x^5$ e. $32x^6$
4. a. NEG b. POS c. NEG d. NEG e. NEG f. NEG g. POS h. NEG
5. a. $d^{17}e^{19}$ b. $x^{28}y^{13}z^{10}$ c. $125m^{20}n^6$ d. $-432a^{17}b^8$
6. a. $\frac{1}{4^6}$ b. $\frac{1}{y^3}$ c. $\frac{1}{5^4x^4}$ *or* $\frac{1}{(5x)^4}$ d. $\frac{5}{x^4}$ e. $\frac{y^2}{3^8}$
7. a. 3^2 b. x^2 c. $5y^6$ d. $\frac{2^2}{3^4}$ e. $\frac{y^8}{x^2}$ f. $(3^2)(3^3)$ *or* 3^5
8. a. $\frac{1}{4^6}$ b. 4^6 c. x^0 d. 17^0 e. $\frac{1}{99^{81}}$ f. $\frac{2^3}{y^6}$
9. a. $(-4t+5)(-4t+5)$ b. $(x-3)(x-3)(x-3)(x-3)$
   c. $(3a+2b-6)(3a+2b-6)(3a+2b-6)$ d. $(6m^2n)(6m^2n)(6m^2n)(6m^2n)$
   e. $(-2x^2+5x+4)(-2x^2+5x+4)$
10. a. a^6 b. $\frac{1}{81y^2}$