Unit 6: Exponents and Radicals

1-1: The Real Number System

Natural Numbers (*N*): - counting numbers. {1, 2, 3, 4, 5, …}

Whole Numbers (*W*): - counting numbers with 0. {0, 1, 2, 3, 4, 5, …}

Integers (*I*): - positive and negative whole numbers. {…, –5, –4, –3, –2, –1, 0, 1, 2, 3, 4, 5, …}

Rational Numbers (*Q*): - numbers that can be turned into a fraction $\frac{a}{b}$, where a, $b \in I$, and $b \neq 0$.

- include all Terminating or Repeating Decimals.
- include all Natural Numbers, Whole Numbers and Integers.
- include any perfect roots (radicals).

a) Terminating Decimals: – decimals that stops $0.25 = \frac{1}{4}$ $-0.7 = \frac{-7}{10}$

b) Repeating Decimals: – decimals that repeats in a pattern and goes on. $0.3\ldots = \frac{1}{3}$ $-1.\bar{7} = \frac{-16}{9}$

c) Perfect Roots: - radicals when evaluated will result in either Terminating or repeating decimals, or fractions $\frac{a}{b}$, where a, $b \in I$, and $b \neq 0$.

$\sqrt{0.16} = \pm 0.4$ $\sqrt{0.111...} = \pm 0.3... = \pm\frac{1}{3}$ $\sqrt{\frac{1}{25}} = \pm\frac{1}{5}$ $\sqrt[3]{0.008} = 0.2$

Irrational Numbers ($\overline{Q}$): - numbers that **CANNOT** be turned into a fraction $\frac{a}{b}$, where a, $b \in I$, and $b \neq 0$.

- include all non-terminating, non-repeating decimals.
- include any non-perfect roots (radicals).

a) Non-terminating, Non-repeating Decimals: - decimals that do not repeat but go on and on.

$\pi = 3.141592654\ldots$ 0.123 123 312 333 123 333 …

b) Non-Perfect Roots: radicals when evaluated will result in Non-Terminating, Non-Repeating decimals.

$\sqrt{5} = \pm 2.236067977...$ $\sqrt{0.52} = \pm 0.7211102551...$

$\sqrt{\frac{1}{6}} = \pm 0.4082482905...$ $\sqrt[3]{-0.38} = -0.7243156443...$

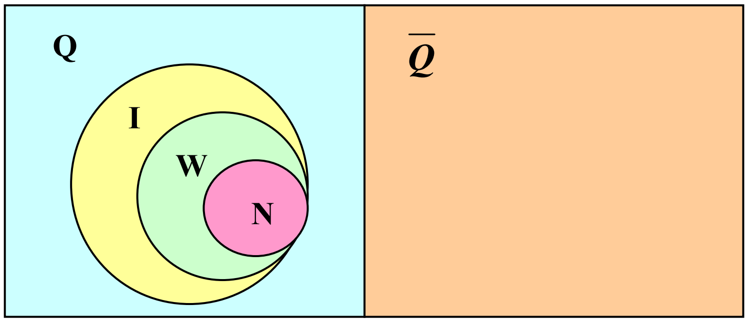
Real Numbers (*R*): - any numbers that can be put on a number line.
- include all natural numbers, whole numbers, integers, rational and irrational numbers.

Absolute Value |*x*|: - the positive value of *x*. $|-5| = 5$ $|3| = 3$

$|4(-6) + 8| = |-16| = 16$ $|7| - |-1| = 7 - 1 = 6$

In general, we can display the relationships between all types of real numbers in a diagram.

***Real Numbers* (R)**



a) All Natural Numbers belong to the set of Whole Number. $N \in W$
b) All Natural and Whole Numbers belong to the set of Integers. N and $W \in I$
c) All Natural, Whole Numbers and Integers belong to the set of Rational Numbers. N, W and $I \in Q$
d) Rational Numbers and Irrational Numbers do NOT belong to each other. (You can have both types at the same time). $Q \notin \overline{Q}$
e) All Natural, Whole Numbers, Integers, Rational and Irrational Numbers belong to the set of Real Numbers. N, W, I, Q and $\overline{Q} \in R$

Example 1: Classify the following numbers.

a. -15
I, Q* and *R

b. 75
N, W, I, Q* and *R

c. -35.24
Q* and *R

d. $-78.1212\ldots$
Q* and *R

e. $\sqrt{42}$
$\overline{Q}$ and *R*

f. $1.459\ 142\ 337\ \ldots$
$\overline{Q}$ and *R*

g. $\dfrac{-6}{85}$
Q* and *R

h. $\sqrt{\dfrac{9}{4}}$
Q* and *R

i) $\sqrt{0.225}$
$\overline{Q}$ and *R*

j) $\sqrt[3]{64}$
N, W, I, Q* and *R

k) $|-7| - |-5|$
$= 7 - 5 = 2$
N, W, I, Q* and *R

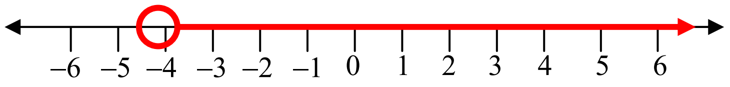
l) $\left|-\dfrac{1}{3}\right|$
$= \dfrac{1}{3}$
Q* and *R

Inequalities

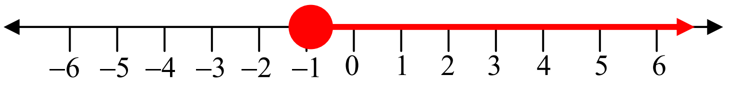
Symbols	Meanings
$>$	Greater than
$<$	Less than
$\geq$	Greater than or equal to
$\leq$	Less than or equal to
$\neq$	NOT Equal to
$b_{lower} \leq x \leq b_{upper}$ $b_{lower} < x < b_{upper}$	x is between the lower and upper boundaries (inclusive). x is between the lower and upper boundaries (exclusive).
$x \leq b_{lower}$ and $x \geq b_{upper}$	x is less than the lower boundary and x is greater than the upper boundary (inclusive).
$x < b_{lower}$ and $x > b_{upper}$	x is less than the lower boundary and x is greater than the upper boundary (exclusive).

Example 2: Graph the following inequalities.

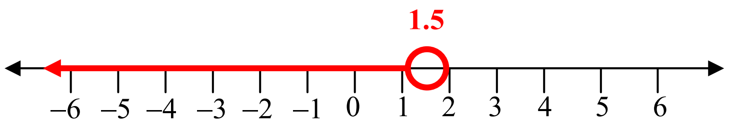
a) $n > -4$



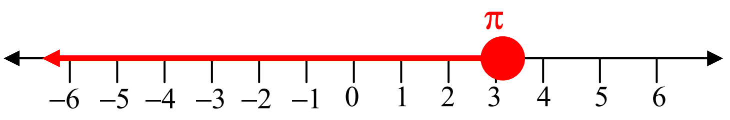
b) $x \geq -1$



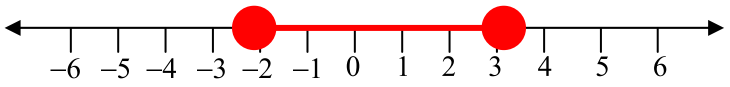
c) $y < 1.5$



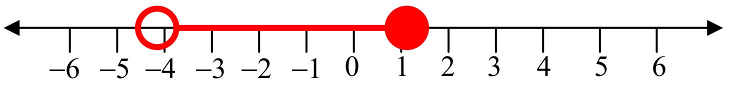
d) $m \leq \pi$



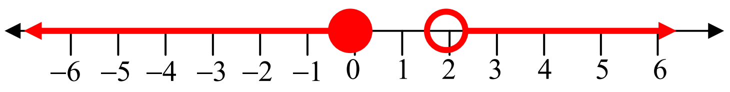
e) $-2 \leq r \leq 3$



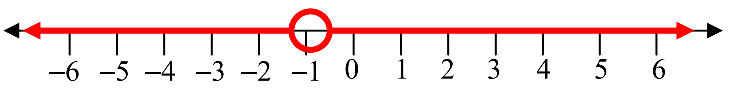
f) $-4 < w \leq 1$



g) $x > 2$ and $x \leq 0$



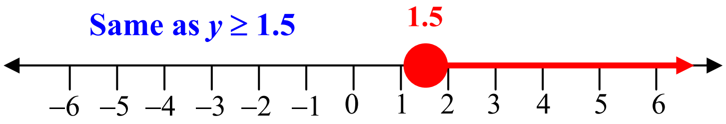
h) $t \neq -1$



(AP) Example 3: Graph the following inequalities.

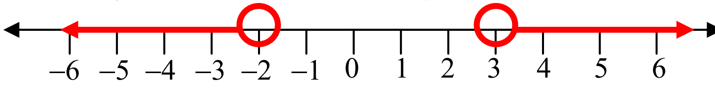
a) $y \nless 1.5$

Same as $y \geq 1.5$



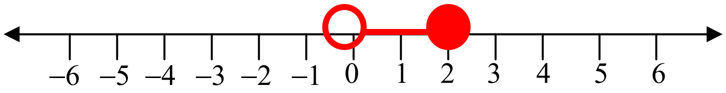
b) $-2 \nleq r \nleq 3$

Same as $r < -2$ and $r > 3$



c) $x \ngtr 2$ and $x \nleq 0$

Same as $0 < r \leq 2$



Example 4: Convert the following decimals to fractions algebraically.

a) $0.555\ldots$

Let $x = 0.555\ldots$

$10x = 5.555\ldots$

(To cancel out the repeating decimals, we have to move the decimal 1 place to the right, which means ×10)

$$\begin{array}{rl} 10x &= 5.555\ldots \\ -\quad x &= 0.555\ldots \\ \hline 9x &= 5 \end{array}$$

$$\boxed{x = \frac{5}{9}}$$

b) $1.323232\ldots$

Let $x = 1.3232\ldots$

$100x = 132.3232\ldots$

(Move the decimal 2 places to the right will line up the repeating decimals)

$$\begin{array}{rl} 100x &= 132.3232\ldots \\ -\quad x &= \quad 1.3232\ldots \\ \hline 99x &= 131 \end{array}$$

$$\boxed{x = \frac{131}{99}}$$

c) $-0.264\ 264\ 264\ldots$

Let $x = 0.264\ 264\ldots$

$1000x = 264.264\ 264\ldots$

First, ignore the negative sign.

(Move the decimal 3 places to the right will line up the repeating decimals)

$$\begin{array}{rl} 1000x &= 264.264\ 264\ldots \\ -\quad x &= \quad 0.264\ 264\ldots \\ \hline 999x &= 264 \end{array}$$

$$x = \frac{264}{999}$$

$$x = \frac{88}{333}$$

$$\boxed{-\frac{88}{333}}$$

Put the negative sign back!

d) $-3.4353535\ldots$

Let $x = 3.43535\ldots$

$10x = 34.3535\ldots$

$1000x = 3435.3535\ldots$

First, ignore the negative sign.

(Move the decimal 1 place to the right will make the repeating decimals appear right after the decimal point.)

$$\begin{array}{rl} 1000x &= 3435.3535\ldots \\ -\quad 10x &= \quad 34.3535\ldots \\ \hline 990x &= 3401 \end{array}$$

$$x = \frac{3401}{990}$$

$$\boxed{-\frac{3401}{990}}$$

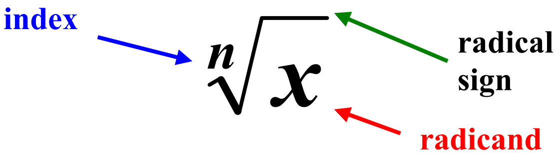
Put the negative sign back!

1-1 Homework Assignments

Regular: pg. 8 to 9 #1 to 55, 57, 58, 61, 63, 65 and 66

AP: pg. 8 to 9 #1 to 55, 57 to 59, 61 to 63, 65 and 66

1-3: Evaluating Irrational Numbers



Radicals: - the result of a number after a root operation.

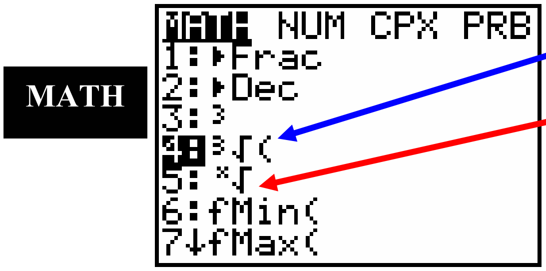
Radical Sign: - the mathematical symbol $\sqrt{\ }$.

Radicand: - the number inside a radical sign.

Index: - the small number to the left of the radical sign indicating how many times a number (answer to the radical) has to multiply itself to equal to the radicand.

$\sqrt{\ }$	square root	$\sqrt[3]{\ }$	cube root	$\sqrt[4]{\ }$	fourth root	$\sqrt[5]{\ }$	fifth root

To call up the cube root $\sqrt[3]{\ }$ or higher root functions $\sqrt[x]{\ }$, press **MATH**



```
MATH NUM CPX PRB
1:▸Frac
2:▸Dec
3:³
4:³√(
5:ˣ√
6:fMin(
7↓fMax(
```

Choose Option 4 for cube root

Choose Option 5 for higher root. But be sure to enter the number for the index first!

Example 1: Evaluate the followings.

a. $\sqrt{25}$

$= \boxed{\pm 5}$

$5^2 = (5)(5) = 25$
$(-5)^2 = (-5)(-5) = 25$

b. $\sqrt[3]{-64}$

$= \boxed{-4}$

$(-4)^3 = (-4)(-4)(-4)$
$= -64$

c. $\sqrt[4]{16}$

$= \boxed{\pm 2}$

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

d. $\sqrt[5]{243}$

$= \boxed{3}$

$(3)^5 = (3)(3)(3)(3)(3)$
$= 243$

A radical with an even index always has two answers (±), and can only have a radicand greater than or equal to 0 inside a radical sign.

A radical with an odd index always has one answer only and can have a negative radicand inside the radical sign.

Example 2: A formula $v_f^2 = v_i^2 + 2ad$ can be used to find the final velocity (speed) of an accelerated object, where v_f = final velocity, v_i = initial velocity, a = acceleration, and d = distance travelled. An apple is thrown from the tall building 300 m high with an initial velocity of 6 m/s. The acceleration due to gravity is 9.81 m/s^2. What is the final velocity of the apple as it reaches the ground?

v_f = ?
v_i = 6 m/s
d = 300 m
a = 9.8 m/s^2

Solve for v_f:

$$v_f^2 = v_i^2 + 2ad$$
$$v_f = \sqrt{v_i^2 + 2ad}$$
$$v_f = \sqrt{(6)^2 + 2(9.81)(300)}$$
$$v_f = \sqrt{36 + 5886}$$
$$v_f = \sqrt{5992}$$

$\boxed{v_f = 76.95 \text{ m/s}}$

Estimating Square Roots

1. Estimating Square Roots GREATER than 1:
   - **a.** **Group** the radicand by **two digits** starting directly to the **LEFT** of the decimal place. The digit **0** may be added to the **beginning of the radicand** if there are an odd number of digits.
   - **b.** Estimate each group of two digits by finding the square root of the nearest **lower** square number.

2. Estimating Square Roots LESS than 1:
   - **a.** **Group** the radicand by **two digits** starting directly to the **RIGHT** of the decimal place. The digit **0** may be added to the **end of the radicand** if there are an odd number of digits.
   - **b.** Estimate each group of two digits by finding the square root of the nearest **lower** square number.

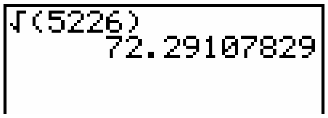
Example 3: Estimate. Then, find the approximated value to the fifth decimal place using a calculator with only positive roots.

a. $\sqrt{5226}$

$\sqrt{52\quad 26}$

$\sqrt{49}\quad\sqrt{25}$

$7\ 5 \approx \boxed{75}$



```
√(5226)
      72.29107829
```

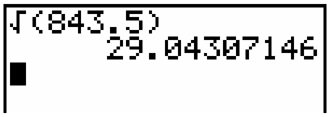
Actual → 72.29108

b. $\sqrt{843.5}$

$\sqrt{08\quad 43.5}$

$\sqrt{4}\quad\sqrt{36}$

$2\ 6 \approx \boxed{26}$



```
√(843.5)
      29.04307146
█
```

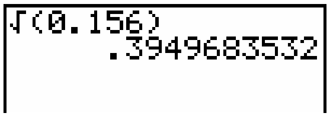
Actual → 29.04307

c. $\sqrt{0.156}$

$\sqrt{0.\quad 15\quad 60}$

$\sqrt{9}\quad\sqrt{49}$

$0.\ 3\ 7 \approx \boxed{0.37}$



```
√(0.156)
     .3949683532
```

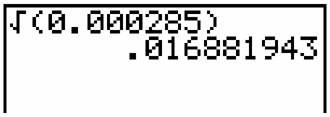
Actual → 0.39497

d. $\sqrt{0.000285}$

$\sqrt{0.\ 00\ 02\ 85}$

$\sqrt{0}\quad\sqrt{1}\quad\sqrt{81}$

$0.\ 0\quad 1\ 9 \approx \boxed{0.019}$



```
√(0.000285)
     .016881943
```

Actual → 0.01688

Example 4: Evaluate by estimating, then, find the approximated value to the fifth decimal place using a calculator with only positive roots.

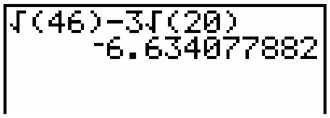
a. $\sqrt{46}-3\sqrt{20}$

$\approx\sqrt{36}-3\sqrt{16}$

$\approx 6-3(4)$

$\approx 6-12$

$\approx \boxed{-6}$



```
√(46)-3√(20)
    -6.634077882
```

Actual → −6.63408

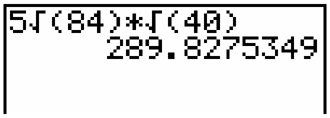
b. $\left(5\sqrt{84}\right)\left(\sqrt{40}\right)$

$\approx 5\sqrt{81}\times\sqrt{36}$

$\approx 5(9)\times 6$

$\approx 45\times 6$

$\approx \boxed{270}$



```
5√(84)*√(40)
     289.8275349
```

Actual → 289.82753

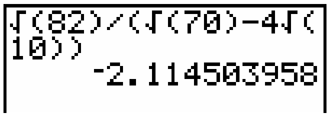
c. $\dfrac{\sqrt{82}}{\sqrt{70}-4\sqrt{10}}$

$$\approx\frac{\sqrt{81}}{\sqrt{64}-4\sqrt{9}}$$

$$\approx\frac{9}{8-4(3)}$$

$$\approx\frac{9}{-4}$$

$$\approx \boxed{-2.25}$$



```
√(82)/(√(70)-4√(
10))
     -2.114503958
```

Actual → −2.11450

Example 5: Evaluate the followings using only positive roots.

a. $\sqrt{36-25}$

$= \sqrt{11}$

$\approx$ **3.31662**

b. $\sqrt{36}-\sqrt{25}$

$= 6 - 5$

$=$ **1**

c. $\sqrt{36\times 25}$

$= \sqrt{900}$

$=$ **30**

d. $\sqrt{36}\times\sqrt{25}$

$= 6 \times 5$

$=$ **30**

$$\sqrt{a+b} \neq \sqrt{a}+\sqrt{b} \qquad \sqrt{a\times b} = \sqrt{a}\times\sqrt{b}$$

$$\sqrt{a-b} \neq \sqrt{a}-\sqrt{b} \qquad \sqrt{a\div b} = \sqrt{a}\div\sqrt{b}$$

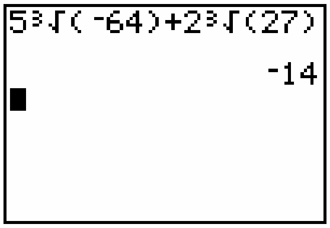
Example 6: Evaluate the followings using only positive roots. Verify by using a calculator.

a. $5\sqrt[3]{-64}+2\sqrt[3]{27}$

$= 5(-4) + 2(3)$

$= -20 + 6$

14



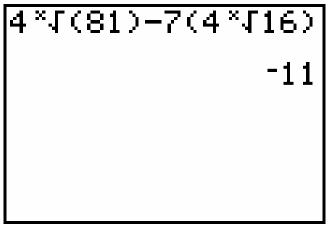
```
5³√( -64)+2³√(27)
                -14
```

b. $\sqrt[4]{81}-7\sqrt[4]{16}$

$= 3 - 7(2)$

$= 3 - 14$

−11



```
4 ˣ√(81)-7(4 ˣ√16)
                -11
```

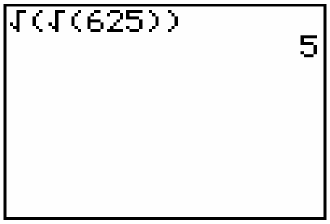
Example 7: Evaluate the followings using only positive roots. Verify by using a calculator.

a. $\sqrt{\sqrt{625}}$

$= \sqrt{\left(\sqrt{625}\right)}$

$= \sqrt{(25)}$

5



```
√(√(625))
          5
```

b. $\sqrt{\sqrt{0.0256}}$

$= \sqrt{\left(\sqrt{0.0256}\right)}$

$= \sqrt{(0.16)}$

0.4

```
√(√(0.0256))
           .4
```

1-3 Homework Assignments

Regular: pg. 14 to 16 #3 to 13 (odd), 14 to 27 (no estimates), 29 to 45, 47 to 52, 54a, 56a and 56b

AP: pg. 14 to 16 #2 to 12 (even), 14 to 27 (no estimates), 29 to 45, 47 to 54a, 56a and 56b

1-4: Simplifying Radicals

$$\sqrt{ab} = \sqrt{a} \times \sqrt{b} \qquad \text{where } a \geq 0 \text{ and } b \geq 0$$

$$\sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}} \qquad \text{where } a \geq 0 \text{ and } b > 0$$

Entire Radicals: - radicals that have no coefficient in front of them. Examples: $\sqrt{52}$ and $\sqrt{48}$

Mixed Radicals: - radicals that have coefficients in front of them.
- the coefficient is the square root of the perfect square factor of the radicand.

Examples: $2\sqrt{13}$ and $4\sqrt{3}$

To convert an entire radical to a mixed radical, find the largest perfect square factor of the radicand and write its root as a coefficient of the remaining radicand factor.

Example 1: Simplify the followings. (Convert them to mixed radicals)

a. $\sqrt{50}$

$= \sqrt{25 \times 2}$

$= \sqrt{25} \times \sqrt{2}$

$\boxed{5\sqrt{2}}$

b. $\sqrt{80}$

$= \sqrt{16 \times 5}$

$= \sqrt{16} \times \sqrt{5}$

$\boxed{4\sqrt{5}}$

c. $\dfrac{\sqrt{168}}{\sqrt{6}}$

$= \sqrt{\dfrac{168}{6}}$

$= \sqrt{28}$

$= \sqrt{4} \times \sqrt{7}$

$\boxed{2\sqrt{7}}$

d. $\sqrt{\dfrac{125}{9}}$

$= \dfrac{\sqrt{125}}{\sqrt{9}}$

$= \dfrac{\sqrt{25} \times \sqrt{5}}{3}$

$\boxed{\dfrac{5\sqrt{5}}{3}}$

To convert a mixed radical to an entire radical, square the coefficient and multiply it to the radicand.

Example 2: Write the followings as entire radicals.

a. $5\sqrt{8}$

$= \sqrt{25} \times \sqrt{8}$

$= \sqrt{25 \times 8}$

$\boxed{\sqrt{200}}$

b. $3\sqrt{7}$

$= \sqrt{9} \times \sqrt{7}$

$= \sqrt{9 \times 7}$

$\boxed{\sqrt{63}}$

c. $\dfrac{2}{3}\sqrt{5}$

$= \sqrt{\dfrac{4}{9}} \times \sqrt{5} = \sqrt{\dfrac{4 \times 5}{9}}$

$\boxed{\sqrt{\dfrac{20}{9}}}$

Example 3: Order $9\sqrt{2}$, $5\sqrt{3}$, and $4\sqrt{13}$ from least to greatest.

$$9\sqrt{2} = \sqrt{81\times 2} = \sqrt{162}$$
$$5\sqrt{3} = \sqrt{25\times 3} = \sqrt{75}$$
$$4\sqrt{13} = \sqrt{16\times 13} = \sqrt{208}$$

$$\sqrt{75} < \sqrt{162} < \sqrt{208}$$

$$\boxed{5\sqrt{3} < 9\sqrt{2} < 4\sqrt{13}}$$

Example 4: Simplify.

a. $12\sqrt{3}\times 5\sqrt{6}$

$$= 12\times 5\times\sqrt{3}\times\sqrt{6}$$
$$= 60\sqrt{18}$$
$$= 60\sqrt{9}\times\sqrt{2}$$
$$\boxed{180\sqrt{2}}$$

b. $\left(8\sqrt{12}\right)\left(3\sqrt{8}\right)$

$$= 8\times 3\times\sqrt{12}\times\sqrt{8}$$
$$= 24\sqrt{96}$$
$$= 24\sqrt{16}\times\sqrt{6}$$
$$\boxed{96\sqrt{6}}$$

Rationalization: - turning radical denominator into a natural number denominator by multiplying a fraction of the radical over itself.

$$\boxed{\frac{\sqrt{a}}{\sqrt{b}} = \frac{\sqrt{a}}{\sqrt{b}}\times\frac{\sqrt{b}}{\sqrt{b}} = \frac{\sqrt{ab}}{b}}$$

Example 5: Simplify.

a. $\sqrt{\dfrac{8}{3}}$

$$= \frac{\sqrt{8}}{\sqrt{3}}$$
$$= \frac{\sqrt{8}}{\sqrt{3}}\times\frac{\sqrt{3}}{\sqrt{3}}$$
$$= \frac{\sqrt{24}}{3} = \frac{\sqrt{4\times 6}}{3}$$
$$\boxed{\frac{2\sqrt{6}}{3}}$$

b. $\dfrac{4\sqrt{5}}{\sqrt{6}}$

$$= \frac{4\sqrt{5}}{\sqrt{6}}\times\frac{\sqrt{6}}{\sqrt{6}}$$
$$= \frac{4\sqrt{30}}{6}$$
$$\boxed{\frac{2\sqrt{30}}{3}}$$

c. $\dfrac{3\sqrt{15}}{4\sqrt{5}}$

$$= \frac{3}{4}\sqrt{\frac{15}{5}}$$
$$= \frac{3}{4}\sqrt{3}$$
$$\boxed{\frac{3\sqrt{3}}{4}}$$

OR

$$= \frac{3\sqrt{15}}{4\sqrt{5}}\times\frac{\sqrt{5}}{\sqrt{5}}$$
$$= \frac{3\sqrt{75}}{4\times 5}$$
$$= \frac{3\sqrt{75}}{20} = \frac{3\sqrt{25\times 3}}{20}$$
$$= \frac{15\sqrt{3}}{20}$$
$$\boxed{\frac{3\sqrt{3}}{4}}$$

Example 6: Simplify.

a. $\sqrt[3]{48}$

Need to find a perfect cube factor of the radicand.

$= \sqrt[3]{8 \times 6}$

$= \sqrt[3]{8} \times \sqrt[3]{6}$

$\boxed{2\sqrt[3]{6}}$

b. $\sqrt[3]{-250}$

We can have a negative perfect cube factor.

$= \sqrt[3]{-125 \times 2}$

$= \sqrt[3]{-125} \times \sqrt[3]{2}$

$\boxed{-5\sqrt[3]{2}}$

c. $\dfrac{\sqrt[3]{768}}{\sqrt[3]{4}}$

$= \sqrt[3]{\dfrac{768}{4}} = \sqrt[3]{192}$

$= \sqrt[3]{64 \times 3}$

$\boxed{4\sqrt[3]{3}}$

d. $\sqrt[4]{48}$

Need to find a perfect fourth factor of the radicand.

$= \sqrt[4]{16 \times 3}$

$= \sqrt[4]{16} \times \sqrt[4]{3}$

$\boxed{2\sqrt[4]{3}}$

Example 7: Write the followings as entire radicals.

a. $4\sqrt[3]{5}$

We need to cube the coefficient and multiply it into the radicand.

$= \sqrt[3]{4^3 \times 5}$

$= \sqrt[3]{64 \times 5}$

$\boxed{\sqrt[3]{320}}$

b. $-5\sqrt[3]{6}$

$= \sqrt[3]{(-5)^3 \times 6}$

$= \sqrt[3]{-125 \times 6}$

$\boxed{\sqrt[3]{-750}}$

c. $\dfrac{2}{3}\sqrt[3]{10}$

$= \sqrt[3]{\left(\dfrac{2}{3}\right)^3 \times 10}$

$= \sqrt[3]{\dfrac{8}{27} \times 10}$

$\boxed{\sqrt[3]{\dfrac{80}{27}}}$

d. $3\sqrt[4]{8}$

We need to take the coefficient to the fourth power and multiply it into the radicand.

$= \sqrt[4]{3^4 \times 8}$

$= \sqrt[4]{81 \times 8}$

$\boxed{\sqrt[4]{648}}$

(AP) Example 8: Simplify.

a. $\sqrt[3]{\dfrac{7}{6}}$

$= \dfrac{\sqrt[3]{7}}{\sqrt[3]{6}} \times \dfrac{\sqrt[3]{36}}{\sqrt[3]{36}}$

$\boxed{\dfrac{\sqrt[3]{252}}{6}}$

We have to multiply the cube root of the square of the radicand to form a perfect cube.

b. $\dfrac{2\sqrt[3]{14}}{\sqrt[3]{9}}$

$= \dfrac{2\sqrt[3]{14}}{\sqrt[3]{9}} \times \dfrac{\sqrt[3]{81}}{\sqrt[3]{81}} = \dfrac{2\sqrt[3]{1134}}{9}$

$= \dfrac{2\sqrt[3]{27 \times 42}}{9} = \dfrac{6\sqrt[3]{42}}{9}$

$\boxed{\dfrac{2\sqrt[3]{42}}{3}}$

c. $\dfrac{3\sqrt[3]{98}}{5\sqrt[3]{3}}$

$= \dfrac{3\sqrt[3]{98}}{5\sqrt[3]{3}} \times \dfrac{\sqrt[3]{9}}{\sqrt[3]{9}}$

$= \dfrac{3\sqrt[3]{882}}{5\sqrt[3]{27}} = \dfrac{3\sqrt[3]{882}}{5 \times 3} = \dfrac{3\sqrt[3]{882}}{15}$

$\boxed{\dfrac{\sqrt[3]{882}}{5}}$

(AP) Example 9: Solve for x.

a. $x\sqrt{42} = \sqrt{7}$

$x = \dfrac{\sqrt{7}}{\sqrt{42}}$

$x = \dfrac{1}{\sqrt{6}} \times \dfrac{\sqrt{6}}{\sqrt{6}}$

$\boxed{x = \dfrac{\sqrt{6}}{6}}$

b. $\dfrac{5\sqrt{7}}{2x} = 4\sqrt{3}$

$\dfrac{5\sqrt{7}}{2(4\sqrt{3})} = x$

$x = \dfrac{5\sqrt{7}}{8\sqrt{3}} \times \dfrac{\sqrt{3}}{\sqrt{3}}$

$\boxed{x = \dfrac{5\sqrt{21}}{24}}$

1-4 Homework Assignments

Regular: pg.19 to 20 #1 to 23 (odd), 25 to 33, 34 to 44 (even), 46 to 55, 59

AP: pg.19 to 20 #2 to 24 (even), 25 to 33, 35 to 45 (odd), 46 to 63

1-5: Operations with Radicals

Adding and Subtracting Radicals:

Convert any entire radicals into mixed radicals first. Then, combine like terms (radicals with the same radicand) by adding or subtracting their coefficients.

Example 1: Simplify the followings.

a. $\sqrt{32}-\sqrt{108}+\sqrt{27}-\sqrt{50}$

$$=4\sqrt{2}-6\sqrt{3}+3\sqrt{3}-5\sqrt{2}$$
$$=4\sqrt{2}-5\sqrt{2}-6\sqrt{3}+3\sqrt{3}$$
$$\boxed{-\sqrt{2}-3\sqrt{3}}$$

b. $-3\sqrt{12}+2\sqrt{20}-\sqrt{75}+3\sqrt{45}$

$$=-3\left(2\sqrt{3}\right)+2\left(2\sqrt{5}\right)-5\sqrt{3}+3\left(3\sqrt{5}\right)$$
$$=-6\sqrt{3}+4\sqrt{5}-5\sqrt{3}+9\sqrt{5}$$
$$\boxed{13\sqrt{5}-11\sqrt{3}}$$

Multiplying Radicals:

When multiplying two mixed radicals, multiply the coefficients first, and then multiply the radicands. Simplify each term afterwards if necessary.

Example 2: Simplify the followings.

a. $5\sqrt{2}\left(2\sqrt{3}+\sqrt{8}\right)$

$$=5\sqrt{2}\left(2\sqrt{3}+\sqrt{8}\right)$$
$$=10\sqrt{6}+5\sqrt{16}$$
$$=10\sqrt{6}+5(4)$$
$$\boxed{10\sqrt{6}+20}$$

b. $2\sqrt{15}\left(9\sqrt{5}-7\sqrt{3}\right)$

$$=2\sqrt{15}\left(9\sqrt{5}-7\sqrt{3}\right)$$
$$=18\sqrt{75}-14\sqrt{45}$$
$$=18\left(5\sqrt{3}\right)-14\left(3\sqrt{5}\right)$$
$$\boxed{90\sqrt{3}-42\sqrt{5}}$$

c. $\left(\sqrt{2}+\sqrt{5}\right)\left(3\sqrt{2}-4\sqrt{5}\right)$

$$=\left(\sqrt{2}+\sqrt{5}\right)\left(3\sqrt{2}-4\sqrt{5}\right)$$
$$=3\sqrt{4}-4\sqrt{10}+3\sqrt{10}-4\sqrt{25}$$
$$=3(2)-\sqrt{10}-4(5)$$
$$=6-\sqrt{10}-20$$
$$\boxed{-\sqrt{10}-14}$$

d. $\left(4\sqrt{6}-2\sqrt{3}\right)\left(7\sqrt{6}+5\sqrt{3}\right)$

$$=\left(4\sqrt{6}-2\sqrt{3}\right)\left(7\sqrt{6}+5\sqrt{3}\right)$$
$$=28\sqrt{36}+20\sqrt{18}-14\sqrt{18}-10\sqrt{9}$$
$$=28(6)+6\sqrt{18}-10(3)$$
$$=168+6\left(3\sqrt{2}\right)-30$$
$$\boxed{18\sqrt{2}+138}$$

e. $\left(4\sqrt{3}-3\sqrt{2}\right)^2$

$$=\left(4\sqrt{3}-3\sqrt{2}\right)\left(4\sqrt{3}-3\sqrt{2}\right)$$
$$=16\sqrt{9}-12\sqrt{6}-12\sqrt{6}+9\sqrt{4}$$
$$=16(3)-24\sqrt{6}+9(2)$$
$$=48-24\sqrt{6}+18$$
$$\boxed{-24\sqrt{6}+66}$$

Conjugates: - binomials that have the exact same terms by opposite signs in between.

Example: $(a + b)$ and $(a - b)$ $\left(a\sqrt{b}+c\sqrt{d}\right)$ and $\left(a\sqrt{b}-c\sqrt{d}\right)$

Multiplying Conjugate Radicals:

The result of multiplying conjugate radicals is **ALWAYS** a Rational Number (the radical terms will always cancel out).

Example 3: Simplify the followings.

a. $\left(\sqrt{5}+3\sqrt{6}\right)\left(\sqrt{5}-3\sqrt{6}\right)$

$$=\left(\sqrt{5}+3\sqrt{6}\right)\left(\sqrt{5}-3\sqrt{6}\right)$$
$$=\sqrt{25}-3\sqrt{30}+3\sqrt{30}-9\sqrt{36}$$
$$=5-9(6)$$
$$=5-54 \qquad \boxed{-49}$$

b. $\left(4\sqrt{7}-5\sqrt{3}\right)\left(4\sqrt{7}+5\sqrt{3}\right)$

$$=\left(4\sqrt{7}-5\sqrt{3}\right)\left(4\sqrt{7}+5\sqrt{3}\right)$$
$$=16\sqrt{49}+20\sqrt{21}-20\sqrt{21}-25\sqrt{9}$$
$$=16(7)-25(3)$$
$$=112-75 \qquad \boxed{37}$$

Notice the middle two terms always cancel out!

Rationalizing Binomial Radical Denominators:

Multiply the radical expressions by a fraction consist of the conjugate of the denominator over itself

Example 4: Simplify the followings.

a. $\dfrac{3\sqrt{2}}{\sqrt{5}+2\sqrt{7}}$

$$=\frac{3\sqrt{2}}{\left(\sqrt{5}+2\sqrt{7}\right)}\times\frac{\left(\sqrt{5}-2\sqrt{7}\right)}{\left(\sqrt{5}-2\sqrt{7}\right)}$$
$$=\frac{3\sqrt{10}-6\sqrt{14}}{\sqrt{25}-4\sqrt{49}}$$
$$=\frac{3\sqrt{10}-6\sqrt{14}}{5-28}$$
$$=\frac{3\sqrt{10}-6\sqrt{14}}{-23} \qquad \boxed{\frac{-3\sqrt{10}+6\sqrt{14}}{23}}$$

b. $\dfrac{2\sqrt{3}-\sqrt{6}}{3\sqrt{15}-5\sqrt{2}}$

$$=\frac{\left(2\sqrt{3}-\sqrt{6}\right)}{\left(3\sqrt{15}-5\sqrt{2}\right)}\times\frac{\left(3\sqrt{15}+5\sqrt{2}\right)}{\left(3\sqrt{15}+5\sqrt{2}\right)}$$
$$=\frac{6\sqrt{45}+10\sqrt{6}-3\sqrt{90}-5\sqrt{12}}{9\sqrt{225}-25\sqrt{4}}$$
$$=\frac{6\left(3\sqrt{5}\right)+10\sqrt{6}-3\left(3\sqrt{10}\right)-5\left(2\sqrt{3}\right)}{9(15)-25(2)}$$
$$=\frac{18\sqrt{5}+10\sqrt{6}-9\sqrt{10}-10\sqrt{3}}{135-50} \qquad \boxed{\frac{18\sqrt{5}+10\sqrt{6}-9\sqrt{10}-10\sqrt{3}}{85}}$$

Example 5: A rectangle has a perimeter of $\sqrt{160}+\sqrt{72}$ and its width is $\sqrt{10}-\sqrt{8}$. What is the length of this rectangle?

$$w=\sqrt{10}-\sqrt{8}$$
$$=\left(\sqrt{10}-2\sqrt{2}\right)$$

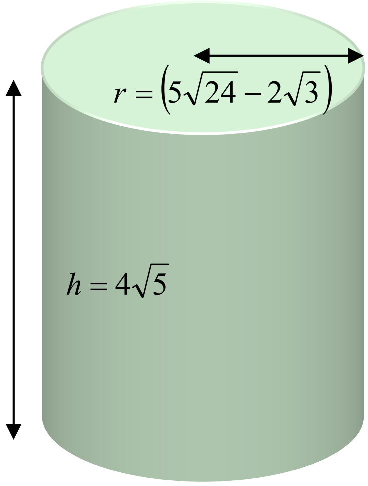
$$P=\sqrt{160}+\sqrt{72}$$
$$=\left(4\sqrt{10}+6\sqrt{2}\right)$$

$$P=2(l+w)$$
$$\frac{P}{2}=l+w$$
$$\frac{P}{2}-w=l$$

$$l=\frac{\left(4\sqrt{10}+6\sqrt{2}\right)}{2}-\left(\sqrt{10}-2\sqrt{2}\right)$$
$$l=\left(2\sqrt{10}+3\sqrt{2}\right)-\left(\sqrt{10}-2\sqrt{2}\right)$$
$$l=2\sqrt{10}+3\sqrt{2}-\sqrt{10}+2\sqrt{2}$$
$$\boxed{length=\sqrt{10}+5\sqrt{2}}$$

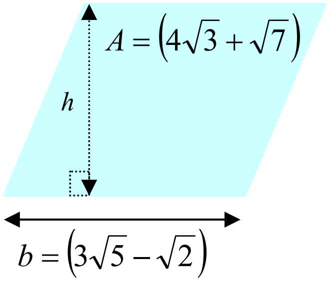
Subtracting a bracket! Switch signs in the second bracket!

Example 6: Find the volume of a cylinder that has a radius of $5\sqrt{24}-2\sqrt{3}$, and its height is $4\sqrt{5}$



$$V=\pi r^2 h$$
$$V=\pi\left(5\sqrt{24}-2\sqrt{3}\right)^2\left(4\sqrt{5}\right)$$
$$V=\pi\left(4\sqrt{5}\right)\left(5\sqrt{24}-2\sqrt{3}\right)\left(5\sqrt{24}-2\sqrt{3}\right)$$
$$V=\pi\left(4\sqrt{5}\right)\left(25(24)-10\sqrt{72}-10\sqrt{72}+4(3)\right)$$
$$V=\pi\left(4\sqrt{5}\right)\left(600-20\sqrt{72}+12\right)$$
$$V=\pi\left(4\sqrt{5}\right)\left(612-20\left(6\sqrt{2}\right)\right)$$
$$V=\pi\left(4\sqrt{5}\right)\left(612-120\sqrt{2}\right)$$
$$V=\pi\left(2448\sqrt{5}-480\sqrt{10}\right)$$
$$\boxed{Volume=2448\pi\sqrt{5}-480\pi\sqrt{10}}$$

Example 7: A parallelogram has an area of $4\sqrt{3}+\sqrt{7}$. Calculate the measure of its height if the base is $3\sqrt{5}-\sqrt{2}$.



$$A=bh$$
$$h=\frac{A}{b}=\frac{\left(4\sqrt{3}+\sqrt{7}\right)}{\left(3\sqrt{5}-\sqrt{2}\right)}$$
$$h=\frac{\left(4\sqrt{3}+\sqrt{7}\right)}{\left(3\sqrt{5}-\sqrt{2}\right)}\times\frac{\left(3\sqrt{5}+\sqrt{2}\right)}{\left(3\sqrt{5}+\sqrt{2}\right)}$$
$$h=\frac{12\sqrt{15}+4\sqrt{6}+3\sqrt{35}+\sqrt{14}}{9(5)-2}$$
$$\boxed{Height=\frac{12\sqrt{15}+4\sqrt{6}+3\sqrt{35}+\sqrt{14}}{43}}$$

Example 8: Simplify.

a. $\sqrt[3]{128}-\sqrt[3]{16}+\sqrt[3]{250}$

$$=\sqrt[3]{64\times 2}-\sqrt[3]{8\times 2}+\sqrt[3]{125\times 2}$$
$$=4\sqrt[3]{2}-2\sqrt[3]{2}+5\sqrt[3]{2}$$
$$\boxed{7\sqrt[3]{2}}$$

b. $2\sqrt[3]{24}-7\sqrt[3]{81}+3\sqrt[3]{648}$

$$=2\sqrt[3]{8\times 3}-7\sqrt[3]{27\times 3}+3\sqrt[3]{216\times 3}$$
$$=2\left(2\sqrt[3]{3}\right)-7\left(3\sqrt[3]{3}\right)+3\left(6\sqrt[3]{3}\right)$$
$$=4\sqrt[3]{3}-21\sqrt[3]{3}+18\sqrt[3]{3}$$
$$\boxed{\sqrt[3]{3}}$$

(AP) c. $\left(\sqrt[3]{4}+5\sqrt[3]{7}\right)\left(6\sqrt[3]{32}-2\sqrt[3]{147}\right)$

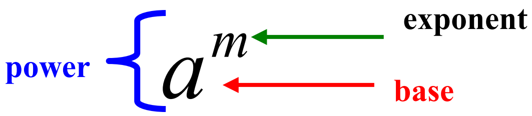
$$=6\sqrt[3]{128}-2\sqrt[3]{588}+30\sqrt[3]{224}-10\sqrt[3]{1029}$$
$$=6\left(4\sqrt[3]{2}\right)-2\sqrt[3]{588}+30\left(2\sqrt[3]{28}\right)-10\left(7\sqrt[3]{3}\right)$$
$$\boxed{24\sqrt[3]{2}-2\sqrt[3]{588}+60\sqrt[3]{28}-70\sqrt[3]{3}}$$

1-5 Homework Assignments

Regular: pg.23 to 24 #1 to 41 (odd), 43 to 60, 64 to 68, 70a

AP: pg.23 to 24 #2 to 40 (even), 43 to 60, 63 to 70

1-7: Reviewing the Exponent Laws



Exponential Laws

$$(a^m)(a^n) = a^{m+n} \qquad \frac{(a^m)}{(a^n)} = a^{m-n} \qquad (a^m)^n = a^{mn} \qquad a^0 = 1$$

$$a^{-n} = \frac{1}{a^n} \qquad (ab)^m = a^m b^m \qquad \left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}$$

Example 1: Simplify. Express all answers in positive exponents only.

a. $(7c^{11}d^4)(-6c^8d^5)$

$$= -42c^{11+8}d^{4+5}$$

$$\boxed{-42c^{19}d^9}$$

b. $\dfrac{9a^5b^{10}}{-36a^{15}b^4}$

$$= \frac{1a^{5-15}b^{10-4}}{-4}$$

$$= -\frac{a^{-10}b^6}{4} \qquad \boxed{\frac{-b^6}{4a^{10}}}$$

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

$$= (3)^3\left(x^{5\times3}\right)\left(y^{2\times3}\right)$$

$$\boxed{27x^{15}y^6}$$

d. $\dfrac{(5x^3y^2)^3(3x^5y^9)^2}{(-6x^7y^3)^4}$

$$= \frac{(125x^9y^8)(9x^{10}y^{18})}{(1296x^{28}y^{12})}$$

$$= \frac{1125x^{9+10-28}y^{8+18-12}}{1296}$$

$$= \frac{125x^{-9}y^{14}}{144}$$

$$\boxed{\frac{125y^{14}}{144x^9}}$$

e. $(4m^4n^{-7})^3\,(2m^3n^5)^{-4}$

$$= \frac{(64m^{12}n^{-21})}{(2m^3n^5)^4}$$

When reciprocating an entire bracket, do NOT mess with its content.

$$= \frac{64m^{12}n^{-21}}{16m^{12}n^{20}}$$

$$= 4m^{12-12}n^{-21-20}$$

$$-4(1)n^{-41} \qquad \boxed{\frac{4}{n^{41}}}$$

f. $\left(\dfrac{-5p^{-4}q^3}{4p^{-7}q^{-3}}\right)^{-2}$

$$= \left(\frac{4p^{-7}q^{-3}}{-5p^4q^3}\right)^2$$

$$= \frac{16p^{-14}q^{-6}}{25p^{-8}q^6}$$

$$= \frac{16p^{-14-(-8)}q^{-6-(-6)}}{25}$$

$$= \frac{16p^{-6}q^{-12}}{25} \qquad \boxed{\frac{16}{25p^6q^{12}}}$$

g. $$\frac{3^{-1}-(-3)^2}{(-3)^{-3}+\left(-\frac{1}{3}\right)^{-4}}$$

$$=\frac{\left(\frac{1}{3}\right)-9}{\left(\frac{-1}{3}\right)^3+(-3)^4}=\frac{\frac{1}{3}-9}{\frac{-1}{27}+81}=\frac{\left(\frac{-26}{3}\right)}{\left(\frac{2186}{27}\right)}$$

$$=\left(\frac{-26}{3}\right)\div\left(\frac{2186}{27}\right) \qquad \boxed{\frac{-117}{1093}}$$

h. $$\frac{\left(-6h^{-2}k^3\right)^{-3}}{\left(9h^5k^{-1}\right)^{-2}\left(-3h^{-4}k^{-2}\right)^4}$$

$$=\frac{\left(9h^5k^{-1}\right)^2}{\left(-6h^{-2}k^3\right)^3\left(-3h^{-4}k^{-2}\right)^4}$$

$$=\frac{81h^{10}k^{-2}}{\left(-216h^{-6}k^9\right)\left(81h^{-16}k^{-8}\right)}$$

$$=\frac{h^{10-(-6)-(-16)}k^{-2-9-(-8)}}{-216} \qquad \boxed{\frac{-h^{32}}{216k^3}}$$

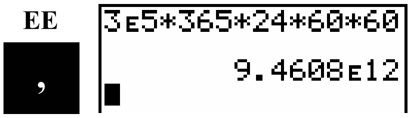
Example 2: In astronomy, one light year is the distance light can travel in one year. Light has a constant speed of 3 × 10^5 km/s in the vacuum of space.

a. Calculate the distance of one light year.

b. The closest star to the Sun, Alpha Centuri, is 3.78 × 10^{13} km. How many light years is it to our sun?

a. One Light Year

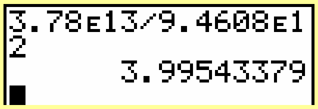
= (3 × 10^5 km/s)(365 days/yr)(24 hr/day)(60 min/hr)(60 s/min)



```
3E5*365*24*60*60
         9.4608E12
```

$\boxed{9.4608 \times 10^{12}\text{ km/yr}}$

b. $$\frac{3.78\times10^{13}\,km}{9.4608\times10^{12}\,km/yr}$$



```
3.78E13/9.4608E1
2
        3.99543379
```

$\boxed{\text{4 light years}}$

Example 3: Solve for *x*.

a. $(x^3)(x^5) = 6561$

$$x^8 = 6561$$
$$x=\sqrt[8]{6561}$$
$$\boxed{x=\pm3}$$

b. $\frac{x^2}{x^7}=-1024$

$$x^{2-7}=-1024$$
$$x^{-5}=-1024$$
$$\frac{1}{x^5}=-1024 \nearrow$$
$$x^5=\frac{1}{-1024}$$
$$x=\sqrt[5]{\left(\frac{-1}{1024}\right)}$$
$$\boxed{x=\frac{-1}{4}}$$

(AP) c. $\frac{-2x^{-3}}{3x^{-5}}=-96$

$$x^{-3-(-5)}=-96\left(\frac{3}{-2}\right)$$
$$x^2=144$$
$$x=\sqrt{144}$$
$$\boxed{x=\pm12}$$

(AP) Example 4: Simplify.

a. $(-3^m)^4\,(-3)^{m+4}$

$$=(-3)^{4m}(-3)^{m+4}$$
$$=(-3)^{4m+(m+4)}$$
$$\boxed{(-3)^{5m+4}}$$

b. $\frac{\left(a^{2x}b^{y+1}\right)^3}{a^{3x+1}b^y}$

$$=\frac{a^{6x}b^{3y+3}}{a^{3x+1}b^y}$$
$$=a^{6x-(3x+1)}b^{(3y+3)-y}$$
$$\boxed{a^{(3x-1)}b^{(2y+3)}}$$

1-7 Homework Assignments

Regular: pg.33 #2 to 48 (even), 50 to 82, 84, 85a, 85b, 86

AP: pg.33 #1 to 49 (odd), 50 to 87

1-8: Rational Exponents

$$a^{\frac{m}{n}} = \sqrt[n]{a^m}$$

The index of the radical is the denominator of the fractional exponent.

Example 1: Evaluate.

a. $-25^{\frac{1}{2}}$

$= -\sqrt{25}$

$\boxed{-5}$

b. $(-64)^{\frac{1}{3}}$

$= \sqrt[3]{-64}$

$\boxed{-4}$

c. $(16)^{\frac{3}{2}}$

$= \sqrt{16^3}$

$= \sqrt{4096}$

$\boxed{64}$

d. $(-216)^{\frac{-1}{3}}$

$= \frac{1}{(-216)^{\frac{1}{3}}} = \frac{1}{\sqrt[3]{-216}}$

$\boxed{\frac{-1}{6}}$

e. $(-27)^{\frac{4}{3}}$

$= \sqrt[3]{(-27)^4}$

$= \sqrt[3]{531441}$

$\boxed{81}$

f. $\left(\frac{-27}{64}\right)^{\frac{-2}{3}}$

$= \left(\frac{64}{-27}\right)^{\frac{2}{3}} = \frac{\sqrt[3]{64^2}}{\sqrt[3]{(-27)^2}}$

$= \frac{\sqrt[3]{4096}}{\sqrt[3]{729}}$ $\boxed{\frac{16}{9}}$

g. $4^{-1.5}$

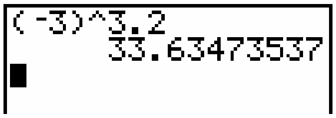
$= 4^{\frac{-3}{2}}$

$= \left(\frac{1}{4}\right)^{\frac{3}{2}} = \frac{1}{\sqrt{4^3}}$

$= \frac{1}{\sqrt{64}}$ $\boxed{\frac{1}{8}}$

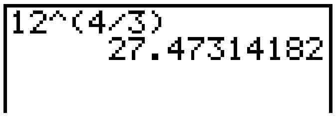
Example 2: Evaluate using a calculator.

a. $(-3)^{3.2}$



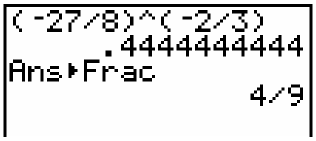
```
(-3)^3.2
          33.63473537
█
```

b. $12^{\frac{4}{3}}$



```
12^(4/3)
          27.47314182
```

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



```
(-27/8)^(-2/3)
         .4444444444
Ans▸Frac
                 4/9
```

Example 3: Write the followings using exponents.

a. $\sqrt[5]{x}$

$\boxed{x^{\frac{1}{5}}}$

b. $\sqrt{2a^3}$

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

$\boxed{2^{\frac{1}{2}} a^{\frac{3}{2}}}$

c. $\sqrt{9y^{12}}$

$= \left(9y^{12}\right)^{\frac{1}{2}} = 9^{\frac{1}{2}} y^{\frac{12}{2}}$

$= \sqrt{9}y^6$

$\boxed{3y^6}$

d. $\frac{1}{\left(\sqrt[4]{x^3y^2}\right)^5}$

$= \left(\sqrt[4]{x^3y^2}\right)^{-5}$

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

$\boxed{x^{\frac{-15}{4}} y^{\frac{-5}{2}}}$

Example 4: Evaluate, if possible.

a. $\left(\sqrt[5]{7^3}\right)\left(\sqrt[5]{7^2}\right)$

$= \left(7^{\frac{3}{5}}\right)\left(7^{\frac{2}{5}}\right)$

$= 7^{\frac{3}{5}+\frac{2}{5}} = 7^1$ $\boxed{7}$

b. $\left(5^{\frac{2}{7}}\right)^{\frac{-5}{6}}$

$= 5^{\frac{2}{7}\times\frac{-5}{6}}$

$\boxed{5^{\frac{-5}{21}}}$

c. $\left[\left(\sqrt[3]{64}\right)^6\right]^{\frac{1}{4}}$

$= \left[(64)^{\frac{6}{3}}\right]^{\frac{1}{4}} = \left[(64)^2\right]^{\frac{1}{4}}$

$= 64^{\frac{1}{2}}$

$\boxed{8}$

Example 5: Write the following expressions using exponents.

a. $\sqrt[4]{\sqrt[2]{256x^9}}$

$= \sqrt[4]{\left(256x^9\right)^{\frac{1}{2}}}$

$= \left[\left(256x^9\right)^{\frac{1}{2}}\right]^{\frac{1}{4}} = \left(256x^9\right)^{\frac{1}{8}}$

$= 256^{\frac{1}{8}}x^{\frac{9}{8}}$ $\boxed{2x^{\frac{9}{8}}}$

b. $\left(27a^{\frac{2}{5}}b^{\frac{-3}{2}}\right)^{\frac{-1}{4}}$

$= \dfrac{1}{\left(27\boldsymbol{a}^{\frac{2}{5}}\boldsymbol{b}^{\frac{-3}{2}}\right)^{\frac{1}{4}}} = \dfrac{1}{27^{\frac{1}{4}}\boldsymbol{a}^{\frac{2}{5}\times\frac{1}{4}}\boldsymbol{b}^{\frac{-3}{2}\times\frac{1}{4}}}$

$= \dfrac{1}{27^{\frac{1}{4}}\boldsymbol{a}^{\frac{1}{10}}\boldsymbol{b}^{\frac{-3}{8}}}$ $\boxed{\dfrac{\boldsymbol{b}^{\frac{3}{8}}}{27^{\frac{1}{4}}\boldsymbol{a}^{\frac{1}{10}}}}$

c. $\left(\sqrt{x^5}\right)\left(\sqrt[4]{x^{-3}}\right)$

$= \left(\boldsymbol{x}^{\frac{1}{5}}\right)\left(\boldsymbol{x}^{\frac{-3}{4}}\right)$

$= \boldsymbol{x}^{\frac{1}{5}+\frac{-3}{4}}$

$= \boldsymbol{x}^{\frac{-11}{20}}$ $\boxed{\dfrac{1}{\boldsymbol{x}^{\frac{11}{20}}}}$

d. $\left(\sqrt[4]{x^7y^5}\right)^{\frac{2}{3}}$

$= \left[\left(\boldsymbol{x}^7\boldsymbol{y}^5\right)^{\frac{1}{4}}\right]^{\frac{2}{3}}$

$= \left(\boldsymbol{x}^7\boldsymbol{y}^5\right)^{\frac{1}{4}\times\frac{2}{3}} = \left(\boldsymbol{x}^7\boldsymbol{y}^5\right)^{\frac{1}{6}}$

$= \boldsymbol{x}^{7\times\frac{1}{6}}\boldsymbol{y}^{5\times\frac{1}{6}}$ $\boxed{\boldsymbol{x}^{\frac{7}{6}}\boldsymbol{y}^{\frac{5}{6}}}$

(AP) Example 6: Solve for *x*.

a. $3^x = 243$

$3^{\boldsymbol{x}} = 3^5$

$\boxed{\boldsymbol{x} = 5}$

b. $5^{2x+7} = 125$

$5^{2\boldsymbol{x}+7} = 5^3$

$2\boldsymbol{x} + 7 = 3$

$2\boldsymbol{x} = 3 - 7$

$2\boldsymbol{x} = -4$

$\boldsymbol{x} = \dfrac{-4}{2}$ $\boxed{\boldsymbol{x} = -2}$

c. $2^{3x-5} = \dfrac{1}{128}$

$2^{3\boldsymbol{x}-5} = \dfrac{1}{2^7}$

$3\boldsymbol{x} - 5 = -7$

$3\boldsymbol{x} = -7 + 5$

$3\boldsymbol{x} = -2$ $\boxed{\boldsymbol{x} = \dfrac{-2}{3}}$

1-8 Homework Assignments

Regular: pg.37 to 38 #1 to 67 (odd), 69 to 83, 84 to 89 (no estimates), 90, 91

AP: pg.37 to 38 #2 to 68 (even), 69 to 83, 84 to 89 (no estimates), 90 to 92