Topic 1-1 Exponents

$10{,}000 = 10^4$ 10 is the base

*count the zeros   4 is the exponent or power
to determine the
exponent

Exponential form

1. $6^2 = 6 \times 6 = 36$ (Six squared)
2. $5^3 = 5 \times 5 \times 5 = 125$ (Five cubed)
3. $3^4 = 3 \times 3 \times 3 \times 3 = 81$ (three to the fourth power)

* Standard Form = 562,384

* Expanded form = 500,000 + 60,000 + 2,000 + 300 +
$$80 + 4$$

* Expanded form w/ Exponents
$$(5 \times 10^5) + (6 \times 10^4) + (2 \times 10^3) + (3 \times 10^2) + (8 \times 10^1) + (4 \times 10^0)$$

Topic 1-2 Properties of Operations

Properties of Addition

1. Commutative: $a + b = b + a$ (the "order")
2. Associative: $a + (b+c) = (a+b) + c$ (the "grouping")
3. Identity: $a + 0 = a$

Properties of Multiplication

1. Commutative: $a \times b = b \times a$
2. Associative: $a \times (b \times c) = (a \times b) \times c$
3. Identity: $a \times 1 = a$

* Associative will always have parentheses *

Topic 1-3 Order of Operations

Please **E**xcuse **M**y **D**ear **A**unt **S**ally

1. Parentheses
2. Exponents
3. Multiplication ⟩ From left to right
   Division
4. Addition ⟩ From left to right
   Subtraction

- $24 \div (4 + 2^3) + 2$
  $24 \div (4 + 8) + 2$
  $24 \div 12 + 2$
  $2 + 2$
  $\boxed{4}$

- $24 \div 4 + 2^3 + 2$
  $24 \div 4 + 8 + 2$
  $6 + 8 + 2$
  $\boxed{16}$

Topic 1-4 Distributive Property

A) 5×27

$5(20) + 5(7)$ or $5(20+7)$

$\quad 100 + 35$

$\qquad 135$

B) $8(32) - 8(2)$

$\quad 8(32-2)$

$\quad 8(30)$

$\quad 240$

C) $8(7+23) = 8(7) + 8(23)$

D) $8(57) - 8(7) = 8(50)$

Topic 1-5 Evaluating Numerical Expressions

PEMDAS (Don't forget to follow the
Order of Operations from 1-3)

1. $4.3 + (8.4 - 5.1)$ $\begin{array}{r} 8.4 \\ -5.1 \\ \hline 3.3 \end{array}$ *Line up decimals
   $4.3 + 3.3$ when you add
   $\boxed{7.6}$ $\begin{array}{r} +4.3 \\ \hline 7.6 \end{array}$ or subtract

2. $[(3.2 + 8.1) - 3.1] + 5.8$ $\begin{array}{r} 3.2 \\ +8.1 \\ \hline 11.3 \end{array}$
   $[\; 11.3 - 3.1\;] + 5.8$ $\begin{array}{r} -3.1 \\ \hline 8.2 \end{array}$
   $8.2 + 5.8$ $\begin{array}{r} +5.8 \\ \hline 14.0 \end{array}$
   $\boxed{14.0}$

3. $4^2 + [(25 - 14.5) \times 7.2]$ $\begin{array}{r} 2\overset{4}{5}.0 \\ -14.5 \\ \hline 10.5 \end{array}$
   $4^2 + [\; 10.5 \times 7.2\;]$
   $4^2 + 75.60$ $\begin{array}{r} 10.5 \\ \times \;\; 7.2 \\ \hline 2 1 0 \\ +7 3 5 0 \\ \hline 75.60 \end{array}$
   $\underset{4\times4}{16} + 75.60$
   $\boxed{91.60}$ $\begin{array}{r} 75.60 \\ +16.00 \\ \hline 91.60 \end{array}$

Topic 1-6 Using Variables to Write Expressions

- Variable: expressed as a letter (x)
- algebraic expression: a phrase that has at least one variable and one operation
$$(3 + x)$$
- coefficient: the number that is multiplied by the variable.
$(3x)$ 3 is the coefficient
X is the variable.

EXAMPLES:
1. five minutes more than time t = $t + 5$
2. ten erasers decreased by a number n = $10 - n$
3. six times a width w = $6 \times w$ or $6w$ or $6(w)$
$$6 \cdot w$$
4. n nectarines divided by three = $n \div 3$ or $\frac{n}{3}$
5. eight more than four times an amount x = $4x + 8$
6. 12 times a number g = $12g$
7. the difference of a number m and 18 = $m - 18$
8. p pennies added to 22 pennies = $22 + p$
9. 5 less than 3 times a number z = $3z - 5$

Topic 1-7 Parts of an Expression

- **Term:** each part of an expression that is separated by a plus or a minus sign is called a _term._

$$\star\ 12r + \frac{r}{2} - 19 \qquad \star\text{There are 3 terms:}$$
1. $12r$
2. $\frac{r}{2}$
3. 19

- **Coefficient:** a number that is multiplied by a variable (letter)
  - $\star$ In the term $12r$, $\underline{12}$ is the _coefficient_ of r.
  - $\star$ In this product, both $\underline{12}$ and $\underline{r}$ are _factors._

Example:

$$14 + 7w - 4z$$

$\star$ There are 3 _terms:_ 14, 7w, 4z

$\star$ What is the _coefficient_ of w: 7

$\star$ Identify the _factors_ of 7w: 7 and w

Topic 1-8 Evaluating Algebraic Expressions

- <u>Evaluate</u>: means to find a value of an expression.
- <u>Substitution</u>: replace the variable (letter) with a number.

★ <u>Evaluate for $x = 14$</u>

$20 + 3x$

$20 + 3(14)$ ← <u>substitute</u>

$20 + 42$

62

<u>Examples</u>:

★ $t - 8; \quad t = 18$

$18 - 8$

10

★ $6(w) + 9; \quad w = 3$

$6(3) + 9$

$18 + 9$

27

★ $2x \div 4; \quad x = 12$

$(2 \times 12) \div 4$

$24 \div 4$

6

★ $3z + 4 - 2z; \quad z = 5$

$(3 \times 5) + 4 - (2 \times 5)$

$15 + 4 - 10$

$19 - 10$

9

Topic 1-9 Using Expressions to Describe Patterns

• <u>Input/Output Table</u>: a table of related
values with a pattern

INPUT	OUTPUT
\$84	\$42
\$66	\$33
\$50	\$25
\$22	?
\$30	?

* What is the relationship

$$\frac{1}{2}(84) = 42$$
$$\frac{1}{2}(66) = 33$$
$$\frac{1}{2}(50) = 25$$

* The pattern is $\frac{1}{2}(input) = output$
* Let x = input
* $\frac{1}{2}x$
* Use the pattern to find the missing values

$$\frac{1}{2}(22) = 11$$
$$\frac{1}{2}(30) = 15$$

INPUT	OUTPUT
\$22	\$11
\$30	\$15

Topic 1-10 Simplifying Algebraic Expressions

• <u>Like Terms</u>: terms that have the same variable such as y and $2y$, are "like terms."

✱ $X + X + X$ → All 3 terms are "like terms"
= $1x + 1x + 1x$ → The coefficient is 1
= $3x$ → Add the coefficients and write the variable to combine "like terms"

✱ $2y - y$ The variable DOES NOT
= $2y - 1y$ change when combining
= y "like terms."

<u>Examples:</u>

✱ $X + X =$ $\boxed{2x}$ ✱ $4y - y =$ $\boxed{3y}$

✱ $2x + 2x + 2x =$ $\boxed{6x}$ ✱ $y + 5y + 1$
                              $= \boxed{6y + 1}$

Topic 1-11 Writing Equivalent Expressions

• **Equivalent Expressions:** have the same value regardless of which number is substituted for the same variable in the expressions

Example:

$$3(4x-1) = 3(4x) - 3(1)$$
$$= 12x - 3$$

So, $3(4x-1) = 12x - 3$

★ Use the distributive property!

$$2x + 4 = 2(x) + 2(2)$$
$$= 2(x + 2)$$

So, $2x + 4 = 2(x + 2)$

★ Find a common factor!

★ $2(x + 3) = 2x + 6$

★ $6(4x - 1) = 24x - 6$

★ $8x + 2 = 2(4x + 1)$

Topic H2 Equivalent Expressions

- Is $3y + 3$ equivalent to $3(y+1)$?
  * Use the distributive property!

$$3y + 3 = 3(y+1)$$
$$3y + 3 = 3y + 3 \qquad \text{YES! They are equivalent.}$$

- Is $3y + 3$ equivalent to $3y + 1$
$$3y + 3 \neq 3y + 1$$
$$3 \neq 1 \qquad \text{NO! They are not}$$
$$\text{equivalent}$$

- Is $2y + 4 - y = y + 4$
  * Combine "like terms"
$$2y - y = 1y \text{ or } y$$

$$y + 4 = y + 4 \qquad \text{YES!}$$

Topic 1-13 Problem Solving:
Make an Organized List

A family has $700. They spent $75 each day
How much money is left after 3 days,
5 days, and 9 days?

X = the number of days of the trip

$\$700 - \$75x$

X	700-75x
3	$ 475
5	$ 325
9	$ 25

★ 700-75(3)
700- 225
475

★ 700-75(9)
700- 675
25

★ 700-75(5)
700- 375
325