CSI: PRE-ALGEBRA

UNIT 1
Operations & Expressions

21st Century Math Projects

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### Project Title: CSI Pre-Algebra: Operations & Expressions

<table>
<thead>
<tr>
<th>Standard Focus: Number Sense and Operations</th>
<th>Time Range: 1-3 Days</th>
<th>Supplies: Pencil and Paper</th>
</tr>
</thead>
</table>

#### Topics of Focus:
- Order of Operations
- Integer Operations
- Verbal Expressions
- Evaluating Expressions with Substitution
- Combining Like Terms

This particular was mapped to the introductory curriculum of most geometry textbooks and can be used as an enrichment or review activity.

<table>
<thead>
<tr>
<th>The Number System</th>
<th>6.NS</th>
<th>5. Understand that positive and negative numbers are used together to describe quantities having opposite directions or values; use positive and negative integers to represent quantities in real-world contexts, explaining the meaning of zero in each situation.</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Number System</td>
<td>6.NS</td>
<td>6a. Recognize opposite signs of numbers as indicating locations on the number line; recognize that the opposite of the opposite of a number is the number itself, e.g., (-(-3) = 3), and that 0 is its own opposite.</td>
</tr>
<tr>
<td>Expressions and Equations</td>
<td>6.EE</td>
<td>2. Write, read, and evaluate expressions in which letters stand for numbers.</td>
</tr>
<tr>
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<td>6.EE</td>
<td>2b. Identify parts of an expression using mathematical terms (sum, term, product, factor, quotient, coefficient); view one or more parts of an expression as a single entity.</td>
</tr>
<tr>
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<td>6.EE</td>
<td>2c. Evaluate expressions at specific values of their variables. Include expressions that arise from formulas used in real-world problems.</td>
</tr>
<tr>
<td>Expressions and Equations</td>
<td>6.EE</td>
<td>2d. Perform arithmetic operations, including those involving whole number exponents, in the conventional order when there are no parentheses to specify a particular order (Order of Operations).</td>
</tr>
<tr>
<td>The Number System</td>
<td>7.NS</td>
<td>1d. Apply properties of operations as strategies to add and subtract rational numbers.</td>
</tr>
<tr>
<td>The Number System</td>
<td>7.NS</td>
<td>3. Solve real-world and mathematical problems involving the four operations with rational numbers.</td>
</tr>
<tr>
<td>-------------------</td>
<td>------</td>
<td>---------------------------------------------------------------------</td>
</tr>
<tr>
<td>Expressions and Equations</td>
<td>7.EE</td>
<td>1. Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.</td>
</tr>
</tbody>
</table>

**Procedures:**

A.) Student will be given the letter from Chief Harris, the possible suspects, and a crime scene puzzle.

B.) Students will work in pairs or individually to solve the crime.

C.) Students will determine which suspect should be arrested.

D.) Students will create a portfolio of evidence proving that they have arrested the right person and will demonstrate their understanding of their mathematical content present in the problem.

*E.) Students can present their evidence to the class as an oral presentation.

*Extensions
CSI Pre-Algebra: Operations & Expressions

Detectives,

As you know we are after a group of international evil geniuses, the Mathemagicians. Our evidence indicates they plan to build a world conquering device – to conquer the world. It seems one of the anonymous henchmen, Pemdas Orelse, has committed a string of robberies all over South America. We fear this is another step in the Mathemagician’s attempt to build a world conquering device.

Fortunately, Pemdas has left behind a trail of notes and a cryptic message that we have been told will calculate to their favorite number. Thus far there are six suspects that police have questioned. It is hoped that someone with a relatively strong number sense can crack some codes that have puzzled the detectives so far.

Your job is to bring Pemdas to justice and save the world. You need to be prepared to state your case and demonstrate your understanding of the following skills that Pemdas is known to use in his notes.

- Order of Operations
- Integer Operations
- Verbal Expressions
- Evaluating Expressions with Substitution
- Combining Like Terms

Be sure to include:

- Other examples of these concepts
- Definitions
- Any other relevant information.

This is no time for sloppiness. The slightest miscalculation or illegible footnote could result in a not guilty verdict.

Oh, did I mention that use of a calculator might prematurely set off his world conquering device? Good luck to you, gumshoe.

Chief Harris
<table>
<thead>
<tr>
<th>Name</th>
<th>Occupation</th>
<th>Favorite Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kaitlin</td>
<td>Organic Grocer</td>
<td>51</td>
</tr>
<tr>
<td>Arnold</td>
<td>Principal</td>
<td>-555</td>
</tr>
<tr>
<td>Rishi</td>
<td>App Developer</td>
<td>3.14</td>
</tr>
<tr>
<td>Dawne</td>
<td>Archivist</td>
<td>1492</td>
</tr>
<tr>
<td>Nikki</td>
<td>Veterinarian</td>
<td>680</td>
</tr>
<tr>
<td>Ricardo</td>
<td>Engineer</td>
<td>11</td>
</tr>
</tbody>
</table>
Scene #1  Museum of Natural History -- Lima, Peru

Pemdas Orelse was caught on a security camera stealing the skeleton of an adult sperm whale. In place of the skeleton, investigators found this note.

Greetings Young Mathematical Cadets! I am the famous Pemdas Orelse and I have decided to boggle your young minds with mathematical puzzles. Hopefully you’ve learned something because if you can’t figure them out, I’ll blow up the world or something like that. #muhahaha

In Peru, I’ve learned about Quipus which is an ancient method of counting by tying knots of alpaca or llama hair. If you can figure out this puzzle, you will get your first clue.

\[
\begin{array}{cccc}
+ & - & + & - \\
\end{array} = M
\]

Scene #2  Cordoba Golf Club -- Cordoba, Argentina

Posing as a player, Pemdas snuck into the woods of a golf course and uprooted an acacia tree. Investigators are unsure how this acacia tree will be used in the World Conquering Device at this time.

I just watched Angél Cabrera sink an eagle at a wild PGA Tour Latinoamérica event! Let’s see if you can tabulate who’s winning after the front nine. Calculate the player’s score relative to par (+/over, -/under).

**PGA TOUR LATINOAMÉRICA**

<table>
<thead>
<tr>
<th>PLAYER</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Andrés</td>
<td>+1</td>
<td></td>
<td></td>
<td>+4</td>
<td>0</td>
<td>-1</td>
<td>+3</td>
<td>0</td>
<td>-1</td>
<td>-2</td>
</tr>
<tr>
<td>Cristo</td>
<td>-2</td>
<td>-1</td>
<td>+2</td>
<td>+1</td>
<td>0</td>
<td>-1</td>
<td>-1</td>
<td>+2</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Ricardo</td>
<td>0</td>
<td>-3</td>
<td>+5</td>
<td>-1</td>
<td>0</td>
<td>-2</td>
<td>+1</td>
<td>-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sofia</td>
<td>-1</td>
<td>+5</td>
<td>-1</td>
<td>0</td>
<td>+6</td>
<td>-2</td>
<td>0</td>
<td>-1</td>
<td>-1</td>
<td></td>
</tr>
</tbody>
</table>

The first letter of the leader’s name will be equal to their current score. _______ = _______
Scene #3  Machu Picchu – Cusco Region of Peru

Posing as an ordinary tourist, Pemdas is suspected to be behind the theft of the Intihuatana Stone. This ritual stone of South America is believed by researchers to be a clock or calendar.

How could I go steal things in South America and not visit some ancient ruins? I hope you know your order of operations! #machumanrandypicchu

Work your way around the maze to exit with your next clue…

...if you can...

e = ________
Scene #4  Organic Farm -- Tumianuma, Ecuador

Farmers were stunned to discover that their entire herd of alpacas were shaven. On the largest alpaca, this note was cut into the wool.

At the organic farm the animals roam free. Animals can move between a Big Yard and a Small Yard where a farmer opens a gate to let them pass. To keep track of how many animals are in the Big Yard the farmer uses the system below. #21stCenturyMathProjects

<table>
<thead>
<tr>
<th>Big Yard Start Count:</th>
<th>65 alpacas, 52 cows and 84 sheep</th>
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<tbody>
<tr>
<td>Activity:</td>
<td>$+5a, -2c, +9a, -5c, -3a, +7a, -18a, +11e, +31c, +2a, +8s$</td>
</tr>
</tbody>
</table>

How many animals are currently in the Big Yard? Which animal does the farmer have more of?

<table>
<thead>
<tr>
<th>Alpacas ________</th>
<th>Cows ________</th>
<th>Sheep ________</th>
</tr>
</thead>
<tbody>
<tr>
<td>(First letter of the animal with the most # of them in the Big Yard)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Scene #5  Carnival -- Rio de Janeiro, Brazil

Three parade float were “parade float-jacked” as they began their route. It is suspected that Pemdas was behind these thefts. This note was dropped by a pigeon moments later.

I’ve found myself in the middle of perhaps the largest festival in the world -- #Carnival!

A top secret Samba Drum Line has a unique way of identifying members of their group. They have to say a verbal expression that is equal to 21 -- the dialing code of Rio de Janeiro.

<table>
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<tr>
<th>“Seven plus four, the result raised to the second power.”</th>
<th>“The product of negative 5 and negative 4 increased by 3.”</th>
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<td>“Six less than three raised to the third power.”</td>
<td>“The quotient of 105 and the sum of one and four.”</td>
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How many of these masked men are **imposters** of the Samba Drum Line?

<table>
<thead>
<tr>
<th>Zero</th>
<th>One</th>
<th>Two</th>
</tr>
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<tbody>
<tr>
<td>$a = 0$</td>
<td>$c = 1$</td>
<td>$r = 2$</td>
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</table>
Scene #6  Residential Home -- Bogota, Colombia

Last night, Pemdas Orelse parachuted onto a residential home and snuck inside through the chimney. He escaped with three garbage bags full of fabric and ribbon.

I've enjoyed baffling you with puzzles all across South America. Now it's time to snuggle in front of a nice campfire with my brand new signature Colombian Quilt! I bought the largest one! Which one is mine? #ilovesuperbigquiltsandcampfires

\[
A = l \cdot w
\]

\[
A = \frac{b \cdot h}{2}
\]

\[
A = \frac{22 \cdot r^2}{7}
\]

Choose the correct clue below the largest quilt

\[
c = 3
\]

\[
r = 7
\]

\[
s = 6
\]

CRYPTIC PUZZLE SOLVER TEXT MESSAGE

Hahaha, todos! #worldconqueringdevice

\[
A + M - E \div R + 1 - C + A
\]

#PemdasOrElse
Thank you for being my Math Friend!

If you liked this 21st Century Math Project, you might like others. (Click the logo)

Who is Pemdas Orelse?

Name: Kaitlin
Occupation: Organic Grocer
Favorite Number: 51

Name: Arnold
Occupation: Principal
Favorite Number: 55

Name: Rishi
Occupation: App Developer
Favorite Number: 3.14

Name: Dawne
Occupation: Archivist
Favorite Number: 1492

Name: Nikki
Occupation: Veterinarian
Favorite Number: 680

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Occupation: Engineer
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Greetings Young Mathematical Cadets!

I am the famous and talented Pemdas Orelse and I have decided to boggle your young little minds with mathematical puzzles. Hopefully you have learned something because if you can’t figure them out, I’ll blow up the world or something like that. #muhaha

In Peru, I learned about Quipus an ancient method for counting by tying knots of alpaca or llama hair. If you can figure out this puzzle, you will get your first clue.

\[ \begin{array}{ccc}
+ & - & \cdot \\
\hline
\end{array} = M \]

\[ M = \underline{___} \quad m=3 \]

Scene #2  Cordoba Golf Club -- Cordoba, Argentina

Posing as a player, Pemdas snuck into the woods of a golf course and uprooted an acacia tree. Investigators are unsure how the acacia tree will be used for the World Conquering Device at this time.

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<tr>
<td>Angel</td>
<td>+1</td>
<td>0</td>
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<td>0</td>
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r=1
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\[ E = \frac{(3)(4)}{(6)} \times (2) + (11)^2 - 4^3 = 61 \]

\[ e = __61 \]
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<td>88</td>
<td>78</td>
<td>83</td>
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(first letter of the animal with the most) = (# of them in the Big Yard)

Scene #5 Carnival -- Rio de Janeiro, Brazil

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\[
\begin{align*}
A &= l \cdot w \\
A &= \frac{b}{2} \\
A &= \frac{22 \cdot \pi^2}{7}
\end{align*}
\]

Area: 18 ft\(^2\)  
Area: 17.5 ft\(^2\)  
Area: 28.28 ft\(^2\)

<table>
<thead>
<tr>
<th>Choose the correct clue below the largest quilt</th>
</tr>
</thead>
<tbody>
<tr>
<td>c = 3</td>
</tr>
</tbody>
</table>

CRYPTIC PUZZLE SOLVER TEXT MESSAGE

Haha! Good one! #worldconquering device

S = A + M - E ÷ R + 1 - C + A

#PemdasOrElse

© 21st Century Math Projects
From Puzzle 1: m = 3
From Puzzle 2: r = -1
From Puzzle 3: e = 61
From Puzzle 4: α = 88
From Puzzle 5: c = 1
From Puzzle 6: s = 6

\[ S \cdot A + M - E \div R + 1 - 1 + A \]
\[ 6 \cdot 88 + 3 - 61 \div -1 - 1 - 1 + 88 = 680 \]