First Name & Last Initial _________________________________

Birthdate: _________________  Male □  Female □

Teacher _____________________  Period ________

This exercise will help us learn how you think about algebra. Please do your best to complete all the questions.

If you don’t know an answer, you may guess or write “I don’t know”. Please don’t leave any questions blank – we want to know how much you had time to try.

If you make a mistake, please lightly cross out the work, but do not erase it. You may not use a calculator.

Each section is timed. If you finish a section early, you may go ahead to the next section. You may not go back, even if you have extra time later. Once you finish a page, please move to the next page and do not look back.

Thank you for doing your best work on this exercise.
**Part I.** You have 15 minutes to solve the following 13 equations. Try to use fast (and correct) ways to solve the problems so you can finish as many as possible. *Show all your work.*

**Warm-up Section:**

A) \( x + 7 + 3 = 13 + 4 \)  
B) \( 2x + 1 = 21 \)

C) \( 2x = 16 \)  
D) \( \frac{1}{3} x = 5 \)

1) \( 3(h + 2) + 4(h + 2) = 35 \)

2) \( \frac{1}{2}(x + 1) = 10 \)
3) \[ 5(y - 4) = 3(y - 4) + 20 \]

4) \[ 3(2x + 3x - 4) + 5(2x + 3x - 4) = 48 \]

5) \[ 2(x + 3) + 5(x + 3) = 4(x + 3) \]
6) \[ \frac{3(m - 2)}{5} = \frac{33}{5} \]

7) \[ \frac{2}{3} (x + 1) + \frac{1}{3} (x + 1) = 10 \]

8) \[ 2(y + 1) + 4(2y - 3) = 6(y + 1) \]

9) \[ 2(x + 1) + 4 = 34 \]
Part II. You have 6 minutes to complete #10 and #11. Solve each equation in two DIFFERENT ways using algebra (do not use guess-and-check).

10a) \( 18 = 3(x + 2) \)

<table>
<thead>
<tr>
<th>Way 1</th>
<th>Way 2</th>
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<tbody>
<tr>
<td>( 18 = 3(x + 2) )</td>
<td>( 18 = 3(x + 2) )</td>
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10b) Which of your ways do you think is easiest and fastest?

___ Way 1
___ Way 2
___ None of my ways are easiest and fastest
11a) \[3(y + 1) = 4(y + 1) + 2(y + 1)\]

Way 1
\[3(y + 1) = 4(y + 1) + 2(y + 1)\]

Way 2
\[3(y + 1) = 4(y + 1) + 2(y + 1)\]

11b). Which of your ways do you think is easiest and fastest?

___ Way 1
___ Way 2
___ None of my ways are easiest and fastest
**Part III.**

12) Below is Jon’s solution to the equation $4(x + 1) + 3(x + 1) = 21$:

\[
\begin{align*}
4(x + 1) + 3(x + 1) &= 21 \\
4x + 4 + 3x + 3 &= 21 \\
7x + 7 &= 21 \\
7x &= 14 \\
x &= 2
\end{align*}
\]

Solve this same equation using a different way that is easier and faster than Jon’s way.

13) Below is Nora’s solution to the equation: $8(x - 1.4) = 3(x - 1.4) + 15$

\[
\begin{align*}
8(x - 1.4) &= 3(x - 1.4) + 15 \\
8x - 11.2 &= 3x - 4.2 + 15 \\
8x - 11.2 &= 3x + 10.8 \\
5x &= 22 \\
x &= 4.4
\end{align*}
\]

Solve this same equation using a different way that is easier and faster than Nora’s way.
For #14 & #15, decide whether each listed step COULD be done first. Circle YES if the step could be done first and NO if the step could NOT be done first.

14) \[2(x + 1) + 4 = 12\]
   Is it ok to combine like terms first?  YES  NO
   Is it ok to distribute across parentheses first?  YES  NO
   Is it ok to subtract the same quantity on both sides first?  YES  NO
   Is it ok to divide by the same quantity on both sides first?  YES  NO

15) \[15(x + 3) + 5(x + 3) = 10(x + 3) + 20\]
   Is it ok to combine like terms first?  YES  NO
   Is it ok to distribute across parentheses first?  YES  NO
   Is it ok to subtract the same quantity on both sides first?  YES  NO
   Is it ok to divide by the same quantity on both sides first?  YES  NO
For #16 & #17, the first step a student used to solve the equation is shown.

16) Adam’s first step:
\[
2(s + 3(s - 1)) = 18 \\
\therefore s + 3(s - 1) = 9
\]

a. What step did Adam use to get from the first line to the second line?
   a. Combine like terms
   b. Distribute across parentheses
   c. Add or Subtract the same quantity on both sides
   d. Multiply or Divide by the same quantity on both sides

b. Do you think this is a good way to start this problem? **Circle one:**
   (a) Very good way       (b) OK, but not a very good way       (c) Not OK

   **Explain your reasoning.**

17) Amy’s first step:
\[
5(x + 3) + 6 = 5(x + 3) + 2x \\
6 = 2x
\]

a. What step did Amy use to get from the first line to the second line?
   a. Distribute across parentheses
   b. Subtract the same quantity on both sides
   c. Divide by the same quantity on both sides
   d. Multiply by the same quantity on both sides

b. Do you think this is a good way to start this problem? **Circle one:**
   (a) Very good way       (b) OK, but not a very good way       (c) Not OK

   **Explain your reasoning.**
Part IV

18) What does the equal sign (=) mean?

19) Which of these is equivalent to (the same as) 
   \((m + 2) + (m + 2) + (m + 2) + (m + 2)\)? Circle your answer.
   
   a. \(m + 8\)  
   b. \(4m + 2\)  
   c. \(m^4 + 8\)  
   d. \(4(m + 2)\)  
   e. none of the above

20) Which of the following is a like term to (could be combined with) \(8k\)?
   
   a. \(4k\)  
   b. \(8\)  
   c. \(8m\)  
   d. \(3(k + 1)\)  
   e. a and c

21) Which of the following is a like term to (could be combined with) 
   \(7(j + 4)\)?
   
   a. \(7(j + 10)\)  
   b. \(7(p + 4)\)  
   c. \(j\)  
   d. \(2(j + 4)\)  
   e. a and d

22) Without solving each equation, which of the following equations are NOT equivalent to 
   (will NOT have the same answer as) the equation: \(x + 25 = 90\):
   
   a. \(x + 25 + 14 = 90 + 14\)  
   b. \(2x + 50 = 180\)  
   c. \(10x + 25 = 900\)  
   d. all of the equations are equivalent
23) Look at this pair of equations. *Without solving the equations, decide if these equations are equivalent (have the same answer).*

\[
34 = 8(x + 1) + 6(x + 1) \\
34 = 14(x + 1)
\]

a. YES (same answer)
b. NO (different answer)
c. CAN’T TELL without doing the math

24) Look at this pair of equations. *Without solving the equations, decide if these equations are equivalent (have the same answer) and explain your reasoning.*

\[
98 = 21x \\
98 + 2(x + 1) = 21x + 2(x + 1)
\]

a. YES (same answer)
b. NO (different answer)
c. CAN’T TELL without doing the math

**Explain your reasoning to #24:**

25) If these two equations are equivalent:

\[
x + 4 = 12 \\
x + 4 + 3 = 12 + y
\]

Then, what is the value of \( y \)?

(a) 0
(b) 3
(c) 4
(d) 8
(e) Can’t tell
26) If \(3x + y = 6\), what is the value of \(6x + 2y\)?

(a) 6  
(b) 8  
(c) 12  
(d) 16  
(e) Can’t tell

27) Without figuring out the solution, which of the following equations are equivalent to (have the same solution as) \(x + 37 = 150\)?

**CIRCLE ALL THAT APPLY**

(a) \(x + 37 + 20 = 150 + 20\)  
(b) \(x = 37 + 150\)  
(c) \(x + 37 - 10 = 150 + 10\)  
(d) \(x + 37 - 2x = 150 - 2x\)

28) To find the area of a rectangle, you multiply the base times the height. So in this picture, the formula for the area would be \(b \times h\).

\[
\begin{array}{c}
\text{h} \\
\text{b}
\end{array}
\]

Now, look at this rectangle. What would the formula be for the area of this rectangle?

\[
\begin{array}{c}
\text{h} \\
\text{a} \quad \text{m}
\end{array}
\]

ANSWER: __________________

29. Circle the **BEST** definition of the equal sign:

(a) “the total”  
(b) “two quantities are the same”  
(c) “what the answer is”  
(d) “that the problem has been solved”