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 use a calculator until you get to p. 11.

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 and II.** You have 18 minutes to complete the following 14 problems.

Simplify each expression by using the Distributive Property:

A) \(3(x + 4)\)  
B) \(2(5x - 4)\)

Solve each equation:

C) \(2x + 4 = 10\)  
D) \(3x - 7 = 11\)

E) Find the value of the following equation when \(x = 2\).
\(3 + 4(x + 1)\)
Part II. Try to use fast (and correct) ways to solve the problems so you can finish as many as possible. Show all your work.

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

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

3) \[5(y - 3) = 20\]
4) \[3(2x + 3x - 4) + 5(2x + 3x - 4) = 48\]

5) \[\frac{2}{3}(m - 1) = 2\]

6) \[\frac{3(m - 2)}{5} = \frac{33}{5}\]
7) \[ \frac{2}{3}(x + 1) + \frac{1}{3}(x + 1) = 10 \]

8) \[ 5(3x + 2) = 40 \]

9) \[ 2(x + 1) + 4 = 34 \]
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) \[ 18 = 3(x + 2) \]

**Way 1**
\[ 18 = 3(x + 2) \]

**Way 2**
\[ 18 = 3(x + 2) \]

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) \(4(y + 1) + 2(y + 1) = 24\)

Way 1
\[4(y + 1) + 2(y + 1) = 24\]

Way 2
\[4(y + 1) + 2(y + 1) = 24\]

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 IV.

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

\[
4(x + 1) + 3(x + 1) = 21 \\
4x + 4 + 3x + 3 = 21 \\
7x + 7 = 21 \\
7x = 14 \\
x = 2
\]

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: \( \frac{1}{3} (x - 4) = 5 \)

\[
\frac{1}{3} (x - 4) = 5 \\
\frac{1}{3} x - \frac{4}{3} = 5 \\
\frac{1}{3} x = \frac{19}{3} \\
x = 19
\]

Solve this same equation using a different way that is easier and faster than Nora’s way.
For #14 and #15, the first step a student used to solve the equation is shown.

14) Adam’s first step:

\[ 2(s + 3(s – 1)) = 18 \]

\[ s + 3(s – 1) = 9 \]

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.

15) Amy’s first step:

\[ 5(x + 3) + 2(x + 3) = 21 \]

\[ 7(x + 3) = 21 \]

a. What step did Amy 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.
Part V. Circle the best response to each multiple choice question. You may not use a calculator on this section.

16) Is the equation $3(2x - 4) = 18$ equivalent to $6x - 12 = 18$?

a. YES, the equations are equivalent by the Associative Property of Multiplication.

b. YES, the equations are equivalent by the Commutative Property of Multiplication.

c. YES, the equations are equivalent by the Distributive Property of Multiplication over Addition.

d. NO, the equations are not equivalent.

17) Which equation below shows the distributive property?

a. $4(3 + 6) = 12 + 24$

b. $(4 + 3) + 6 = 6 + (4 + 3)$

c. $(12 + 4) + 0 = 12 + 4$

d. $12 + (4 + 6) = (12 + 4) + 6$

18) Which of the following is equivalent to the expression: $17(83 - 16)$

a. $17(83) - 16$

b. $(17 - 16)(83)$

c. $17(83) - 17(16)$

d. $(17 - 83) (17 - 16)$
19) 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”

20) 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

21) 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
22) Which of these expressions is equal to $2x - 3y + 7x + 5y$?

a. $5x + 2y$

b. $5x + 8y$

c. $9x + 2y$

d. $9x + 8y$

23) Look at this pair of equations. **Without solving the equations**, decide if these equations are equivalent (have the same answer).

\[
\begin{align*}
34 & = 8(x + 1) + 6(x + 1) \\
34 & = 14(x + 1)
\end{align*}
\]

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.

\[
\begin{align*}
98 & = 21x \\
98 + 2(x + 1) & = 21x + 2(x + 1)
\end{align*}
\]

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. I can’t tell

26) If \( x \) can be replaced by any number, then **when** is the expression \( 2x \) equal to \( x + x \)? Circle your answer.

   (a) Always       (b) Sometimes       (c) Never

27) If \( x \) can be replaced by any number, then **when** is the expression \( 2x \) equal to \( 2 + x \)? Circle your answer.

   (a) Always       (b) Sometimes       (c) Never