First Name & Last Initial _______________________________

Date _______________________________

Teacher _______________________________

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.

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 12 minutes to solve the following 8 equations. 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)  \[ 5(y - 4) = 3(y - 4) + 20 \]

4)  \[ \frac{3m - 2}{5} = \frac{7}{5} \]
5) \[3(2x + 3x - 4) + 5(2x + 3x - 4) = 48\]

6) \[2(x + 3) + 5(x + 3) = 4(x + 3)\]

7) A formula for the perimeter of a rectangle is \(P = 2(b + h)\), where \(b\) stands for the length of the base and \(h\) stands for the height. Solve the equation for \(h\) so you could find the height if you were given both the perimeter and the length of the base.

8) An exchange student wants to know the temperature in degrees Celsius (C), but in the U.S., we use degrees Farenheit (F). To help her, solve this formula for \(C\): \[F = \frac{9}{5}C + 32\]
Part II. You have 6 minutes to complete #7 and #8. Solve each equation 3 DIFFERENT ways using algebra (do not use guess-and-check).

7a) \(0.5(d + 3) = 10\)

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<tr>
<th>Way 1</th>
<th>Way 2</th>
<th>Way 3</th>
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<td>(0.5(d + 3) = 10)</td>
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7b) Which of your ways do you think is easiest and fastest?

___ Way 1 ___ Way 2 ___ Way 3 ___ No way is easiest
8a) \(7(y + 1) = 4(y + 1) + 6(y + 1)\)

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8b). Which of your ways do you think is easiest and fastest?

___ Way 1  ___ Way 2  ___ Way 3  ___ No way is easiest & fastest

STOP. Wait for directions as a class.
Mental Math

Practice: ________________________________

a) ________________________________

b) ________________________________
**Part III.** You have 10 minutes to complete #9 – #16.

For #9 & 10, 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.

9) \[2(x + 1) + 4 = 12\]

- 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**

10) \[15(x + 3) + 5(x + 3) = 10(x + 3) + 20\]

- 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 # 11 & 12, the first step a student used to solve the equation is shown.

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

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. Subtract the same quantity on both sides
   d. 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

   c. For which of these equations would it be good to use Adam’s way to start the problem?
      a. \(4(y + 3) = 11\)
      b. \(4(y + 6) = 32\)
      c. \(5(x + 2) + 7 = 20\)
      d. none of the above
12) 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**

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

c. For which of these equations would it be good to use Amy’s way to start the problem?
   a. \[ 6(x + 4) + 20 = 8(x + 4) \]
   b. \[ 10x = 11(x + 1) \]
   c. \[ 15(y + 23) + 40 = 16(y + 30) \]
   d. none of the above
13) 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

14) Which of the following is a like term to (could be combined with) 8\(k\)?

   a. 4\(k\)
   b. 8
   c. 8\(m\)
   d. 3\((k + 1)\)
   e. a and c

15) 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

16) **Without solving each equation**, which of the following equations are equivalent to (will have the same answer as) the equation: 32\((x - 12) = 96\)

   a. 32\(x - 12 = 96\)
   b. \(x - 12 = 96 - 32\)
   c. 16\(x - 16\times12 = 48\)
   d. 16\(x - 6 = 48\)
   e. \(\frac{32(x - 12)}{32} = \frac{96}{32}\)
   f. c & e
17) 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

<note, choice on this combine like term item has one of highest intra-item correlations, although explanation quality does not>

18) 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:*