Jakarta International School

7th Grade

Practice Test - Black

Simplifying Expressions and Solving Basic Equations

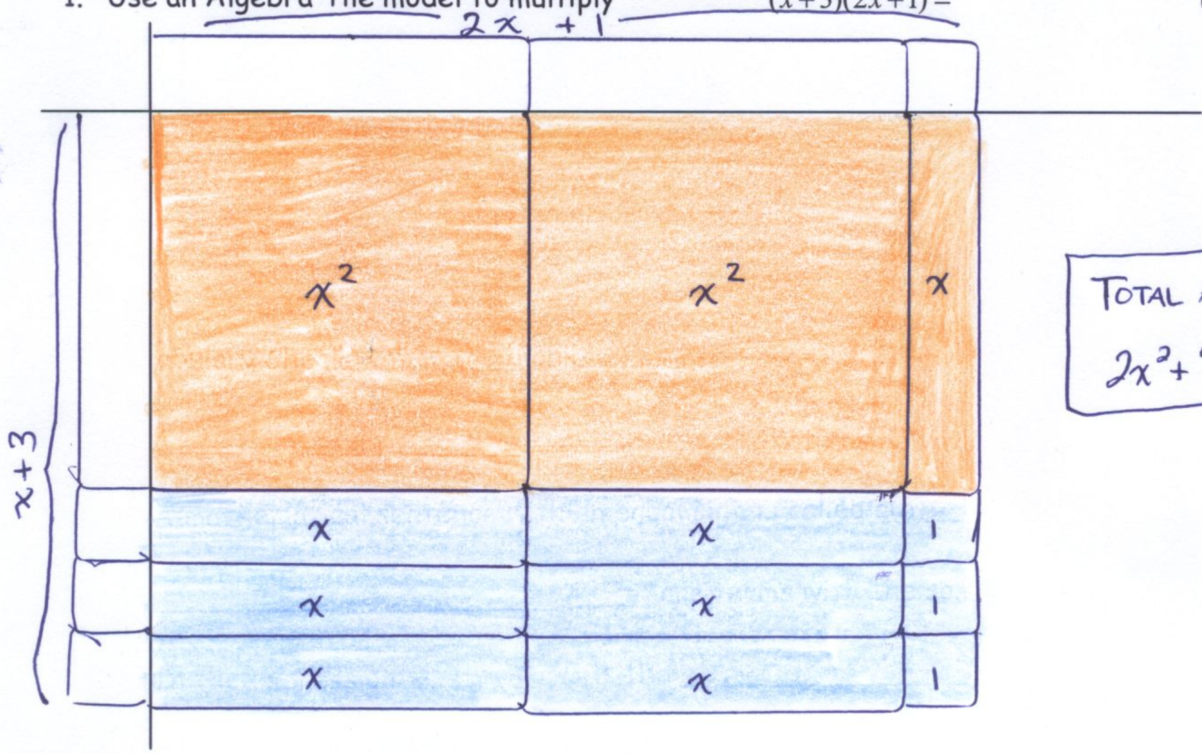
Name: SOLUTIONS

Date: ______________

Score: $\frac{42}{42}$

Clearly show required work. Check Carefully!

1. Use an Algebra Tile model to multiply $(x+3)(2x+1) =$ (1 point)



TOTAL AREA = $2x^2+7x+3$

2. Now, use the Distributive Property to multiply $(x+3)(2x+1) =$ (1 point)

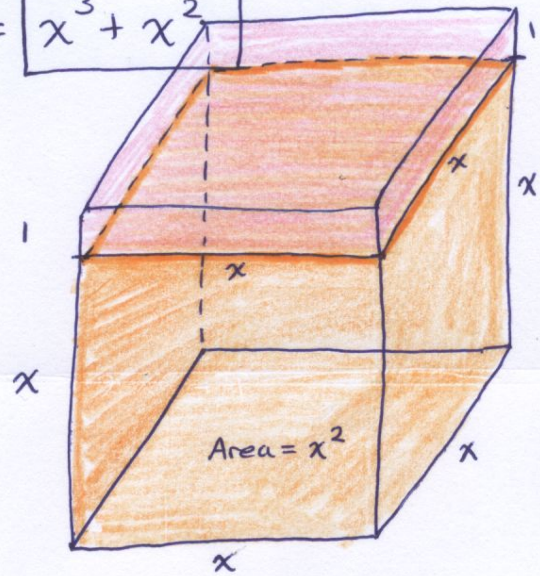
$$(x+3)(2x+1) = x(2x+1) + 3(2x+1)$$
$$= 2x^2 + 1x + 6x + 3 = \boxed{2x^2+7x+3}$$

3. How would you explain to a 6th grader why the distributive property works (in problem like number 3) using the Algebra Tile model (in problem a like number 2)? (1 point)

First, I would show that $x(2x+1)$ is represented by the orange shaded area. Then, I'd show that $3(2x+1)$ is represented by the blue shaded area. If I use the distributive property and then simplify, I get the same answer as when I combine the blue and orange areas together.

4. Simplify $x^2(x+1)$ using the distributive property. Then, draw a geometric interpretation of the result. (hint: the volume of a cube can be computed by multiplying the area of its base by its height) (2 points)

$x^2(x+1) = \boxed{x^3 + x^2}$



Bottom Volume = $x \cdot x \cdot x = x^3$

Top Volume = $x \cdot x \cdot 1 = x^2$

$\boxed{\text{TOTAL VOLUME} = x^3 + x^2}$

5. Vocabulary Check. Fill in the blank. ($\frac{1}{2}$ point per blank = 3 points)

a) A CONSTANT is a term that has no variable.

b) A mathematical sentence with an equal sign is called a(n) EQUATION.

c) LIKE TERMS are terms with the same variables.

d) In the expression: $3x - y + 16$, 3 is the COEFFICIENT of x.

e) Operations that undo each other are called INVERSE OPERATIONS.

f) Any value or values that make an equation true is called the SOLUTION of the equation.

6. Simplify each expression. Write your answer in its simplest form:

(2 points per expression = 4 points)

a. $3b + 6\{4 - 2[b - (7 + b)]\}$

$3b + 6[4 - 2[b - 7 - b]]$

$3b + 6[4 - 2b + 14 + 2b]$

$3b + 24 - 12b + 84 + 12b$

$\boxed{3b + 108}$

b. $(x+5)(x^2 - 3x + 4)$

$x^3 - 3x^2 + 4x + 5x^2 - 15x + 20$

$\boxed{x^3 + 2x^2 - 11x + 20}$

7. Write the following equation in function form. Then, find at least 4 coordinate pairs that make the equation true. Last, graph the solutions on a coordinate plane.

(3 points)

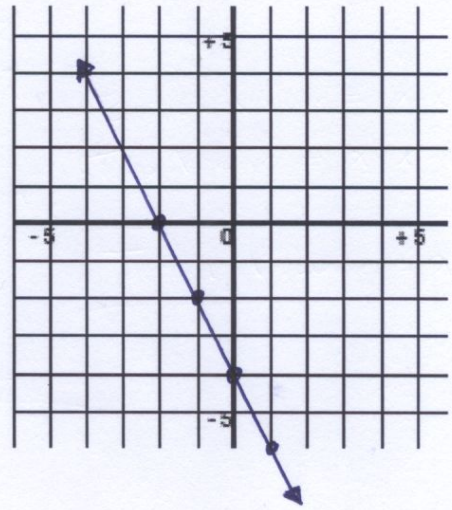
$6x+3y=-12$ ($-6x$ on both sides)

$3y=-6x-12$

$\frac{3y}{3}=\frac{-6x}{3}-\frac{12}{3}$

$\boxed{y=-2x-4}$

x	y
-2	0
0	-4
1	-6
2	-8
-1	-2



8. Explain why it's not possible to solve the following equation using the Backtracking method. (1 point)

$x^2-2x=-1$

To use backtracking, x must only appear in 1 term. Since x^2 and $-2x$ are not like terms, we cannot simplify. Therefore, x will appear in 2 terms, and consequently, we cannot use Backtracking to solve this equation.

9. Solve the following equations for x *using Inverse Operations*. Check your solution. (3 points each: 1 point for correct work, 1 point for correct answer, 1 point for correct check step)

(3 points each: 1 point for correct work, 1 point for correct answer, 1 point for correct check step)

a. $2x+3(x+7)=2x+3$

$2x+3x+21=2x+3$

$5x+21=2x+3$

$5x-2x+21-21=2x-2x+3-21$

$\frac{3x}{3}=\frac{-18}{3}$

$\boxed{x=-6}$

Check: $2(-6)+3(-6+7)\overset{?}{=}2(-6)+3$

$-12+3=-12+3$

$-9=-9$ ✓

b. $2x+h=6z-3h$

$2x+h-h=6z-3h-h$

$\frac{2x}{2}=\frac{6z}{2}-\frac{4h}{2}$

$\boxed{x=3z-2h}$

Check:

$2(3z-2h)+h\overset{?}{=}6z-3h$

$6z-4h+h=6z-3h$

$6z-3h=6z-3h$ ✓

10. For each word problem, define a variable, write an equation, solve the equation using inverse operations, and check your answer to make sure it makes sense.

(4 points each: 1 point for correct variable, 1 point for correct equation, 1 point for correct work/answer, 1 point for correct check step)

a. Ji Won bought 5 cartons of milk and received Rp. 20,000 in change. If he gave Rp. 100,000 to the shop keeper, work out the cost of each carton of milk.

* Let x = the cost of each milk carton

* $100{,}000 - 5x = 20{,}000$

OR

$20{,}000 + 5x = 100{,}000$

$20{,}000 + 5x - 20{,}000 = 100{,}000 - 20{,}000$

$\frac{5x}{5} = \frac{80{,}000}{5}$

* $\boxed{x = 16{,}000 \text{ Rupiah}}$

* check $100{,}000 - 5(16{,}000) \overset{?}{=} 20{,}000$

$20{,}000 = 20{,}000$ ✓

b. J and K start from 1,000 km apart and approach each other at constant, but different rates. It takes 25 hours for them to meet. If J goes 20 km/h faster than K, how fast does each one travel?

* Let x = the rate K moves

$x + 20$ = the rate J moves

* $D = rt$ so...

$1000 = \underbrace{[x + (x+20)]}_{R}\,\underline{25}$

$D = R \cdot T$

$1000 = 25(2x + 20)$

$1000 = 50x + 500$

$500 = 50x$

$10 = x$

* So $\boxed{\text{K travels 10 km/hr and J travels 30 km/hr}}$

* Check: $1000 \overset{?}{=} 40 \cdot 25$

$1000 = 1000$ ✓

c. Eva and her sister Aurora are both college students, but at different schools. They've both been working very hard, and their mother wants to give them each a weekend away from school to relax and have fun. There is a nice resort which is located 22 miles closer to Aurora's campus than it is to Eva's. Their mother makes a reservation for the two girls.

On Friday afternoon, Eva meant to leave school at noon to drive to the resort, but she is late getting started and doesn't leave until 2 PM. She takes a lot of back roads and averages 40 miles per hour on her trip. Aurora leaves her campus at 3 PM. Much of her route follows Highway 19, which has a speed limit of 65 miles per hour, and Aurora winds up averaging 55 miles per hour for her trip.

If they both arrived at the resort at the same time, what time would it have been?

Let d = distance travelled by Eva and t = time taken by Eva

$d - 22$ = distance travelled by Aurora and $t - 1$ = time taken by Aurora.

$R = \frac{d}{t}$ for Aurora $\frac{d-22}{t-1} = 55$

From Eva, we know $d = 40t$

So, we can substitute $40t$ into Aurora's Equation. $\frac{40t - 22}{t - 1} = 55$

multiplying both sides by $t-1$ gives

$40t - 22 = 55(t-1)$

Solving for t gives

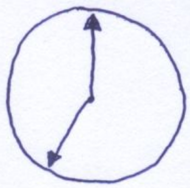
$40t - 22 = 55t - 55$

$33 = 15t$

$\boxed{2 \text{ hours } 12 \text{ minutes} = t}$

So they arrive at 4:12 p.m.

d. At exactly what time between 7:00 and 8:00 will the minute hand of a clock be directly over the hour hand? * let t = the time it takes for the second hand to catch the hour hand.



$D = 35$ minutes

$r = 60 - 5 = 55$ minutes/hr

$D = rt$

$35 = 55t$

$\frac{35}{55} = t$

$\frac{7}{11} = t$

$\frac{7}{11}$ hours $= t$

$\frac{7}{11} \cdot 60 = \frac{420}{11}$ minutes $= t$

$38 \frac{2}{11}$ minutes.

The minute hand will be directly over the hour hand at 7:38 and $\frac{2}{11}$ minutes.

e. As I was driving down the highway on my recent trip to Bandung, I happened to look down at my odometer. You can imagine my excitement when I discovered that the reading was 45954, a palindrome! Continuing on my journey, watching the sights and trying to think of an interesting problem to pose for this week, I was careful to stay within the posted speed limit.

After two hours of driving I knew I had the perfect problem when I glanced down at my odometer to see yet another palindrome!

i. How many miles had I traveled in the two-hour period?

The next palindrome is 46064. So, distance = $46064 - 45954 = \boxed{110 \text{ miles}}$.

ii. What was my average speed for the two hours?

$D = rt$ $\quad D = 110$ miles, $t = 2$ hours

so

$\frac{110}{2} = \frac{2r}{2}$

$\boxed{55 \text{ miles/hr} = r}$