

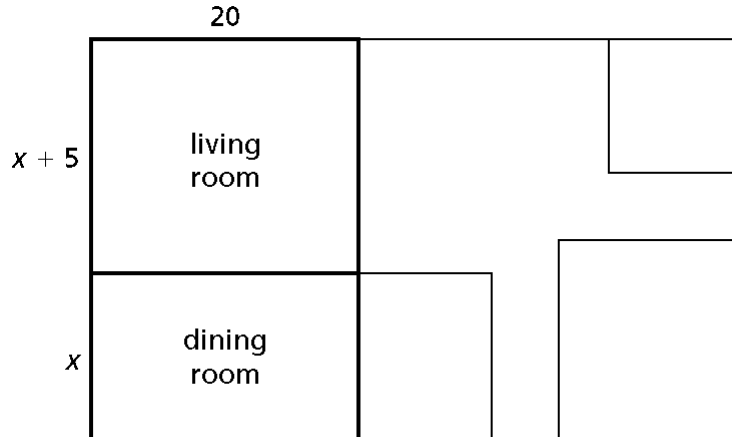
HARD WORK = TALENT

SIWS Investigations 1 and 2 extra practice problems (Mazzeo 2011)

Short Answer

1. Decide whether $2x + 8 + 4$ and $2(x + 4) + 4$ are equivalent expressions. Explain how you know.
2. Find an equivalent expression for parts (a) and (b).

a. $2x + 10x$
b. $2(x - 4) + x$
3. Michael is designing a garden. He wrote $A = 8x^2 + \frac{\pi x^2}{2}$ to represent the area of his garden. Based on Michael's equation make a sketch of what you think his garden looks like. Explain your reasoning.
4. The Morales family is remodeling their home. The wall between the living room and dining room is going to be removed to make one big living space. Write two equivalent expressions for the area of the new living space.



5. Three of the following expressions are equivalent. Choose the expression that is not equivalent to the others and explain how you can tell, without using a calculator, that it is not equivalent.

A. $8x - 12x + 4$
B. $12x - 16x + 4$
C. $4 - 4x$
D. $4(1 - 4x)$
6. Write an expression equivalent to each of these expressions.

a. $(15 - 4x) - (10 - x)$
b. $3(10 + x) - (30 + 3x)$

7. Explain how you can tell, without using a calculator, that these expressions are not equivalent.

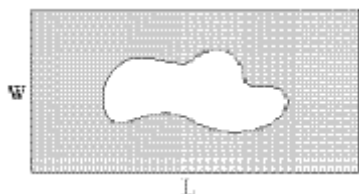
$$5 - 4x^2$$

$$4x^2 - 5$$

$$4x(x - 5)$$

8. What does it mean to say that two algebraic expressions are *equivalent*?

The rectangle below has length L and width W .



9. Write two equations for the perimeter, P , of the rectangle.
10. Suppose the length of the rectangle is equal to twice the width, or $2W$.
- If the width of the rectangle is 1.5, what is the length?
 - If the width is 2, what is the perimeter?
 - Write two equations for the perimeter of the rectangle, P , in terms of only the width, W .
11. If $L = 14$ meters and $W = 6.5$ meters, what is the area of the shaded region inside the rectangle if the area of the blob is 38 square meters? Show how you found your answer.
12. Write an equation for the area, A , of the shaded region inside the rectangle if the area of the blob is Q .
13. For each pair of expressions, show that they are equivalent by drawing a rectangle divided into four sections. Label the sections to support your argument.
- 32×47 and $1200 + 80 + 210 + 14$
 - 3.2×4.7 and $12 + 0.8 + 2.1 + 0.14$
 - $(3 + x)(4 + y)$ and $12 + 4x + 3y + xy$

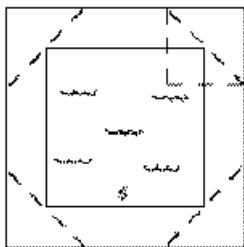
14. All the expressions below contain the same string of symbols. Only the placement of the parentheses varies. Which, if any, of the expressions are equivalent?

- a. $6 + 3x + 8 - 4x + 4$
- b. $6 + 3(x + 8) - 4x + 4$
- c. $(6 + 3x) + 8 - 4x + 4$
- d. $6 + 3x + 8 - 4(x + 4)$

15. Use the distributive and commutative properties to determine whether the following statements are equal for all values of x .

- a. $3(x + 1) + x$ and $4x + 1$
- b. $6x$ and $(12x - 4x) - 2x$
- c. $6x$ and $12x - (4x - 2x)$
- d. $7x + 5x + 1$ and $12x + 1$

16. Dave made the following sketch, which includes four right isosceles triangles and four trapezoids for the number of tiles around the pool in Problem 1.1.

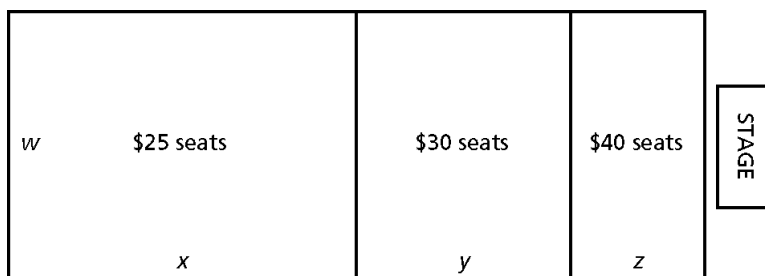


- a. Write an equation relating the number of tiles, N , to the length of the side, s , that Dave might have used to represent his sketch and his thinking about the Tiling Pools problem.
- b. Check to see if your equation is equivalent to the ones that you found in Problem 1.1.

17. Write each of the following expressions in two different but equivalent forms. Be prepared to explain why the new forms are equivalent to those that are given.

- a. $7x(3 - 9x)$
- b. $15x + 8x^2$
- c. $(5x^2 - 9x + 7) + 4x(3 + 5x)$
- d. $(450 - 8a + 7b) - 3(5a - 2b)$
- e. $(2x + 3)(5x - 7)$

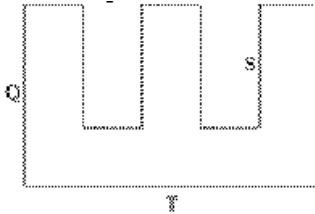
18. Suppose that concert seating is usually arranged in three sections as shown. Specific dimensions of the sections vary depending on the space available at each concert site.



- a. Write two equivalent equations showing the area of the entire seating area, A .
 - i. In one equation, show how A depends on the areas of the three seating sections.
 - ii. In the other equation, write an equivalent expression that requires fewer calculations to find A .
- b. Seating is arranged to allow one square meter of space for every 2 people. Write two equivalent equations that show the number of seats, S , in terms of w , x , y and z .
 - i. In one equation, show how S depends on the number of seats in the separate sections.
 - ii. In the other equation, write an expression that requires fewer calculations to find S .

19. The Metropolis Middle School volleyball team is operating the concession stand at school basketball games to help raise money for new uniforms. The profit in dollars, P , from operating the stand is given by the equation $P = N - 0.5(\frac{N}{5} + 300)$, where N is the total number of items sold.
- How much money will the volleyball team raise if they sell 400 items?
 - How much money will the volleyball team raise if they sell 550 items?
 - If the team needs to raise \$1000 for new uniforms, will they have to sell more than or fewer than 1000 items? Explain your reasoning.
 - Write another equation for P .

20. Refer to the figure below to answer a–d.



- If $Q = 4$ m, $S = 3$ m, and $T = 7$ m, what is the perimeter of the figure?
- If $Q = 3$ m, $S = 2.5$ m, and $T = 4$ m, what is the perimeter of the figure?
- Using the variables Q , S , and T , write three equations for the perimeter, P , of the figure.
- Using the values from part a, find the perimeter of the figure using each of your equations. Check or revise your equations if you do not get the same perimeter in each case.
- Show that your three expressions for the perimeter are equivalent.

21. At Metropolis Middle School, the number of cans, N , collected for recycling after a basketball game depends on the number of people, P , who attend the game. The approximate relationship is given by $N = 2.5(P - 40) - 100$.
- Is the relationship between the number of cans collected and the number of people attending linear or quadratic? Explain.
 - If 400 people attended the game for the semifinals of the district championship, how many cans would you expect to be collected?
 - If 300 cans were collected at a game, how many people would you expect to have attended the game?
 - If 675 cans were collected at another game, how many people would you expect to have attended that game?
22. The cost, C , of each uniform for the players on an N -person basketball team is given by the equation $C = \frac{(40N + 260)}{N}$.
- If there are 25 players on the team, what is the cost of each uniform?
 - If the cost of each uniform is \$53, how many players are on the basketball team?
 - If the cost of each uniform is \$56.25, how many players are on the basketball team?

Multiple Choice

Identify the choice that best completes the statement or answers the question. Write your answer on the line provided using capital letters and circle it as well.

- _____ 23. Which equation is *not* equivalent to $W = 1500 - 150T$?
- | | |
|---------------------------|---------------------|
| A. $15(100 - 10T)$ | C. $1500(1 - 150T)$ |
| B. $125 + 1375 - 10(15T)$ | D. $10(150 - 15T)$ |
- _____ 24. Which of the following expressions is equivalent to $3(x + 4) - 6 + 5x$?
- | | |
|------------------|-------------|
| A. $3x + 12 - x$ | C. $8x - 2$ |
| B. $8x + 6$ | D. $2x + 6$ |

Simplify the expression.

- _____ 25. $\frac{3}{4}(-8m + 12)$
A. $-24m + 9$ C. $-6m + 12$
B. $-6m + 9$ D. $-6m + 36$
- _____ 26. Suppose $3x$ represents an even integer. What polynomial represents the product of $3x$, the *even* integer that comes just before $3x$, and the *even* integer that comes just after $3x$?
A. $27x^3 - 12x$ B. $27x^3 + 12x$ C. $27x^3 - 3x$ D. $3x^3 - 12x$
- _____ 27. The base of a triangle is $(8t - 16)$ centimeters. The height of the triangle is $(4t + 8)$ centimeters. Find the area of the triangle.
A. $(32t^2 - 128t - 64) \text{ cm}^2$ C. $(32t^2 + 64) \text{ cm}^2$
B. $(16t^2 + 16t - 64) \text{ cm}^2$ D. $(16t^2 - 64) \text{ cm}^2$

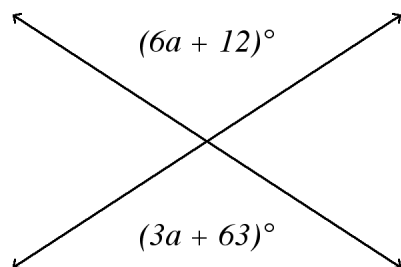
Simplify the expression.

- _____ 28. $-4 - 6(c + 10)$
A. $56 - 6c$ B. $6 - 10c$ C. $-64 - 6c$ D. $-14 - 10c$

Solve the equation.

- _____ 29. $7d - 4d + 6d + 8 = 4d$
A. $-\frac{8}{7}$ B. -9 C. $-\frac{8}{5}$ D. $-\frac{8}{13}$

- _____ 30. **a.** Find the value of a .
b. Find the value of the marked angles.



- not drawn to scale
- A. 21; 138° B. 16; 108° C. 19; 126° D. 17; 114°

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Answer Section

SHORT ANSWER

1. No; They are not equivalent. Students may make a graph or table to show that the values for each expression are not the same. If they use a graph they will graph 2 parallel lines. Using the distributive property students may notice that the first equation is $2x + 8$ while the second equation is $2x + 8 + 4$ or $2x + 12$.

2. **a.** $x(10 + 2)$ or $12x$. **b.** $2x - 8 + x$ or $3x - 8$

3. Some possible sketches:

Students probably will have a rectangular piece of the garden, which is represented by $8x^2$. The dimensions of the rectangular piece are ax by bx where a times b is 8. Students will also have a

section of the garden that is a half circle, which is represented by $\frac{\pi x^2}{2}$. However students may break the rectangle of the half circle up into different shapes. For example the student could have 2 squares which are $2x$ on a side and two quarter circles.

4. The area, if you see this as two parts, is $20x + 20(x + 5)$ or, as one room, $20(x + x + 5) = 20(2x + 5)$ or $40x + 100$
5. D. The 4 was not distributed to the negative $4x$ inside the parentheses. A, B, C are all equivalent to the expression $-4x + 4$ whereas D is equivalent to the expression $-16x + 4$.

From tables of values, it can be seen that D is not equivalent to the others. Since these are all linear expressions students may plug in a point (or possibly two points) in order to find the expression, which is not equivalent to the others.

6. Answers may vary. Some possibilities are:

a. $(15 - 4x) - (10 - x) = 15 - 4x - 10 + x = 5 - 3x$

b. $3(10 + x) - (30 + 3x) = 30 + 3x - 30 - 3x = 3(10 + x - 10 - x) = 0$

7. $y = 5 - 4x^2$

$$y = 4x^2 - 5$$

$$y = 4x(x - 5)$$

The first two expressions are not equivalent; the “5” is positive in the first and negative in the second. In fact all the signs of the terms in the second are opposite from those in the first. If the third expression is expanded, using the distributive property, it would be $4x^2 - 20x$, which is not equivalent to the other two expressions.

8. Equivalent expressions give the same value for any given values of the variables involved.

9. $P = 2L + 2W$ and $P = 2(L + W)$

10. **a.** $L = 2W = 2(1.5) = 3$

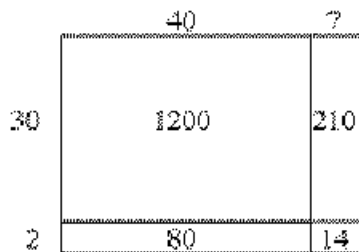
b. $P = 2L + 2W = 2(4) + 2(2) = 12$

c. $P = 2(2W) + 2W$ and $P = 6W$

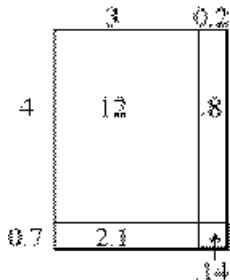
11. $14(6.5) - 38 = 53 \text{ m}^2$

12. $A = WL - Q$

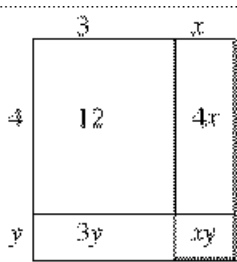
13. **a.** 32×47 and $1200 + 80 + 210 + 14$



- b.** 3.2×4.7 and $12 + 0.8 + 2.1 + 0.14$



- c.** $(3 + x)(4 + y)$ and $12 + 4x + 3y + xy$



14. The expression **a.** $6 + 3x + 8 - 4x + 4$ is equivalent to $18 - x$.

The expression **b.** $6 + 3(x + 8) - 4x + 4$ is equivalent to $34 - x$.

The expression **c.** $(6 + 3x) + 8 - 4x + 4$ is equivalent to $18 - x$.

The expression **d.** $6 + 3x + 8 - 4(x + 4)$ is equivalent to $-2 - x$; So expressions *a* and *c* are equivalent

15. **a.** No; The expressions $3(x + 1) + x$ and $4x + 1$ are not equivalent: $4x + 3$ and $4x + 1$

b. Yes; The expressions $6x$ and $(12x - 4x) - 2x$ are equivalent.

c. No; The expressions $6x$ and $12x - (4x - 2x)$ not equivalent: $6x$ and $10x$

d. Yes; The expressions $7x + 5x + 1$ and $12x + 1$ are equivalent.

16. a. The sketch contains 4 trapezoids each having bases of s and $s - 2$ and 4 triangles having a base and height of 2. So Dave's expression is $4\left(\frac{s + (s - 2)}{2}\right) + 4\left(\frac{4}{2}\right)$.

b. This expression does simplify to $4s + 4$ however students may need help with simplifying. You may suggest for students to write out the repeated additions involving fractions.

17. a. $21x - 63x^2$ or $21x(1 - 3x)$

b. $x(15 + 8x)$ or $8x^2 + 15x$

c. $5x^2 - 9x + 7 + 12x + 20x^2$ or $25x^2 + 3x + 7$

d. $450 - 8a + 7b - 15a + 6b$ or $-23a + 13b + 450$

e. $10x^2 - 14x + 15x - 21$ or $10x^2 + x - 21$

18. a. i. $A = wx + wy + wz$

ii. $A = w(x + y + z)$

b. i. $S = 2wx + 2wy + 2wz$

ii. $S = 2w(x + y + z)$

c. $A = 4(1.5w) + 2(1.5x) + 2(1.5y) + 2(1.5z) + 8(1.5)^2 = 6w + 3x + 3y + 3z + 18$

Students who don't consider the 8 corner squares where the boards covering the aisles meet will omit $8(1.5)^2$ in computing the area.

19. a. \$210

b. \$345

c. Possible answers: They will need to sell more than 1000 items because the equation shows that P is N minus a number. Or, they must sell 1278 items to make a profit of at least \$1000.

d. Possible answer: $P = 0.9N - 150$.

20. a. $2(4) + 4(3) + 2(7) = 34$ m

b. $2(3) + 4(2.5) + 2(4) = 24$ m

c. Possible answer: $P = 2Q + 4S + 2T$, $P = 2(Q + T) + 4S$, and $P = 2(Q + T + 2S)$

d. Answers will vary.

e. $P = 2(Q + T) + 4S = 2Q + 2T + 4S = 2Q + 4S + 2T$

$P = 2(Q + T + 2S) = 2Q + 2T + 4S = 2Q + 4S + 2T$

21. **a.** linear; It can be simplified to $N = 2.5P - 200$, which is a linear equation of the form $y = mx + b$.
b. 800 cans
c. 200 people
d. 350 people
22. **a.** \$50.40
b. 20 players
c. 16 players

MULTIPLE CHOICE

23. C
24. B
25. B
26. A
27. D
28. C
29. C
30. D