unit a

algebra

4.1 Evaluating Expressions

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1. Evaluate the following for $x = -3$ and $y = 4$. Show your substitution and remember to follow the rules of order of operations (BEDMAS)!

a) $x + y =$ _____

b) $5x - 2y =$ _____

c) $y - 5x =$ _____

d) $xy - x =$ _____

e) $x^2 + 7 =$ _____

f) $3x^2 - 4 =$ _____

g) $x + y - (x - y) =$ _____

h) $-2(x + 2y) =$ _____

i) $\dfrac{y^2}{8} + x^2 =$ _____

j) $\dfrac{y+x}{y-x}+\dfrac{3}{4}=$ _____

k) $\dfrac{8}{5}\div\dfrac{3y}{10}=$ _____

l) $\dfrac{5}{6}x+\dfrac{1}{8}y=$ _____

m) $x^3+y^3=$ _____

n) $(x+y-2)^{99}=$ _____

o) $6-2(x+3y)=$ _____

2. Given the relation $y=5-x$, complete the table below:

y					1	12	-6	-2.5
x	0	2	-3	0.5				

3. The formula for converting degrees Celsius (C) to degrees Fahrenheit (F) is:

$$F = \frac{9}{5}C + 32$$

a) What would 30 degrees Celsius be?   b) What would 10 degrees Celsius be?

4. The formula for height above ground (h) of a watermelon dropped off the top of a 200m building is approximated by $h = 200 - 5t^2$, where t is measured in seconds.

a) How high will the watermelon be after 2 seconds?

b) When will the watermelon hit the ground (h = 0) and splatter all over? Justify your answer.

5. Explore the following conjectures by trying numbers of your own. Decide whether the statements are true or false. Show your evidence. (Don't use zero)

a) $x + y = y + x$

b) $x - y = y - x$

c) $a(x + y) = ax + ay$

d) $a(x - y) = ax - ay$

e) $3x - 2x + 4x = 5x$

f) $\dfrac{a + b}{b} = a$

g) $a(bc) = ab + ac$

h) $(a + b)(a + b) = a^2 + b^2$

6. In international soccer, teams are awarded 3 points for a win, 1 point for a tie, and 0 points for a loss.

a) Complete the table below for the results below and rank the 4 teams.

Team	Wins	Ties	Losses	Points	
Italy	2	0	1		
Netherlands	3	0	0		
Turkey	1	2	0		
Romania	0	0	3		

1^{rst}_____   2nd_____   3rd_____   4th_____

b) Write a formula for how to calculate the total number of points. Use W (# of wins), T (# of ties) and L (# of losses).

c) Use this formula to answer the following question: A certain team played 4 games and didn't lose any, what are all the different possible point totals they could have?

d) How would the standings differ if each win were only worth 2 points (like in hockey)? Use the last column to investigate this.

4-2 Like Terms and the Distributive Property

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1. Simplify:

a) $3x + 4x$

b) $4w + 7w - 2w$

c) $-3\phi - 5\phi - (-2\phi)$

d) $4x^2 - 9x^2$

e) $6x + 4 - 2x + 8$

f) $3y + 2q + 4y - 7q$

g) $x + y - x + y$

h) $5 + 3a + (-7a) - (-8)$

i) $6 + 2(3d) + 5d - 1$

j) $7a^2 - 3a + 5a^2$

k) $-7b - 7a - 6b - 6a + c^2 - 2b + c$

l) $\dfrac{1}{2}b + \dfrac{3}{4}c - \dfrac{3}{5}b + \dfrac{1}{2}c$

2. Use the distributive property to remove the brackets:

a) $2(x+5)$

b) $5(k-4)$

c) $3(2n+5)$

d) $6(-2+4r)$

e) $-3(\Omega+2)$

f) $-4(m-3)$

g) $-(x+2y)$

h) $-(x-3y)$

i) $-5(x-2y+3z)$

3. Simplify completely:

a) $3(x+2)+2(x-4)$

b) $3(a-b)+7(2a+b)$

c) $(a-b)-(a+b)$

d) $5(x-7)-2(x+3)$

e) $-2(x+4)+3(6-x)$

f) $3(2m-3n)+4(6n-m)$

g) $5 + 2(3x - 4)$

h) $7 - 2(3x + 4)$

i) $6x - 4(7 - 2x) + 20$

j) $\dfrac{3}{4}(8x + 12)$

k) $\dfrac{6x + 9}{3} + \dfrac{20x - 8}{4}$

l) $\dfrac{1}{3}(n + 3) + \dfrac{5}{6}(n - 1)$

4. The distributive property can be used to help you do mental math. For example:

$6 \times 12 = 6(10 + 2) = 60 + 12 = 72$ and $12 \times 18 = 12(20 - 2) = 240 - 24 = 216$

Try this method on the following questions:

a) 20×19

b) 7×32

c) 8×13

d) $11(18)$

4-3 Writing Expressions and Equations

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1. Translate the following into equations. Use "n" for "a number."

a) Five more than a number is twelve.

b) Seven less than a number is eight.

c) The sum of a number and six is eleven.

d) Eight decreased by a number is negative four.

e) A number less than twelve is two.

f) Twice a number, decreased by three is seven.

g) Twice the sum of a number and four is twenty.

h) Three more than four times a number is seventeen.

i) The product of a number and four more than the number is forty-two.

j) Two less than one-third a number is four.

2. Ginny has $20. How much does she have left if she spends

a) $13   b) $4.50   c) $14.87   d) $x

3. In the 2007-08 season, Dan and Henrik combined scored 44 goals. If Dan scored 'n' goals, how many did Henrik score?

4. Fill in the following table:

	Age now	Age in 7 years	Age 4 years ago
Brad	45		
Angelina		40	
George			43
Britney	n		
Miley		x	
Hannah			a

5. I'm thinking of a number, I double it, then add 5, then triple the result and I get 57. Write an equation for this, let "the number I'm thinking of" be 'n.'

6. Fill in the table: (Nickel = 5¢, Dime = 10¢, Quarter = 25¢)

	# of coins	Value (¢)
Nickels	7	
Dimes		70
Quarters		
Total	25	

	# of coins	Value (in cents)
Nickels	n	
Dimes	d	
Quarters	q	
Total		

7. Examples of 3 consecutive numbers are 2, 3, 4 or 7, 8, 9.
   a) Let 'n' represent the smallest of the three consecutive numbers, give an expression for the other two numbers.

   Middle number_____   Largest number_____

   b) Let 'x' represent the middle number. Give an expression for the other two numbers.

   Smallest number_____   Largest number_____

8. Examples of 3 consecutive odd numbers are 3, 5, 7 or 21, 23, 25
   a) Let 'n' represent the smallest of the three consecutive odd numbers, give an expression for the other two numbers.
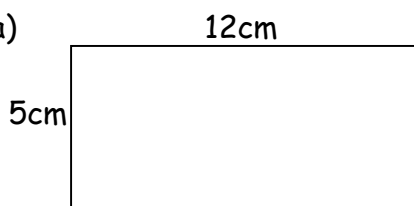
   Middle number_____   Largest number_____

   b) Let 'x' represent the middle number, give an expression for the other two numbers.

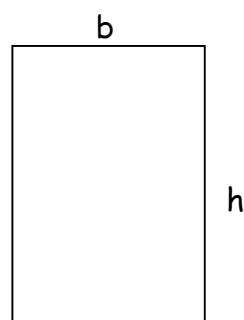   Smallest number_____   Largest number_____

9. The perimeter of a rectangle is the distance around the edge of the shape. Give the perimeter for each of the following rectangles:

a)   12cm

5cm

b)   b

                h

c) The base of a rectangle is 3 more than twice the height. Let h = the height.
   i)   Give an expression for the base_____
   ii)   Give an expression for the perimeter_____

4-4 Solving One and Two Step Equations

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1. Solve the following equations. Show your steps. Check your solution.

a) $x + 7 = 19$

b) $13 = n - 4$

c) $7 = x + 16$

d) $12 + m = 3$

e) $p - \dfrac{2}{5} = \dfrac{1}{5}$

f) $d + \dfrac{1}{4} = \dfrac{1}{3}$

g) $2b = 24$

h) $-3f = 24$

i) $-36 = 4n$

j) $-54 = -6v$

k) $\dfrac{x}{6} = 3$

l) $\dfrac{n}{4} = -7$

m) $\dfrac{3}{4} = \dfrac{n}{16}$ n) $\dfrac{2}{7} = \dfrac{x}{5}$ o) $\dfrac{1}{5}x = -4$

p) $\dfrac{2}{5}n = 20$ q) $-12 = \dfrac{3}{4}x$ r) $\dfrac{y}{9} = 0$

2. Check to see if the following are solutions to the equations:

a) $2p + 5 = 17; (p = 6)$ b) $25 = -3x + 1; (x = -8)$

c) $6 + 4x = 50; (x = 5)$ d) $7 - 3w = 34; (w = 9)$

e) $\dfrac{1}{3}n + 5 = 4; (n = 7)$ f) $\dfrac{3}{2}x - 9 = 12; (x = 14)$

3. Solve the following equations. Show your work. Check your answers by substituting back into the original equation.

a) $2x+3=33$

b) $3n-4=22$

c) $-31=5+9a$

d) $4h-7=-31$

e) $-3x+5=17$

f) $-6x-8=34$

g) $0.5x+5=11$

h) $8-3x=-28$

i) $-50=10+5x$

j) $\dfrac{d}{2} + 3 = 12$

k) $\dfrac{r}{3} - 7 = -15$

l) $31 = 13 - \dfrac{b}{2}$

m) $\dfrac{1}{2}x - 1 = 13$

n) $4 + \dfrac{2}{3}c = 16$

o) $22 = \dfrac{3}{5}x - 23$

p) $\dfrac{3}{5}x - \dfrac{2}{5} = \dfrac{4}{5}$

q) $4x + 3 = -2 + 5$

4-5 Multi-Step Equations

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Solve the following equations. Show your steps. Check your answers by substituting back into the original equation.

1. $7x - 4x = 14 + 16$

2. $-3n - 5n = 6 - 22$

3. $\dfrac{z}{5} + 4 = 16$

4. $\dfrac{3}{5}y + 4 = -8$

5. $5p + 4 = -3p + 20$

6. $6x - 3 = 4x + 13$

Check

Check

7. $23 = 7 - 2x$

8. $6 - 4w = 3w + 20$

Check

Check

9. $-4x - 5 = 3x + 16$

10. $-5g - 5 = -23 + g$

Check

Check

11. $8x - 6 = 2x - 7$

12. $-5m + 5 = -3m - 6$

Check

Check

13. $8x - \dfrac{2}{5} = 2x + \dfrac{1}{5}$

14. $\dfrac{1}{4}y + 6 = \dfrac{3}{4}y - 4$

Check

Check

15. $8x = 3(x + 2)$

16. $8(x + 1) = 2(x - 5)$

Check

Check

17. $-2(x+5)=12+9x$

18. $4x-9=-3(x-4)$

19. $8y-7-3y=6+5y-1$

20. $-3x+7+5x=9+2x-2$

21. $8m + 7 - m = 2m - 12 - 5m$

22. $2(6k - 1) = -38$

Check

Check

23. $7w + 3(4w + 8) = 52 + 12w$

24. $7 - 4(8 + 5n) = 15$

Check

Check

25. $6 - 5(6x - 2) = 13(2 - 2x)$

26. $60 + 2(9x - 1) = -7(x + 6)$

Check

Check

27. $3x + 2(5 - 4x) + 3 = -3(2x + 3) - 10x$

Check

4-6 Word Problems

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Include a LET statement and/or picture, write an equation, solve it using algebra, and then give your solution for each question. Feel free to use trial and error to get an idea of a reasonable answer.

1. Seven times a number, increased by four equals sixty. What is the number?

2. When a number is added to twice itself the result is 45. Find the number.

3. Three more than twice a number is the same as seven less than four times the number. Find the number.

4. Jen is three years older than Tom. The sum of their ages is 55. How old is Tom?

5. Twenty-four decreased by a number is thirty-nine. Find the number.

6. When a number is divided by nine and then decreased by two, the result is three more than the square root of 64. What is the number?

7. The sum of three consecutive whole numbers is 129. Find the numbers.

8. The sum of four consecutive odd integers is 296. Find the integers.

9. During an election between Hillary and Obama, 615 votes were cast. Obama received 75 more votes than twice the number of votes Hillary received. How many votes did each receive?

10. A number is only one-third of another number, if their difference is 38, find the numbers.

11. A father is four times as old as his son. 10 years ago, the sum of their ages was 60 years. Find each of their present ages.

12. Mr. Brown will need 186ft of fence to enclose his rectangular garden. If the length is 9ft more than the width, what are the dimensions of the yard?

13. Shazan had 35 coins. If he had 2 more pennies than dimes, and three fewer nickels than dimes, how many of each coin did he have, and how much money did he have?

14. Satoshi and Veronica are planning their wedding reception. It costs $1500 to rent a hall and $30 per guest. What is the maximum number of guests they can invite if they have at most $4000 to spend on the reception?

15. Yue is seven years older than his sister Mii. In three years Yue will be twice as old as Mii is then. How old is Mii now?

16. The sum of three numbers is 179, the third number is twice the first and the second number is 15 more than the first. Find the numbers.

17. The perimeter of an isosceles triangle is 100 cm. If the shortest side is 5 cm less than the two longer sides, find the length of each side.

18. Miss Moneypenny looked in her purse and noticed that she had twice as many quarters as dimes, and 4 fewer nickels than quarters. If she had a total of $8.20, how many of each coin did she have?

19. Take your age, multiply it by 5, then add 7 to the result, then double the result and add 16. Now subtract off 10 times your age. What will your answer be? Use algebra to prove it.

20. A student multiplies a number by 5 then to the result she adds 12. She then subtracts the original number and divides the result by 4. She notices that the answer she gets is 3 more than the original number. She says "I think this will happen whatever number I started with." Prove she is right.