Application Problems

WORDS TO SYMBOLS

ADDITION	SUBTRACTION	MULTIPLICATION	DIVISION
Add	Subtract	Multiply	Divide
Sum	Subtracted from	Product	Quotient
Plus	Minus	Times	Divided By or Into
Total	Difference	Part Of	Split
Increase	Less	Twice	Each
More	Less Than	Area	Shared
More Than	Decrease	Volume	Per
Combined	Reduce		Equal Parts
Altogether	Remain		Ratio
In All	Fewer		
	(Other Comparison Words)		

Note: The words ***than***, ***from***, and ***into*** will reverse the order of how the expression or equation is written.

CONSECUTIVE INTEGERS

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1^{st} consecutive integer = x
2^{nd} consecutive integer = $x + 1$
3^{rd} consecutive number = $x + 2$

CONSECUTIVE **EVEN** OR **ODD** INTEGERS

1^{st} consecutive even or odd integer = x
2^{nd} consecutive even or odd integer = $x + 2$
3^{rd} consecutive even or odd integer = $x + 4$

Recall: An algebraic **expression** is any single variable or constant or any grouping of variables and constants without an equal sign. Algebraic expressions can only be *simplified*.
An **equation** is a statement that has an equal sign (=). Equations can be *solved*.

EQUALS

Equals
Is
Is Equal To
Is The Same As
The Result Is
Was
Are

STEPS TO FOLLOW WHEN SOLVING APPLICATION PROBLEMS.

1. Read the problem once.
2. Go back and carefully reread the problem to see what you know and what is to be found.
3. Organize the information using one of the following:
   A. List: General number and consecutive integer problems.
   B. Sketch: Perimeter problems.
   C. Chart: Money, distance, and interest problems.
4. Use a variable to represent one of the items, often the one you know the least about. Then represent the other items in terms of this variable.
5. Translate the words of the problems into an equation.
6. Solve the equation.
7. State all answers that are requested and label answers with the correct units when appropriate.
8. Check your answers in the words of the problem, not just in the equation.

HELPFUL HINTS FOR APPLICATION PROBLEMS.

1. **Consecutive integers** can be represented as $x, x + 1, x + 2$, and so on. **Consecutive <u>even</u>** or **<u>odd</u> integers** can be represented as $x, x + 2, x + 4$, and so on. Organize the information in consecutive number problems using a **list**.

2. **Perimeter** is the sum of all the sides of a figure. Organize the information using a **sketch** for these types of problems.

3. In **money problems**, you must consider both the *value/cost* of each item and the *number* of each item. Organize the information in money problems using a **chart** similar to the one below.

Items	Value/Cost of Each	Number of Each	Value/Cost of Each Kind
			Total Value/Cost

4. **Distance** is equal to the rate multiplied by the time. ***D = rt***. Organize the information in distance problems using a **chart** similar to the one below.

	Rate	Time	Distance
			Total Distance

5. **Simple interest** is equal to the product of the principal, rate, and the time. ***I = Prt***. Organize the information in simple interest problems using a **chart** similar to the one below.

Principal	Rate	Time	Interest
			Total Interest

8.1 Introduction to Application Problems

Write the algebraic expression for each of the following. Use x to represent the unknown quantity. We will assume $x \neq 0$. *Simplify if possible.*

1. The sum of a number and ten.

2. Seven more than a number. *(The word than will reverse the order.)*

Words:	*Three*	*more than*	*a number*	
Algebraic Expression:	x	$+$	7	$x+7$

3. Five less a number.

4. Five less than a number.

5. The product of a number and negative twenty.

Words:	*a number*	*The product of*	*negative six*	$x\cdot(-20)$
Algebraic Expression:	x	$\cdot$	(-20)	$-20x$

6. Two-fifths of a number.

7. Sixteen divided into a number. *(The word **into** will reverse the order.)*

Words:	*six*	*divided into*	*a number*
Expression:	x	$\div$	16

$x \div 16$ *or* $\frac{x}{16}$

8. The quotient of eight and a number.

9. Find the sum of two consecutive integers.

		The sum of	
Words:	*1st consecutive number*	*and*	*2nd consecutive number*
Algebraic Expression:	x	$+$	$x+1$

$x + x + 1$

$2x+1$

10. The total of three consecutive odd integers.

11. Three times the difference of a number and five.

		The difference of	
Words:	*Four times*	*a number and seven*	
Algebraic Expression:	$3\cdot$	$(x-5)$	

$3\cdot(x-5)$

$3x-15$

12. Twice the sum of negative eleven and a number.

13. A number subtracted from negative one, divided by four.

Write the algebraic expression for each of the following. Simplify if possible.

14. Beth is *Y* years old now. Express her age in seven years.

15. Represent the amount of money you have if you have *D dimes*.

16. The difference of two consecutive integers.

17. Travis has *A* apples. How do you represent an amount that is four more than that? How do you represent an amount that is four times the original amount? How do you represent the sum of all three amounts?

8.2 General Number and Consecutive Number Problems

Solve the following application problems. Organize your information using a list.

1. The difference of a number and three is five. Find the number.

2. Thirty is equal to the quotient of a number and two. What is the number?

3. Twice a number increased by eight is twenty. Find the number.

4. Four less than six times a number is thirty-eight. Find the number.

5. One number is three times the other number. If the smaller number is subtracted from the larger number, the result is 26. What are the numbers?

6. One number is three more than another number. The difference between twice the smaller and three times the larger is one. Find the numbers.

7. The sum of the larger and four times the smaller of two numbers is negative five. Find the numbers if the smaller is five less than the larger number.

8. If the largest of three consecutive odd integers is subtracted from five times the first, the result is sixteen. Find the three numbers.

9. The sum of the first and the second of three consecutive odd integers is forty-four. Find all three numbers.

10. Hanna spent $5 more for dinner than Ruth. If the total bill was $17, how much did Hanna's dinner cost?

11. Misty's salary this week was six dollars more than twice Jay's salary. Together they earned $249. How much did Misty earn for the week?

12. Les has decided to donate $30,000 to three local charities, but he does not want to give them all the same amount. The donations will be in the ratio of 3 to 2 to 1. What will be the amount of each donation?

13. Justin, Nathan, and Chris work at the Tutoring Center. Last week Nathan worked 5 hours less than Justin, and Chris worked twice as long as Nathan. If the three worked a total of 61 hours, how many hours did Nathan work?

14. A 27-foot length of wood is to be divided into three pieces in the ratios of 1 to 3 to 5. What is the length of each piece?

8.3 Solving Perimeter Problems

Solve the following application problems. Organize your information using a sketch.

1. A four-sided figure has a perimeter of 150 feet. The lengths of three of the sides are 43 feet, 34 feet, and 31 feet. What is the length of the fourth side?

2. Find the length of a rectangle if the perimeter is 152 meters and the length is three times the width.

3. If the perimeter of a regular pentagon (a figure with five equal sides) is 85 inches, what is the length of each side?

4. A triangle has two equal sides and a third side that is two less than one of the equal sides. What are the dimensions of the triangle if the perimeter is 85 centimeters?

5. Find the dimensions of a rectangle if the perimeter is 72 feet and the length is four feet more than the width.

6. The width of a rectangle is 5 feet less than the length. Find both dimensions if the perimeter is 34 feet.

7. The perimeter of a triangle is 27 inches. The length of the first side is 3 inches less than the second side. The third side is twice the first side. Find the lengths of the three sides.

8. The length of a rectangle is two times the width. If the length is increased by four feet and the width is decreased by three feet, the perimeter of the new rectangle will be fifty-six feet. What are the dimensions of the original rectangle? What are the dimensions of the new rectangle?

8.4 Solving Problems Using a Chart

Solve the following application problems. Organize your information using a chart.

1. A charity collection bucket holds only quarters and dollar bills. There are two times as many quarters as dollar bills. If the bucket holds a total of $4.50, how many quarters are there?

Items	Value of Each	Number of Each	Value of Each Kind
			Total Value

2. Brad purchased twice as many notebooks as pens on his last visit to the bookstore. He spent a total of $35.88 (excluding tax). If notebooks cost $3.79 and pens cost $1.39, how many of each did he purchase?

Items	Cost of Each	Number of Each	Cost of Each Kind
			Total Cost

3. While emptying his vending machine, Kandis noticed that he had five times as many dimes as quarters and twice as many nickels as dimes. How many of each coin did he have if there was a total of $16.25 in the machine?

Items	Value of Each	Number of Each	Value of Each Kind
			Total Value

4. At the football game, three times as many students as non-students attended. The total amount in ticket sales was $6,762. If student tickets cost $2.75 and non-student tickets cost $4.00, how many students attended the game?

Items	Cost of Each	Number of Each	Cost of Each Kind
			Total Cost

5. The office petty cash box contains only $5 and $1 bills. If there are 21 bills altogether and they total $57, how many of each are there?

Items	Value of Each	Number of Each	Value of Each Kind
			Total Value

6. The drink stand at the soccer game last Thursday took in $55.75. The money consisted of $5 bills, $1 bills, and quarters. There were twice as many $1 bills as $5 bills, and the number of quarters was six more than three times the number of $5 bills. How many of each were there?

Items	Value of Each	Number of Each	Value of Each Kind
			Total Value

8.5 Distance Problems

Solve the following application problems. Organize your information using a chart.

Distance = Rate X Time

$D = rt$

1. Audrey and Matt start at the same place at the same time and travel in opposite directions. At the end of three hours, they are 9 miles apart. How fast is each traveling, if Audrey bikes at twice the rate Matt walks?

	Rate	Time	Distance
			Total Distance

2. At the same time, two cars leave cities that are 840 miles apart and travel toward each other. One car averages 65 mph and the other 55 mph. In how many hours will they meet?

	Rate	Time	Distance
			Total Distance

3. Two cars start toward each other at the same time from cities that are 540 miles apart. They will meet in 4 hours. If one car averages 70 mph, how fast is the other car traveling?

	Rate	Time	Distance
			Total Distance

4. Tanya leaves her house on her bicycle, traveling 8 mph. One hour later, her husband leaves the house on his motorbike, going 20 mph. How long will it take her husband to catch up to Tanya?

	Rate	Time	Distance
			Total Distance

5. Two trains leave the same city at the same time and travel in opposite directions. After six hours they are 354 miles apart. How fast is each traveling if one averages 25 miles per hour faster than the other?

	Rate	Time	Distance
			Total Distance

6. Devon left the house for his daily walk traveling at 2 mph. His wife left 1 ½ hours later and jogged 6 mph. How long will Devon be walking before she catches up with him?

	Rate	Time	Distance
			Total Distance

8.6 Simple Interest Problems

Solve the following application problems. Organize your information using a chart.

Interest = Principal X Rate X Time
$I = Prt$

1. A department store plans to replace its delivery truck in two years and is making investments in two separate accounts now that will provide money for a down payment later. The company will invest $8,000 at 5% annual interest for the 2-year period. How much should they invest in an account paying 8½% if they want to have earned a total of $2,194 interest at the end of two years?

Principal	Rate	Time	Interest
			Total Interest

2. Aubrey plans to go on a trip to Europe in three years. She wants to invest money now so that the interest will pay for the trip. If she invests three times as much at 8% as she invests at 6 ½%, she should have $2,013 in interest in three years. How much should be put into each investment?

Principal	Rate	Time	Interest
			Total Interest

3. Todd Alder Construction will need to replace a backhoe in 2 years and wants to invest money now to earn enough for the down payment by that time. The company wants to invest twice as much at 9% as it invests at 7% and still earn $4,200 in interest. How much should be put in each investment?

Principal	Rate	Time	Interest
			Total Interest

4. If $11,000 is available to be invested, how much should be put in stocks paying 9% annual interest and how much in mutual funds paying 7.5% to have $4,590 in interest at the end of five years?

Principal	Rate	Time	Interest
			Total Interest

5. If $22,000 is available to be invested, how much should be invested at 8.5% and how much at 6% to yield $6,180 in interest in 4 years?

Principal	Rate	Time	Interest
			Total Interest