

## Chapter 4: Solving Equations and Inequalities: Applications

### 4.1 Translating Sentences into Equations

Translate “nine less than twice a number is five times the sum of the number and twelve” into an equation and solve.

The sum of two numbers is two. The difference between eight and twice the smaller number is two less than four times the larger. Find the two numbers.

A molecule of octane gas has eight carbon atoms. This represents twice the number of carbon atoms in a butane gas molecule. Find the number of carbon atoms in a butane molecule.

A company manufactures 160 bicycles per day. Four times the number of 3-speed bicycles made equals 30 less than the number of 10-speed bicycles made. Find the number of 10-speed bicycles manufactured each day.

## 4.2 Integer, Coin, and Stamp Problems

### Consecutive Integer Problems

Let a variable represent one of the integers.

Express each of the other integers in terms of that variable.

Determine the relationship among the integers.

Find three consecutive integers whose sum is  $-12$ .

The sum of three consecutive odd integers is 39. Find the integers.

Twice the smallest of three consecutive odd integers is three more than the largest. Find the integers.

# Coin and Stamp Problems

- For each denomination of coin, write a numerical or variable expression for the number of coins, the value of coins in cents, and the total value of the coins in cents.
- Determine the relationship between the total values of the different coins.
- Use the fact that the sum of the total values of each denomination of coin is equal to the total value of all the coins.

A coin purse contains 18 coins in nickels and dimes. The coins have a total value of \$1.15. Find the number of nickels and dimes in the coin purse.

A coin bank contains nickels, dimes and quarters. There are five times as many nickels as dimes and six more quarters than dimes. The total value of all the coins is \$6.30. Find the number of each kind of coin in the bank.

## 4.3 Geometry Problems

Perimeter = sum of the sides

$$\text{Triangle} \quad P = a + b + c$$

$$\text{Rectangle} \quad P = 2L + 2W$$

$$\text{Square} \quad P = 4s$$

A square patio has a perimeter of 52 feet. What is the length of each side?

In an isosceles triangle the length of the equal sides is twice the length of the third side. The perimeter is 30m. Find the length of the sides.

The perimeter of a rectangle is 30m.  
The width of the rectangle is 3m less than the length. Find the length of each side.

The width of a rectangle is 40% of the length. The perimeter is 56m. Find the length of each side.

Problems involving angles formed by intersecting lines.

Right angle

Straight angle

Acute angle

Obtuse angle

Complementary angles

Supplementary angles

Parallel lines

Perpendicular lines

Vertical angles

Adjacent angles

Find the measure of angle  $x$

Find the measure of angle  $x$

Find  $x$

Transversal

Alternate interior angles

Alternate exterior angles

Corresponding angles

Given  $L_1$  parallel to  $L_2$  find angles  $a$  and  $b$ .

Given  $L_1$  parallel to  $L_2$  find  $x$ .

Given  $a = 60^\circ$ , find  $b$ .

Problems involving the angles of a triangle.

The sum of the measures of the interior angles of a triangle is  $180^\circ$

Interior angles

Exterior angle

Given  $y = 55^\circ$ , find the measures of angles  $a$ ,  $b$ , and  $c$ .

A triangle has a  $13^\circ$  angle and a  $65^\circ$  angle. What is the third angle?

One angle of a triangle is a right angle, and one angle measures  $27^\circ$ . Find the third angle.

In an isosceles triangle, one angle is  $25^\circ$  less than half one of the equal angles. Find each angle.

## 4.4 Markup and Discount Problems

Cost

Selling Price

Markup

Markup rate

The cost to the manager is a sporting goods store for a tennis racket is \$60. The selling price of the racket is \$90. Find the markup rate.

A hardware store employee uses a markup rate of 40% on all items. The selling price of a lawnmower is \$133. Find the cost.

## Discount problems

Regular price

Sale price

Discount

Discount rate

Discount = Discount rate x Regular price

Sale price = Reg price – rate(Reg price)

$$\text{Discount rate} = \frac{\textit{discount}}{\textit{regularprice}}$$

A case of motor oil that regularly sells for \$29.80 is on sale for \$22.35. What is the discount rate?

The sale price for a telephone is \$43.50. This price is 25% off the regular price. Find the regular price.

## 4.5 Investment Problems

Interest = Principal x interest rate x time

An investment of \$2500 is made at an **annual** simple interest rate of 7%. How much additional money must be invested at 10% so that the total interest earned will be 9% of the total investment?

	Principal	Int. rate	interest
Amt @			
Amt @			

Tom Smith has a total of \$6000 invested into two simple interest accounts. The annual simple interest rate on one account is 9%. The annual simple interest rate on the other account is 6%. How much is invested in each account if both accounts earn the same amount of interest?

	Principal	Int. rate	interest
Amt@			
Amt@			

A bank offers a 3 year CD that earns 6% compound annual interest. Find the value in 3 years of a \$5000 investment in this CD.

	Principal	Int. rate	interest
Amt@			
Amt@			

## 4.6 Mixture problems

A coffee merchant wants to make 9 lb of a blend of coffee costing \$6 per pound. The blend is made using a \$7 grade and a \$4 grade of coffee. How many pounds of each of these grades should be used?

	Amount	Unit cost	Value
\$7 grade			
\$4 grade			
\$6 blend			

A gardener has 20 lb of a lawn fertilizer that costs \$.90 per pound. How many pounds of a fertilizer that costs \$.75 per pound should be mixed with this 20 lb of lawn fertilizer to produce a mixture that costs \$.85 per pound?

	Amount	Unit cost	Value
\$.90grade			
\$.75grade			
\$.85blend			

Percent mixture problems  $Q = Ar$

How many quarts of pure orange juice are added to 5 qt of fruit drink that is 10% orange juice to make an orange drink that is 25% orange juice?

	Amount of liquid, A	Percent of concentration, r	Quantity of substance, Q

Thirty ounces of pure silver are added to 50 oz of a silver alloy that is 20% silver. What is the percent concentration of the resulting alloy?

## 4.7 Uniform Motion Problems

A car travels 65 mph for 3 hrs.

$$d = r t$$

A car leaves a town traveling at 35 mph. Two hours later, a second car leaves the same town, on the same road, traveling at 55 mph. In how many hours after the second car leaves will the second car be passing the first car?

	Rate, $r$	Time, $t$	Distance, $d$

Two trains, one traveling at twice the speed of the other, start at the same time from stations that are 306 mi apart and travel toward each other. In 3 h, the trains pass each other. Find the rate of each train.

	Rate, $r$	Time, $t$	Distance, $d$

On a survey mission, a pilot flew out to a parcel of land and back in 7 hr. The rate out was 120 mph. The rate back was 90 mph. How far away was the parcel of land?

	Rate, $r$	Time, $t$	Distance, $d$

## 4.8 Inequalities

A student must have at least 450 points out of 500 points on five tests to receive an A in the course. One student's results on the first four tests were 93, 79, 87, and 94. What scores on the last test will enable this student to receive an A in the course?

An appliance dealer will make a profit on the sale of a television set if the cost of the new set is less than 70% of the selling price. What minimum selling price will enable the dealer to make a profit on a television set that costs the dealer \$340?

The base of a triangle is 8 in., and the height is  $(3x - 5)$  in. Express as an integer the maximum height of the triangle when the area is less than  $112 \text{ in}^2$ .

Company A rents cars for \$9 per day and 10 ¢ per mile driven. Company B rents cars for \$12 per day and 8 ¢ per mile driven. You want to rent a car for one week. What is the maximum number of miles you can drive a Company A car if it is to cost you less than a Company B car?