## UNIT 6: SYSTEMS OF LINEAR EQUATIONS

## Topic 1: Graphing and Substitution

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## WHY LEARN THIS?

Equations can be used in many real-world applications. For example, a hydrologist might use an equation to determine the difference between two rivers' discharge rates. Equations are also used with many businesses.

## CAREER: BUSINESS AND TOURISM

Business decision makers often use systems of linear equations to model a real-world situation in order to predict future events. Being able to make an accurate prediction helps them plan and manage their businesses.

Trends in the travel industry change with time. For example, in recent years, the number of tourists traveling to South America, the Caribbean, and the Middle East is on the rise.


## TOPIC 1:

GRAPHING
AND
SUBSTITUTION

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## Solving Systems by Graphing

FOCUS QUESTION: How do you solve a system of equations?

## OBJECTIVES:

- I can solve a system of equations graphically.

VOCABULARY:
System of Equations

Solution

## Solving Systems of Equations by Graphing






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## Unit 6 Topic 1 Homework 1: Solving Systems by Graphing

## Directions: Write the system of equations shown on the graph and identify its solution.

1) 



Solution: $\qquad$
2)

$\qquad$

Solution: $\qquad$

Directions: Solve each system by graphing. Be sure to clearly give the solution.
3) $\left\{\begin{array}{l}y=-x-4 \\ y=5 x+2\end{array}\right.$

5) $\left\{\begin{array}{c}y=\frac{1}{2} x+4 \\ y=-\frac{5}{2} x-2\end{array}\right.$

4) $\left\{\begin{array}{l}y=\frac{2}{3} x+3 \\ y=-x-7\end{array}\right.$

6) $\left\{\begin{array}{c}y=-2 x+7 \\ y=5\end{array}\right.$


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## $8^{\text {th }}$ Grade Math

# More Practice with Solving Systems by Graphing 

FOCUS QUESTION: How do you solve a system of equations?

## OBJECTIVES:

- I can solve a system of equations graphically.

VOCABULARY:
System of Equations

## Solution

## Solving Systems of Equations by Graphing



| 3) $\left\{\begin{array}{c}y=3 x+8 \\ y=x-2\end{array}\right.$ <br> Solution: $\square$ | 4) $\left\{\begin{array}{l}y=-\frac{1}{2} x+2 \\ y=-\frac{1}{2} x+2\end{array}\right.$ <br> Solution: $\square$ |
| :---: | :---: |
| 5) $\left\{\begin{array}{c}y=-\frac{1}{3} x-5 \\ y=-7\end{array}\right.$ <br> Solution: $\square$ | 6) $\left\{\begin{array}{l} y=x+5 \\ y=x-2 \end{array}\right.$  $\square$ |
| 7) $\left\{y=\frac{3}{5} x+7\right.$ <br> $y=-2 x-6$ <br> Solution: $\square$ | 8) $\left\{\begin{array}{c}x=-2 \\ y=\frac{3}{2} x+9\end{array}\right.$ <br> Solution: $\square$ |

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Unit 6 Topic 1 Homework 2: More Practice with Solving Systems by Graphing
Directions: Solve each system of equations by graphing. Clearly identify your solution.



## Questions:

1) If a system of equations has one solution, what does this mean about the two lines?
2) If a system of equations has no solution, what does this mean about the two lines?
3) If a system of equations has infinitely many solutions, what does this mean about the two lines?
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## $8^{\text {th }}$ Grade Math

## Solving Systems by Substitution

FOCUS QUESTION: How do you solve a system of equations?

## OBJECTIVES:

- I can solve a system of equations using substitution.

VOCABULARY:
System of Equations

Solution

Solving Systems of Equations by Substitution


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## Unit 6 Topic 1 Homework 3: Solving Systems by Substitution

Directions: Solve each system of equations by substitution.

| 1) $\left\{\begin{array}{l}y=4 x+13 \\ y=6 x+19\end{array}\right.$ | 2) $\left\{\begin{array}{l}y=-3 x+20 \\ y=-2 x+12\end{array}\right.$ |
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| 3) $\left\{\begin{array}{c}y=-5 x-19 \\ y=5 x+1\end{array}\right.$ | 4) $\left\{\begin{array}{c}y=-4 \\ y=-2 x-20\end{array}\right.$ |
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| 5) $\left\{\begin{array}{c}y=4 x-29 \\ x+y=1\end{array}\right.$ | 6) $\left\{\begin{array}{c}y=10 x+2 \\ -5 x+4 y=-27\end{array}\right.$ |

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## Solving Systems by Substitution Using Isolation

FOCUS QUESTION: How do you solve a system of equations? OBJECTIVES:

- I can solve a system of equations using substitution.

Solving Systems of Equations by Substitution

| WARM-UP | 1) Solve for $y: 2 x+y=5$ | 2) Solve for $x$ : $x-4 y=7$ |
| :---: | :---: | :---: |
| Substitution that Requires ISOLATION | The first step to solve a system of equations by substitution is to look for an equation that is solved for x and y . If there is not an equation, you will need to create one! |  |
| Examples | Directions: Solve each system of equations using substitution. |  |
|  | 1) $\left\{\begin{array}{c}-3 x+y=8 \\ 8 x-3 y=-19\end{array}\right.$ |  |
|  | 2) $\left\{\begin{array}{c}-x-2 y=-16 \\ 4 x+y=1\end{array}\right.$ |  |
|  | 3) $\left\{\begin{array}{c}2 x+4 y=-2 \\ 5 x-y=6\end{array}\right.$ |  |
|  | 4) $\left\{\begin{array}{l}3 x+y=-14 \\ 9 x+3 y=-42\end{array}\right.$ |  |


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Unit 6 Topic 1 Homework 4: Solving Systems by Substitution Using Isolation

Directions: Solve each system of equations by substitution.

| 1) $\left\{\begin{array}{c}4 x+y=1 \\ 5 x-2 y=-15\end{array}\right.$ | 2) $\left\{\begin{array}{c}3 x+4 y=-24 \\ 5 x+y=-23\end{array}\right.$ |
| :--- | :--- |
| 3) $\left\{\begin{array}{l}9 x+2 y=-14 \\ -7 x+y=16\end{array}\right.$ | 4) $\left\{\begin{array}{c}3 x-y=-27 \\ 2 x+3 y=4\end{array}\right.$ |
| 5) $\left\{\begin{array}{l}-2 x+y=-1 \\ 4 x-2 y=2\end{array}\right.$ |  |
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## TOPIC 2: ELIMINATION

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## Solving Systems by Elimination

FOCUS QUESTION: How do you solve a system of equations?

## OBJECTIVES:

- I can solve a system of equations using elimination.


## VOCABULARY:

System of Equations
Coefficient

## Solving Systems of Equations by Elimination



$\qquad$ Date: $\qquad$
Unit 6 Topic 2 Homework 1: Solving Systems by Elimination

Directions: Solve each system of equations by elimination.

| 1) $\left\{\begin{array}{l}y=3 x+13 \\ y=7 x+17\end{array}\right.$ | 2) $\left\{\begin{array}{l}y=4 x-15 \\ y=-2 x-3\end{array}\right.$ |
| :--- | :--- |
| 3) $\left\{\begin{array}{l}y=-4 x+14 \\ y=10 x-28\end{array}\right.$ | 4) $\left\{\begin{array}{l}y=-7 x-29 \\ y=-3 x-9\end{array}\right.$ <br> 5) $\left\{\begin{array}{l}x-y=-13 \\ x+y=-5\end{array}\right.$ <br>  |

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| 7) $\left\{\begin{array}{l}3 x-y=7 \\ 3 x-y=7\end{array}\right.$ | 8) $\left\{\begin{array}{c}-8 x+y=6 \\ -8 x+3 y=-14\end{array}\right.$ |
| :--- | :--- |
| 9) $\left\{\begin{array}{l}2 x+y=-5 \\ 7 x+y=-20\end{array}\right.$ |  |

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## $\mathbf{8}^{\text {th }}$ Grade Math

## Solving Systems by Elimination: Different Coefficients

FOCUS QUESTION: How do you solve a system of equations?

## OBJECTIVES:

- I can solve a system of equations using elimination.


## VOCABULARY:

System of Equations
Coefficient

Solving Systems of Equations by Elimination

| What if there are NO COMMON COEFFICIENTS? |  |
| :---: | :---: |
|  |  |
|  |  |
| EXAMPLES | 1) $\left\{\begin{array}{c}x-3 y=2 \\ 4 x+7 y=27\end{array}\right.$ |
|  | 2) $\left\{\begin{array}{c}7 x-2 y=-32 \\ x-5 y=-47\end{array}\right.$ |
|  | 3) $\left\{\begin{array}{l}2 x-5 y=39 \\ 4 x-3 y=43\end{array}\right.$ |
|  | 4) $\left\{\begin{array}{l}4 x+y=-16 \\ 3 x+2 y=-17\end{array}\right.$ |


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Unit 6 Topic 2 Homework 2: Solving Systems by Elimination - Different Coefficients

Directions: Solve each system of equations by elimination.

| 1) $\left\{\begin{array}{l}y=3 x+13 \\ y=7 x+17\end{array}\right.$ | 2) $\left\{\begin{array}{l}y=4 x-15 \\ y=-2 x-3\end{array}\right.$ |
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|  | 4) $\left\{\begin{array}{c}y=-7 x-29 \\ y=-3 x-9\end{array}\right.$ |
| 3) $\left\{\begin{array}{l}y=-4 x+14 \\ y=10 x-28\end{array}\right.$ |  |
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| 5) $\left\{\begin{array}{c}x-y=-13 \\ x+y=-5\end{array}\right.$ | 6) $\left\{\begin{array}{c}2 x-9=17 \\ 2 x+3 y=-19\end{array}\right.$ |


| 7) $\left\{\begin{array}{l}3 x-y=7 \\ 3 x-y=7\end{array}\right.$ | 8) $\left\{\begin{array}{c}-8 x+y=6 \\ -8 x+3 y=-14\end{array}\right.$ |
| :--- | :--- |
| 9) $\left\{\begin{array}{l}2 x+y=-5 \\ 7 x+y=-20\end{array}\right.$ |  |

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Date: $\qquad$

## Solving Systems Using All Methods

FOCUS QUESTION: How do you solve a system of equations?

## OBJECTIVES:

- I can solve a system of equations using graphing, substitution, and elimination.


## SYSTEMS OF EQUATIONS REVIEW

Solve each system of equations by GRAPHING. Clearly identify your solution.

1) $\left\{\begin{array}{c}y=-x+3 \\ y=-\frac{2}{3} x+7\end{array}\right.$


## VOCABULARY:

System of Equations
Isolation
2) $\left\{\begin{array}{c}y=-\frac{1}{2} x+3 \\ x=4\end{array}\right.$


Solve each system of equations by SUBSTITUTION. Clearly identify your solutions.

| 3) $\left\{\begin{array}{c}y=7 x+6 \\ 4 x-3 y=16\end{array}\right.$ | 4) $\left\{\begin{array}{c}x-7 y=-21 \\ 2 x-14 y=-42\end{array}\right.$ |
| :--- | :--- |
| 5) $\left\{\begin{array}{c}3 x-5 y=15 \\ x-4 y=12\end{array}\right.$ | 6) $\left\{\begin{array}{c}y=-5 \\ 8 x+5 y=-17\end{array}\right.$ |

Solve each system of equations by ELIMINATION. Clearly identify your solution.

| 7) $\left\{\begin{array}{c}x-y=-10 \\ x-6 y=-25\end{array}\right.$ | 8) $\left\{\begin{array}{l}2 x+2 y=28 \\ 8 x-2 y=22\end{array}\right.$ |
| :--- | :--- |

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Unit 6 Topic 2 Homework 3: Solving Systems Using All Methods

Solve each system of equations by GRAPHING. Clearly identify your solution.

1) $\left\{\begin{array}{l|l}y=4 x-3 \\ y=-3 x+4\end{array}\right.$ 2) $\left\{\begin{array}{l}y=-\frac{5}{2} x+2 \\ y=-\frac{1}{2} x-2\end{array}\right.$


2) $\left\{\begin{array}{c}y=-2 x+1 \\ y=\frac{1}{2} x-9\end{array}\right.$
3) $\left\{\begin{array}{l}y=\frac{1}{3} x-1 \\ y=\frac{1}{3} x+4\end{array}\right.$



Solve each system by SUBSTITUTION. Clearly identify your solution.
5) $\left\{\begin{array}{c}x+3 y=9 \\ 4 x-2 y=-6\end{array}\right.$
6) $\left\{\begin{array}{c}2 x+5 y=-7 \\ 7 x+y=-8\end{array}\right.$
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$$
\text { 7) }\left\{\begin{array}{l}
x-3 y=-24 \\
5 x+8 y=-5
\end{array}\right.
$$

$$
\text { 8) }\left\{\begin{aligned}
5 x+3 y & =15 \\
x-6 y & =3
\end{aligned}\right.
$$

Solve each system of equations by ELIMINATION. Clearly identify your solutions.
9) $\left\{\begin{array}{c}x+y=-5 \\ x-y=9\end{array}\right.$
11) $\left\{\begin{array}{c}4 x+3 y=-1 \\ 5 x+4 y=1\end{array}\right.$
10) $\left\{\begin{array}{c}x+5 y=20 \\ 2 x-7 y=-45\end{array}\right.$
12) $\left\{\begin{array}{c}x=2 y-3 \\ 2 x-3 y=-5\end{array}\right.$

## TOPIC 3:

 APPLICATIONSDate: $\qquad$

## Systems of Equations Applications

FOCUS QUESTION: How do you apply systems of equations?

## OBJECTIVES:

- I can apply systems of equations to word problems and solve.


## VOCABULARY:

System of Equations
Isolation

## Systems of Equations Applications

Many real-world problems can be modeled and solved using a system of equations. Use the process below to solve these problems.
 EQUATIONS using the given information.


ANSWER IT! Give exactly what the problem is asking for.
1)The sum of two numbers is 51. The difference of the numbers is 13. Find the numbers.

| Variables: |
| :--- |
|  |
|  |
| System: |
|  |
|  |

## Solution:

2) Braden bought three adult tickets and one child ticket at the movie theater and paid $\$ 32$. Karen bought seven adult tickets and two child tickets and paid $\$ 73$. Find the cost of one child ticket.

| Variables: |
| :--- |
|  |
|  |
|  |

System:

## Solution:

3) At the fast food restaurant, one hamburger and five small fries cost $\$ 8.74$. If two hamburgers and three small fries cost $\$ 7.75$, what is the cost of one hamburger?

| Variables: |  |  |
| :--- | :--- | :--- |
|  |  |  |
| System: |  | Solution: |
|  |  |  |

4) Colton sold a total of 28 t -shirts and sweatshirts as part of a fundraiser for his football team. If t -shirts cost $\$ 12$ each and sweatshirts cost $\$ 20$ each and he raised a total of $\$ 424$, how many $t$-shirts did he sell?

| Variables: |  |  |
| :--- | :--- | :--- |
|  |  |  |
| System: |  | Solution: |
|  |  |  |

5) Katelyn has two part-time jobs: tutoring and working at the grocery store. Last week, she worked a total of 15 hours. If she makes $\$ 15$ per hour tutoring and $\$ 9$ per hour at the grocery store and made a total of $\$ 159$, how many hours did she work at the grocery store?


## Solution:

6) Rick bought a total of 8 pounds of steak and chicken. If steak costs $\$ 13.50$ per pound and chicken costs $\$ 3.25$ per pound and he paid a total of $\$ 77.25$, how many pounds of steak did he purchase?
Variables:

System:

Solution:
7) Anna has a collection of 45 nickels and quarters worth $\$ 8.05$. How many nickels does she have?

Variables:

System:

## Solution:

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Unit 6 Topic 3 Homework 1: Systems of Equations Applications

1) The sum of two numbers is 53 . If their difference is 25 , find both numbers.

| Variables: |
| :--- |
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| System: |
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## Solution:

2) Rob and Adam went to Taco Express. Rob bought seven tacos and two fajitas and paid $\$ 12.65$. Adam bought four tacos and one fajita and paid $\$ 6.95$. Find the cost of a taco.

| Variables: |
| :--- |
|  |
|  |
| System: |

## Solution:

| 3) The soccer team is selling tubs of cookie dough and brownie mix for a fundraiser. Elaina raised $\$ 75$ by selling <br> one tub of cookie dough and five tubs of brownie mix. Megan raised $\$ 141$ by selling three tubs of cookie dough <br> and eight tubs of brownie mix. How much is a tub of brownie mix? |  |
| :--- | :--- |
| Variables: |  |
| System: |  |

4) A theater sold a total of 98 adult and senior tickets to the sneak preview of a movie. Adult tickets sold for $\$ 12$ each and senior tickets sold for $\$ 8$, bringing in a total of $\$ 1,072$. How many adult tickets were sold?

## Variables:

## System:

## Solution:

5) Elijah bought a total of 16 pounds of peanuts and cashew nuts and paid $\$ 49.50$. If peanuts cost $\$ 2.75$ per pound and cashew nuts cost $\$ 3.25$ per pound, how many pounds of cashew nuts did he buy?

## Variables:

## Solution:

6) Bella has a cell phone plan in which she pays for each call minute and text message she sends. The total minutes used and text messages sent last month was 561. If call minutes cost 8 c each and text messages cost $5 ¢$ each and her bill was $\$ 34.26$, how many minutes did she use?
Variables:

## System:

## Solution:

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7) Allison burns 15 calories per minute on the elliptical and 12 calories per minute on the treadmill. If she spent one hour at the gym on these two machines and burned a total of 774 calories, how long did she spend on the elliptical?

## Variables:

## System:

## Solution:

8) Max has a collection of 99 dimes and pennies worth $\$ 4.41$. How many pennies does he have?

Variables:

## System:

## Solution:

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# More Practice with Systems of Equations Applications 

## FOCUS QUESTION: How do you apply systems of equations?

## OBJECTIVES:

- I can apply systems of equations to word problems and solve.

VOCABULARY:
System of Equations
Isolation

## Solution

Coefficient

## Systems of Equations Applications

Many real-world problems can be modeled and solved using a system of equations. Use the process below to solve these problems.


| 1) The sum of two numbers is 30 and their difference | 2) The sum of two numbers is 24 and their difference <br> is 2. What are the numbers? <br> is 12. Find the two numbers. |
| :--- | :--- |
| 3) The difference between two numbers is 9. The first <br> number plus twice the second number is 27. Find the <br> two numbers. | 4) The sum of two numbers is 36. Twice the first <br> number minus the second is 6. Find the numbers. |

5) The sum of two numbers is 20 . The difference between three times the first number and twice the second is 40 . Find the two numbers.
6) The sum of two numbers is 25 . One number is twice the second number plus seven. What are the two numbers?
7) The cost of 3 boxes of envelopes and 4 boxes of notebook paper is $\$ 13.25$. Two boxes of envelopes and 6 boxes of notebook paper cost $\$ 17$. Find the cost of each.
8) The cost of 12 oranges and 7 apples is $\$ 5.36$. Eight oranges and 5 apples cost $\$ 3.68$. Find the cost of each.
9) Gabby and Sydney bought some pens and pencils. Gabby bought 4 pens and 5 pencils for $\$ 6.71$. Sydney bought 5 pens and 3 pencils for $\$ 7.12$. Find the cost of each.
10) At a sale on winter clothing, Cody bought two pairs of gloves and four hats for $\$ 43.00$. Tori bought two pairs of gloves and two hats for $\$ 30.00$. Find the cost of each.
11) A garden supply store sells two types of lawn mowers. The smaller mower cost $\$ 249.99$ and the larger mower cost $\$ 329.99$. If 30 total mowers were sold and the total sales for a given year was $\$ 8379.70$, find how many of each type were sold.
12) The Town Recreation Department ordered a total of 100 baseballs and bats for the summer baseball camp. Baseballs cost $\$ 4.50$ each and bats cost $\$ 20$ each. The total purchase was $\$ 822$. How many of each item was ordered?
13) A group of 40 children attended a baseball game on a field trip. Each child received either a hot dog or bag of popcorn. Hot dogs were $\$ 2.25$ and popcorn was $\$ 1.75$. If the total bill was $\$ 83.50$, how many hotdogs and bags of popcorn were purchased?
14) One night a theater sold 548 movie tickets. An adult's ticket cost $\$ 6.50$ and a child's ticket cost $\$ 3.50$. In all, \$2881 was taken in. How many of each kind of ticket were sold?
15) An adult ticket for the school musical sold for $\$ 3.50$ and student tickets sold for $\$ 2.50$. On a given night, 321 tickets were sold for $\$ 937.50$. How many of each kind of ticket were sold?
16) A collection of dimes and nickels is worth $\$ 3.30$. If there are 42 coins in all, how many of each kind of coin are there?
17) Mary has a collection of nickels and quarters for a total value of $\$ 4.90$. If she has 42 coins total, how many of each kind are there?
18) Rob has $\$ 1.65$ in nickels and dimes. He has 25 coins in all. How many of each kind of coin are there?
19) Your math teacher tells you that the next text is worth 100 points and contains 38 problems. Multiplechoice questions are worth 2 points each and word problems are worth 5 points. How many of each type of question are there?
20) Ms. Miller decides to give a test worth 90 points and contains 25 questions. Multiple-choice questions are worth 3 points and word problems are worth 4 points. How many of each type of question are there?
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Unit 6 Topic 3 Homework 2: More Practice with Systems of Equations Applications

Directions: Solve each word problem using a system of equations. Use substitution or elimination.

1) One number added $t$ three times another number is 24 . Five times the first number added to three times the other number is 36 . Find the numbers.
2) Ashley had a summer lemonade stand where she sold small cups of lemonade for $\$ 1.25$ and large cups for $\$ 2.50$. If Ashley sold a total of 155 cups of lemonade for $\$ 265$, how many cups of each type did she sell?
3) Your family goes to a Southern-style restaurant for dinner. There are 6 people in your family. Some order the chicken dinner for $\$ 14$ and some order the steak dinner for $\$ 17$. If the total bill was $\$ 99$, how many people ordered each dinner?
4) Tickets to a movie cost $\$ 7.25$ for adults and $\$ 5.50$ for students. A group of friends purchased 8 tickets for $\$ 52.75$. How many adult tickets and student tickets were purchased?
5) A sporting goods store sells right-handed and left-handed baseball gloves. In one month, 12 gloves were sold for a total of $\$ 561$. Right-handed gloves cost $\$ 45$ each and left-handed gloves cost $\$ 52$ each. How many of each type of glove were sold?
6) David bought 3 DVDs and 4 books for $\$ 40$ at a yard sale. Anna bought 1 DVD and 6 books for $\$ 18$. How much did each DVD and book cost?
7) Airline fares for a flight from Dallas to Austin are $\$ 30$ for first class and $\$ 25$ for tourist class. If a flight had 52 passengers who paid $\$ 1360$, how many first class and tourist class passengers were there?
8) Sue has 100 dimes and quarters. If the total value of the coins is $\$ 21.40$, how many of each kind of coin does she have?
9) At the Holiday Valley Ski Resort, skis cost $\$ 16$ to rent and snowboards cost $\$ 19$. If 28 people rented on a certain day and the resort brought in $\$ 478$, how many skis and snowboards were rented?
10) Ben and Joel are raising money for their class trip by selling wrapping paper. Ben raised $\$ 43.50$ by selling 12 rolls of solid paper and 9 rolls of printed paper. Joel raised $\$ 51.50$ by selling 8 rolls of solid paper and 15 rolls of printed paper. Find the cost of each type of wrapping paper.
