Intermediate Algebra

Workbook 2 - Spring Semester, 1st Edition

2017-2018

Mr. Gregory Koch
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Textbooks: Intermediate Algebra Workbook 1 (first semester) and Intermediate Algebra Workbook 2 (second semester), Holt Algebra I (additional reference)
Tutoring Hours: MWF Lyceum, TTh after school (room 210)
Course website: kochcpa.wordpress.com

Overview:
In this course, we will continue our exploration of algebra, which is the bridge from arithmetic to advanced, abstract mathematics. We will also study geometry and other special topics throughout the year. Special emphasis will be given to problem solving and correct mathematical writing.

Texts and Supplies:
Please bring the following every day:

- The primary math textbook (*Intermediate Algebra*). Holt Algebra I should be left at home as an extra reference.
- Basic multi-function calculator with a square root button (it *should not* be programmable or a graphing calculator, or any sort of calculator with games or apps).
- At least 1 colored pen (not red; blue or green are excellent choices).
- Supply of graph paper (1/4-inch or similar)
- At least 2 sharpened pencils or mechanical pencils, as well as a good eraser.
- At least 2 expo whiteboard markers.
- 3-ring binder with college or wide ruled lined paper (for homework, notes, and quizzes or tests). A notebook is allowed, but keeping an organized binder instead is highly recommended.

Grading:

- **Tests/Projects (40%)**: Each quarter, there will be two to three cumulative tests which require the full class period. There are no “test correction” or ”extra credit” opportunities; you are expected to study hard and perform your best on each test. There will be a practice test prior to each test. The probability/statistics project will also count towards this category.

- **Quizzes (30%)**: There will be 1-2 pop quizzes (10-12 minutes) each week covering recent concepts from the homework. Quizzes will contain simpler questions similar to homework exercises. Quizzes will not cover material from the day before.

- **Homework Completion (10%)**: The best way to learn mathematics is to practice regularly. You will be assigned nightly homework from this workbook. Homework will be collected randomly and assigned a score from 0 to 5 based on effort, completion, and overall accuracy. A homework does not necessarily need to be “perfect” to earn a score of 5, but it should reflect adequate practice and understanding, with few errors.

- **Participation (20%)**: You should come to class every day prepared to discuss your ideas. Asking questions, helping classmates, being prepared for class, and showing enthusiasm for the subject are all quality ways to participate. Above all, good participation should show that you are thinking deeply about mathematics and that you are striving to improve at problem solving. Consideration will also be given to exemplary classroom behavior.
Absences and Make-up Work:
- You are expected to complete all homework that was due during your absence from school. Give these to Mr. Koch when you return from absence.
- All missed tests must be made up, but missed pop quizzes do not need to be made up. Your grade will reflect the pop quizzes that you were in school for.
  e.g. - If you missed 2 quizzes out of 12 in a quarter, your average would be out of 10 quizzes, instead of 12.

Rules and Expectations:
General:
- For every four tardies you earn, you will be assigned a detention.
- Most misbehavior will be first be addressed with a verbal warning or discussion, and then a detention for the repeat offense. Serious rule violations are an exception to this policy.

Entering class:
- Enter class quietly. Leave any non-academic conversation with classmates in the hallway.
- Write down the homework from the board in your planner right away and put extra belongings under your desk.
- Have your homework out in case it will be turned in.
- If there is a quiz announced, have your cover sheet out.
- If you are late or need to return to your locker to gather supplies, you will be assigned a tardy.

Class time:
- You are expected to be present for the entire class in order to learn your best. Use restroom breaks only when necessary. There will be a sign out sheet for you to leave the room, which will be reviewed by the teacher on a regular basis.
- Work time (whether on whiteboards or on paper) is to be used productively. When you are finished, attempt to help other students or inform the teacher.

Homework:
- The answers to all homework problems are in the back of the book. You are expected to self-correct homework as a part of your nightly homework time and seek help at tutoring for problems you could not figure out. **You must take responsibility for checking your answers!**
- An average student should spend approximately twenty minutes per night on mathematics homework *if the lesson from class has been understood*. You may expect it will take longer to do the homework if you need to review notes or relearn how to solve problems.
- You should make your best effort on your homework for class without spending much longer than this amount of time. If math homework is often a significant challenge to complete each night, your parent should contact Mr. Koch to discuss the matter.
- You should expect your parents to be contacted if you neglect homework.

Tutoring:
- Tutoring hours are available multiple times per week as a place to receive extra help. This is a good place to ask how to do homework problems you were stuck on, as well as ask questions about previous quizzes and exams. Bring these by tutoring hours to discuss the questions you do not understand very well.
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Preface to the 1st Edition

Mathematics is a vast and wonderful discipline, but it is often challenging for the young middle school student. Often, a great many topics are included in an introductory Algebra course, but retention of these topics is poor by the next school year.

In an effort to reduce this problem, the topics have been reordered such that each area (e.g. - rational numbers, geometry, percent, expressions, equations, etc.) is revisited several times throughout the school year. This follows the idea of interleaving topics to ensure that each topic is engaged on a somewhat frequent basis. Neural synapses in the brain become reactivated to help those ideas become cemented into long-term memory, rather than fading away entirely after the unit test.

This poses a new and different challenge for the student, since a more diverse skill set must be mastered simultaneously. However, there is less time to simply forget everything encountered during the school year. This in turn reduces the amount of future days that must be spent reviewing key concepts prior to entry into a more advanced Algebra I course.

While this means that studying each individual unit can at times be more challenging, like any worthwhile pursuit, the results are worth the effort. Furthermore, the student gets a chance to experience a breadth of mathematics for the entire school year, rather than regimenting those ideas into narrow chapters.

I wish the reader all of the best in this next step of an exciting journey into the infinite - into mathematics! Its inner beauty and many applications have captured the imagination for millenia, and it is my sincere hope that it will fascinate you in the same way!

How to Use This Book

This is designed as a workbook to accompany the second semester of the 7th grade Intermediate Algebra course at Chandler Preparatory Academy. Since the workbook does not include exposition or worked examples for each topic, full class notes are available at:

kochepa.wordpress.com

Our goal will be to cover as many sections in the workbook as possible throughout the first semester.

This workbook should be primarily used for completing homework (which should be done on notebook or graph paper). It may also be used for extra practice to study for exams and improve your understanding of the topics in the course.

All answers are included in the back of the workbook. You should take responsibility for doing this as part of your homework time. Ask for help if you cannot understand how to do the problems even after reviewing your notes and checking against the answer key.
Advice for Success in 7th Grade Mathematics

Course website: kochcpa.wordpress.com
This includes homework assignments, test dates, the syllabus, class notes, and practice resources in addition to the material covered in this book.

1. **Regular completion of homework is important to success in mathematics**, since you will improve at problem solving by solving more problems independently.

An average student should plan to spend up to 20 minutes per night on math homework, and sometimes longer studying before major exams. **If you are having difficulty with completing the homework problems in this amount of time, do not spend all night working on the homework, but stop working and get a good night’s sleep.** Then, plan to come to tutoring later. If you are spending too long on math homework, your parent should contact Mr. Koch so that the situation can be discussed in more detail.

Homework completion and quality will be assessed on a 5 point scale:

- **0**: The homework is missing or disqualified for academic integrity reasons.

- **1-2**: A substantial number of problems are missing or incomplete, or work is of poor quality; many answers are written with little or no explanation.

- **3**: The homework is only partially complete and/or a significant number of problems are incorrect. Some of the directions may have been ignored.

- **4**: Most or all of the homework is complete, however, there is clear room for improvement. This may mean some of the answers are incorrect or a few problems do not have proper explanations or have been rushed. **This category also includes homework where the original problems have not been copied out or at least summarized, if the problems are too long to write. In most cases, diagrams should also be copied.**

- **5**: The homework is a high quality piece of work. There are complete answers to every question, along with work justifying those answers. It has been formatted correctly, and most or all of the answers are correct. **Ideally, you have checked and corrected your work using the answer key.**

2. **You must take responsibility for your own learning.** Homework will not be regularly collected or corrected in class, so this means you must **use the answers in the back of the textbook to check over your work for mistakes.** This should be a regular part of your routine during homework time.

Remember that the answers in the back are to help make corrections, and copying them does not count as “doing your homework”. Almost every problem you solve should have at least some basic work and explanation. If you copy answers out of the back, you will not learn, and you will have difficulty on quizzes and tests, as well as with mathematics in the future!
3. **Always do your homework on the day it is assigned, and not on the day it is due.** When you attempt math problems at the last minute, you will not gain the full benefit of the work. If this happens every day, you will fall behind and not do your best in the course. Also, when you do homework ahead of time, you will feel more relaxed and not under time pressure, and you will know where you need help.

4. **Do not make a habit of completing all of your math homework in groups.** Study groups can be a great way to make doing schoolwork more enjoyable. However, you might not actually learn the material by doing this. You will learn the most from thinking independently, since that teaches your brain how to approach new problems.

   If you do plan to study and do homework with friends anyway, you are encouraged to discuss problems with them and make notes about how to complete each problem (write a rough draft of your homework). However, write your final copy of the homework on your own when you are not talking to friends. This may seem like a lot of work, but it is the best way to learn.

5. **Come to tutoring hours AFTER you have made an independent effort to read your notes and figure out problems on your own.** You will benefit much more from tutoring hours if you come with some work already attempted. This also shows the teacher you take your studies seriously.

6. **Whenever you receive a quiz or test back, you should make a habit of correcting the mistakes on your own.** Then, if you do not understand some questions even after review of your work, come ask for help. For even more effective studying, rewrite the problems on a sheet of paper and do them again from scratch. This is better than just glancing over your mistakes.

7. **Review your work before turning in a quiz or test:**
   - The gold standard for “checking your work” is to do each problem a second time, if time allows. This is the best way to check for mistakes. Do not just glance over your work, nodding your head! This will not help you at all!
   - Read the directions for each problem again to make sure you have not overlooked a key fact or instruction.
   - Check if you have written the answer in the correct form (e.g. - units, fraction/decimal).

8. **Spend time studying in advance for quizzes and tests.** Here are some suggestions:
   - While the homework on the night before a test will be to study, this is usually too late to significantly improve your results. You must start earlier!
   - Spend a few minutes every night reviewing during the week leading up to the test.
   - For tests, you will be given a practice test that has extra problems which show you what to focus on for the test. Use this to guide you!

9. **Use class time as an opportunity to actively further your own understanding.** It is very important that you use the available time in class to practice, ask questions, and get the help that you need to improve.
# How to Format Your Solutions

This page will give several examples of *acceptable* and *unacceptable* solutions to problems.

Here are some basic guidelines:

- **Every problem should have some explanation** leading to the correct answer, even if the explanation is a single step of arithmetic. Math always counts as an explanation!
- **You must include the correct units with your answer and write your answer in simplest form.** It does not matter whether you write your answer as a fraction, decimal, etc. unless instructed to use a certain form.
- **You should copy down the problem, along with any diagrams, unless it is a word problem.** If it is a word problem, just write down any key facts. You may summarize problems as long as you have written down any equations or expressions given, as well as what the problem is asking for.
- **Circle or box your final answer.** If you forget, it’s not necessarily wrong, it just helps your teacher to read your work more easily!

<table>
<thead>
<tr>
<th>Problem</th>
<th>Acceptable Soln.</th>
<th>Unacceptable Soln.</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solve: (2y + 5 = 17)</td>
<td>(2y = 12) [y = 6]</td>
<td>(y = 6)</td>
<td>Never write just an answer. The problem is an equation, so it should be written out. Some steps should be included, though format may vary.</td>
</tr>
<tr>
<td>Solve: (\frac{5}{2}x = -\frac{3}{4})</td>
<td>(x = -\frac{3}{4} \cdot \frac{2}{5}) [x = -\frac{6}{20} = -\frac{3}{10}]</td>
<td>(x = -\frac{6}{20} = -\frac{3}{10})</td>
<td>The intermediate step to solve the equation should be written in some way.</td>
</tr>
<tr>
<td>Simplify: (-3 + 2(6 - 2)^2)</td>
<td>(-3 + 2(6 - 2)^2) [= -3 + 2(16)] [= -3 + 32 = 29]</td>
<td>(-3 + 2(6 - 2)^2) [= 6 - 2 = 4] [= 16 \times 2 = 32] [= -3 + 32 = 29]</td>
<td>The best solution will start with the original expression, and then make only correct mathematical statements. This student has written work, but uses equals signs incorrectly and writes messily.</td>
</tr>
<tr>
<td><strong>Jaina has four more dollars than Bob. The sum of their money is 30. How much money does each have? Solve by writing an equation.</strong></td>
<td>Bob: (b), Jaina (b + 4) [2b + 4 = 30] [2b = 26] [b = 13] [Bob: $13, Jaina: $17]</td>
<td>sum of money: 30 [13 + 17 = 30]</td>
<td>The variables in the problem should be defined. All information asked for in the problem must be given (Jaina’s money is missing, and so are the units). Also, the unacceptable example did not actually solve an equation.</td>
</tr>
</tbody>
</table>
CHAPTER 6

CIRCLES AND PERCENTS

6.1 Area and Circumference of Circles

Problems

1. Find the area and circumference of a circle with a diameter of 2 mm, using $\pi \approx 3.14$.

2. Find the area and circumference of a circle with a radius of 3.5 m, using $\pi \approx \frac{22}{7}$.

3. Consider the circle below.
   (a) Find the area in terms of $\pi$.
   (b) Find the circumference in terms of $\pi$.

4. Consider the circle below.
   (a) Find the area in terms of $\pi$.
   (b) Find the circumference in terms of $\pi$.

5. Consider the circle below.
   (a) Find the area in terms of $\pi$ and $x$.
   (b) Find the circumference in terms of $\pi$ and $x$.

6. Consider the circle below.
   (a) Find the area in terms of $\pi$ and $y$.
   (b) Find the circumference in terms of $\pi$ and $y$.

7. The radius of a circle is $\frac{2}{5}$ cm. What are the area and circumference of the circle in terms of $\pi$?

8. The diameter of a circle is $\frac{8}{7}$ km. What are the area and circumference of the circle in terms of $\pi$?
Challenge Problems

1. The area of a circle is equal to its circumference. What is the radius of the circle? Prove your answer by solving an equation.

2. A geometric figure is shown below.

(a) Find the area and circumference in terms of $\pi$.
(b) Approximate the area and circumference using $\pi \approx 3.14$.

Extra Practice

1. Find the area and circumference of a circle with a diameter of 8 mm, using $\pi \approx 3.14$.

2. Find the area and circumference of a circle with a radius of 1.5 ft, using $\pi \approx \frac{22}{7}$.

3. Find the area and circumference of a circle with a diameter of 6 in, using $\pi \approx 3.14$.

4. Find the area and circumference of a circle with a radius of 5 m, using $\pi \approx \frac{22}{7}$.

5. Consider the circle below.

(a) Find the area in terms of $\pi$.
(b) Find the circumference in terms of $\pi$.

6. Consider the circle below.

(a) Find the area in terms of $\pi$.
(b) Find the circumference in terms of $\pi$.

7. Consider the circle below.

(a) Find the area in terms of $\pi$.
(b) Find the circumference in terms of $\pi$. 
8. Consider the circle below.

![Diagram of a circle with a radius of 3 ft.]

(a) Find the area in terms of $\pi$.
(b) Find the circumference in terms of $\pi$.

9. Consider the circle below.

![Diagram of a circle with a radius of 24 mm.]

(a) Find the area in terms of $\pi$.
(b) Find the circumference in terms of $\pi$.

10. Consider the circle below.

![Diagram of a circle with a radius of 11n yd.]

(a) Find the area in terms of $\pi$ and $n$.
(b) Find the circumference in terms of $\pi$ and $n$.

11. Consider the circle below.

![Diagram of a circle with a radius of 0.5k in.]

(a) Find the area in terms of $\pi$ and $k$.
(b) Find the circumference in terms of $\pi$ and $k$.

12. Consider the circle below.

![Diagram of a circle with a radius of 4y cm.]

(a) Find the area in terms of $\pi$ and $y$.
(b) Find the circumference in terms of $\pi$ and $y$.

13. The radius of a circle is $\frac{5}{3}$ cm. What are the area and circumference of the circle in terms of $\pi$?

14. The diameter of a circle is $\frac{11}{2}$ in. What are the area and circumference of the circle in terms of $\pi$?

15. The radius of a circle is $\frac{1}{2}$ ft. What are the area and circumference of the circle in terms of $\pi$?

16. The diameter of a circle is $\frac{20}{3}$ yd. What are the area and circumference of the circle in terms of $\pi$?

17. John’s pizza shop offers three sizes of pizza. The small, medium and large pizzas have diameters of 8 inches, 10 inches and 12 inches. Find the area and circumference of each pizza size in terms of $\pi$. 

18. Consider the circle below.

![Diagram of a circle with a radius of 20x ft.]

(a) Find the area in terms of $\pi$ and $x$.
(b) Find the circumference in terms of $\pi$ and $x$. 

6.2 Area and Circumference of Circles #2

Problems

1. A bicycle wheel has a diameter of 26 inches. How many feet does the bicycle travel after 1000 revolutions of the wheel, rounded to the nearest tenth of a foot?

2. An ant crawls along a circular tire which has a radius of 15 in. Approximately how far does the ant travel if it crawls around the edge of the tire three times? Use \( \pi \approx 3.14 \) to estimate your answer.

3. A circular dance floor has a radius of 9 m. A can of wax will cover an area of 10 m\(^2\). How many cans of wax would be needed? Give your answer as an integer number of cans.

4. The distance from the edge to the center of a circular ice skating rink is \( x \) meters. What is the minimum integer value of \( x \) so that the ice skating rink would be at least 200 m\(^2\) in size?

5. A semicircle is shown below.

(a) Find the perimeter and area in terms of \( \pi \).
(b) Estimate the perimeter and area using \( \pi \approx 3.14 \). Round your answer to the nearest hundredth.

6. A semicircle is shown below.

(a) Find the perimeter and area in terms of \( \pi \).
(b) Estimate the perimeter and area using \( \pi \approx 3.14 \). Round your answer to the nearest hundredth.

Challenge Problems

1. Find the area of the shaded region. Include \( \pi \) in your answer.

2. Four semicircles of radius 14 cm are fit inside a square. Find the area of the shaded region in terms of \( \pi \).
Extra Practice

1. A large circle drawn in chalk on the playground is 8 feet in diameter. A small ladybug crawls around the outside edge three times. Approximately how far did the ladybug travel? Use $\pi \approx 3.14$ to estimate your answer.

2. On a boring day, an ant crawls around the edge of a circular merry-go-round 7 times. Suppose that the distance from the center to the edge is 3 feet. How many feet did the ant travel? Express your answer in terms of $\pi$.

3. A lawn sprinkler sprays water over a distance of $x$ meters in every direction as it rotates. Mr. Koch wishes to install one such lawn sprinkler that will water at least 80 m$^2$ of his lawn. What is the least integer value of $x$ that will work?

4. A large circular stage is going to be painted with three coats of paint. If the diameter of the stage is 24 feet and each full bucket of paint can cover 300 ft$^2$ of floor space, how many buckets of paint will be needed? Give your answer as an integer number of buckets.

5. At a fancy restaurant, a fly crawls along the outside edge of a circular table with a diameter of 36 inches. If the fly makes 8 complete circles around the table throughout the meal, how far will it have walked, in feet? Use $\pi \approx 3.14$ to estimate your answer.

6. Tanisha purchases a round photo frame for her parents. The radius of the photo frame is 9 cm. What are the photo frame’s area and circumference? Use $\pi \approx 3.14$ to estimate your answer.

7. You bake a tray of cookies for Mother’s Day. The diameter of each cookie is $\frac{4}{3}$ of an inch.
   (a) What are the cookie’s area and circumference, in terms of $\pi$?
   (b) Use $\pi \approx \frac{22}{7}$ to estimate your answers from part (a).

8. A bicycle wheel has a radius of 12 inches. How many feet does the bicycle travel after 500 revolutions of the wheel?

9. The first Ferris wheel was built in 1893 in Chicago. Its diameter was 250 feet. What was the actual circumference of the Ferris wheel? Use $\pi \approx 3.14$ to estimate your answer.

10. A semicircle is shown below.

   (a) Find the perimeter and area in terms of $\pi$.
   (b) Estimate the perimeter and area using $\pi \approx 3.14$. Round your answer to the nearest hundredth.
11. A semicircle is shown below.

![Semicircle](image)

(a) Find the perimeter and area in terms of $\pi$.
(b) Estimate the perimeter and area using $\pi \approx 3.14$. Round your answer to the nearest hundredth.

### 6.3 Area and Circumference of Circles #3

**Problems**

1. The area of a circle is $100\pi$ m$^2$.
   (a) Find the radius.
   (b) Find the diameter.
   (c) Find the circumference.

2. The circumference of a circle is $32\pi$ ft.
   (a) Find the radius.
   (b) Find the diameter.
   (c) Find the area.

3. The area of a circle is $45\pi$ in$^2$.
   (a) Find the radius.
   (b) Find the diameter.
   (c) Find the circumference.

4. The circumference of a circle is $24\pi$.
   (a) What is the radius of the circle?
   (b) What is the diameter of the circle?
   (c) What is the area of the circle?
   (d) Approximate the area of the circle using $\pi \approx \frac{22}{7}$.

5. The circumference of a circle is $4\sqrt{2}\pi$.
   (a) Find the radius.
   (b) Find the diameter.
   (c) Find the area.

6. The approximate circumference of a circle is 28.26 cm, rounded to the nearest hundredth.
   (a) Find the radius of the circle.
   (b) Find the diameter of the circle.
   (c) Approximate the area of the circle using $\pi \approx 3.14$.

7. The estimated area of a circular pond is 78.5 m$^2$. If you were to walk around the edge of the circular pond five times, how far would you travel, in meters?
### Challenge Problems

1. The circumference of a circle is $9\sqrt{7}\pi$. Estimate the area and give your answer as a decimal to the nearest hundredth.

2. The circumference of a circle is $6\pi$ cm. What would be the radius of a circle whose area is half that of the given circle, rounded to the nearest hundredth?

### Extra Practice

1. The area of a circle is $49\pi$ ft$^2$.
   - (a) Find the radius.
   - (b) Find the diameter.
   - (c) Find the circumference.

2. The circumference of a circle is $50\pi$ cm.
   - (a) Find the radius.
   - (b) Find the diameter.
   - (c) Find the area.

3. The area of a circle is $80\pi$ mm$^2$.
   - (a) Find the radius.
   - (b) Find the diameter.
   - (c) Find the circumference.

4. The circumference of a circle is $128\pi$.
   - (a) What is the radius of the circle?
   - (b) What is the diameter of the circle?
   - (c) What is the area of the circle?
   - (d) Approximate the area of the circle using $\pi \approx \frac{22}{7}$.

5. The circumference of a circle is $8\sqrt{3}\pi$.
   - (a) Find the radius.
   - (b) Find the diameter.
   - (c) Find the area.

6. The circumference of a circle is $10\sqrt{2}\pi$.
   - (a) Find the radius.
   - (b) Find the diameter.
   - (c) Find the area.

7. The approximate circumference of a circle is 21.98 cm, rounded to the nearest hundredth.
   - (a) Find the radius of the circle.
   - (b) Find the diameter of the circle.
   - (c) Find the area of the circle. Use $\pi \approx 3.14$.

8. The approximate circumference of a circle is 34.54 in, rounded to the nearest hundredth.
   - (a) Find the radius of the circle.
   - (b) Find the diameter of the circle.
   - (c) Find the area of the circle. Use $\pi \approx 3.14$.

9. The estimated area of a circular park is 12.56 km$^2$. If you were to walk around the edge of the park three times, how far would you travel, in kilometers? Give your answer rounded to the nearest hundredth of a kilometer.

### 6.4 Area of Sectors and Arc Length

#### Problems

1. Find the area and arc length formed by the sector of the circle shown below. Write your answers in terms of $\pi$.

   ![Diagram of a sector](image)

2. Find the area and arc length formed by the sector of the circle shown below. Write your answers in terms of $\pi$.
3. The diameter of the circle shown below is 10 in. Find the area and arc length formed by the sector of the circle shown below. Write your answers in terms of $\pi$.

4. Find the area and arc length formed by the sector of the circle shown below. Write your answers in terms of $\pi$.

5. Find the area and perimeter of the composite figure shown below. Do not count the dotted line as part of the perimeter. Write your answers in terms of $\pi$.

Challenge Problems

1. The radius of a circle is 1. The area of a sector of this circle is $\frac{\pi}{3}$. What is the arc length of the sector, in terms of $\pi$?

2. Find the distance travelled by the tip of the second hand of a clock in 1 minute if the hand is 6 cm long.

Extra Practice

1. Find the area and arc length formed by the sector of the circle shown below. Write your answers in terms of $\pi$.

2. Find the area and arc length formed by the sector of the circle shown below. Write your answers in terms of $\pi$. 
3. Find the area and arc length formed by the sector of the circle shown below. Write your answers in terms of $\pi$.

4. Find the area and arc length formed by the sector of the circle shown below. Write your answers in terms of $\pi$.

5. Find the area and arc length formed by the sector of the circle shown below. Write your answers in terms of $\pi$.

6. Find the area and arc length formed by the sector of the circle shown below. Write your answers in terms of $\pi$.

7. Find the area and arc length formed by the sector of the circle shown below. Write your answers in terms of $\pi$.

8. Find the area and arc length formed by the sector of the circle shown below. Write your answers in terms of $\pi$.

9. Find the area and arc length formed by the sector of the circle shown below. Write your answers in terms of $\pi$.

10. Find the area and arc length formed by the sector of the circle shown below. Write your answers in terms of $\pi$. 
6.5 Solving Circle Problems

1. A circular ring is shown below. The measurements for the inner and outer radius of the ring are labeled.

   (a) Find the area of the disk (shaded region). Write your answer in terms of $\pi$.
   (b) Find the perimeter of the disk (include both the inner and outer edges). Write your answer in terms of $\pi$.

2. Find the area of the shaded region below. Express your answer in terms of $\pi$.

3. Consider the figure below. Find the total area and perimeter. Express your answer in terms of $\pi$. For the perimeter, you are doing the outside edge only, not the dotted lines.

4. Consider the figure below. Find the total area and perimeter. Express your answer in terms of $\pi$. For the perimeter, you are doing the outside edge only, not the dotted lines.

5. The figure below is made up of two semicircles. Find its area and perimeter in terms of $\pi$. For the perimeter, you are doing the outside edge only, not the dotted lines.
Challenge Problems

1. Find the area and perimeter of the composite figure in terms of $\pi$. Do not count the dotted line in the perimeter.

2. A right triangle with legs 5 and 12 is inscribed in a semicircle. Find the area of the shaded region. Express your answer in terms of $\pi$.

Extra Practice

1. A small circle is cut out from a larger circle, as shown below. Find the area of the remaining shaded region. Leave $\pi$ in your answer.

2. A circular ring is shown below. The measurements for the inner and outer radius of the ring are labeled.

   (a) Find the area of the disk (shaded region). Write your answer in terms of $\pi$.
   (b) Find the perimeter of the disk (include both the inner and outer edges). Write your answer in terms of $\pi$.

3. The square below has four congruent semicircles attached to each side. The area of the square is $36 \text{ cm}^2$.

   (a) What is the total area of the shaded region? Write your answer in terms of $\pi$.
   (b) What is the total perimeter of the shaded region? Include both the inner and outer edges. Write your answer in terms of $\pi$. 
4. Consider the figure below.

(a) What is the total area of the figure? Write your answer in terms of \( \pi \).
(b) What is the total perimeter of the figure? For the perimeter, you are doing the outside edge only, not the dotted lines. Write your answer in terms of \( \pi \).

5. Two congruent semicircles are fit inside a square. The radius of a semicircle is labeled. What is the area of the shaded region?

6. Find the area of the shaded region. Write your answer in terms of \( \pi \).

7. Consider the figure below.

(a) What is the total area of the figure? Write your answer in terms of \( \pi \).
(b) What is the total perimeter of the figure? For the perimeter, you are doing the outside edge only, not the dotted lines. Write your answer in terms of \( \pi \).

8. A medium circle and small circle are fit into a larger circle. What is the area of the shaded region if the radius of the medium circle is 4 cm and the radius of the small circle is 1 cm? Write your answer in terms of \( \pi \).

9. A semicircle is cut out of a triangle. Find the area of the remaining shaded region.
10. A path is built around a pond. The measurements of the path and the pond are shown below.

(a) What is the area of only the pond? Write your answer in terms of \( \pi \).
(b) What is the area of only the path? Write your answer in terms of \( \pi \).
(c) What is the total perimeter of the path, including both the circumferences of the inner and outer edges? Write your answer in terms of \( \pi \).

6.6 Solving Circle Problems #2

1. A small circle is cut out from a larger circle, as shown below. Find the area of the remaining shaded region. Leave \( \pi \) in your answer.

2. A circle is cut out of a trapezoid, as shown. Find the area of the shaded region. Write in your answer in terms of \( \pi \).

3. Four congruent circles are drawn inside of a square. What is the total area of all circles, in terms of \( \pi \)?

4. In the figure below, \( AB \) is the diameter of the circle, and \( AC = BC \). What is the area of the shaded region? Write your answer in terms of \( \pi \).
5. Let $A$, $B$, and $C$, be three points on a line such that $AB = 2$ and $BC = 4$. Semicircles are drawn with diameters $AB$, $AC$, and $BC$. Find the area of the shaded region in terms of $\pi$.

**Challenge Problems**

1. A shaded region bordered by four congruent quarter circles inside a rectangle is shown below.

   (a) What is the area of the region in terms of $\pi$?
   (b) What is the perimeter of the region in terms of $\pi$, as measured by the solid line?

**Extra Practice**

1. Determine the area of the shaded region. Leave $\pi$ in your answer.

2. Find the area of the shaded region if the radius of each congruent small circle is 1 in. Leave $\pi$ in your answer.
3. Two semicircles are drawn inside a large circle. These semicircles intersect at point B, which is the center of the large circle. The length of AC is 8. What is the total area of the shaded regions?

4. Find the area of the shaded region. Write your answer in terms of $\pi$.

5. In rectangle ABCD, the length of side AB is 12. The two circles shown are congruent. What is the total area of the shaded region, in terms of $\pi$?

6. This figure shows five shaded circles (four small, one medium) within a large circle of radius 7 cm. The diameter of each of the small shaded circles is 2 cm. What is the area of the shaded region? Write your answer in terms of $\pi$.

7. A right triangle is inscribed in a circle, shown below. Find the circumference of the circle.

8. A large circle is shown below, divided such that ABC and CDE are semicircles. The lengths $AC$ and $CE$ are 4 in and 6 in, respectively. What is the area of the shaded region in terms of $\pi$?
6.7 Percentages

Problems

1. Calculate the following percents:
   (a) 25% of 350
   (b) 180% of 180
   (c) 55% of 90
   (d) 2% of 500
   (e) 6.5% of 52
   (f) 22.5% of 40

2. Calculate the following percents:
   (a) \( \frac{2}{3} \% \) of 64
   (b) \( \frac{5}{6} \% \) of 300
   (c) \( 27\frac{1}{3} \% \) of 900

3. A boy scores 30 out of 36 on a test. What percent is this? Round your answer to the nearest whole number.

4. There are 54 boys and 72 girls on a swim team. (a) The number of boys is what percent of the number of girls? (b) Find the percentage of boys on the team and the percentage of girls on the team, to the nearest whole percent.

5. The price of a bottle of shampoo A is $8 and the price of a bottle of shampoo B is $5. (a) What is the price of a bottle of shampoo A as a percentage of the price of a bottle of shampoo B? (b) What is the price of a bottle of shampoo B as a percentage of the price of a bottle of shampoo A?

6. Six meters is what percent of fifteen meters?

7. Would you rather have 55% of 2 pizzas or 24% of 5 pizzas?

Challenge Problems

1. If \( b \) equals 10% of \( a \) and \( c \) equals 20% of \( b \), then \( c \) is what percent of \( a \)?

2. Joshua got 65% of the problems right on an 80 problem test, 75% of the problems right on a 60 problem test, and 85% of the problems right on a 40 problem test. What percent of all the questions did Joshua answer correctly? Round your answer to the nearest whole percent.

3. The side lengths of a triangle are consecutive even integers. The length of the longest side is 40% of the perimeter. What is the length of the shortest side?

Extra Practice

1. What is 15% of 64? 4. Find 2.5% of 30.

2. What is 150% of 30? 5. Find 8.5% of 42.

3. Find 65% of 140. 6. A girl invites 24 friends to a party and 18 are able to come. What percent is this?
7. A boy receives 8 out of the 15 gifts he wanted for his birthday. What percent is this, to the nearest tenth?

8. The school orchestra has 24 violinists, 3 bassists, 12 violists, and 6 cellists. Suppose there are 96 students in the orchestra.
   (a) What percent play the violin (violinists)?
   (b) What percent play the viola (violists)?
   (c) What percent play the cello?
   (d) What percent do not play the bass? Round to the nearest tenth of a percent.

9. In a choir, 60 out of the 75 members are not sopranos. What percent are sopranos?

10. There are 76 boys and 84 girls at a middle school dance.
    (a) The number of boys is what percent of the number of girls? Round your answer to the nearest tenth of a percent.
    (b) Find the percentage of boys at the dance and the percentage of girls at the dance.

11. 16 feet is what percent of 80 feet?

12. A certain bookstore sells fiction books, non-fiction books, and magazines. Every day, 20% of the total number of items sold are magazines, 50% of the total items sold are non-fiction books. If the store sells 150 items in one day, how many are fiction books?

13. Would you rather have 15% of $8 or 75% of $1.60?

14. Three groups of students are interviewed and asked whether they completed all of their homework last night:
   • Group A (20 students): 16 students said yes, 4 students said no.
   • Group B (25 students): 18 students said yes, 7 students said no.
   • Group C (28 students): 21 students said yes, 7 students said no.
Which group has the highest percentage of students who said they did their homework?

6.8 Reverse Percentages

Problems

1. The number 24 is 6% of what larger number?

2. The number 12.5 is 40% of what larger number?

3. Arianna is twelve years old. Arianna’s age is 150% of her brother’s age. How old is Arianna’s brother?

4. Sydney answers 85% percent of the questions on a test. Sydney answered 51 questions. How many questions long is the test?

5. In a box of candy, 30% of the candy is strawberry flavored. If there are 42 strawberry flavored candies, how many pieces of candy are in the box, in total?

6. A box has 15% green candies, 45% red candies, and 48 orange candies.
   (a) What is the total number of candies in the box?
   (b) How many green candies are in the box?
   (c) How many red candies are in the box?
7. Two siblings are walking to the beach. After a half hour, they have walked 2 miles, but they estimate they are only 40% of the way to the beach.
   (a) How far is their total trip?
   (b) How much further do the siblings have to walk?

8. On a coed basketball team, 60% of the players are boys. If there are 130 girls, how many players are on the basketball team?

Challenge Problems

1. An certain quiz had two questions. The first question was solved by 70% of all students. The second question was harder and was only solved by 60% of the students. Every student solved at least one of the two problems. Nine students managed to solve both problems. How many students took this quiz?

2. In an election contested by two candidates, Candidate A received 12% more of the total votes than Candidate B. If Candidate B got 132,000 votes, by how many votes did he lose the election?

Extra Practice

1. The number 35 is 20% of what larger number?

2. The number 140 is 250% of what smaller number?

3. Lydia and her sister received a gift of candy. Her sister has \(3\frac{1}{2}\) ounces of candy. This is 25% of the total amount of candy that they received.
   (a) How much candy did the sisters receive in total?
   (b) How much candy did Lydia receive?

4. Mia is training for a race. After 40 min of training, she has run 4.5 miles and takes a break. She is 60% done with her workout.
   (a) How many miles is Mia’s total workout?
   (b) How much further does Mia have to run?

5. In a pet store, 14% of the pets are rabbits and 30% are fish. There are 112 other animals in the store.
   (a) How many animals are there in the store, in total?
   (b) How many rabbits are in the store?
   (c) How many fish are in the store?

6. Tyler has read 36 pages of a book, which is 12% of the total number of pages. How long is the book?

7. Lucy is twelve years old. Lucy’s age is 60% of her sister’s age. How old is Lucy’s sister?

8. Chelsea misses 13 points on a large exam. This is only 4% of the total points. How many points is the exam worth?
6.9 Percent Increase and Decrease

Problems

1. The price of a new surfboard is originally $120. If there is a 15% markup, what is the new price?

2. After a new school is opened in the area, the number of students at an older school reduces from 500 to 440. What was the percent decrease in students?

   (a) What was the percent decrease in the weight of Sofia’s backpack? Round your answer to the nearest tenth of a percent.
   (b) If Sofia puts her history book back in the backpack, what would be the new percent increase in the weight of her backpack?

4. Ali originally had $25 in her pocket. If she has $33 after borrowing from a friend, what is the percent increase in Ali’s money?

5. It used to take Madison 70 seconds to swim a certain distance, but now it takes her 30% less time. How long does it take Madison to swim that distance now?

6. The regular price of a train fare across the country is $260. If the price is increased to $325, what was the percent increase?

Challenge Problems

1. Suppose the amount of water in a lake decreases by 20% per year as it dries up. How many years will it take for the lake to have less than half its water left?

2. The price of a popular brand of skates was $120. When the skates were in demand, their price increased by 25%. After the skates became less popular, their price dropped by 30% of the increased price. The price when the skates became less popular is what percent of the original price?

Extra Practice

1. Haziel drank 48 ounces of water yesterday. Today, it was hot outside, so he drank 40% more. How much water did he drink today?

2. A boy received a 90 on the first math test, but stopped studying and only received a 54 on the second math test. What was the percent decrease in his score?

3. A child received $5 allowance each week when he was eight years old. If he receives an $8.50 allowance at twelve years old, what is the percent increase in his allowance?

4. A man previously had to drive 80 miles to visit his mother. After a new road is constructed, the distance is 19% less. How far must the man drive now?
5. A year ago before he started training, Kodey could run 100 meters in 25 seconds. Now he can do it in 18 seconds. What percent decrease is this?

6. An igloo is made out of 750 pounds of ice. The weather heats up, so 12% of the igloo melts. How many pounds of ice remain?

7. Najee studied 8 hours this weekend for her classes. Last weekend, she studied 5 hours. What was the percent increase in her studying time?

8. A bookstore had 8400 books in stock. After 30.5% of the books were sold, how many books were left in stock?

9. Suppose a certain item used to sell for $75, but now sells for $81. What is the percent increase in price?

10. On the first quiz, a student gets 40 points. On the second quiz, the student gets 32 points. By what percent of the first quiz’s score did the student’s score decrease?

11. A merchant put some books on sale for $10 that were once $16.
   (a) What is the percent decrease in the price of the books?
   (b) If in a week’s time, the merchant restores the price to $16 from $10, what would be the percent increase?

6.10 Percent Increase and Decrease #2

Problems

1. Suppose the price of a shirt is increased by 25% to $45. What was the original price?

2. Belen scored an 80 on her first art quiz, but got a 90 on the second quiz. What percent increase is this?

3. If the price of a bicycle is increased by 20% to $90, what was the original price?

4. A boy scored a 91 on his math test. This is 30% more than what he scored on his Latin test. What did he score on his Latin test?

5. A sofa is reduced by 5% in price to $285. What did the sofa cost originally?

6. The water level in heating tank A decreased from 350 liters to 250 liters while draining into tank B. As a result, tank B increased from 50 liters to 150 liters.
   (a) What was the percent decrease of water in tank A, to the nearest tenth?
   (b) What was the percent increase of water in tank B?
   (c) The new amount of water in tank B is what percent of the new amount of water in tank A?

7. An investment starts at $500. Its value increases by 75% the first year. The value drops by 20% of the new amount the second year. What is its final value after two years?
Challenge Problems

1. Two years ago, the population of Littleville increased by 25%. Last year, Littleville’s population decreased by 25%. Suppose that 9,000 people now live in Littleville. What was the population two years ago, before the changes?

2. A certain brand of t-shirt was reduced in price by 35% at the store, while a pair of jeans from the same brand was increased in price by 15%. The price on sale for the t-shirt is $26, while the jeans now cost $71.30. What was the original price for a pair of jeans and a t-shirt combined?

Extra Practice

1. A dress sells for $126 after a 40% increase in price. What was the original price of the dress?

2. A girl scored an 60 on her science test. This is 20% less than what she scored on her history test. What did she score on her history test?

3. A boy scored an 70 on his first math quiz, but got a 75 on the second quiz. What percent increase is this? Round your answer to the nearest tenth of a percent.

4. A certain model of computer is sold at $1400, which is 20% below the recommended retail price.
   (a) What was the recommended retail price?
   (b) The store realizes the computers are selling too quickly and want to make a larger profit by selling at only 15% off. Find what price 15% below the recommended retail price would be.

5. Your sister was 54 inches in height on her birthday this year, which represented a growth of 8% from the previous year. How tall was she the previous year, in inches?

6. An item is being sold at $189, which is 35% increase from the original price. What was the original price of the item?

7. The price of a stock lowers from $35 to $32.
   (a) This reduction represents what percent of decrease? Round your answer to the nearest tenth of a percent.
   (b) If the stock’s price goes back up to $35 from $32, by what percent did the price increase, to the nearest tenth?

8. An investment starts at $800. Its value increases by 40% the first year. The value drops by 10% of the new amount the second year. What is its final value after two years?
Chapter 7

Inequalities and Probability

7.1 Solving Inequalities

Problems
Solve each inequality and graph the solution set on a number line.

1. \(-5x \geq 75\)  
   2. \(2y + 7 < 15\)  
   3. \(-\frac{3}{5}x \geq -9\)  
   4. \(6(n - 1) > 3(2n + 4)\)  
   5. \(7 - 2x < -5 + 4x\)  
   6. \(\frac{5x - 8}{11} \leq 2\)  
   7. \(-5h - 1 > 5\)  
   8. \(6(b - 2) + b \leq 7b - 10\)  
   9. \(\frac{x}{-5} + 3 \leq -1\)  
   10. \(7(w + 2) - 10 > 5w - (2w - 3)\)

Challenge Problems

1. Write an inequality whose solution set is \(x < -\frac{1}{2}\) by filling in the boxes with whole numbers 0 through 9, using each number at most once. (There are many possible answers, see if you can find one!)
   
   \[\square x + \square > \square x + \square\]

2. In how many ways can each of the digits 3, 5 and 7 be used exactly once to replace X, Y, and Z to make the true inequality 0.XY < 0.Z?

Extra Practice
Solve each inequality and graph the solution set on a number line.

1. \(-5(n - 2) > 4n - 6\)  
   2. \(\frac{n}{3} - 7 < -22\)  
   3. \(4(-2c - 5) - 3(c - 2) > c\)  
   4. \(\frac{5}{6}x < -\frac{2}{9}\)  
   5. \(-2(m - 3) < 5(m + 1) - 12\)  
   6. \(-8x \leq 32\)
7.  $3(5x - 4) + 2(x + 6) \geq -51$
8.  $3a + 4 < 25$
9.  $-\frac{2}{3}y < -4$
10.  $5w - (-2w - 2) > 7w + 3 - 1$

11.  $15 - 2x \geq 23$
12.  $-2(c - 3) \geq 5 - 2c$
13.  $2(1 - x) + 5 \leq 3(2x - 1)$
14.  $\frac{3n - 1}{4} \geq -3n$

7.2 Solving Inequalities #2

Problems
Solve each inequality and graph the solution set on a number line.

1.  $\frac{2b}{5} > \frac{7b - 1}{3}$
2.  $\frac{r}{2} + \frac{6r - 1}{4} \leq -3$
3.  $\frac{k + 1}{3} - \frac{k - 2}{4} < \frac{7}{6}$
4.  $\frac{2y - 1}{3} \geq \frac{3y + 4}{5}$
5.  $\frac{2}{3}x + \frac{1}{4}y > 15$
6.  $\frac{y + 2}{3} - \frac{4y - 7}{10} > \frac{2y + 1}{5}$

Challenge Problems
1.  Solve and graph:
   
   $$x - \frac{2x - 1}{3} - \frac{3x - 2}{4} \leq \frac{4x - 3}{5}$$

2.  *Nesbitt’s inequality* states that for positive $a, b, c$,

   $$\frac{a}{b+c} + \frac{b}{c+a} + \frac{c}{a+b} \geq \frac{3}{2}$$

   Show the two sides of the inequality are equal when all of the variables are equal.

Extra Practice
Solve each inequality and graph the solution set on a number line.

1.  $\frac{5}{2}g - 4(g + 2) > \frac{1}{3}g$
2.  $\frac{7 - x}{4} \leq \frac{1 - 3x}{6}$
3.  $\frac{8a}{5} \geq -\frac{2}{7}$
4.  $\frac{d + 3}{8} \leq \frac{2d - 4}{5}$
5.  $\frac{h - 1}{5} + \frac{2h}{3} < 3h + 2$
6.  $\frac{n}{2} - \frac{4n - 5}{8} > \frac{3w - 2}{5}$
7.  $\frac{n + 4}{3} + \frac{2n - 1}{7} > \frac{4}{3}$
8.  $\frac{5g}{4} > \frac{7g - 5}{2}$
9.  $\frac{3k - 9}{4} - \frac{4k - 2}{3} \geq \frac{k + 8}{6}$
10.  $\frac{1}{5}x - 2(x - 3) < 4$
7.3 Solving Inequality Problems

Problems
Answer each question by writing an inequality using a variable and solve for that variable.

1. Five increased by half of a number is no more than -7 decreased by a sixth of that same number. What are the possible values of this number?

2. The product of -4 with five less than six times a number is at least four more than twice that same number. What are the possible values of this number?

3. JP has 5 more pencils than twice the number that Jose has. If the two boys have a total that is at most 50 pencils, what are the maximum number of pencils that JP and Jose could each have?

4. The selling price of a bouquet of flowers is $25. What is the minimum number of bouquets of flowers a florist must sell if she wants her total sales to be more than $360?

5. Company A quotes a rental rate for a car at $45 per day. Company B quotes a rental rate of $38 per day, but with an initial charge of $75. Find the minimum number of complete days of rental required so that the charges by Company B will be lower than the charges by Company A.

Challenge Problems

1. Solve $4\sqrt{x} + 3 \leq 5$ and graph the solutions.

2. Alice and three other students took a math test. Each of their scores was a non-negative integer. The teacher announced that the average score (of the 4 students) was 20. Alice immediately knew that all of the other three students scored below average. What is the minimum score that Alice could have gotten to be certain of the above situation?

Extra Practice
Answer each question by writing an inequality using a variable.

1. Three less than four times a number is at least -2. What are the possible values of this number?

2. Two more than three times a number is no greater than 47 decreased by twice the same number. What are the possible values of this number?

3. The price of a concert ticket is fourteen less dollars than three times the price of a movie ticket. If the total price of buying one concert ticket and one movie ticket does not exceed $50, what is the maximum price of each ticket?

4. In a chemical reaction, the mass of a product grows 11 g each hour. The current mass of the product is 46 g. What is the minimum number of hours that it will take for the mass of the product to exceed 101 g?
5. Ten less than twice a number is at least -8. What are the possible values of this number?

6. Five increased by half of a number is no more than six increased by a fourth of a number. What are the possible values of this number?

7. David has three more than half as many pieces of candy as Kyle. If their total number of pieces of candy is no greater than 64, what is the maximum number of pieces of candy that each boy could have?

8. Two decreased by two-thirds of a number is no less than 5 increased by a fifth of that same number. What are the possible values of this number?

9. Company A quotes a rental rate for a boat at $85 per day. Company B quotes a rental rate of $73 per day, but with an initial charge of $130. Find the maximum number of complete days of rental required so that the charges by Company A will be less than the charges by Company B.

10. The product of -3 with seven less than four times a number is at most the product of 2 with five more than that same number. What are the possible values of this number?

11. Alexandra has found three pairs of running sneakers that she likes, costing $150, $159, and $179. She has saved $31 already, and she has a job where she earns $8.50 per hour. How many hours will she have to work in order to afford all of these sneakers?

12. Seongju has four times as many books as Nathan. If you subtract 12 from Seongju’s books, he has at least twice the number of books as Nathan. What is the minimum number of books that could Nathan have?

### 7.4 Compound Inequalities

**Problems**

Solve each inequality and graph the solution set on a number line.

1. $12 < 10x + 2 < 32$
2. $-6 \leq 2(x - 5) < 8$
3. $-3 < \frac{3}{2}(2 - x) \leq 5$
4. $-14 < -7(3x + 2) < 1$

5. $x - 2 \leq 4$ and $x - 2 \geq 4$
6. $1 - 4x \leq 21$ and $5x + 2 \geq 22$
7. $2x + 8 \geq 5x - 7$ and $5x - 3 > 3x + 1$
8. $-5b + 10 \leq 30$ and $7b + 2 \leq -40$

**Challenge Problems**

1. Solve and graph: $4b + 18 \leq -12b - 14 \leq 14 - 5b$

2. If $n$ is an even integer such that $-2 < 5n - 2 < 48$, what is the sum of all possible unit fractions of the form $\frac{1}{n}$? Express your answer as a common fraction.
Extra Practice

Solve each inequality and graph the solution set on a number line.

1. \(-6n \leq 12\) and \(\frac{n}{3} \leq 2\)
2. \(-1 < 9 + n < 17\)
3. \(-5 < x + 1 < 2\)
4. \(7 - 3x < 16\) and \(x + 12 < -8\)
5. \(x + 6 < -8\) and \(x - 1 > -1\)
6. \(-9x < 63\) and \(\frac{x}{4} < 1\)
7. \(3x - 9 < 2x + 10\) and \(5 + 7x \leq 10x - 10\)
8. \(10 < 3w + 4 < 19\)
9. \(-4 \leq 3g + 5 < 11\)
10. \(-8 + b < -3\) and \(4b < 20\)
11. \(15 \leq 3 - 2y < 33\)
12. \(1 \leq \frac{p}{8} < 0\)
13. \(3x + 2 < 14\) and \(2x - 5 > -11\)
14. \(-6 < -2x - 4 < 12\)
15. \(-36 < 3p - 6 < 15\)
16. \(2x + 9 \geq 10x + 1\) and \(3x - 2 < 7x + 2\)

7.5 Solving Inequality Problems #2

Problems

Answer each question by writing an inequality using a variable and solve for that variable.

1. Mary works in a store and is paid strictly between $75 and $150. If Mary’s hourly rate of pay is $12 per hour, what are the maximum and minimum integer number of hours that Mary could have worked?

2. A swimming club charges a monthly membership fee of $20 and an admission fee of $3 per entry. Cathy paid between $50 and $100 to the club last month. What are the minimum and maximum possible integer number of times that Cathy went to the swimming club?

3. Tyler and Corbin are comparing how many math problems they have completed. Tyler has completed ten less than twice as many problems as Corbin. If together, the boys have completed strictly between 60 and 80 problems, what are the minimum and maximum integer number of problems that each of them could have finished?

4. The sum of three consecutive odd numbers is between 90 and 100. Find two possible sets of the three consecutive odd numbers.

5. The length of a rectangle is five inches longer than twice its width. The perimeter of the rectangle is between 32 inches and 58 inches. If the side length of the rectangle must be an integer, what are the minimum and maximum possible length and width for this rectangle?
Challenge Problems

1. Colorado has strictly between $2.60 and $3.00 in coins. If he has 30 dimes and nickels in total, what are all of the possible combinations of coins he could have? Solve by writing a compound inequality using a variable.

2. The triangle inequality states that the sum of any two lengths in a triangle must exceed the length of the third side. Use this fact for the following problem. In a triangle with integer side lengths, one side is three times as long as a second side, and the length of the third side is 15. What is the greatest possible perimeter of the triangle?

Extra Practice

Answer each question by writing a compound inequality using a variable.

1. Oscar must pay $6 for a movie ticket. If Oscar spends between $35 and $84 at the movies, what is are the maximum and minimum integer number of movie tickets that he could have purchased?

2. The length of a rectangle is six inches shorter than three times its width. If the perimeter of the rectangle is between 100 and 120 inches, what are the minimum and maximum possible length and width for this rectangle?

3. The weight of a book is 1.5 pounds. If the weight of a pile of books is strictly between 18 and 30 pounds, what are the minimum and maximum integer number of books that could be in the pile?

4. If Ashlyn has seven more dollars than twice her sister’s amount, and the total of their money is strictly between $125 and $160, what are the maximum and minimum integer number of dollars that Ashlyn and her sister could each have?

5. The sum of four consecutive even integers is between 116 and 128. Find two possible sets of the four consecutive even integers.

6. A festival charges $6 per guest admitted. What are the maximum and minimum integer number of guests at the festival if the festival received between $1640 and $1704 in total ticket sales?

7. A babysitter charges $16, plus $15 per hour. What are the maximum and minimum integer number of hours the babysitter must work to earn strictly between $150 and $200?

8. The sum of three consecutive integers is between 165 and 170. Find two possible sets of the three consecutive integers.
7.6 Compound Inequalities #2

Problems
Solve each inequality and graph the solution set on a number line.

1. \( \frac{x - 3}{2} \geq 4 \text{ or } 2x < 6 \)
2. \(-4a - 2 > 10 \text{ or } 8 - 2a < -6\)
3. \(5n + 3 < 8 \text{ or } 6 + 3n > 0\)
4. \(2y + 5 < -13 \text{ or } 6 - 2y \geq 5\)
5. \(8r - 5 - 5 \geq 6r - 1 \text{ or } 4 + 4r \leq 3r - 3\)
6. \(2y + 7 < 13 \text{ or } -3y - 2 \leq 10\)
7. \(5z - 3 > -18 \text{ or } -2z - 1 > 15\)
8. \(2x - 5 > 3 \text{ or } 4 - x \geq 6\)

Challenge Problems
1. If \(-1 < x < 4\), then determine \(a\) and \(b\) in \(a < 2x + 3 < b\).
2. If \(-2 < x < 2\) and \(-5 < y < 5\), find \(a\) and \(b\) in \(a < y - x < b\).

Extra Practice
Solve each inequality and graph the solution set on a number line.

1. \(y + 4 < 6 \text{ or } y - 1 \geq 3\)
2. \(5x + 1 < 0 \text{ or } 8 \leq x - 5\)
3. \(2g > 8 \text{ or } -2g < 4\)
4. \(4x + 8 > 2x - 10 \text{ or } \frac{1}{3}x - 3 < 2\)
5. \(2m + 3 < -2 \text{ or } m - 1 \geq 2\)
6. \(3(x + 1) \leq 4 \text{ or } -2(x + 3) \leq 4\)
7. \(2y - 5 \geq 3 \text{ or } y + 4 \leq 7\)
8. \(3x + 2 \leq -4 \text{ or } 4x + 4 > 24\)
9. \(2r < 10 \text{ or } \frac{r}{2} \geq 3\)
10. \(5h \leq 21 + 2h \text{ or } 3(h + 1) \geq 24\)
11. \(3n + 2 < -2 + 7n \text{ or } 8n - 4 \leq 3n - 4\)
12. \(5x - 5 > -7x - 5 \text{ or } 3x + 5 \leq x - 1\)

7.7 Solving Absolute Value Equations

Problems
Solve each equation.

1. \(|y| = 3\)
2. \(|x - 4| = 10\)
3. \(|2y - 5| = 10\)
4. \(|3g - 5| = 0\)
5. \(|10h - 4| = -2\)
6. \(-3|x + 2| = -12\)
7. $2|b + 5| + 4 = 18$

8. $|3z - 8| - 10 = -6$

9. $3 + 5|8 - 2x| = 63$

10. $\frac{|-4 - 3n|}{4} = 2$

**Challenge Problems**
Solve each equation.

1. $|x - 2| = 3x + 1$

2. $|2x - 1| = |4x + 9|

**Extra Practice**
Solve each equation.

1. $|b| = 1$

2. $|x - 4| = 24$

3. $|y + 3| = 6$

4. $|2c - 5| = 9$

5. $|5n + 7| = 23$

6. $|3 - x| = 6$

7. $|2 + 2b| + 1 = 0$

8. $|w + 2| = 6$

9. $|5g + 7| = 12$

10. $|n| = -7$

11. $|1 - 3n| = 20$

12. $|10y - 3| = 0$

13. $5|n + 6| = -15$

14. $|3x - 5| + 12 = 18$

15. $|5x - 8| = 1$

16. $2|3x - 5| = 8$

17. $|w - 7| = 0$

18. $|5d + 9| = -3$

19. $|9n + 2| = 14$

20. $-7| - 3 - 3r| = -21$

21. $|8 + 6m| = 50$

22. $|6b - 2| + 10 = 44$

23. $\frac{|-4b - 10|}{8} = 3$

24. $-7 + 8| - 7x - 3| = 73$
7.8 Solving Absolute Value Inequalities

Problems
Solve each inequality and graph the solution set.

1. \(|x| \leq 5\)           5. \(|3w + 2| < 0\)
2. \(|2y - 4| < 10\)        6. \(|y - 9| \leq 0\)
3. \(|9m + 2| \leq 1\)      7. \(|5k - 3| + 2 \leq 0\)
4. \(|3 - 2n| \leq 5\)      8. \(|8r + 7| - 1 < 4\)

Challenge Problems
1. Consider the inequality: \(|ax + b| < c\).
   (a) If \(a > 0\), solve for \(x\) in terms of \(a, b,\) and \(c\).
   (b) If \(a < 0\), solve for \(x\) in terms of \(a, b,\) and \(c\).

2. How many ordered pairs of integers \((x, y)\) are there that satisfy \(|x| + |y| \leq 10\)?

Extra Practice
Solve each inequality and graph the solution set.

1. \(|x| < 10\)                 8. \(|y - 8| < 12\)
2. \(|y + 5| < 9\)             9. \(|3x - 2| \leq 9\)
3. \(|10 + 4x| < 14\)         10. \(|2q - 3| \leq 3\)
4. \(|4v - 9| \leq 27\)        11. \(|p + 7| < 2\)
5. \(|-8n| < 32\)             12. \(|3w + 1| - 4 < 7\)
6. \(|2x + 5| < 9\)           13. \(|7 - 2r| < 19\)
7. \(|4p + 2| + 6 < 2\)       14. \(|3d - 5| + 7 < 4\)
7.9 Solving Absolute Value Inequalities #2

Problems
Solve each inequality and graph the solution set.

1. \(|n| > 5\)
2. \(|y + 4| > 6\)
3. \(|6x - 3| \geq 9\)
4. \(|4x - 3| \geq 1\)
5. \(|3d - 5| + 7 > 4\)
6. \(|k - 4| \geq 12\)
7. \(|2x - 1| - 7 \geq -3\)

Challenge Problems
1. Consider the inequality: \(|ax + b| > c\).
   (a) If \(a > 0\), solve for \(x\) in terms of \(a\), \(b\), and \(c\).
   (b) If \(a < 0\), solve for \(x\) in terms of \(a\), \(b\), and \(c\).
2. Solve:
   \[
   1 - \frac{|x|}{1 + |x|} \leq \frac{1}{2}
   \]

Extra Practice
Solve each inequality and graph the solution set.

1. \(|b| \geq 3\)
2. \(|5 - x| > 12\)
3. \(|2x + 6| \geq 10\)
4. \(|4x + 5| > 13\)
5. \(|5x - 3| \geq -1\)
6. \(|2x - 4| > 6\)
7. \(|19 - 5t| \geq 7\)
8. \(|4p + 2| + 6 > 2\)
9. \(|b - 8| + 10 > 22\)
10. \(|x - 6| - 7 \geq -3\)
11. \(|x + 1| + 5 > 7\)
12. \(8 + |4v - 7| \geq 17\)
13. \(|1 - 2x| > 9\)
14. \(1 + \left|\frac{1}{2}t - 5\right| \geq 3\)
7.10 Possibility Diagrams

Problems

1. An unbiased coin is tossed and a fair 6-sided die is rolled.
   (a) Represent the sample space using a possibility diagram.
   (b) Find the probability of getting a head on the coin and an even number on the die.
   (c) Find the probability of getting a number less than 5 on the die.
   (d) Find the probability of getting a number less than 5 on the die and a tail on the coin.

2. A letter is selected at random from each of the words, NICE and ICE.
   (a) Represent the sample space using a possibility diagram.
   (b) Find the probability that the two letters are the same.
   (c) Find the probability that the two letters are both vowels.
   (d) Find the probability that exactly one of the two letters is a consonant.

3. Ana plays a game with two spinners, shown below. Each space is equally likely to come up. Ana
   spins each spinner once.

   (a) Represent the sample space using a possibility diagram.
   (b) Find the probability that both spinners will stop at the same number.
   (c) Find the probability that the first spinner shows a larger number than the second spinner.
   (d) Ana now decides to add together the two numbers on the spinner to find her score. Write a
       new possibility diagram to represent the possible sums.
   (e) Find the probability that the sum of the two numbers is greater than 6.
   (f) Find the probability that the sum of the two numbers is prime.
   (g) If instead Ana decides to multiply the two numbers together, write a new possibility diagram
       to represent the possible products.
   (h) Find the probability that the product is a multiple of 3.
   (i) Find the probability that the product is a single digit number.

Challenge Problems

1. Two regular six-sided dice are thrown. What is the probability that the product of the two numbers
   is a prime number or greater than 15? Use a possibility diagram to answer.

2. You have two spinners shown below, where each space is equally likely to come up. The number
   on the first spinner is divided by the number on the second spinner. Use a possibility diagram to
   find the probability that the quotient is greater than \( \frac{3}{4} \).
Extra Practice

1. Box X contains a gold coin and a silver coin. Box Y contains a copper coin, a gold coin, and a silver coin. Paul picks a coin at random from each box.
   (a) Represent the sample space using a possibility diagram.
   (b) Find the probability that he will pick two gold coins.
   (c) Find the probability that he will pick one gold coin and one silver coin.
   (d) Find the probability that he will pick at least one silver coin.

2. Sandra plays a game with two spinners, shown below. Each space is equally likely to come up. Sandra spins each spinner once.

   ![Spinners Diagram]

   (a) Represent the sample space using a possibility diagram.
   (b) Find the probability that both spinners will stop at the same number.
   (c) Find the probability that the first spinner shows a number that is at least two more than the second spinner.
   (d) Sandra now decides to add together the two numbers on the spinner to find her score. Write a new possibility diagram to represent the possible sums.
   (e) Find the probability that the sum of the two numbers is less or equal to than 5.
   (f) Find the probability that the sum of the two numbers is not prime.
   (g) If instead Sandra decides to multiply the two numbers together, write a new possibility diagram to represent the possible products.
   (h) Find the probability that the product is a multiple of 4.
   (i) Find the probability that the product is a double digit number.

3. A fair coin is tossed and a letter is selected at random from the word NUMBER.
   (a) Represent the sample space using a possibility diagram.
   (b) Find the probability of getting a head on the tossed coin and the letter M from the word.
   (c) Find the probability of getting a vowel.
   (d) Find the probability of getting a vowel with heads or a consonant with tails.

4. A letter is selected at random from each of the words, HOME and WORK.
   (a) Represent the sample space using a possibility diagram.
   (b) Find the probability that the two letters are the same.
   (c) Find the probability that the two letters are both vowels.
   (d) Find the probability that exactly one of the two letters is a consonant.

5. Two fair six-sided dice are rolled. The numbers are added together.
   (a) Represent the sample space using a possibility diagram.
   (b) Find the probability that the sum of the two numbers shown is 10.
   (c) Find the probability that the sum is a 2 or a 12.
   (d) Find the probability that the sum is a prime number.
6. Two spinners are shown below. The first spinner and second spinner are spun independently.

(a) Represent the sample space using a possibility diagram.
(b) Find the probability that both spinners will stop at different numbers.
(c) Find the probability that the first spinner shows a smaller number than the second spinner.
(d) Suppose the two numbers are the spinners are added together. Write a new possibility diagram to represent the possible sums.
(e) Find the probability that the sum of the two numbers is less than 7.
(f) Find the probability that the sum of the two numbers is prime.
(g) If instead the two numbers on the spinners are multiplied together, write a new possibility diagram to represent the possible products.
(h) Find the probability that the product is even.
(i) Find the probability that the product is greater than 10.

7.11 Tree Diagrams

Problems

1. A regular 6-sided die is thrown, followed by a weighted coin. Each outcome has a \( \frac{1}{6} \) probability on the die. Heads has a \( \frac{7}{10} \) probability of occurring on the coin. Use a tree diagram to find the probability of getting a tails and a prime number.

2. Jack wakes up late \( \frac{3}{5} \) of the time. If Jack wakes up late, the probability he is late for school is \( \frac{9}{10} \). If Jack does not wake up late, the probability he is late for school is \( \frac{3}{10} \). What is the probability that Jack is late for school? Use a tree diagram to solve the problem.

3. Bag \( A \) contains three red chips and two blue chips. Bag \( B \) contains four red chips and six blue chips. A chip is drawn at random from bag \( A \), then from bag \( B \). Assume there is an equal probability of drawing any single chip from a bag. Use a tree diagram to determine the probability of drawing exactly one chip of each color.

4. The probability of a fine day is \( \frac{2}{3} \) and the probability of a wet day is \( \frac{1}{3} \). If it’s a fine day, the probability Joe cycles to work is \( \frac{7}{10} \), the probability Joe drives to work is \( \frac{2}{10} \), and the probability Joe takes the train is \( \frac{1}{10} \). If it’s a wet day, the probability Joe cycles to work is \( \frac{1}{6} \), the probability Joe drives to work is \( \frac{2}{6} \), and the probability Joe takes the train is \( \frac{3}{6} \). What is the probability Joe takes the train to work on a random day? Use a tree diagram to solve the problem.
Challenge Problems

1. Suppose that the probability of rolling an \( n \) on a 6-sided die is \( \frac{n}{21} \). What is the probability of rolling a number less than 3, then a prime number?

2. Teddy has two pairs of black shoes and three pairs of brown shoes. He also has three pairs of red socks, four pairs of brown socks and six pairs of black socks. If Teddy chooses a pair of shoes at random and a pair of socks at random, what is the probability that the colors he chooses are black and brown (in any order)?

Extra Practice

1. Maria has 7 American stamps and 5 British stamps. Norah has 12 American stamps and 18 British stamps. Each of them selects a stamp at random from her own collection. Using a tree diagram, find the probability that the two stamps selected are both American or both British.

2. There is a \( \frac{1}{5} \) chance of going out to a restaurant for dinner. If you go out to a restaurant, there is a \( \frac{1}{3} \) chance of getting to have dessert. However, if you don’t go out to a restaurant, there is a \( \frac{3}{5} \) chance you will get to have dessert. What is the probability that you will get to have dessert? Use a tree diagram to answer the problem.

3. At a certain lake, there is a \( \frac{3}{5} \) chance of good weather and a \( \frac{2}{5} \) chance of bad weather. When there is good weather, the probability of catching a fish is \( \frac{2}{3} \). When there is bad weather, the probability of catching a fish is \( \frac{1}{4} \). Find the probability of catching a fish. Use a tree diagram to answer the problem.

4. Tina’s favorite meal is pasta, followed by ice cream for dessert. Tina’s mom cooks pasta one day out of seven (\( \frac{1}{7} \) of the time). If Tina’s mom cooks pasta, the probability that Tina gets ice cream for dessert is \( \frac{2}{3} \). If she does not cook pasta, then the probability Tina gets ice cream for dessert is \( \frac{1}{4} \). What is the probability that Tina gets ice cream for dessert? Use a tree diagram to solve the problem.

5. A representative is chosen at random from a boy and a girl. A flag is chosen at random from a red one, a green one, and a yellow one. The chosen representative will carry the hoisted flag in a school parade. Use a tree diagram to find the probability that the chosen representative is a boy and the flag is not a red one.
7.12 Tree Diagrams #2

Problems

1. There are three purple and seven yellow marbles in a bag. You draw two times in a row with replacement.
   (a) Draw a tree diagram for this problem. Label all branches with the correct probability.
   (b) What is the probability of drawing a yellow marble twice in a row?
   (c) What is the probability of drawing two different colored marbles?
   (d) What is the probability of drawing at least one purple marble?

2. There are three X’s, four Y’s, and two Z’s in a bag with letter tiles. You draw twice in a row without replacement.
   (a) Draw a tree diagram for this problem. Label all branches with the correct probability.
   (b) What is the probability of drawing out an X, then a Y?
   (c) What is the probability of drawing out exactly one Y and one Z?
   (d) What is the probability of drawing two of the same letter in a row?

3. There are four chocolate candies and three vanilla candies in a bag. You take three candies in a row and put them back each time.
   (a) Draw a tree diagram for this problem. Label all branches with the correct probability.
   (b) What is the probability of taking a chocolate candy on the first draw, then a vanilla candy on the next two draws?
   (c) Find the probability of taking three candies of the same flavor in a row.

4. There are five salmon and three trout in a pond. You catch two fish in a row and do not throw them back each time.
   (a) Draw a tree diagram for this problem. Label all branches with the correct probability.
   (b) What is the probability of catching a trout, then a salmon?
   (c) Find the probability of catching two different type of fish.

Challenge Problems

1. The letter tiles C, A, and T are in a bag. There are 3 C tiles, 4 A tiles, and 5 T tiles. What is the probability of pulling three tiles, in any order and without replacement, which let you spell CAT?

2. Roll an ordinary die three times. What is the probability of getting at least one six?

Extra Practice

1. Two marbles are drawn without replacement from a jar containing 4 black and 6 white marbles.
   (a) Draw a tree diagram for this problem. Label all branches with the correct probability.
   (b) Find the probability of drawing out one marble of each color.
   (c) Find the probability of drawing two marbles of the same color.
2. A jar consists of 15 sweets. 10 are green and 5 are blue. Rachel picked a sweet at random, put it back, and then picked another sweet at random.
   (a) Draw a tree diagram for this problem. Label all branches with the correct probability.
   (b) Find the probability that both sweets are blue.
   (c) Find the probability that one sweet is blue and one sweet is green.
   (d) Find the probability that no sweets are blue.

3. A jar consists of 18 sweets. 12 are green and 6 are blue. Andrew picked two sweets at random without replacement.
   (a) Draw a tree diagram for this problem. Label all branches with the correct probability.
   (b) Find the probability that both sweets are blue.
   (c) Find the probability that one sweet is blue and one sweet is green.
   (d) Find the probability that no sweets are blue.

4. A bag contains 5 yellow marbles, 4 red marbles, and 3 green marbles. Suppose you draw two marbles out of the bag and do not place them back in the bag after each draw.
   (a) Draw a tree diagram to represent the problem. Label your branches with all probabilities.
   (b) What is the probability of drawing two marbles of the same color?
   (c) What is the probability of drawing a green marble, then a marble that is not green?
   (d) What is the probability of drawing at least one red marble, but no yellow marbles?

5. Suppose you have a bag with letter tiles in it. There are 2 tiles with the letter A and 5 tiles with the letter B. You take two letter tiles from the bag without replacement.
   (a) Make a tree diagram for this problem. Label every branch with the correct probability.
   (b) What is the probability of drawing two B’s in a row?
   (c) What is the probability of drawing at exactly one A?

6. Suppose you have a bag with letter tiles in it. There are 7 tiles with the letter R and 3 tiles with the letter O. You take three letter tiles from the bag with replacement.
   (a) Make a tree diagram for this problem. Label every branch with the correct probability.
   (b) What is the probability of spelling ROR, in that exact order?
   (c) What is the probability of drawing three of the same letter in a row?
CHAPTER 8

SLOPE

8.1 Linear Graphs

Problems
Verify whether each ordered pair is a solution to the equation.

1. \( y = 4x - 10 \)
   (a) \((0, -10)\)
   (b) \((1, -14)\)
   (c) \((-1, -14)\)

2. \( 2x - y = 6 \)
   (a) \((-3, -10)\)
   (b) \((3, 0)\)
   (c) \(\left(\frac{5}{2}, -1\right)\)

Solve for \(y\), if necessary. Then, graph the equation by finding at least 3 points.

3. \( y = -2x + 3 \)

4. \( y = 3x - 1 \)

5. \( y = \frac{1}{4}x + 2 \)

Challenge Problems
1. Verify whether \((-\frac{1}{4}, \frac{5}{3})\) is a solution to \(4x + 6y = 9\).

2. For what value of \(y\) will the point \((3, y)\) be a solution of the equation \(y = 3x - 1\)?

Extra Practice
Verify whether each ordered pair is a solution to the equation.

1. \( y = 2x + 5 \)
   (a) \((1, 8)\)
   (b) \((-3, 1)\)
   (c) \((4, 12)\)

2. \( y = -\frac{1}{2}x + 7 \)

3. \( 4x + 3y = 9 \)
Chapter 8

5. 2y − x = 5

(a) (3, −1)
(b) (6, 7)
(c) (−3, −9)

4. y = −6x − 1

(a) (−1, 2)
(b) (2, −11)
(c) (0, −1)

6. 4y + 5x = 9

(a) (1, 1)
(b) (2, 5)
(c) (0, 2)

Solve for y, if necessary. Then, graph the equation by finding at least 3 points.

7. y = 2x
8. y = 3x + 1
9. 4x − 2y = −6
10. −2x + 4y = 8
11. y − 3 = x
12. −6x + 10 = 2y
13. y = −x − 3
14. \( \frac{1}{2}x + y = 2 \)
15. \( y = \frac{1}{3}x + 4 \)
16. x + y = −5

8.2 Linear Graphs #2

Problems

Graph each equation.

1. y = 5
2. x = 4
3. y = −2
4. x = −7

Graph each linear equation by finding the x and y-intercepts. If there is only one intercept, pick another point to graph the line.

5. y = x + 4
6. 4x + 2y = −12
7. y = 5 − 3x
8. −3x = y
9. x + 3 = 0
10. 2y − 8 = −2
**Challenge Problems**

1. Find $a$ such that the x-intercept of $y = ax + 5$ is 3.

2. Find $b$ such that the y-intercept of $y = -2x + b$ is 5.

**Extra Practice**

Graph each equation.

1. $y = -3$
2. $x = -2$
3. $y = 0$
4. $x = 4$

Graph each linear equation by finding the x and y-intercepts. If there is only one intercept, pick another point to graph the line.

5. $3x - 6y = -18$
6. $-6x + 2y = 6$
7. $y = -3x - 6$
8. $3x + 4y = 24$
9. $6x - 2y = 12$
10. $3y - 12 = 0$
11. $5x - 3y = 15$
12. $-2x - 6 = 8$

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**8.3 Slope**

**Problems**

Find the slope of the line containing the two points.

1. $(3,2), (6,11)$
2. $(-1,-4), (-5,-1)$
3. $(-3,3), (-3,8)$
4. $(5,0), (7,0)$

Name the slope of the given line.

5. [Graph showing slope]
6. [Graph showing slope]
Given a point and the slope of a line, graph the line.

11. Point: (1, 2), Slope: 4

Given the intercept and the slope of the line, graph the line.

13. x-intercept: 3, Slope: -3

14. y-intercept: -2, Slope: $\frac{3}{5}$

**Challenge Problems**

1. The point (2, 5) is shown in the standard (x, y) coordinate plane below. Which point is another point on the line through the point (2, 5) with a slope of $-\frac{2}{3}$?

2. A line passes through (2, 4) and (-2, 2). Find the value of y if (6, y) lies on the line.

3. A line with slope of -3 passes through (-8, p) and (2, 3p). Find the value of p.
Extra Practice
Find the slope of the line containing the two points.

1. $(3, 4), (-4, 7)$
2. $(-1, 6), (0, 6)$
3. $(0, 5), (-2, 3)$
4. $(5, 4), (9, 1)$
5. $(6, 1), (6, -3)$
6. $(-1, -9), (4, 1)$
7. $(5, 2), (2, 5)$
8. $(7, -4), (3, -2)$

Name the slope of the given line.

9.

10.

11.

12.

13.

14.
Given a point and the slope of a line, graph the line.

15. Point: (1, 2), Slope: 3
16. Point: (0, 0), Slope: \( \frac{5}{6} \)
17. Point: (-1, -3), Slope: -1
18. Point: (4, -2), Slope: \(-\frac{1}{4}\)
19. Point: (3, 5), Slope: 4
20. Point: (-2, 1), Slope: \(-\frac{2}{3}\)

Given the intercept and the slope of the line, graph the line.

21. \(x\)-intercept: 5, Slope: -2
22. \(y\)-intercept: 7, Slope: \(\frac{3}{2}\)

### 8.4 Slope-Intercept Form

**Problems**

Use each graph to write an equation for the line in slope-intercept form.

1. ![Graph 1](image1)
2. ![Graph 2](image2)
3. ![Graph 3](image3)
4. ![Graph 4](image4)
Graph each equation. Rewrite into slope-intercept form first, if the equation is not already in slope-intercept form.

5. \( y = -2x + 3 \) 
6. \( y = 3x + 1 \) 
7. \( y = \frac{1}{4}x - 3 \) 
8. \( x + y = -4 \) 
9. \( y = \frac{3}{2}x + 5 \) 
10. \( 8x + 2y = 0 \)

**Challenge Problems**

1. Convert \( \frac{1}{2}x + \frac{2}{3}y = 5 \) to slope-intercept form.

2. What is the number of square units in the triangular region bounded by the lines \( y = 2x \), \( y = -2x \), and \( x = 5 \)?

**Extra Practice**

Use each graph to write an equation for the line in slope-intercept form.

1. 

2. 

3. 

4.
Graph each equation. Rewrite into slope-intercept form first, if the equation is not in slope-intercept form.

7. $y = 4x - 2$

8. $y = -\frac{3}{2}x + 5$

9. $y = \frac{1}{3}x - 3$

10. $-6x - 3y = 3$

11. $y = -\frac{3}{5}x + 4$

12. $4x + 2y = 8$

13. $x + y = -7$

14. $18 - 3y = x$

8.5 Slope-Intercept Form #2

Problems
1. Convert to slope-intercept form, then graph the equation of the line.

$$2x + 3y = 18$$

Write an equation in slope-intercept form for the line using the given information, then graph the line.

2. Point: $(−3, −4)$, Slope: 4

3. Point: $(−6, 5)$, Slope: $−\frac{3}{2}$

4. Points: $(2, 5), (−1, −4)$

5. Points: $(−4, −6), (1, 9)$
**Challenge Problems**

1. Graph \( \frac{x}{3} + \frac{y}{5} = 1 \).

2. Convert \( dx + ky = g \) to slope-intercept form.

**Extra Practice**

Convert to slope-intercept form, then graph the equation of the line.

1. \( 4y - 5x = 20 \)  
2. \( 3y - 2x = -12 \)

Write an equation in slope-intercept form for the line using the given information, then graph the line.

3. Point: \((-3, 2)\), Slope: \(-\frac{4}{3}\)  
4. Points: \((3, 2), (6, 11)\)  
5. Point: \((4, 3)\), Slope: -2  
6. Points: \((4, 4), (8, 1)\)

7. Point: \((6, 2)\), Slope: \(\frac{2}{3}\)  
8. Points: \((0, 5), (-2, 3)\)  
9. Point: \((5, 6)\), Slope: 1  
10. Points: \((5, 0), (7, 0)\)

---

**8.6 Slope-Intercept Form #3**

**Problems**

Write an equation in slope-intercept form for the line containing the given intercept and slope.

1. x-intercept: 8, Slope: \(\frac{1}{2}\)  
2. y-intercept: 5, Slope: 0

Write an equation in slope-intercept form for the line using the given information.

3. x-intercept: 3, Point: \((0, -2)\)  
4. x-intercept: 8, y-intercept: -2

Write an equation in slope-intercept form using the given information, then graph the line.

5. y-intercept: -4, Slope: \(-\frac{5}{4}\)  
6. x-intercept: -2, Point: \((6, -4)\)  
7. x-intercept: -5, y-intercept: 7
Challenge Problems

1. For a line with a positive slope, which of the following are correct?
   (a) The x-intercept and y-intercept must have opposite signs.
   (b) The x-intercept and y-intercept can both be 0.
   (c) The x-intercept and y-intercept can have opposite signs.
   (d) The slope is equal to y-intercept/x-intercept.
   (e) The product of x-intercept and y-intercept can be positive.
   (f) None of the above.

2. When graphed in the standard \((x,y)\) coordinate plane, the lines \(x = -3\) and \(y = x - 3\) intersect at which point?

Extra Practice

Write an equation in slope-intercept form for the line containing the given intercept and slope.

1. \(x\)-intercept: 6, Slope: \(-\frac{3}{2}\)
2. \(y\)-intercept: 2, Slope: 3
3. \(x\)-intercept: -3, Slope: \(\frac{5}{3}\)
4. \(y\)-intercept: -1, Slope: \(-2\)

Write an equation in slope-intercept form for the line using the given information.

5. \(x\)-intercept: -2, Point: \((-3, -3)\)
6. \(x\)-intercept: -5, \(y\)-intercept: 4
7. \(y\)-intercept: 3, Point: \((1, -5)\)
8. \(x\)-intercept: 1, \(y\)-intercept: -2

Write an equation in slope-intercept form using the given information, then graph the line.

9. \(x\)-intercept: 2, Point: \((-2, -2)\)
10. \(y\)-intercept: 0, Slope: \(\frac{2}{5}\)
11. \(x\)-intercept: -3, Slope: \(-\frac{2}{3}\)
12. \(x\)-intercept: 6, \(y\)-intercept: 2
13. \(y\)-intercept: -2, Slope: \(\frac{4}{3}\)
14. \(y\)-intercept: 8, Point: \((-3, 2)\)

8.7 Point-Slope Form

Problems

Rewrite each equation from point-slope form to slope-intercept form.

1. \(y - 1 = -2(x + 3)\)
2. \(y + 4 = \frac{1}{2}(x - 6)\)

Given a line containing the point and the slope listed, write the equation of the line in point-slope form, then graph the line.

3. Point: \((5, 1)\), Slope: \(-\frac{3}{5}\)
4. Point: \((2, -4)\), Slope: -2
Given the intercept and the slope of the line, write the equation of the line in point-slope form, then graph the line.

5. \(x\)-intercept: -5, Slope: 2
6. \(y\)-intercept: 4, Slope: \(\frac{1}{2}\)

Given a line containing the two points listed, write the equation of the line in point-slope form, then graph the line.

7. Points: \((2, 1)\) and \((4, -5)\)
8. Points: \((5, 3)\), \((-1, -9)\)

**Challenge Problems**

1. What is the point-slope equation of the line that passes through the point \((2, -3)\) and has the same \(y\)-intercept as \(-5x + y - 2 = 0\)?

2. The line \(y = \frac{5}{3}x + b\) goes through the point \((7, -1)\). What is the value of \(b\)?

**Extra Practice**

Rewrite each equation from point-slope form to slope-intercept form.

1. \(y + 3 = -\frac{1}{3}(x + 6)\)
3. \(y - 4 = -(x - 2)\)
2. \(y - 1 = 5(x - 1)\)
4. \(y + 7 = -2(x + 3)\)

Given a line containing the point and the slope listed, write the equation of the line in point-slope form, then graph the line.

5. Point: \((6, 3)\), Slope: \(-\frac{4}{3}\)
6. Point: \((0, 0)\), Slope: 3
7. Point: \((2, -2)\), Slope: 5
8. Point: \((-4, -1)\), Slope: \(\frac{1}{2}\)

Given the intercept and the slope of the line, write the equation of the line in point-slope form, then graph the line.

9. \(x\)-intercept: 2, Slope: -3
10. \(y\)-intercept: 1, Slope: \(\frac{2}{3}\)
11. \(x\)-intercept: -3, Slope: 4
12. \(y\)-intercept: -5, Slope: \(-\frac{3}{5}\)

Given a line containing the two points listed, write the equation of the line in point-slope form, then graph the line.

13. Points: \((3, 2)\), \((0, 1)\)
14. Points: \((-1, 3)\), \((4, 2)\)
15. Points: \((2, -1)\), \((-1, 6)\)
16. Points: \((-4, -2)\), \((5, -3)\)
8.8 Parallel and Perpendicular Lines

Problems
Find the slope of the line that is (a) parallel and (b) perpendicular to the given line.

1. \( y = 3x + 4 \)
2. \( y = \frac{4}{5}x - 3 \)
3. \( y = x \)
4. \( 4x + 3y = 9 \)

5. A graph is shown below. Find equations in slope-intercept form for the parallel and perpendicular lines which pass through \((2, 1)\), then graph these two lines along with the original line.

Write equations for the line in BOTH point-slope form and slope-intercept form (first do point-slope, then convert to slope-intercept form as well) that:

6. Passes through \((1, 5)\) and is parallel to \(y = 2x - 6\)
7. Passes through \((3, -4)\) and is perpendicular to \(y = \frac{1}{2}x - 7\)

Challenge Problems
1. The graphs of the equations \(y = 3x + 2\) and \(6x + ky = 10\) are parallel. What is the value of \(k\)?
2. The graphs of the equations \(x + 3y = 6\) and \(kx + 2y = 12\) are perpendicular. What is the value of \(k\)?
Extra Practice

Find the slope of the line that is (a) parallel and (b) perpendicular to the given line.

1. \( y = -2x - 3 \)
2. \( y = \frac{2}{7}x \)
3. \( y = 5x + 10 \)
4. \(-5x + 2y = -6\)
5. \( \frac{3}{8}x + y = 5 \)
6. \( -\frac{2}{3}x + y = 0 \)
7. \( y - 3x = 2 \)
8. \( 8x - 4y = 12 \)

9. A graph is shown below. Find equations in slope-intercept form for the parallel and perpendicular lines which pass through \((3, 4)\), then graph these two lines, along with the original line.

10. A graph is shown below. Find equations in slope-intercept form for the parallel and perpendicular lines which pass through \((0, -4)\), then graph these two lines, along with the original line.

Write an equation for the line in point-slope form that:

11. Passes through \((2, -1)\) and is parallel to \( y = -\frac{1}{4}x + 5 \)
12. Passes through \((4, 6)\) and is perpendicular to \( y = \frac{2}{3}x + 5 \)

13. Passes through \((-7, 2)\) and is parallel to \( 7x + 2y = 0 \)
14. Passes through \((-2, 7)\) and is perpendicular to \( 5x - 3y = 30 \)

Write an equation for the line in slope-intercept form that:

15. Passes through \((-2, -5)\) and is parallel to \( y = 4x - 1 \)
16. Passes through \((4, 2)\) and is perpendicular to \( 2x - 5y = 3 \)

17. Passes through \((-3, 5)\) and is parallel to \( 2x - 3y - 12 = 0 \)
18. Passes through \((6, -1)\) and is perpendicular to \( y = 2x - 3 \)
CHAPTER 9

SYSTEMS OF LINEAR EQUATIONS

9.1 Solving Systems by Graphing

Problems
Verify whether each ordered pair is a solution to the system of linear equations.

1. \[
\begin{cases}
2x - y = -8 \\
x + y = 5
\end{cases}
\Rightarrow (1, 10)
\]

2. \[
\begin{cases}
y = -\frac{1}{2}x + 4 \\
y = 2x - 6
\end{cases}
\Rightarrow (4, 2)
\]

3. \[
\begin{cases}
y + 5x = -14 \\
2x - 3y = 6
\end{cases}
\Rightarrow (-2, -4)
\]

4. \[
\begin{cases}
y + x = 7 \\
x - y = -1
\end{cases}
\Rightarrow (3, 4)
\]

Solve each system of linear equations by graphing.

5. \[
\begin{cases}
y = -2x + 7 \\
y = x + 1
\end{cases}
\]

6. \[
\begin{cases}
x + y = 3 \\
x - y = 1
\end{cases}
\]

7. \[
\begin{cases}
x + y = 4 \\
-3x + y = -4
\end{cases}
\]

8. \[
\begin{cases}
y = -2x + 2 \\
y = 3x - 3
\end{cases}
\]

Challenge Problems

1. Solve by graphing.
\[
\begin{cases}
y = -\frac{1}{3}x - 2 \\
y = \frac{4}{3}x + 8
\end{cases}
\]

2. Find the value of \(a\) for which \((4, -3)\) is a solution to the system of linear equations.
\[
\begin{cases}
ax + 2y = 6 \\
y = -2x + 5
\end{cases}
\]

Extra Practice
Verify whether the ordered pair is a solution to the system of linear equations.

1. \[
\begin{cases}
2x - 3y = 3 \\
3x - 5y = 15
\end{cases}
\Rightarrow (0, -1)
\]

2. \[
\begin{cases}
y = 3x - 1 \\
x - 2y = 3
\end{cases}
\Rightarrow (1, 2)
\]

3. \[
\begin{cases}
4x + 3y = 5 \\
-2x + 5y = 17
\end{cases}
\Rightarrow (-1, 3)
\]

4. \[
\begin{cases}
y = -2x \\
3x + 2y = 1
\end{cases}
\Rightarrow (-2, 4)
\]

5. \[
\begin{cases}
2x + y = -8 \\
y - x = 1
\end{cases}
\Rightarrow (-3, -2)
\]

6. \[
\begin{cases}
y = 3x \\
2x - y = 6
\end{cases}
\Rightarrow (3, 9)
\]
9.2 Solving Systems by Graphing #2

Problems
Solve each system of linear equations by graphing.

1. \(\begin{align*}
    y &= \frac{2}{5}x - 1 \\
    x &= 5
\end{align*}\)

2. \(\begin{align*}
    x + y &= 5 \\
    y &= -x - 3
\end{align*}\)

3. \(\begin{align*}
    2y &= 4x + 6 \\
    y - 2x &= 3
\end{align*}\)

4. \(\begin{align*}
    y &= \frac{3}{4}x + 6 \\
    y &= -\frac{1}{2}x - 4
\end{align*}\)

5. \(\begin{align*}
    y &= -4x + 5 \\
    2y + 8x &= -6
\end{align*}\)

6. \(\begin{align*}
    7x + 3y &= 12 \\
    x + 3y &= -6
\end{align*}\)

Challenge Problems

1. Solve by graphing. \(\begin{align*}
    y &= 2x - 1 \\
    y &= -4x + 8
\end{align*}\)

2. Solve by graphing. \(\begin{align*}
    y &= -\frac{2}{3}x + 3 \\
    \frac{1}{2}y - \frac{1}{4}x &= 5
\end{align*}\)
Extra Practice

Solve each system of linear equations by graphing.

1. \[
\begin{align*}
y &= -\frac{3}{2}x + 1 \\
x &= -2 \\
y &= \frac{7}{2}x + 3
\end{align*}
\]

2. \[
\begin{align*}
y &= \frac{1}{2}x - 3 \\
2x + y &= 5 \\
y &= \frac{3}{4}x + 6 \\
y &= -\frac{1}{2}x - 4
\end{align*}
\]

3. \[
\begin{align*}
2x + y &= 10 \\
y &= -\frac{5}{3}x + 3 \\
x - 2y &= -4 \\
y &= \frac{1}{2}x + 2
\end{align*}
\]

4. \[
\begin{align*}
y &= -\frac{5}{3}x + 3 \\
y &= \frac{1}{3}x - 3
\end{align*}
\]

5. \[
\begin{align*}
y &= -\frac{3}{2}x - 1 \\
y &= \frac{1}{2}x - 4 \\
y &= -\frac{5}{2}x + 4 \\
y &= 3x - 4
\end{align*}
\]

6. \[
\begin{align*}
y &= -\frac{1}{2}x + 3 \\
y &= -\frac{1}{2}x - 2 \\
y &= -\frac{3}{2}x + 2 \\
y &= \frac{1}{3}x \\
y &= -x + 1
\end{align*}
\]

9.3 Solving Systems by Substitution

Problems

Solve each system of linear equations using the substitution method.

1. \[
\begin{align*}
y + 5 &= 2x \\
y - x &= 2
\end{align*}
\]

2. \[
\begin{align*}
y &= x - 2 \\
y &= 4x + 1
\end{align*}
\]

3. \[
\begin{align*}
4x + 12y &= 4 \\
y - 5x &= 11
\end{align*}
\]

4. \[
\begin{align*}
3x - 2y &= 7 \\
x + 3y &= -5
\end{align*}
\]

5. \[
\begin{align*}
y &= -3x - 1 \\
2x - 3y &= -8
\end{align*}
\]

6. \[
\begin{align*}
x + 2y &= -1 \\
2x + 3y &= 0
\end{align*}
\]
Challenge Problems

1. Find \( a \) and \( b \) such that the system \[
\begin{align*}
ax + by &= 8 \\
bx + ay &= 7
\end{align*}
\] has solution \((2, 1)\). (Hint: Substitute the given \( x \)- and \( y \)-values and solve the resulting linear system in terms of \( a \) and \( b \).)

2. Solve \[
\begin{align*}
\frac{1}{x} + \frac{1}{y} &= 4 \\
\frac{1}{x} - \frac{3}{y} &= -6
\end{align*}
\] by using a change of variables, where \( u = \frac{1}{x} \) and \( v = \frac{1}{y} \). Use these substitutions, then solve the system in terms of \( u \) and \( v \). When you are finished, find \( x \) and \( y \).

Extra Practice

Solve each system of linear equations using the substitution method.

1. \[
\begin{align*}
4x &= y - 1 \\
3x - 2y &= -7
\end{align*}
\]
2. \[
\begin{align*}
2x - y &= 6 \\
x + y &= -3
\end{align*}
\]
3. \[
\begin{align*}
y &= x - 4 \\
y &= -x + 2
\end{align*}
\]
4. \[
\begin{align*}
2x + 2y &= 2 \\
-4x + 4y &= 12
\end{align*}
\]
5. \[
\begin{align*}
y &= -3x + 4 \\
x &= 2y + 6
\end{align*}
\]
6. \[
\begin{align*}
y - 2x &= 6 \\
x + 4y &= 15
\end{align*}
\]
7. \[
\begin{align*}
x + 2y &= 8 \\
x + 3y &= 12
\end{align*}
\]
8. \[
\begin{align*}
y &= 3x + 1 \\
y &= 5x - 3
\end{align*}
\]
9. \[
\begin{align*}
x - y &= 4, x = 2y - 2
\end{align*}
\]
10. \[
\begin{align*}
4x + 5y &= 6, y + 10 = 2x
\end{align*}
\]
9.4 Solving Systems by Substitution #2

Problems
Solve each system of linear equations using the substitution method.

1. \[
\begin{align*}
  x &= 2y - 4 \\
  -2x + 4y &= 6
\end{align*}
\]

4. \[
\begin{align*}
  4x + 2y &= 7 \\
  5x - y &= 0
\end{align*}
\]

2. \[
\begin{align*}
  -x + y &= -5 \\
  2x - 5y &= 1
\end{align*}
\]

5. \[
\begin{align*}
  2x - 4y &= 0 \\
  x - 2y &= 9
\end{align*}
\]

3. \[
\begin{align*}
  4x - 2y &= -6 \\
  y - 3 &= 2x
\end{align*}
\]

6. \[
\begin{align*}
  x - y &= 8 \\
  3x + 2y &= 9
\end{align*}
\]

Challenge Problems
1. Find \( k \) such that \( 3x + 4y = 12 \) and \( kx + 12y = 30 \) has no solution.

2. Show that there is no common point of intersection for the lines \( x + 2y = 1, \ y = 2x + 3, \) and \( 4x - 3y = 2 \). (Hint: find the intersection point for a pair of these lines and show it cannot work for the third line).

Extra Practice
Solve each system of linear equations using the substitution method.

1. \[
\begin{align*}
  -2x + 4y &= 22 \\
  x &= 2y - 11
\end{align*}
\]

6. \[
\begin{align*}
  x - y &= 4 \\
  x &= 2y - 2
\end{align*}
\]

2. \[
\begin{align*}
  x + 4y &= 8 \\
  3x &= 3 - 12y
\end{align*}
\]

7. \[
\begin{align*}
  3x + 2y &= -18 \\
  x - 3y &= 5
\end{align*}
\]

3. \[
\begin{align*}
  x - 3y &= -4 \\
  2x + 3y &= -5
\end{align*}
\]

8. \[
\begin{align*}
  4x + 5y &= 6 \\
  y + 10 &= 2x
\end{align*}
\]

4. \[
\begin{align*}
  3x - y &= 11 \\
  5x - 7x &= 1
\end{align*}
\]

9. \[
\begin{align*}
  x - 7y &= 3 \\
  2x - 5y &= 15
\end{align*}
\]

5. \[
\begin{align*}
  x - y &= 7 \\
  y &= 2x - 12
\end{align*}
\]

10. \[
\begin{align*}
  4x - 12y &= 5 \\
  -x + 3y &= -1
\end{align*}
\]
11. \[\begin{align*}
5x - 6y &= 21 \\
x - 2y &= 5
\end{align*}\]  
12. \[\begin{align*}
4x + 3y &= -11 \\
5x + y &= -11
\end{align*}\]  
13. \[\begin{align*}
6x - 5y &= 27 \\
x &= 5y + 2
\end{align*}\]  
14. \[\begin{align*}
10x - 2y &= 4 \\
y - 5x &= -2
\end{align*}\]  
15. \[\begin{align*}
3x - 2y &= -7 \\
6x + y &= 6
\end{align*}\]  
16. \[\begin{align*}
2x - y &= -1 \\
y &= -2x
\end{align*}\]

### 9.5 Solving Systems by Elimination

#### Problems

Solve each system of linear equations using the elimination method.

1. \[\begin{align*}
x + y &= 10 \\
x - y &= 2
\end{align*}\]  
5. \[\begin{align*}
6x - 3y &= 3 \\
6x &= 10 + 4y
\end{align*}\]  
2. \[\begin{align*}
2x &= 1 + y \\
-2x + 3y &= 5
\end{align*}\]  
6. \[\begin{align*}
2x - y &= 8 \\
x - y &= 4
\end{align*}\]  
3. \[\begin{align*}
2x + 3y &= 1 \\
5x &= 16 - 3y
\end{align*}\]  
7. \[\begin{align*}
2y + x &= 0 \\
-x - 2y &= 0
\end{align*}\]  
4. \[\begin{align*}
3x + 2y &= 4 \\
2x - 2y &= 1
\end{align*}\]  
8. \[\begin{align*}
4x - y &= 2 \\
-4x + y &= 8
\end{align*}\]

#### Challenge Problems

1. Solve: \[\begin{align*}
u + v + w + x + y + z &= 45 \\
v + w + x + y + z &= 21
\end{align*}\]  
2. Solve: \[\begin{align*}
x + \frac{1}{2}y &= \frac{9}{2} \\
\frac{1}{4}x - \frac{1}{6}y &= \frac{5}{6}
\end{align*}\]

#### Extra Practice

Solve each system of linear equations using the elimination method.

1. \[\begin{align*}
x + y &= 7 \\
x - y &= -3
\end{align*}\]  
2. \[\begin{align*}
-2x + y &= -1 \\
2x + 3y &= 5
\end{align*}\]
3. \[ \begin{align*} 2x &= 1 - 3y \\ -2x + y &= 7 \end{align*} \] 7. \[ \begin{align*} 3x + 5y &= 12 \\ 7x &= -5y + 8 \end{align*} \]

4. \[ \begin{align*} x + 3y &= 12 \\ 2x - 3y &= 6 \end{align*} \] 8. \[ \begin{align*} 4x + 8y &= 40 \\ -4x + y &= -13 \end{align*} \]

5. \[ \begin{align*} -2x + 2y &= 5 \\ 2x &= 3 + 2y \end{align*} \] 9. \[ \begin{align*} 3x + 6y &= 9 \\ 4y + 3x &= 2 \end{align*} \]

6. \[ \begin{align*} x + 2y &= -2 \\ 3x + 2y &= -12 \end{align*} \] 10. \[ \begin{align*} 2x + 2y &= 4 \\ -x + 2y &= 4 \end{align*} \]

### 9.6 Solving Systems by Elimination #2

#### Problems
Solve each system of linear equations using the elimination method.

1. \[ \begin{align*} 3x - 4y &= 2 \\ 4x + y &= 9 \end{align*} \] 4. \[ \begin{align*} 3x &= 4 + y \\ 6x - 2y &= 8 \end{align*} \]

2. \[ \begin{align*} -2x + 7y &= 2 \\ 3x - 5y &= -14 \end{align*} \] 5. \[ \begin{align*} 2x + 3y &= 3 \\ -10x + 2y &= -32 \end{align*} \]

3. \[ \begin{align*} -5x + 2y &= -4 \\ 3x - 4y &= 1 \end{align*} \] 6. \[ \begin{align*} 5y + x &= 7 \\ 2x &= 8 - 7y \end{align*} \]

#### Challenge Problems
1. If \(3a + 5b = 10\) and \(5a + 3b = 30\), what is the average of \(a\) and \(b\)?

2. Solve: \[ \begin{align*} 1.3x + 0.1y &= 0.35 \\ 0.5x + y &= -2.75 \end{align*} \]

#### Extra Practice
Solve each system of linear equations using the elimination method.

1. \[ \begin{align*} 3x - 2y &= 1 \\ -6x + 4y &= -2 \end{align*} \] 2. \[ \begin{align*} 4x &= 2 - 5y \\ 3x + 4y &= 1 \end{align*} \]
3. \( \begin{align*}
5x - 2y &= 3 \\
10x - 4y &= 6
\end{align*} \)

4. \( \begin{align*}
3x - 2y &= 7 \\
-6x + 4y &= -15
\end{align*} \)

5. \( \begin{align*}
3x + 4y &= 0 \\
5x - 3y &= -29
\end{align*} \)

6. \( \begin{align*}
2x - y &= 4 \\
-3y &= -6x + 10
\end{align*} \)

7. \( \begin{align*}
3x - 4y &= 2 \\
4x - y &= 20
\end{align*} \)

8. \( \begin{align*}
5x &= 2y + 31 \\
4x + 3y &= 11
\end{align*} \)

9. \( \begin{align*}
2x + y &= 8 \\
-4x - 2y &= -16
\end{align*} \)

10. \( \begin{align*}
x - y &= -2 \\
2x + 3y &= 21
\end{align*} \)

11. \( \begin{align*}
3x + y &= 7 \\
x + 2y &= -1
\end{align*} \)

12. \( \begin{align*}
3x + 4y &= 2 \\
6x &= 4 - 8y
\end{align*} \)

9.7 Solving Systems by Any Method

Problems

Solve each system of linear equations using any method.

1. \( \begin{align*}
3x - 2y &= -4 \\
x - 2y &= 4
\end{align*} \)

2. \( \begin{align*}
-5x - y &= 12 \\
7x + y &= -16
\end{align*} \)

3. \( \begin{align*}
3x &= -3y + 12 \\
-6x - 6y &= -24
\end{align*} \)

4. \( \begin{align*}
4x + 3y &= 14 \\
3x - 3y &= 14
\end{align*} \)

5. \( \begin{align*}
2x + y &= 5 \\
3x &= 4 + 2y
\end{align*} \)

6. \( \begin{align*}
4x - 8y &= 24 \\
-3x + 6y &= 12
\end{align*} \)

7. Solve the system of linear equations using all three methods.

\( \begin{align*}
2x + y &= 4 \\
x + 2y &= -1
\end{align*} \)
Challenge Problems

1. Solve:
\[
\begin{align*}
\frac{1}{2}x + \frac{1}{3}y &= 5 \\
\frac{1}{4}x + y &= 10
\end{align*}
\]

2. Solve:
\[
\begin{align*}
2x - y + 3z &= -10 \\
6x + 5y - z &= 4 \\
-2x + y + 2z &= 5
\end{align*}
\]

Extra Practice

Solve each system of linear equations using any method.

1. \[
\begin{align*}
-10x - 15y &= 25 \\
x - 5y &= -9
\end{align*}
\]

2. \[
\begin{align*}
-7x &= 10 + 6y \\
y + 6 &= x
\end{align*}
\]

3. \[
\begin{align*}
2x + 7y &= 19 \\
5x + 3y &= -25
\end{align*}
\]

4. \[
\begin{align*}
x &= 3y + 9 \\
x + 3y &= -3
\end{align*}
\]

5. \[
\begin{align*}
-4x + 4y &= -4 \\
2x - 8y &= 2
\end{align*}
\]

6. \[
\begin{align*}
4y + 2x &= 5 \\
x + 2y &= 8
\end{align*}
\]

7. \[
\begin{align*}
-6x + 4y &= 2 \\
2y &= -1 - 3x
\end{align*}
\]

8. \[
\begin{align*}
8x + 2y &= 17 \\
-4x - y &= 9
\end{align*}
\]

9. \[
\begin{align*}
2y &= -2x + 4 \\
5y - 3x &= 6
\end{align*}
\]

10. \[
\begin{align*}
3x + y &= 5 \\
15x + 5y &= 2
\end{align*}
\]

11. \[
\begin{align*}
2x + 9y &= 0 \\
3x + 5y &= 17
\end{align*}
\]

12. \[
\begin{align*}
3x + 2y &= 6 \\
6x &= 12 - 4y
\end{align*}
\]

13. \[
\begin{align*}
2x &= y - 1 \\
4y - 8x &= 4
\end{align*}
\]

14. \[
\begin{align*}
x + y &= 3 \\
x - y &= 1
\end{align*}
\]

15. \[
\begin{align*}
3x - 2y &= -7 \\
6x + y &= 6
\end{align*}
\]

16. \[
\begin{align*}
y + 2x &= -3 \\
y - 1 &= -2x
\end{align*}
\]

Solve each system of linear equations using all three methods.

17. \[
\begin{align*}
4x - 3y &= 12 \\
3x + 4y &= -16
\end{align*}
\]

18. \[
\begin{align*}
3x - 2y &= -4 \\
6x - 4y &= -8
\end{align*}
\]
9.8 Solving Problems using Systems

Problems
Solve each problem by writing a system of linear equations in two variables.

1. The sum of two numbers is 50. The difference between the numbers is 14. What are the two numbers?

2. The perimeter of a rectangular garden is 62 feet. The length is 1 foot more than twice the width. Find the dimensions of the garden.

3. Sadie has some money in the bank. Her friend has twelve dollars less than three times Sadie’s amount. If their combined amount of money is $172, how much money does each person have?

4. Griffen loves to go to the movies. He goes both on weekends and weekdays. The cost of a weekday show is $7.00. The cost of a weekend show is $10.00. If Griffen went to see a total of 15 movies and spent $144.00, how many of each type of movie did Griffen see?

5. David has $5.85 in nickels and dimes. If David has a total of 75 coins, how many of each type of coin does David have?

Challenge Problems
1. Dorian and Micah have been saving money from their summer jobs. If Dorian had twice as much money and Micah had half as much, together they would have $2,075. And if Micah had twice as much money and Dorian had half as much, together they would have $2,300. How much money does Dorian have?

2. The sum of the digits of a two-digit number is 8. If the digits are reversed, the new number is 36 more than the original number. Find the original number. (Hint: If $u$ represents the units digit of the number and $t$ the tens digit, the original number can be represented by $10t + u$.)

Extra Practice
1. The sum of two numbers is 94. The difference between the two numbers is 50. What are the two numbers?

2. One number is 4 less than 3 times another. If the sum of the numbers is 36, what are the two numbers?

3. Twice a number minus three times another number is equal to -2. Four times the first number added to the other number is equal to 17. What are the two numbers?

4. Two angles are supplementary. The larger angle is 48 degrees more than 10 times the smaller angle. Find the measure of each angle.

5. Two angles are complementary. The larger angle is 3 degrees less than twice the measure of the smaller angle. Find the measure of each angle.
6. Eli has $15 less than three times Zach’s amount. If Eli and Zach have $161 combined, how much money does each boy have?

7. Tobias has $3.20 in nickels and quarters. He has ten more nickels than quarters. How many of each type of coin does Tobias have?

8. The length of a rectangle is 3 cm more than twice its width. If the perimeter of the rectangle is 36 cm, find the dimensions of the rectangle.

9. Last season, two running backs on the football team rushed for a combined total of 1550 yards. One rushed 4 times as many yards as the other. How many yards were rushed by each player?

10. The perimeter of a rectangle is 58 ft. The length is seven less feet than twice the width. What are the dimensions of the rectangle?

11. Antonio is buying miniature cars. He wants to buy 10 cars total for a big race he and his friends are having. Silver cars are $7 dollars each. Red cars are $5 dollars each. If he spends $60, how many of each color car did he buy?

12. A basketball team scored a total of 85 points using only two and three point shots, and no free throws. The total number of two and three point shots was 39. How many of each type of shot did the team make?
CHAPTER 10

POLYNOMIALS

10.1 Adding and Subtracting Polynomials

Summary: In this section, we learn how to add and subtract polynomials involving several terms.

Problems
1. Name each polynomial as a monomial, binomial, trinomial, or none of the above and give its degree.
   (a) \( n + 1 \)  
   (b) \( x^4 + 4x^6 - 2x^2 \)  
   (c) \( -10x^4y^2 \)  
   (d) \( 5x^2 - 6x + 1 \)  
   (e) \( -3 \)  
   (f) \( n^3 + 6n^2 - 5n + 4 \)  
   (g) \( 2jk + 4 \)  
   (h) \( -3y^3 - 5y^5 + 7y^7 \)

2. Add \( x^2 + 6x + 7 \) to \( 6x^2 - 4x - 3 \).

3. Subtract \( 8n^2 - 2n + 6 \) from \( 2n^2 + n + 4 \).

4. Simplify:
   (a) \( (3x^2 + 4) - (1 - x^2) \)  
   (b) \( (n^2 + 5n + 4) + (5n^2 - 6n - 4) \)  
   (c) \( (-2x^8 - 6x^7 + 3x^9) + (-5x^8 + 4 + 9x^7) \)  
   (d) \( (3y^2 + 2y^3 + 12y^7) - (4y^2 + 3y^7 - 11y^3) \)  
   (e) \( (r^4 - 4r^3 - 6r^2) + (r^4 + 6r^3 - 3r^2) \)  
   (f) \( (4h^2 - hk + 2k^2) - (-7h^2 - hk + 3k^2) \)

5. A student insists she has done a polynomial problem correctly, but the teacher says she has made an error. Help the student find her error and explain in a few words what it is. Then redo the problem correctly.
   \[
   (5n^3 + 2n^2 - 4n) - (-5n^2 - 3n + 7) \\
   = 5n^3 + 2n^2 - 4n + 5n^2 + 3n - 7 \\
   = 5n^3 + 7n^2 - 7n - 7
   \]
Challenge Problems

1. Suppose the perimeter of a parallelogram is 54. Two adjacent sides of the parallelogram can be represented by the expressions $-3x^2 + 5x - 1$ and $3x^2 - 4x + 3$. Solve for $x$.

2. If $(5x^2 + 10x - 7) - (3x^2 + 3x - 10) = ax^2 + bx + c$, what is the value of $\frac{-b + \sqrt{b^2 - 4ac}}{2a}$?

Extra Practice

1. Name each polynomial as a monomial, binomial, trinomial, or none of the above and give its degree.

   (a) $x^2 + 6x + 5$  
   (b) 5  
   (c) $6n - 2n^2 + 3n^3$  
   (d) $-4 + k$  
   (e) $r^4 - r^3$  
   (f) $5k^5 - 4k^3 + 3k - 6$  
   (g) $wx - x$  
   (h) $-24a^3b^2c$

2. Simplify:

   (a) $(x^3 - 4) - (2x^3 - 4)$  
   (b) $(5x^2 + 6xy + 4) + (6x^4 - 10xy - 7)$  
   (c) $(-6h^2 + 4h^9) - (2h^8 - h^9 + 3h^2)$  
   (d) $(a^2 + 2b^2 - 3c^2) - (4c^2 + 3b^2 - 2a^2)$

3. Simplify:

   (a) $(x^2 + 9x) + (7 + 5x - 4x^2)$  
   (b) $(y^4 + 2y^2 - 3) - (-4 + 5y^4 + 9y^7)$  
   (c) $(-4r^5 - 3r^2 - 6r) + (2r^5 + r^3 - 7r^2)$  
   (d) $(3x^2 + 10xy - 5y^2) - (15x^2 - 4xy + 8y^2)$

4. A student insists she has done a polynomial problem correctly, but the teacher says she has made a key mistake in combining terms. Help the student find her error and explain in a few words what it is. Then redo the problem correctly.

   $(-4x^4 + 3x^3 - 6x^2) + (6x^4 + 9x^2 - 4x) = 2x^8 + 12x^5 - 10x^3$

5. What is the sum of $x^2 + 1$, $-3x^2 + 4x + 3$, and $-2x - 10$?

6. Subtract $3y^5 - 4y^4 + 6y^2$ from $7y^5 - 3y^4 + 2y^3 - y^2$.

7. Add $8m^2 - 7m$ to $7 + 6m - 2m^2$.

8. Subtract $a^2 - 2ab + b^2$ from $-5a^2 + ab + 6b^2$.

9. Subtract $12x^2 + 14x - 48$ from $-4x^3 + 12x^2 - 18x$.

10. What is the sum of $y^2 - 4y$, $y^2 - xy + x^2$, and $xy + 6y + 3y^2$?
10.2 Multiplying Monomials with Polynomials

Problems
Multiply, then simplify:

1. \(3x(4x - 2)\)
2. \(-5h(2h^2 - 4)\)
3. \(x^2y(2x^2 - 3)\)
4. \(3(x^2 + 2x + 6)\)
5. \(b(-2b^2 + 8b + 12)\)
6. \(\frac{3}{2}d(4d^2 + 10d + 6)\)

7. \(4y(3x^2 + 2xy + 7y)\)
8. \(-3y(y^2 - 7x + 1)\)
9. \(-\frac{1}{4}y^3(8y^2 - 4y + 40)\)
10. \(3xy^2(5xy + 4x - 3)\)

Challenge Problems

1. Multiply, then simplify:
   \(-4x^3(8x^2 - 9) - x^2(8x^2 - 9x)\).
2. Solve:
   \(2(3x^2 + 3x - 1) = 6x(x + 4)\).

Extra Practice
Multiply, then simplify:

1. \(8x(-x + 2y)\)
2. \(\frac{1}{2}xy(10x^2y - 6xy)\)
3. \(-2x(-4 - 6x - 5x^3)\)
4. \(n(n^2 - 6n + 5)\)
5. \(\frac{5}{2}k(4k + 6km)\)
6. \(7y(3 - 2y)\)
7. \(2x(3x^2 + 4x + 9)\)
8. \(-4mn(2n - 3m)\)
9. \(5x^5(2x^4 - 4x^2 + 6x)\)
10. \(6n^4(3n^8 - 6n)\)
11. \(14rs^2(10rs^2 - 2r + 5s)\)
12. \(-4w^3(w^2x - 2w)\)
13. \(-\frac{1}{5}x^2y(-3x^3 + 6y)\)
14. \(6x(5x^2 - 3x + 2)\)
15. \(\frac{4}{3}r^2(6r + 21)\)
16. \(5x^2(4x^3 + 7x)\)
17. \(10n(2n + 7)\)
18. \(-6a^2b^3(-2a^4 - 3a^3b + 4ab^2)\)
19. \(2xy(3x^2y + 4xy - 5xy^2)\)
20. \(-3cd(cd + 3c^2)\)
21. \(-4g(g^3 - 2g^2 + 5g)\)
22. \(-2x(-3x^2 - 2)\)
### 10.3 Factoring Polynomials using the GCF

#### Problems
Factor out the GCF from each polynomial.

1. \(4x^2y + 6xy^2 - 24xy\)  
2. \(6m^2 + 15m\)  
3. \(2pq + 6p^2q - 4p^3q\)  
4. \(4x^2(n + 5) + 10y^2(5 + n)\)  
5. \(12c^5 - 18c^3 - 3c^2\)  
6. \(15x^3y^2 + 10x^2y^4\)  
7. \(36x^4 - 9x^2\)  
8. \(15m^3n^2 + 20m^2n^3 + 12m^4n\)  
9. \(36p^6q + 45p^5q^4 + 81p^3q^2\)  
10. \(r(x + 5) - t(x + 5)\)  
11. \(22a^5b^7 - 14a^3b^8 + 18a^6b^4\)

#### Challenge Problems
Factor completely.

1. \(6n + 3mn + 4(m + 2)\)  
2. \(8x^n + 4x^{n+2} - 10x^n-1\)

#### Extra Practice
Factor out the GCF from each polynomial.

1. \(4x^5 - 8x^4 - 4x^3\)  
2. \(16x^2 - 12x\)  
3. \(18c^4d^5 + 36c^3d^7\)  
4. \(6x^5 - 15x^4 - 21x^3 + 27x^2\)  
5. \(15r^3s^2 - 10rs\)  
6. \(10ab + 5a\)  
7. \(4x^3 - 44x^2 + 96x\)  
8. \(50h^4 - 2h^2\)  
9. \(3g^3h - 9g^2h + 12h\)  
10. \(6x^2y^3 + 9xy^4 + 18y^5\)  
11. \(30m^2n^4 + 42m^3n^3 - 54m^4n\)

### 10.4 Multiplying Polynomials

#### Problems
Multiply, then simplify:

1. \((x + 4)(x - 1)\)  
2. \((2y + 4)(y + 3)\)  
3. \((n + 1)^2\)  
4. \((4 - y)(4 + y)\)  
5. \((x - 4)(10x - 3)\)  
6. \((5g - 2)(2g + 6)\)  
7. \((6r - 1)(s + 2)\)  
8. \((4x + 3y)(3x - 2y)\)  
9. \((3w - 4)(2w + 7)\)  
10. \((5x + 4)(3 - 2x)\)  
11. \((2y - 3)^2\)  
12. \((4h - 2j)(3h + j)\)
Challenge Problems

1. Multiply, then simplify: \((x + 4)(x^2 - 3x + 2)\).

2. Suppose \(x > 0\). Solve \((x - 3)(x + 3) = 11\).

3. Suppose that \(6x + 4\) and \(3x - 2\) are the side lengths of a right triangle. Find \(x\) if the area of the triangle is equal to 68 units\(^2\).

Extra Practice

Multiply, then simplify:

1. \((k + 3)(k - 5)\)
2. \((2x + 5)(3x - 1)\)
3. \((n - 5)(6n + 2)\)
4. \((2e - 3)^2\)
5. \((g - 4)(4g + 10)\)
6. \((3x - 3)(3x - 1)\)
7. \((k + 4)^2\)
8. \((8b - 3)(b + 2)\)
9. \((u + 4)(2u - 5)\)
10. \((p - 3)(p + 4)\)
11. \((4x + 1)(x + 3)\)
12. \((3g - 1)^2\)
13. \((h + 6)(4h - 7)\)
14. \((5s - 2)(2s + 3)\)
15. \((4c + 3)(9c + 5)\)

10.5 Multiplying Polynomials #2

Problems

Multiply, then simplify:

1. \(- (2x - y)(3x + 4y)\)
2. \(2(r + s)^2\)
3. \((b^2 + 4)(b - 2)\)
4. \(10(2x - 3)(2x + 3)\)
5. \(-5(2n + 1)(n - 4)\)
6. \((9 + 4y)(-y - 2)\)
7. \(6g(2g - 3)(g + 3)\)
8. \((x^2 + 4)(x^2 - 2)\)
9. \((2x + 3)(x^2 + 3x + 4)\)
10. \((2y^2 - 1)(4y^2 + 3)\)
11. \((4n^2 - 3n + 7)(3n - 1)\)
12. \(h(h + 5)(h - 5)\)

Challenge Problems

1. Multiply, then simplify:
   
   (a) \((2\sqrt{x} + 3)(3\sqrt{x} - 2)\)
   (b) \((\sqrt{3} + 4)(2\sqrt{15} - 1)\)

2. The length of a rectangular prism is six less than twice the width. The height of the rectangular prism is the sum of the length and width. In terms of the width \(w\), write an expression for the volume of the rectangular prism.

3. Multiply, then simplify: \((x - y)^3\).
Extra Practice
Multiply, then simplify:

1. \(- (4x + 4)(x + 1)\)  
   5. \(10(x - 2y)(x + 3y)\)  
   9. \(- j(j - 2)(j^2 + 3)\)

2. \(3(x + 4)^2\)  
   6. \(x(x + 4)(x - 6)\)  
   10. \((4p - 3)(p^2 + 2p + 1)\)

3. \((y^2 - 3)(y + 4)\)  
   7. \(3b(2b - 3)(b - 4)\)  
   11. \(10(k + 2)^2\)

4. \(2(2a - 3b)(3a + 4b)\)  
   8. \((2x + 3)(6x^2 + 4x - 1)\)  
   12. \(3(2m - 1)(m + 4)\)

10.6 Polynomial Applications

Problems

1. A circle is shown below, along with its radius. Find the area and circumference in terms of \(x\). Simplify your answers completely.

2. The areas of the square and rectangle below are equal. Solve for \(x\) by writing an equation.

3. Find the area of the triangle in terms of \(x\). Simplify your answer completely.

4. Find the area of the trapezoid in terms of \(n\). Simplify your answer completely.

5. What is the area of the shaded region, in terms of \(y\)? Simplify your answer completely.

6. Find the surface area of the cube in terms of \(x\). Simplify your answer completely.
Challenge Problems

1. The diameter of a circular fountain is 10 feet. City engineers want to build a sidewalk that is $y$ feet wide around the fountain. Write an expression for the total area of the sidewalk in terms of $y$. Simplify your answer completely.

2. A diagram of a composite figure is shown below. Find a simplified expression for the total area in terms of $x$.

3. The net of a rectangular prism is shown below and labeled in terms of $x$. Find simplified expressions for the volume and surface area of this rectangular prism.

Extra Practice

1. Find the volume of the rectangular prism in terms of $x$. Simplify your answer completely.

2. Find the volume and surface area of the rectangular prism in terms of $x$.

3. A circle is shown below, along with its radius. Find the area and circumference in terms of $n$. Simplify your answers completely.

4. Find the surface area of the cube in terms of $x$. 
5. What is the area of the shaded region, in terms of \( x \)? Simplify your answer completely.

6. A circle has a diameter of \( 10x + 2 \) inches. What are its area and circumference in terms of \( x \)? Simplify your answers completely.

7. A square and a rectangle with equal area are shown below. Write an equation to solve for \( y \).

8. A square has a side length of \( x \). A rectangle has a side length 4 inches longer than the square and a width that is 2 inches shorter than the square. If the areas of the square and rectangle are equal, what is the length of the rectangle? Solve by writing an equation.

9. A mat border inside a picture frame has the following dimensions. Find the area of the mat border in terms of \( w \). Simplify your answer completely.

10. Find the area of the triangle in terms of \( m \). Simplify your answer completely.

11. Find the area and perimeter of the triangle in terms of \( y \). Simplify your answer completely.

10.7 Factoring Quadratic Polynomials

Problems
Factor each polynomial or state prime if the polynomial cannot be factored.

1. \( x^2 + 11x + 30 \)
2. \( y^2 - 2y - 15 \)
3. \( r^2 - 2r + 1 \)
4. \( n^2 + 9n - 36 \)
5. \( g^2 - 12g - 28 \)
6. \( x^2 + 13x + 36 \)
7. \( s^2 + 3s - 18 \)
8. \( w^2 + 44w - 45 \)
9. \( x^2 + 7x - 6 \)
10. \( v^2 + 3v - 10 \)
11. \( b^2 - b - 72 \)
12. \( c^2 - 3c - 130 \)
**Challenge Problems**

1. What is the sum of all values in the list \{-9, -12, 20, 21\} for which \(x^2 + px + 20\) can be factored, where \(p\) is one of the values in the list?

2. Factor \(2x^2 + 7x + 5\).

**Extra Practice**

Factor each polynomial or state *prime* if the polynomial cannot be factored.

1. \(m^2 - 10m - 24\)

2. \(y^2 - 23y + 42\)

3. \(d^2 - 15d + 14\)

4. \(y^2 + 2y - 3\)

5. \(n^2 + 16n - 36\)

6. \(z^2 - 12z - 45\)

7. \(h^2 + 4h - 5\)

8. \(x^2 + x + 1\)

9. \(w^2 - 14w + 33\)

10. \(x^2 + 7x + 6\)

11. \(j^2 - 15j + 36\)

12. \(h^2 + 8h - 9\)

13. \(m^2 - 10m + 25\)

14. \(y^2 - 9y + 20\)

15. \(d^2 - 14d - 32\)

16. \(x^2 + 8n - 10\)

17. \(n^2 + 11n + 24\)

18. \(u^2 - 5u - 50\)

19. \(x^2 + 2x - 48\)

20. \(g^2 - 17g + 42\)

21. \(k^2 + 8k + 16\)

22. \(x^2 + 21x + 80\)

---

### 10.8 Factoring Quadratic Polynomials #2

**Problems**

Factor each polynomial or state *prime* if the polynomial cannot be factored.

1. \(5c^2 + 7c - 6\)

2. \(2y^2 - y - 10\)

3. \(5x^2 - 8x + 3\)

4. \(2v^2 - 7v + 3\)

5. \(11x^2 - 9x - 11\)

6. \(3w^2 + w - 30\)

7. \(2n^2 + n - 21\)

8. \(3r^2 - 10r + 8\)

9. \(3g^2 + 11g - 4\)

10. \(7x^2 - 33x - 10\)
Challenge Problems
1. What is the difference between the largest and smallest values of \( w \) for which \( x^2 - wx + 48 \) can be factored?

2. Factor: \(-3y^2 + 4y - 1\)

Extra Practice
Factor each polynomial or state prime if the polynomial cannot be factored.

1. \( 3p^2 - 2p - 5 \)
2. \( 2n^2 + 3n - 9 \)
3. \( 3w^2 - 8w + 4 \)
4. \( 2x^2 + 14x + 3 \)
5. \( 5y^2 + 19y + 12 \)
6. \( 2v^2 + 11v + 5 \)
7. \( 3y^2 + 20y + 8 \)
8. \( 2n^2 + 5n + 2 \)
9. \( 7w^2 - 17w + 6 \)
10. \( 13x^2 - 12x - 1 \)
11. \( 5a^2 + 7a - 6 \)
12. \( 3b^2 + 10b + 8 \)
13. \( 2g^2 + 7g - 15 \)
14. \( 11n^2 + 10n - 24 \)
15. \( 7a^2 + 53a + 28 \)
16. \( 3k^2 - 28k - 20 \)
17. \( 2y^2 - 14y + 24 \)
18. \( 5y^2 + 7y - 4 \)

10.9 Factoring Quadratic Polynomials #3

Problems
Factor each polynomial or state prime if the polynomial cannot be factored.

1. \( 6x^2 + 11x + 4 \)
2. \( 16x^2 + 22x - 3 \)
3. \( 6b^2 + 5b - 6 \)
4. \( 8x^2 + 2x - 15 \)
5. \( 5x^2 - 21x - 20 \)
6. \( 24x^2 + 2x - 12 \)
7. \( 2x^2 - 5x - 3 \)
8. \( 4x^2 - 13xy + 3y^2 \)
9. \( 6a^2 - 4ab - 5b^2 \)
10. \( 12x^2 + 10x - 8 \)
Challenge Problems
1. Factor: $8x^4 + 44x^3 + 56x^2$ (Hint: first factor out the GCF).

2. Factor: $6x^{2n} - x^n - 12$

3. What is the sum of all possible values of $b$ which make the polynomial factorable: $16x^2 + bxy + 49y^2$?

Extra Practice
Factor each polynomial or state prime if the polynomial cannot be factored.

1. $4x^2 - 12x + 9$
2. $12n^2 + n - 6$
3. $2x^2 - 11x - 6$
4. $10y^2 + 13y - 3$
5. $4g^2 - 29g + 30$
6. $6x^2 + 17xy + 5y^2$
7. $x^2 + 13x - 36$
8. $3a^2 - 28ab - 20b^2$
9. $15y^2 - 4y - 3$
10. $4x^2 - 15x - 25$
11. $21d^2 + 8d - 4$
12. $2x^2 - 3x - 9$
13. $3n^2 + 5n - 2$
14. $3v^2 + 7v + 4$
15. $6x^2 + 7x - 5$
16. $8n^2 - 2n - 3$
17. $4n^2 + 13n - 12$
18. $6y^2 - 11y + 4$

10.10 Special Cases for Factoring Polynomials

Problems
Factor each polynomial using either the perfect square or difference of squares factorization. No polynomials in this section are prime.

1. $x^2 - 9$
2. $4n^2 + 4n + 1$
3. $9r^2 - 4s^2$
4. $121d^2 - 44d + 4$
5. $w^2 + 10w + 25$
6. $16 - 16d + 4d^2$
7. $36 - 25y^2$
8. $100h^2 - 81$
9. $64x^2 - 16x + 1$
10. $49y^2 - 169$
11. $k^2 - 30k + 225$
12. $4c^6 - 49$
13. $x^2 - 24xy + 144y^2$
14. $x^4 - 9$
15. $49x^2 - 9y^2$
16. $9a^4 - 6a^2 + 1$

Challenge Problems
Factor each polynomial using either the perfect square or difference of squares factorization. No polynomials in this section are prime.

1. $(x+4)^2 - (y+1)^2$
2. $\frac{4}{9}x^2y^2 - \frac{25}{36}z^2$
3. $x^{4n} + 10x^{3n} + 25x^{2n}$

Extra Practice
Factor each polynomial using either the perfect square or difference of squares factorization. No polynomials in this section are prime.

1. $n^2 - 25$
2. $9b^2 - 12b + 4$
3. $4x^2 + 24x + 36$
4. $9g^2 - 4$
5. $49j^2 - 112j + 64$
6. $144p^2 - 9q^2$
7. $25n^2 - 20n + 4$
8. $121x^2 + 66x + 9$
9. $h^2 - 289$
10. $n^2 - 14n + 49$
11. $x^2 + 8x + 16$
12. $n^2 - 4n + 4$
13. $81x^2 - 90x + 25$
14. $49x^2 - 14x + 1$
15. $4y^2 - 20y + 25$
16. $4 - 12y + 9y^2$
17. $25a^2 + 60a + 36$
18. $16 + 40x + 25x^2$
19. $x^2 + 12x + 36$
20. $a^2 - 12ab + 36b^2$
21. $64y^2 - 48y + 9$
22. $4n^6 - 16$
23. $9n^4 + 24n^2 + 16$
24. $a^2b^2 + 6ab + 9$
10.11 Simplifying Expressions by Factoring

Problems
Simplify each expression.

1. \( \frac{4x + 8}{x + 2} \)
2. \( \frac{5n + 20}{15} \)
3. \( \frac{x^2 + 4x + 3}{x + 1} \)
4. \( \frac{c - 6}{c^2 - 6c} \)
5. \( \frac{4n^2 - 25}{4n - 10} \)
6. \( \frac{8 - 2x}{x - 4} \)
7. \( \frac{x(x + 1)}{x^2 - 4x} \)
8. \( \frac{2y^2 + 5y - 3}{2y - 1} \)
9. \( \frac{x^2 + 8x + 15}{6 + 2x} \)
10. \( \frac{5n^2 - 9n - 18}{n^2 - 9} \)

Challenge Problems
Simplify each expression.

1. \( \frac{x^2 + x - 20}{16 - x^2} \)
2. \( \frac{12 - 3k}{3k^2 - 3k - 36} \)
3. \( \frac{4gh^2 - 2g^2h}{10gh} \)
4. \( \frac{40n^2 + 40n + 10}{20n^2 - 30n - 20} \)

Extra Practice
Simplify each expression.

1. \( \frac{5r + 15}{r + 3} \)
2. \( \frac{x + 2}{x^2 - 4} \)
3. \( \frac{j - 3}{j^2 - 9} \)
4. \( \frac{c + 4}{10c + 40} \)
5. \( \frac{6h^2 - 3h}{2h - 1} \)
6. \( \frac{v - 6}{2v^2 - 15v + 18} \)
### 10.12 Solving Equations by Factoring

#### Problems
Solve each quadratic equation.

1. \( x(x + 5) = 0 \)
2. \( (7y - 5)(2y + 18) = 0 \)
3. \( 6x(2 - 4x) = 0 \)
4. \( x^2 - 4 = 0 \)
5. \( 4d^2 - 6d = 0 \)
6. \( w^2 + 8w + 15 = 0 \)
7. \( 2n^2 + 16n + 30 = 0 \)
8. \( h^2 + 6h + 5 = 0 \)
9. \( 10y^2 - y - 3 = 0 \)
10. \( 2k^2 - 13k + 15 = 0 \)

#### Challenge Problems
1. Solve by factoring: \( 2x^2 - 1 = x \)
2. Solve by factoring: \( \frac{(y + 1)(4y^2 - 2y - 30)}{2y + 5} = 0 \)
Extra Practice
Solve each quadratic equation.

1. \((n - 4)(n - 5) = 0\)
2. \((3n - 1)(2n + 9) = 0\)
3. \((2y - 6)(y + 4) = 0\)
4. \((4k - 3)(6k + 10) = 0\)
5. \(x^2 + 5x - 6 = 0\)
6. \(y^2 + 6y - 40 = 0\)
7. \(6n^2 - 24n = 0\)
8. \(5n^2 + 17n + 6 = 0\)
9. \(9a^2 - 16 = 0\)
10. \(2w^2 + 5w - 12 = 0\)
11. \(g^2 + 2g - 8 = 0\)
12. \(12x^2 + 5x - 2 = 0\)
13. \(3v^2 - 32v - 48 = 0\)
14. \(2r^2 - 15r + 27 = 0\)
15. \(y^2 + 14y + 40 = 0\)
16. \(3n^2 + 15n = 0\)
Answers to All Problems

Chapter 6

6.1
Problems (pg. 13)

1. Area: 3.14 mm
   Circumference: 6.28 mm
2. Area: 38.5 m
   Circumference: 22 m
3. Area: 64 π ft^2
   Circumference: 16 π ft
4. Area: 121 π m^2
   Circumference: 22 π m
5. Area: 9 π x^2 cm^2
   Circumference: 6 π x cm
6. Area: 6.25 π y^2 in^2
   Circumference: 5 π y in
7. Area: 4/25 π cm^2
   Circumference: 4/5 π cm
8. Area: 16/49 π km^2
   Circumference: 8/7 π km

Challenge Problems (pg. 14)

1. r = 2
2. a) Area: 27π, Circumference: 9π + 12
   b) Area: 84.78, Circumference: 40.26

Extra Practice (pg. 14-15)

1. Area: 50.24 mm^2
   Circumference: 25.12 mm
2. Area: 7.07 ft^2
   Circumference: 9.42 ft
3. Area: 28.26 in^2
   Circumference: 18.84 in
4. Area: 78.6 m^2
   Circumference: 31.4 m
5. a) 225π ft^2
   b) 30π ft
6. a) 49π yd^2
   b) 14π yd
7. a) 16π km^2
   b) 8π km
8. a) 9π ft^2
   b) 6π ft
9. a) 144π mm^2
   b) 24π mm
10. a) 16π y^2 cm^2
     b) 8π y cm
11. a) 100πx^2 ft^2
     b) 20πx ft
12. a) 121/4 πn^2 yd
     b) 11πn yd
13. a) 0.25πk^2 in^2
    b) πk in
14. a) 25/9 π cm^2
    b) 10/3 π cm
15. a) 121/4 π in^2
    b) 11/2 π in
16. a) 1/4 π ft^2
    b) π ft
17. a) 100/9 π yd^2
    b) 20/3 π yd
18. Small: 16π in^2 and 8π in,
    Medium: 25π in^2 and 10π in,
    Large: 36π in^2 and 12π in

6.2
Problems (pg. 16)

1. 6803.3 ft
2. 282.6 in
3. 26 cans
4. x = 8 m
5. a) Perimeter: 6π + 12 cm
    Area: 18π cm^2
   b) Perimeter: 30.84 cm
    Area: 56.52 cm^2
6. a) Perimeter: 7π + 14 cm
    Area: 24.5π cm^2
   b) Perimeter: 35.98 cm
    Area: 76.93 cm^2

Challenge Problems (pg. 16)

1. 2.28
2. 168.56 cm^2

Extra Practice (pg. 17-18)

1. 75.36 ft
2. 131.88 ft
3. x = 6
4. 5 buckets
5. 75.36 ft
6. Area: 254.34 cm^2
    Circumference: 56.52 cm
7. a) Area: 4/9 π in^2
    Circumference: 4/3 π in
   b) Area: 88/63 in^2
    Circumference: 88/21 in
8. 3140 ft
9. 785 ft
10. a) Perimeter: 6π + 12 cm
    Area: 18π cm^2
    b) Perimeter: 30.84 cm
    Area: 56.52 cm^2
11. a) Perimeter: 4π + 8 cm
    Area: 8π cm^2
    b) Perimeter: 20.56 cm
    Area: 25.12 cm^2

6.3
Problems (pg. 18)

1. a) 10m
   b) 20m
   c) 20π m
2. a) 16 ft  
   b) 32 ft  
   c) 256 ft²
3. a) $3\sqrt{5}$ in  
   b) $6\sqrt{5}$ in  
   c) $6\sqrt{5}\pi$ in
4. a) 12  
   b) 24  
   c) $144\pi$  
   d) 452.57
5. a) $2\sqrt{2}$  
   b) $4\sqrt{2}$  
   c) $8\pi$
6. a) 4.5 cm  
   b) 9 cm  
   c) 63.58 cm²
7. 157 m

Challenge Problems (pg. 19)
1. 445.1
2. 2.12 cm

Extra Practice (pg. 19)
1. a) 7 ft  
   b) 14 ft  
   c) $14\pi$ ft
2. a) 25 cm  
   b) 50 cm  
   c) $625\pi$ cm²
3. a) $2\sqrt{2}$ mm  
   b) $4\sqrt{2}$ mm  
   c) $4\sqrt{2}\pi$ mm
4. a) 64  
   b) 128  
   c) $4096\pi$  
   d) $\frac{7}{90112}$
5. a) $4\sqrt{3}$  
   b) $8\sqrt{3}$  
   c) $48\pi$
6. a) $5\sqrt{2}$  
   b) $10\sqrt{2}$  
   c) $200\pi$
7. a) 3.5 cm  
   b) 7 cm  
   c) 153.86 cm²
8. a) 5.5 in  
   b) 11 in  
   c) 379.94 in²
9. 37.68 km

6.4

Problems (pg. 19-20)
1. Area: $\frac{27}{4}\pi$ cm²,  
   Arc length: $\frac{9}{2}\pi$ cm
2. Area: $\frac{12}{5}\pi$ cm²,  
   Arc length: $\frac{4}{5}\pi$ cm
3. Area: $\frac{15}{4}\pi$ in²,  
   Arc length: $\frac{3}{2}\pi$ in
4. Area: $18\pi$,  
   Arc length: $3\pi$
5. Area: $\frac{28}{3}\pi$ cm²,  
   Arc length: $\frac{14}{3}\pi + 8$ cm

Challenge Problems (pg. 20)
1. Area: $\frac{\pi}{3}$,  
   Arc length: $\frac{2}{3}\pi$
2. Area: $24\pi$ cm²  
   Arc length: $4\pi$ cm

Extra Practice (pg. 20-21)
1. Area: $\pi$ in²  
   Arc length: $2\pi$ in
2. Area: $24\pi$ cm²  
   Arc length: $4\pi$ cm
3. Area: $\frac{12}{3}\pi$ in²  
   Arc length: $\frac{35}{6}\pi$ in
4. Area: $4\pi$ cm²  
   Arc length: $\frac{4}{3}\pi$ cm
5. Area: $\frac{5}{4}\pi$ m²  
   Arc length: $\frac{5}{2}\pi$ m
6. Area: $\frac{512}{3}\pi$ ft²  
   Arc length: $\frac{64}{3}\pi$ ft
7. Area: $\frac{500}{9}\pi$ in²  
   Arc length: $\frac{100}{9}\pi$ in
8. Area: $\frac{5}{6}\pi$  
   Arc length: $\frac{5}{3}\pi$
9. Area: $9\pi$ cm²  
   Arc length: $2\pi$ cm
10. Area: $\frac{7}{2}\pi$  
    Arc length: $\frac{7}{5}\pi$

6.5

Problems (pg. 22)
1. a) Area: $40\pi$ cm²  
   b) Perimeter: $20\pi$ cm
2. $12\pi$
3. Area: $80 + 8\pi$ ft²  
   Perimeter: $28 + 4\pi$ ft
4. Area: $4 + \pi$ in²  
   Perimeter: $4 + 2\pi$ in
5. Area: $\frac{245}{2}\pi$ cm²  
   Perimeter: $21\pi$ cm

Challenge Problems (pg. 23)
1. Area: $\frac{1}{8}\pi + \sqrt{3}$ in²  
   Perimeter: $\pi + 2$ in
2. $\frac{169}{8}\pi - 30$

Extra Practice (pg. 23-25)
1. $144 - 36\pi$ in²
2. a) $80\pi$ ft²  
   b) $40\pi$ ft
3. a) $18\pi$ cm²  
   b) $12\pi + 24$ cm
4. a) $8\pi + 64$  
   b) $4\pi + 26$
5. $144 - 36\pi$ cm²
6. $61 - 4\pi$
7. a) $24 + 18\pi$  
   b) $16 + 6\pi$
8. $8\pi$ cm²
9. $18 - \frac{9}{8}\pi$
10. a) $16\pi$ m²  
    b) $20\pi$ m²  
    c) $20\pi$ m

6.6

Problems (pg. 25-26)
1. $108.75\pi$ cm²
2. $84 - 16\pi \text{ ft}^2$
3. $16\pi$
4. $\pi - 4$
5. $2\pi$

Challenge Problems (pg. 26)
1. a) $48 - 9\pi$
   b) $6\pi + 4$
2. $25\pi \text{ cm}^2$

Extra Practice (pg. 26-27)
1. $16\pi - 32$
2. $2\pi \text{ in}^2$
3. $12\pi$
4. $108\pi \text{ cm}^2$
5. $72 - 18\pi$
6. $21\pi \text{ cm}^2$
7. $17\pi$
8. $15\pi \text{ in}^2$

6.7
Problems (pg. 28)
1. a) 87.5
   b) 324
   c) 49.5
   d) 10
   e) 3.38
   f) 9
2. a) 1.6
   b) 2.5
   c) 246
3. 83%
4. a) 75%
   b) Boys: 43%,
      Girls: 57%
5. a) 160%
   b) 62.5%
6. 40%
7. 24% of 5 pizzas

Challenge Problems (pg. 28)
1. 2%
2. 73%
3. $x = 4$

Extra Practice (pg. 28-29)
1. 9.6
2. 45
3. 91
4. 0.75
5. 3.57

6. $75\%$
7. 53%
8. a) 25%
    b) 12.5%
    c) 6.3%
9. 20%
10. a) 47.5%
    b) 52.5%
11. 20%
12. 45 fiction books
13. These are the same!
14. Group A (80%)
Chapter 7

7.1

Problems (pg. 35)
1. \( x \leq -15 \)

2. \( y < 4 \)

3. \( x \leq 15 \)

4. no solution

5. \( x > 2 \)

6. \( x \leq 6 \)

7. \( h \leq \frac{-6}{5} \)

8. all real numbers

9. \( x \geq 20 \)

10. all real numbers

Challenge Problems (pg. 35)
1. many different answers

2. 3

Extra Practice (pg. 35-36)
1. \( n < \frac{16}{9} \)

2. \( n < -45 \)

3. \( c < -\frac{7}{6} \)

4. \( x < -\frac{4}{15} \)

5. \( m > \frac{13}{7} \)

6. \( x \geq -4 \)

7. \( x \geq -3 \)

8. \( a < 7 \)

9. \( y > 6 \)

10. all real numbers

11. \( x \leq -4 \)

12. all real numbers

13. \( x \geq \frac{5}{4} \)

14. \( n \geq \frac{1}{24} \)

7.2

Problems (pg. 36)
1. \( b < \frac{5}{29} \)
2. $r \leq -\frac{11}{8}$

3. $k < 4$

4. $y \geq -\frac{7}{19}$

5. $x > \frac{180}{11}$

6. $y < \frac{5}{2}$

**Challenge Problems (pg. 36)**

1. $x \geq \frac{86}{73}$

2. Let $a = b = c$.

   \[
   \frac{a}{2a} + \frac{a}{2a} + \frac{a}{2a} \geq \frac{3}{2}
   \]

   \[
   \frac{3a}{2a} \geq \frac{3}{2}
   \]

   \[
   \frac{3}{2} \geq \frac{3}{2} \text{ (true!)}
   \]

**Extra Practice (pg. 36)**

1. $g < -\frac{48}{11}$

2. $x \leq -\frac{19}{3}$

3. $a \geq -\frac{5}{28}$

4. $d \geq \frac{47}{11}$

5. $h > -\frac{33}{32}$

6. $w < \frac{41}{24}$

7. $n > \frac{3}{13}$

8. $g < -\frac{10}{9}$

9. $k \leq -\frac{35}{9}$

10. $x > \frac{10}{9}$

**7.3 Problems (pg. 37)**

1. $x \leq -18$

2. $x \leq \frac{8}{13}$


4. 15 bouquets

5. 11 days

**Challenge Problems (pg. 37)**

1. $x \leq \frac{1}{4}$

2. 61

**Extra Practice (pg. 37-38)**

1. $x \geq \frac{5}{4}$

2. $x \leq 9$
3. Movie: $16
   Concert: $34
4. 5 hours
5. $x \geq 1$
6. $x \leq 4$
7. Kyle: 40
   David: 23
8. $x \leq \frac{45}{13}$
9. 10 days
10. $x \geq \frac{11}{14}$
11. 54 hours
12. 6 books

7.4
Problems (pg. 38)
1. $1 < x < 3$
2. $2 \leq x < 9$
3. $-\frac{4}{3} \leq x < 4$
4. $-\frac{5}{7} < x < 0$
5. $x = 6$
6. $x \geq 4$
7. $2 < x \leq 5$
8. no solution

Challenge Problems (pg. 38)
1. $-4 \leq b \leq -2$
2. $\frac{25}{24}$

Extra Practice (pg. 39)
1. $-2 \leq n \leq 6$
2. $-10 < n < 8$
3. $-6 < x < 1$
4. no solution
5. no solution
6. $-7 < x < 4$
7. $5 \leq x < 19$
8. $2 < w < 5$
9. $-3 \leq g < 2$
10. $b < 5$
11. $-15 \leq y \leq -6$
12. no solution
13. $-3 < x < 4$
14. $-8 < x < 1$
15. \(-10 < p < 7\)

16. \(-1 < x \leq 1\)

7.5

Problems (pg. 39)
1. min: 7 hours, max: 12 hours
2. min: 10, max: 26
3. Corbin: min: 10, max 29
   Tyler: min: 38, max: 48
4. 29, 31, 33 and 31, 33, 35
5. width: min: 4 in, max: 8 in
   length: min: 13 in, max: 21 in

Challenge Problems (pg. 40)
1. \(0 < n < 8\) and \(22 < d < 30\)
2. 43 (this one is tricky!)

Extra Practice (pg. 40)
1. min: 6 tickets, max: 14 tickets
2. min: 15 in, max: 17.5 in
3. min: 13 books, max: 19 books
4. Sister: min: $40, max: $50
   Ashlyn: min: $87, max: $107
5. 26, 28, 30, 32 and 28, 30, 32, 34
6. between 274 and 284 guests
7. between 8 and 12 hours
8. 54, 55, 56 and 55, 56, 57

7.6

Problems (pg. 41)
1. \(x < 3\) or \(x \geq 11\)

2. \(a < -3\) or \(a > 7\)

3. all real numbers

4. \(y \leq \frac{1}{2}\)

5. \(r \leq -7\) or \(r \geq \frac{9}{2}\)

6. all real numbers

7. \(z < -8\) or \(z > -3\)

8. \(x \leq -2\) or \(x > 4\)

Challenge Problems (pg. 41)
1. \(a = 1, b = 11\)
2. \(a = -7, b = 7\)

Extra Practice (pg. 41)
1. \(y < 2\) or \(y \geq 4\)

2. \(y < \frac{1}{5}\) or \(y \geq 13\)

3. \(g > -2\)

4. all real numbers

5. \(m < -\frac{5}{2}\) or \(m \geq 3\)

6. all real numbers

7. \(y \leq 3\) or \(y \geq 4\)

8. \(x \leq -2\) or \(x > 5\)

9. \(r < 5\) or \(r \geq 6\)
10. all real numbers

11. \( n \leq 0 \) or \( n > 1 \)

12. \( x \leq -3 \) or \( x > 0 \)

7.7
Problems (pg. 41-42)
1. \( y = \{3, -3\} \)
2. \( x = \{14, -6\} \)
3. \( y = \{\frac{15}{2}, -\frac{5}{2}\} \)
4. \( g = \frac{5}{3} \)
5. no solution
6. \( x = \{2, -6\} \)
7. \( b = \{2, -12\} \)
8. \( z = \{4, \frac{4}{3}\} \)
9. \( x = \{-2, 10\} \)
10. \( n = \{-4, \frac{4}{3}\} \)

Challenge Problems (pg. 42)
1. \( x = \frac{1}{4} \)
2. \( x = \{4, \frac{5}{3}\} \)

Extra Practice (pg. 42)
1. \( b = \{1, -1\} \)
2. \( x = \{28, -20\} \)
3. \( y = \{3, -9\} \)
4. \( c = \{7, -2\} \)
5. \( n = \{\frac{16}{5}, -6\} \)

6. \( x = \{-3, 9\} \)
7. no solution
8. \( w = \{4, -8\} \)
9. \( g = \{1, -\frac{19}{5}\} \)
10. no solution
11. \( n = \{-\frac{19}{3}, 7\} \)
12. \( y = \frac{3}{10} \)
13. no solution
14. \( x = \{\frac{11}{3}, -\frac{1}{3}\} \)
15. \( x = \{\frac{9}{5}, \frac{7}{5}\} \)
16. \( x = \{3, \frac{1}{3}\} \)
17. \( w = 7 \)
18. no solution
19. \( n = \{\frac{4}{3}, -\frac{16}{9}\} \)
20. \( r = \{-2, 0\} \)
21. \( m = \{7, -\frac{29}{3}\} \)
22. \( b = \{6, -\frac{16}{3}\} \)
23. \( b = \{-\frac{17}{2}, \frac{7}{2}\} \)
24. \( x = \{-\frac{13}{7}, 1\} \)

7.8
Problems (pg. 43)
1. \(-5 \leq x \leq 5 \)
2. \(-3 < y < 7 \)
3. \(-\frac{1}{3} \leq m \leq -\frac{1}{9}\)

4. \(-1 \leq n \leq 4\)

5. no solution

6. \(y = 9\)

7. no solution

8. \(-\frac{3}{2} < r < -\frac{1}{4}\)

3.\(9. -4 < y < 20\)

4.\(10. 0 \leq q \leq 3\)

5.\(11. -9 < p < -5\)

6.\(12. -4 < w \leq \frac{10}{3}\)

7.\(13. -6 < r < 13\)

8.\(14. \text{no solution}\)

Challenge Problems (pg. 43)
1. a) \(-\frac{c-b}{a} < x < \frac{c-b}{a}\)

b) \(-\frac{c-b}{a} < x < \frac{c-b}{a}\)

Extra Practice (pg. 43)
1. \(-10 < x < 10\)

2. \(-14 < y < 4\)

3. \(-6 < x < 1\)

4. \(-\frac{9}{2} \leq v \leq 9\)

5. \(-4 < n < 4\)

6. \(-7 < x < 2\)

7. no solution

Problems (pg. 44)
1. \(n < -5 \text{ or } n > 5\)

2. \(y < -10 \text{ or } y > 2\)

3. \(x \leq -1 \text{ or } x \geq 2\)

4. \(x \leq \frac{1}{2} \text{ or } x \geq 1\)

5. all real numbers

6. \(k \leq -8 \text{ or } k \geq 16\)

7. \(x \leq -\frac{3}{2} \text{ or } x \geq \frac{5}{2}\)
8. all real numbers

**Challenge Problems (pg. 44)**

1. a) $x < \frac{-c - b}{a}$ or $x > \frac{c - b}{a}$
   
   b) $x > \frac{-c - b}{a}$ or $x < \frac{c - b}{a}$

2. $x \geq 1$ or $x \leq -1$

**Extra Practice (pg. 44)**

1. $b \leq -3$ or $b \geq 3$

2. $x < -7$ or $x > 17$

3. $x \leq -8$ or $x \geq 2$

4. $x < -\frac{9}{2}$ or $x > 2$

5. all real numbers

6. $x < -1$ or $x > 5$

7. $t \leq \frac{12}{5}$ or $t \geq \frac{26}{5}$

8. all real numbers

9. $b < -4$ or $b > 20$

10. $x \leq 2$ or $x \geq 10$

11. $x < -3$ or $x > 1$

12. $v \leq -\frac{1}{2}$ or $v \geq 4$

13. $x < -4$ or $x > 5$

14. $t \leq 6$ or $t \geq 14$
7.10

Problems (pg. 45)

1. a) \[
\begin{array}{ccc}
6 & x \times x \\
5 & x \times x \\
4 & x \times x \\
3 & x \times x \\
2 & x \times x \\
1 & x \times x \\
\end{array}
\]
   H \ T
b) \frac{1}{4}

c) \frac{2}{3}
d) \frac{1}{3}

2. a) E
   C
   I
   N
   I
   C
   E
b) \frac{1}{4}
c) \frac{1}{3}
d) \frac{1}{2}

3. a) 5
   3
   1
   2 4 6
b) 0
c) \frac{1}{3}
d) \frac{2}{3}

e) \frac{2}{3}
f) \frac{7}{9}

g) 5
   10 20 30
   6 12 18
   1 2 4 6
   2 4 6

h) \frac{5}{9}
i) \frac{4}{9}

Challenge Problems (pg. 45)

1. \frac{17}{36}

2. \frac{3}{4}

Extra Practice (pg. 46-47)

1. a) S
   C
   G
   G
   S
b) \frac{1}{6}
c) \frac{1}{3}
d) \frac{2}{3}

e) \frac{3}{4}
f) \frac{5}{12}

g) 3
   1
   2
   4
   6
   8
   1
   2
   3
   4

h) \frac{1}{3}
i) \frac{1}{12}

3. a) N
   U
   M
   X
   X
   X
   B
   E
   X
   X
   X
   R
b) H
   T

4. a) \begin{array}{cccc}
H & x & x & x \\
O & x & x & x \\
M & x & x & x \\
E & x & x & x \\
W & O & R & K
\end{array}
b) \frac{1}{16}
c) \frac{1}{8}
d) \frac{1}{2}

5. a) 6
   7
   8
   9
   10
   11
   12
   5
   6
   7
   8
   9
   10
   11
   4
   5
   6
   7
   8
   9
   10
   3
   4
   5
   6
   7
   8
   9
   2
   3
   4
   5
   6
   7
   8
   1
   2
   3
   4
   5
   6
   1
   2
   3
   4
   5
   6
b) \frac{1}{12}
c) \frac{1}{18}
d) \frac{15}{36}
6. a)  
\[
\begin{array}{c|c}
7 & x x x x x \\
6 & x x x x x \\
5 & x x x x x \\
4 & x x x x x \\
\hline
1 & 1 1 2 3
\end{array}
\]
b) 1  
c) 1  
d)  
\[
\begin{array}{c|c}
7 & 8 8 8 9 10 \\
6 & 7 7 7 8 9 \\
5 & 6 6 6 7 8 \\
4 & 5 5 5 6 7 \\
\hline
1 & 1 1 2 3
\end{array}
\]
e) 7/25  
f) 11/25  
g)  
\[
\begin{array}{c|c}
7 & 7 7 7 14 21 \\
6 & 6 6 6 12 18 \\
5 & 6 6 6 12 18 \\
4 & 5 5 5 10 15 \\
3 & 4 4 4 8 12 \\
\hline
1 & 1 1 1 2 3
\end{array}
\]
h) 18/25  
i) 8/25  

7.11

Problems (pg. 47)

1. Probability: \(\frac{3}{20}\)  
   Tree diagram:  
\[
\begin{array}{c}
1/6 \\
1/6 \text{ (all)} \\
7/10 \text{ (H)} \\
HT HT HT HT HT HT
\end{array}
\]

Extra Practice (pg. 48)

1. Probability: \(\frac{29}{60}\)  
   Tree diagram:  
\[
\begin{array}{c}
7/12 \text{ (A)} \\
5/12 \text{ (B)} \\
A B A B
\end{array}
\]

7.12

Problems (pg. 49)

1. a)  
\[
\begin{array}{c}
3/10 \text{ (a)} \\
7/10 \text{ (b)} \\
P P P Y P Y
\end{array}
\]
b) 49/100  
c) 21/50  
d) 12/25
Extra Practice (pg. 49-50)

1. a) 4/10 6/10
   b) 8/15
   c) 7/15

2. a) 10/15 5/15
   b) 1/9
   c) 4/9
   d) 4/9

3. a) 12/18 6/18
   b) 5/51
   c) 24/51
   d) 22/51

4. a) 5/12 4/12 3/12
   b) 19/66
   c) 9/44
   d) 3/11

Challenge Problems (pg. 49)

1. \( \frac{3}{11} \)

2. \( \frac{91}{216} \)
Chapter 8

8.1
Problems (pg. 51)
1. a) Yes
   b) No
   c) Yes
2. a) No
   b) Yes
   c) Yes
3. \( y = -2x + 3 \)
4. \( y = 3x - 1 \)
5. a) No
   b) No
   c) No
6. \( y = 3x - 4 \)
7. \( y = -4x + 9 \)
8. \( y = 3x + 1 \)
9. \( y = 2x + 3 \)

Challenge Problems (pg. 51)
1. Yes
2. \( y = -8 \)

Extra Practice (pg. 51-52)
1. a) No
   b) No
   c) No
2. a) No
   b) Yes
   c) No
3. a) Yes
   b) No
   c) Yes
4. a) Yes
   b) No
   c) Yes
10. \( y = \frac{1}{2}x + 2 \)
14. \( y = -\frac{1}{2}x + 2 \)
2. \( x = 4 \)

11. \( y = x + 3 \)
15. \( y = \frac{1}{3}x + 4 \)
3. \( y = -2 \)

12. \( y = -3x + 5 \)
16. \( y = -x - 5 \)
4. \( x = -7 \)

5. intercepts: \((0, -4)\) and \((4, 0)\)

8.2
Problems (pg. 52)
1. \( y = 5 \)
6. intercepts: $(0, -6)$ and $(-3, 0)$  
10. intercepts: $(-3, 0)$ (x-int only)  
4. $x = 4$

7. intercepts: $(0, 5)$ and $(\frac{5}{3}, 0)$

8. intercepts: $(0, 0)$ and $(0, 0)$

9. intercepts: $(0, 3)$ (y-int only)

Challenge Problems (pg. 53)
1. $a = -\frac{5}{3}$
2. $b = 5$

5. intercepts: $(-6, 0)$ and $(0, 3)$

Extra Practice (pg. 53)
1. $y = -3$

6. intercepts: $(-1, 0)$ and $(0, 3)$

2. $x = -2$

7. intercepts: $(-2, 0)$ and $(0, -6)$

3. $y = 0$

8. intercepts: $(8, 0)$ and $(0, 6)$
9. intercepts: (2, 0) and (0, -6)

10. intercepts: (0, 4) (y-int only)

11. intercepts: (3, 0) and (0, -5)

12. intercepts: (-7, 0) (x-int only)

8.3
Problems (pg. 53-54)

1. 3
2. \(-\frac{3}{4}\)
3. undefined
4. 0
5. 2
6. -\frac{3}{2}
7. 0
8. 1
9. -\frac{2}{3}
10. undefined
11. (1, 2), slope: 4
12. (2, -5), slope: -\frac{3}{4}

13. x-intercept: 3, slope: -3

14. y-intercept: -2, slope: \frac{3}{5}

Challenge Problems (pg. 54)

1. point D
2. \(y = 6\)
3. \(p = -15\)

Extra Practice (pg. 55-56)

1. \(-\frac{3}{7}\)
2. 0
3. 1
4. \frac{3}{4}
5. undefined
6. 2
7. -1
8. \frac{1}{2}
9. 6
10. $\frac{1}{4}$
11. undefined
12. $\frac{3}{5}$
13. $-\frac{4}{3}$
14. 0
15. $(1, 2)$, slope: 3
16. $(0, 0)$, slope: $\frac{5}{6}$
17. $(-1, -3)$, slope: -1
18. $(4, -2)$, slope: $-\frac{1}{4}$
19. $(3, 5)$, slope: 4
20. $(-2, 1)$, slope: $-\frac{2}{3}$
21. x-intercept: 5, slope: -2
22. y-intercept: 7, slope: $\frac{3}{2}$

8.4 Problems (pg. 56-57)
1. $y = 3x + 3$
2. $y = -2x - 4$
3. $y = -6x + 1$
4. $y = -\frac{1}{2}x - 2$
5. $y = -2x + 3$
6. $y = 3x + 1$
7. \( y = \frac{1}{4}x - 3 \)

9. \( y = \frac{1}{3}x - 3 \)

1. \( y = \frac{-3}{4}x + \frac{15}{2} \)

2. \( 50 \text{ units}^2 \)

Extra Practice (pg. 57-58)

1. \( y = \frac{5}{2}x - 5 \)

2. \( y = 2x \)

10. \( y = -x - 1 \)

3. \( y = -\frac{1}{5}x + 1 \)

4. \( y = -x - 2 \)

11. \( y = \frac{-3}{5}x + 4 \)

5. \( y = \frac{4}{5}x - 4 \)

6. \( y = -5x - 6 \)

7. \( y = 4x - 2 \)

12. \( y = -2x + 4 \)

8. \( y = -\frac{3}{2}x + 5 \)

13. \( y = -x - 7 \)

9. \( y = \frac{3}{2}x + 5 \)

10. \( y = -4x \)
14. $y = -\frac{1}{3}x + 6$

4. $y = 3x - 1$

3. $y = -\frac{4}{3}x - 2$

8.5
Problems (pg. 58)
1. $y = -\frac{2}{3}x + 6$

5. $y = 3x + 6$

4. $y = 3x - 7$

Challenge Problems (pg. 59)
1. $y = -\frac{5}{3}x + 5$

2. $y = -\frac{d}{k}x + \frac{g}{k}$

Extra Practice (pg. 59)
1. $y = -\frac{5}{4}x + 5$

5. $y = -2x + 11$

2. $y = \frac{2}{3}x - 4$

6. $y = -\frac{3}{4}x + 7$
7. \( y = \frac{2}{3}x - 2 \)

8. \( y = x + 5 \)

9. \( y = x + 1 \)

10. \( y = 0 \)

4. \( y = \frac{1}{4}x - 2 \)

5. \( y = -\frac{5}{4}x - 4 \)

6. \( y = -\frac{1}{2}x - 1 \)

7. \( y = \frac{7}{5}x + 7 \)

8. \( y = x + 5 \)

Extra Practice (pg. 60)

1. \( y = -\frac{3}{2}x + 9 \)
2. \( y = 3x + 2 \)
3. \( y = \frac{5}{3}x + 5 \)
4. \( y = -\frac{2}{3}x - 1 \)
5. \( y = 3x + 6 \)
6. \( y = \frac{5}{4}x + 4 \)
7. \( y = -8x + 3 \)
8. \( y = 2x - 2 \)
9. \( y = \frac{1}{2}x - 1 \)

Challenge Problems (pg. 60)

1. a) False  
   b) True  
   c) True  
   d) False  
   e) False  
   f) False
2. \((-3, -6)\)
13. \( y = \frac{4}{3}x - 2 \)

14. \( y = 2x + 8 \)

8.7

Problems (pg. 60-61)
1. \( y = -2x - 5 \)
2. \( y = \frac{1}{2}x - 7 \)
3. \( y - 1 = -\frac{3}{5}(x - 5) \)

4. \( y + 4 = -2(x - 2) \)

5. \( y = 2(x + 5) \)

6. \( y - 4 = \frac{1}{2}x \)

7. \( y - 1 = -3(x - 2) \) or \( y + 5 = -3(x - 4) \)

8. \( y - 3 = 2(x - 5) \) or \( y + 9 = 2(x + 1) \)

Challenge Problems (pg. 61)
1. \( y + 3 = -\frac{5}{2}(x - 2) \)
2. \( b = -\frac{38}{3} \)

Extra Practice (pg. 61)
1. \( y = -\frac{1}{3}x - 5 \)
2. \( y = 5x - 4 \)
3. \( y = -x + 6 \)
4. \( y = -2x - 13 \)
5. \( y - 3 = -\frac{4}{3}(x - 6) \)

6. \( y = 3x \)
7. \( y + 2 = 5(x - 2) \)

11. \( y = 4(x + 3) \)

15. \( y + 1 = -\frac{7}{3}(x - 2) \) or \( y - 6 = -\frac{7}{3}(x + 1) \)

8. \( y + 1 = \frac{1}{2}(x + 4) \)

12. \( y + 5 = -\frac{3}{5}x \)

16. \( y + 2 = \frac{1}{9}(x + 4) \) or \( y + 3 = -\frac{1}{9}(x - 5) \)

9. \( y = -3(x - 2) \)

13. \( y - 2 = \frac{1}{3}(x - 3) \) or \( y - 1 = \frac{1}{3}x \)

10. \( y - 1 = \frac{2}{3}x \)

14. \( y - 3 = -\frac{1}{5}(x + 1) \) or \( y - 2 = -\frac{1}{5}(x - 4) \)

8.8

Problems (pg. 62)

1. Parallel: 3, Perpendicular: \(-\frac{1}{3}\)

2. Parallel: \(-\frac{4}{5}\), Perpendicular: \(\frac{5}{4}\)

3. Parallel: 1, Perpendicular: -1

4. Parallel: \(-\frac{4}{3}\), Perpendicular: \(\frac{3}{4}\)
5. Parallel: \( y = -\frac{1}{2}x + 2 \),
    Perpendicular: \( y = 2x - 3 \)

9. Parallel: \( y = -3x + 13 \),
    Perpendicular: \( y = \frac{1}{3}x + 3 \)

6. Point-slope form:
    \( y - 5 = 2(x - 1) \)
    Slope-intercept form:
    \( y = 2x + 3 \)
7. Point-slope form:
    \( y + 4 = -2(x - 3) \)
    Slope-intercept form:
    \( y = -2x + 2 \)

Challenge Problems (pg. 62)
1. \( k = -2 \)
2. \( k = -6 \)

Extra Practice (pg. 63)
1. Parallel: -2,
    Perpendicular: \( \frac{1}{2} \)
2. Parallel: \( \frac{2}{7} \),
    Perpendicular: \( -\frac{7}{2} \)
3. Parallel: 5,
    Perpendicular: \( -\frac{1}{5} \)
4. Parallel: \( \frac{5}{2} \),
    Perpendicular: \( -\frac{2}{5} \)
5. Parallel: \( -\frac{3}{8} \),
    Perpendicular: \( \frac{8}{3} \)
6. Parallel: \( \frac{2}{3} \),
    Perpendicular: \( -\frac{3}{2} \)
7. Parallel: 3,
    Perpendicular: \( -\frac{1}{3} \)
8. Parallel: 2,
    Perpendicular: \( -\frac{1}{2} \)
11. \( y + 1 = -\frac{1}{4}(x - 2) \)
12. \( y - 6 = -\frac{3}{2}(x - 4) \)
13. \( y - 2 = -\frac{7}{2}(x + 7) \)
14. \( y - 7 = -\frac{3}{5}(x + 2) \)
15. \( y = 4x + 3 \)
16. \( y = -\frac{5}{2}x + 12 \)
17. \( y = \frac{2}{3}x + 7 \)
18. \( y = -\frac{1}{2}x + 2 \)
2. \((-6, 7)\)

**Extra Practice (pg. 66)**
1. \((-2, -2)\)
2. \((-2, -4)\)
3. no solution
4. \((-8, 0)\)
5. \(\infty\)-many solutions
6. no solution
7. \(\infty\)-many solutions
8. no solution
9. \((-3, -2)\)
10. \((-1, -1)\)
11. \((4, -3)\)
12. \((2, -1)\)
13. \((2, 2)\)
14. no solution
15. \((4, -4)\)
16. \((3, -2)\)

**Challenge Problems (pg. 65)**
1. \((-6, 0)\)
2. \(a = 3\)

Extra Practice (pg. 65-66)
1. No
2. No
3. Yes
4. No
5. Yes
6. No
7. \((-1, 2)\)
8. \((2, -3)\)
9. \((-1, 1)\)
10. \((-1, -3)\)
11. \((-1, 3)\)
12. \((1, 0)\)
13. \((1, -4)\)
14. \((2, 1)\)
15. \((-2, 0)\)
16. \((2, -3)\)
17. \((2, 3)\)
18. \((-3, 2)\)
19. \((4, -1)\)
20. \((3, -4)\)

**Chapter 9**

**9.1 Problems (pg. 67)**
1. No
2. Yes
3. No
4. Yes
5. \((2, 3)\)
6. \((2, 1)\)
7. \((2, 2)\)
8. \((1, 0)\)

**Extra Practice (pg. 66)**
1. No
2. No
3. Yes
4. No
5. Yes
6. No
7. \((-1, 2)\)
8. \((2, -3)\)
9. \((-1, 1)\)
10. \((-1, -3)\)
11. \((-1, 3)\)
12. \((1, 0)\)
13. \((1, -4)\)
14. \((2, 1)\)
15. \((-2, 0)\)
16. \((2, -3)\)
17. \((2, 3)\)
18. \((-3, 2)\)
19. \((4, -1)\)
20. \((3, -4)\)

**9.2 Problems (pg. 66)**
1. \((5, 1)\)
2. no solution
3. \(\infty\)-many solutions
4. \((-8, 0)\)
5. no solution
6. \((3, -3)\)

**Challenge Problems (pg. 66)**
1. \(\frac{3}{2}, 2\)

**Extra Practice (pg. 66)**
1. \(\frac{3}{2}, 2\)

**Extra Practice (pg. 67)**
1. \((7, 9)\)
2. \((-1, -3)\)
3. \((-2, 1)\)
4. \((-1, -2)\)
5. \((-1, 2)\)
6. \((3, -2)\)

**Challenge Problems (pg. 68)**
1. \(a = 3, b = 2\)
2. \(x = \frac{2}{3}, y = \frac{2}{5}\)

**Extra Practice (pg. 68)**
1. \((1, 5)\)
2. \((1, -4)\)
3. \((3, -1)\)
4. \((-1, 2)\)
5. \((2, -2)\)
6. \((-1, 4)\)
7. \((0, 4)\)
8. \((2, 7)\)
9. \((10, 6)\)
10. \((4, -2)\)

**9.3 Problems (pg. 67)**
1. \((7, 9)\)
2. \((-1, -3)\)
3. \((-2, 1)\)
4. \((-1, -2)\)
5. \((-1, 2)\)
6. \((3, -2)\)

**Challenge Problems (pg. 68)**
1. \(a = 3, b = 2\)
2. \(x = \frac{2}{3}, y = \frac{2}{5}\)

**Extra Practice (pg. 68)**
1. \((1, 5)\)
2. \((1, -4)\)
3. \((3, -1)\)
4. \((-1, 2)\)
5. \((2, -2)\)
6. \((-1, 4)\)
7. \((0, 4)\)
8. \((2, 7)\)
9. \((10, 6)\)
10. \((4, -2)\)

**9.5 Problems (pg. 70)**
1. \((6, 4)\)
2. \((2, 3)\)
3. \((5, -3)\)
4. \((1, \frac{1}{2})\)
5. \((-3, -7)\)
6. \((4, 0)\)
7. no solution
8. no solution

**Challenge Problems (pg. 70)**
1. \(u = 24\)
2. \((4, 1)\)

**Extra Practice (pg. 70-71)**
1. \((2, 5)\)
2. \((1, 1)\)
3. \((-\frac{5}{2}, 2)\)
4. (6, 2)  
5. no solution  
6. (−5, −2)  
7. (−1, 3)  
8. (4, 3)  
9. (−4, 2)  
10. (0, 2)  

9.6  
Problems (pg. 71)  
1. (2, 1)  
2. (−8, −2)  
3. (1, 2)  
4. ∞-many solutions  
5. (3, −1)  
6. (−3, 2)  

Challenge Problems (pg. 71)  
1.  
2. (0.5, −3)  

Extra Practice (pg. 71-72)  
1. ∞-many solutions  
2. (3, −2)  
3. ∞-many solutions  
4. no solution  
5. (−4, 3)  
6. no solution  
7. (6, 4)  
8. (5, −3)  
9. ∞-many solutions  
10. (3, 5)  
11. (3, −2)  
12. ∞-many solutions  

9.7  
Problems (pg. 72)  
1. (−4, −4)  
2. (−2, −2)  
3. ∞-many solutions  
4. (4, −2)  
5. (2, 1)  
6. no solution  
7. (3, −2)  

Challenge Problems (pg. 73)  
1. (4, 9)  

9.8  
Problems (pg. 74)  
1. 32, 18  
2. length: 21 ft, width: 10 ft  
3. Sadie: $46, friend: $126  
4. weekdays: 2, weekends: 13  
5. nickels: 33, dimes: 42  

Challenge Problems (pg. 74)  
1. Dorian: $800, Micah: $950  
2. 26  

Extra Practice (pg. 74-75)  
1. 72, 22  
2. 10, 26  
3. 7, 3  
4. 12°, 168°  
5. 31°, 59°  
7. 19 nickels, 9 dimes
Chapter 10

10.1

Problems (pg. 77)

1. a) binomial of degree 1
   b) trinomial of degree 6
   c) monomial of degree 6
   d) trinomial of degree 2
   e) monomial of degree 0
   f) none of the above, degree 3
   g) binomial of degree 2
   h) trinomial of degree 7

2. $7x^2 + 2x + 4$

3. $6n^2 + 3n - 2$

4. a) $4x^2 + 3$
   b) $6n^2 - n$
   c) $-7x^8 + 3x^7 + 3x^9 + 4$
   d) $-y^2 + 13y^3 + 9y^7$
   e) $2r^4 + 2r^2 - 9t^2$
   f) $11h^2 - k^2$

5. When simplifying the 2nd expression, $-3n$ was not changed to $3n$ when multiplying by -1; $5n^3 + 7n^2 - n - 7$

Challenge Problems (pg. 78)

1. $x = 25$

2. $\frac{1}{2}$

Extra Practice (pg. 78)

1. a) trinomial of degree 2
   b) monomial of degree 0
   c) trinomial of degree 3
   d) binomial of degree 1
   e) binomial of degree 4
   f) none of the above of degree 5
   g) binomial of degree 2
   h) monomial of degree 6

2. a) $-x^3$
   b) $6x^4 + 5x^2 - 4xy - 3$
   c) $5h^9 - 2h^8 - 9h^2$
   d) $3a^2 - b^2 - 7c^2$

3. a) $-3x^2 + 14x + 7$
   b) $-7y^3 - 4y^4 + 1$
   c) $-2r^5 + r^3 - 10r^2 - 6r$
   d) $-12x^2 + 14xy - 13y^2$

4. Should not have added exponents:
   $2x^4 + 3x^3 + 3x^2 - 4x$

5. $-2x^2 + 2x - 6$

6. $4y^5 + y^7 - 7y^3$

7. $6m^2 - m + 7$

8. $-6a^2 + 3ab + 5b^2$

9. $-4x^2 - 32x + 48$

10. $5y^2 + 2y + x^2$

10.2

Problems (pg. 79)

1. $12x^2 - 6x$
2. $-10h^3 + 20h$
3. $2x^4y - 3x^2y$
4. $3x^2 + 6x + 18$
5. $-2b^3 + 8b^2 + 12b$
6. $6d^3 + 15d^2 + 9d$
7. $12x^2y + 8xy^2 + 28y^2$
8. $-3y^2 + 21xy - 3y$
9. $-2y^2 + y^4 - 10y^3$
10. $15x^2y^3 + 12x^2y^2 - 9xy^2$
11. $9a^5 - 18a^4 + 21a^3 - 27a^2$
12. $-20j^3k^3 + 12j^3k^3 + 20j^2k^2$

Challenge Problems (pg. 79)

1. $-32x^5 - 8x^4 + 45x^3$

2. $x = \frac{1}{9}$

Extra Practice (pg. 79)

1. $-8x^2 + 16xy$
2. $5x^3y^2 - 3x^2y^2$
3. $8x + 12x^2 + 10x^4$
4. $n^3 - 6n^2 + 5n$
5. $10k^2 + 15k^2m$
6. $21y - 14y^2$
7. $6x^3 + 8x^2 + 18x$
8. $-8mn^2 + 12m^2n$
9. $10x^3 - 20x^2 + 30x^6$
10. $18n^2 - 36n^6$
11. $140r^2s^4 - 28r^2s^2 + 70rs^3$
12. $-4w^5x + 8w^4$
13. $x^5y - 2x^2y^2$
14. $30x^3 - 18x^2 + 12x$
15. $8r^3 + 28r^2$
16. $20x^5 + 35x^3$
17. $20n^2 + 70n$
18. $12a^6b^3 + 18a^5b^4 - 24a^3b^5$
19. $6x^3y^2 + 8x^2y^2 - 10x^2y^3$
20. $-3c^4d^2 + 9c^3d$
21. $-4g^4 + 8g^3 - 20g^2$
22. $6x^3 + 4x$

10.3

Problems (pg. 80)

1. $2xy(x + 3y - 12)$
2. $3m(2m + 5)$
3. $2pg(1 + 3p - 2p^2)$
4. $2(n + 5)(2x^2 + 5y^2)$
5. $3c^2(4c^3 - 6c - 1)$
6. $5x^2y^2(3x + 2y^2)$
7. $9x^2(x^2 - 1)$
8. $m^2(n(15mn - 20n^2 + 12m^2))$
9. $9p^3q(4p^3 + 5p^2q^2 + 9q)$
10. $(x + 5)(r - t)$
11. $2a^2b^4(2a^2b^3 - 7b^5 + 9a^3)$
12. $x(x^4 + 7x^3y^3 - 8y^4 + 14y)$

Challenge Problems (pg. 80)

1. $(3n + 4)(2 + m)$
2. $2a^3 - 1(4x + 2x^3 - 5)$

Extra Practice (pg. 80)

1. $4x^3(x^2 - 2x - 1)$
2. $4x(4x - 3)$
3. $18c^3d^5(e + 2d^2)$
4. $3x^2(2x^3 - 5x^2 - 7x + 9)$
5. $5rs(3r^2s - 2)$
6. $5a(2b + 1)$
7. $4x(x^2 - 11x + 24)$
8. $2h^2(25h^2 - 1)$
9. $3h(g^3 - 3g^2 + 4)$
10. $3y^3(2x^2 + 3xy + 6y^2)$
11. $6m^2n(5n^3 + 7mn^2 - 9m^2)$

10.4

Problems (pg. 80)

1. $x^2 + 3x - 4$
2. $2y^2 + 10y + 12$
3. $n^2 + 2n + 1$
4. $16 - y^2$
5. $10x^2 - 43x + 12$
6. $10g^2 + 26g - 12$
7. $6rs - s + 12r - 2$
8. $12x^2 + xy - 6j^2$
9. $6w^2 + 13w - 28$
10. $-10x^2 + 7x + 12$
11. $4y^2 - 12y + 9$
12. $12h^2 - 2hj - 2j^2$

Challenge Problems (pg. 81)

1. $x^3 + x^2 - 10x + 8$
2. $x = 2\sqrt{5}$
3. \( x = 8 \)

**Extra Practice (pg. 81)**
1. \( k^2 - 2k - 15 \)
2. \( 6x^2 + 13x - 5 \)
3. \( 6n^2 - 28x - 10 \)
4. \( 4e^2 - 12e + 9 \)
5. \( 4g^2 - 6g - 40 \)
6. \( 9x^2 - 12x + 3 \)
7. \( k^2 - 8k + 16 \)
8. \( 8b^2 + 13b - 6 \)
9. \( 2u^2 + 3u - 20 \)
10. \( p^2 + p - 12 \)
11. \( 4x^2 + 13x + 3 \)
12. \( 9g^2 - 6g + 1 \)
13. \( 4h^2 + 17h - 42 \)
14. \( 10x^2 + 11x - 6 \)
15. \( 36c^2 + 47c + 15 \)

**10.5**

**Problems (pg. 81)**
1. \( -6x^2 - 5xy + 4y^2 \)
2. \( 2r^2 + 4rs + 2s^2 \)
3. \( b^3 - 2b^2 + 4b - 8 \)
4. \( 40x^2 - 90 \)
5. \( -10n^2 + 45n - 20 \)
6. \( -4y^2 - 17y - 18 \)
7. \( 12g^3 + 18g^2 - 54g \)
8. \( x^3 - 2x^2 - 8 \)
9. \( 2x^3 + 9x^2 + 17x + 12 \)
10. \( 8y^4 + 2y^2 - 3 \)
11. \( 12n^3 - 13n^2 + 24n - 7 \)
12. \( h^3 - 25h \)

**Challenge Problems (pg. 81)**
1. a) \( 6x + 5\sqrt{x} - 6 \)
   b) \( 6w^3 - 30w^2 + 36w \)
2. \( x^3 - 3x^2y + 3xy^2 - y^3 \)

**Extra Practice (pg. 82)**
1. \( -4x^2 - 8x - 4 \)
2. \( 3x^2 + 24x + 48 \)
3. \( y^3 + 4y^2 - 3y - 12 \)
4. \( 12a^2 - 2ab - 24b^2 \)
5. \( 10x^2 + 10xy - 60y^2 \)
6. \( x^3 - 2x^2 - 24x \)
7. \( 6b^3 - 33b^2 + 36b \)
8. \( 12x^3 + 26x^2 + 10x - 3 \)
9. \( -j^4 + 2j^3 - 3j^2 + 6j \)

10. \( 4p^3 + 5p^2 - 2p - 3 \)
11. \( 10k^2 + 40k + 40 \)
12. \( 6m^2 + 21m - 12 \)

**Extra Practice (pg. 82)**

**Extra Practice (pg. 83-84)**
1. \( 4x^3 + 8x^2 + 3x \text{ ft}^3 \)
2. \( 12x^2 + 16x - 3 \)
3. Volume: \( 2x^2 - 16x + 32 \text{ in}^3 \)

**Challenge Problems (pg. 83)**
1. \( \pi(y^2 + 10y) \)
2. \( 5x^2 + 6x + 1 \)
3. Volume: \( \pi x^2 + 32 \text{ in}^3 \)
   Surface area: \( 2x^2 - 8x \text{ in}^2 \)

**Extra Practice (pg. 83-84)**

1. \( x = 6 \)
2. \( 6x^2 + 11x + 6 \)
3. \( 15n^2 + 28n - 32 \)
4. \( 50x^2 + 35x - 28 \)
5. \( 54x^2 + 72x + 24 \)

**10.6**

**Problems (pg. 82)**
1. Area: \( \pi(9x^2 + 12x + 4) \)
   Circumference: \( \pi(6x + 4) \)
2. \( x = 6 \)
3. \( 6x^2 + 11x + 6 \)
4. \( 15n^2 + 28n - 32 \)
5. \( 50x^2 + 35x - 28 \)
6. \( 54x^2 + 72x + 24 \)

**Challenge Problems (pg. 83)**
1. \( \pi(x^2 + 10y) \)
2. \( 5x^2 + 6x + 1 \)
3. Volume: \( 2x^2 - 16x + 32 \text{ in}^3 \)
   Surface area: \( 2x^2 - 8x \text{ in}^2 \)

**Extra Practice (pg. 83-84)**
1. \( 4x^3 + 8x^2 + 3x \text{ ft}^3 \)
2. \( 12x^2 + 16x - 3 \)
3. Volume: \( 2x^2 + 32x + 6 \)
4. \( 150x^2 - 120x + 24 \)
5. \( 8x^2 - 7 \)
6. Area: \( 25\pi x^2 + 10\pi x + \pi \)
   Circumference: \( 10\pi x + 2\pi \)
7. \( y = \frac{9}{2} \)
8. \( x = 4 \text{ in} \)
9. \( 40w^2 - 20w \)
10. \( 4m^2 - 15m - 3 \)
11. Area: \( 10y^2 - 26y - 12 \)
   Perimeter: \( 22y + 8 \)

**10.7**

**Problems (pg. 84)**
1. \( (x + 5)(x + 6) \)
2. \( (y + 3)(y - 5) \)
3. \( (r - 1)(r - 1) \)
4. \( (n + 12)(n - 3) \)
5. \( (g + 2)(g - 14) \)
6. \( (x + 9)(x + 4) \)
7. \( (s + 6)(s - 3) \)
8. \( (w + 45)(w - 1) \)
9. prime
10. \( (v + 5)(v - 2) \)

**Challenge Problems (pg. 86)**
1. \( 35 \)
2. \( (-3y + 1)(y - 1) \)

**Extra Practice (pg. 86)**
1. \( (3p - 5)(p + 1) \)
2. \( (2n - 3)(n + 3) \)
3. \((w - 2)(3w - 2)\)
4. \(\text{prime}\)
5. \((5y + 4)(y + 3)\)
6. \((2v + 1)(v + 5)\)
7. \(\text{prime}\)
8. \((2n + 1)(n + 2)\)
9. \((w - 2)(7w - 3)\)
10. \((x - 1)(13x + 1)\)
11. \((5a - 3)(a + 2)\)
12. \((3b + 4)(b + 2)\)
13. \((2g - 3)(g + 5)\)
14. \((11n - 12)(n + 2)\)
15. \((7a + 4)(a + 7)\)
16. \((k - 10)(3k + 2)\)
17. \(2(y - 4)(y - 3)\)
18. \(\text{prime}\)

10.10
Problems (pg. 87-88)
1. \((x + 3)(x - 3)\)
2. \((2n + 1)^2\)
3. \((3r - 2x)(3r + 2x)\)
4. \((11d - 2)^2\)
5. \((w + 5)^2\)
6. \((4 - 2d)^2\)
7. \((6 - 5y)(6 + 5y)\)
8. \((10n - 9)(10n + 9)\)
9. \((8x - 1)^2\)
10. \((7y + 13)(7y - 13)\)
11. \((k - 15)^2\)
12. \((2c^3 - 7)(2c^3 + 7)\)
13. \((x - 12y)^2\)
14. \((x^2 - 3)(x^2 + 3)\)
15. \((7x - 3y)(7x + 3y)\)
16. \((3a^2 - 1)^2\)

Challenge Problems (pg. 88)
1. \((x - y + 3)(x + y + 5)\)
2. \(\left(\frac{xy - 5}{2}\right)(\frac{xy - 5}{2})\)
3. \((x^2n + 5x^n)^2\)

Extra Practice (pg. 87)
1. \((2x - 3)^2\)
2. \((3n - 2)(4n + 3)\)
3. \((x - 6)(2x + 1)\)
4. \((5y - 1)(2y + 3)\)
5. \((g - 6)(4g - 5)\)
6. \((3x + y)(2x + 5y)\)
7. \(\text{prime}\)
8. \((a - 10b)(3a + 2b)\)
9. \((5y - 3)(3y + 1)\)
10. \((x - 5)(4x + 5)\)
11. \((7d - 2)(3d + 2)\)
12. \((x - 3)(2x + 3)\)
13. \((3n - 1)(n + 2)\)
14. \((v + 1)(3v + 4)\)

10.11
Problems (pg. 89)
1. \(4\)
2. \(\frac{n + 3}{3}\)
3. \(x + 3\)
4. \(\frac{1}{c}\)
5. \(\frac{2n + 5}{2}\)
6. \(-2\)
7. \(\frac{x + 1}{x - 4}\)
8. \(y + 3\)

Challenge Problems (pg. 89)
9. \(\frac{x + 5}{2}\)
10. \(\frac{5n + 6}{n + 3}\)

Extra Practice (pg. 89-90)
1. \(5\)
2. \(\frac{1}{x - 2}\)
3. \(\frac{1}{j + 3}\)
4. \(\frac{1}{10}\)
10.12
Problems (pg. 90)

1. \( x = 0 \) or \( x = -5 \)
2. \( y = \frac{5}{7} \) or \( y = 9 \)
3. \( x = 0 \) or \( x = \frac{1}{2} \)
4. \( x = 2 \) or \( x = -2 \)
5. \( d = 0 \) or \( d = \frac{3}{2} \)
6. \( w = -3 \) or \( w = -5 \)
7. \( n = -3 \) or \( n = -5 \)
8. \( h = -1 \) or \( h = -5 \)
9. \( y = \frac{3}{5} \) or \( y = -\frac{1}{2} \)
10. \( k = \frac{3}{2} \) or \( k = 5 \)

Challenge Problems (pg. 90)

1. \( x = -\frac{1}{2} \) or \( x = 1 \)
2. \( y = -1 \) or \( y = 3 \)
3. \( y = 3 \) or \( y = -4 \)
4. \( k = \frac{3}{4} \) or \( k = \frac{5}{3} \)
5. \( x = -6 \) or \( x = 1 \)
6. \( y = -8 \) or \( y = 2 \)
7. \( n = 0 \) or \( n = 4 \)
8. \( n = -\frac{2}{5} \) or \( n = -3 \)
9. \( a = \frac{4}{3} \) or \( a = -\frac{4}{3} \)
10. \( w = \frac{3}{2} \) or \( w = -4 \)
11. \( g = -4 \) or \( g = 2 \)
12. \( x = \frac{1}{4} \) or \( x = -\frac{2}{3} \)
13. \( v = -\frac{4}{3} \) or \( v = 12 \)
14. \( r = \frac{9}{2} \) or \( r = 3 \)
15. \( y = -10 \) or \( y = -4 \)
16. \( n = 0 \) or \( n = -5 \)

Extra Practice (pg. 91)

1. \( n = 4 \) or \( n = 5 \)