

Adult Basic Education
Mathematics

Mathematics 3107B

Relations and Formulas

Curriculum Guide

Prerequisites: Mathematics 2105A, 2105B, 2105C
Mathematics 3107A

Credit Value: 1

Mathematics Courses [General College Profile]

Mathematics 2105A

Mathematics 2105B

Mathematics 2105C

Mathematics 3107A

Mathematics 3107B

Mathematics 3107C

Mathematics 3109A

Mathematics 3109B

Mathematics 3109C

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To the Instructor

I. Introduction to Mathematics 3107B

The primary goal of Relations and Formulas is to investigate the characteristics of linear relations. Linear relations whose graphs pass through the origin, as well as relations whose graphs have a fixed value, will be examined. Students will learn to express a linear relation in words, as a table of values, as a graph, and as a formula. Students will also learn to calculate the slope of a line and interpret its meaning in the context of a specific problem. Applications of linear relations to real-world situations will also be explored. Finally, students will be required to interpret graphs of non-linear relations and evaluate formulas.

II. Prerequisites

Students should know how to apply the order of operations correctly in calculations. Students should also know how to change percents to their decimal equivalents. If necessary, the instructor should provide worksheets on these topics to ensure students have fully understood these concepts. Some worksheets are provided in the Appendix of this guide and are referenced in the *Suggestions for Assessment* column with the appropriate outcome(s).

III. Textbook

Essentials of Mathematics 11 is designed to emphasize the skills needed in adult life as well as in the workplace. Students should appreciate that mathematics is practical and useful for accomplishing real-world activities. With this in mind, this resource has been developed with contents that are real and relevant to the lives of students.

Each chapter begins with an introduction which presents the key mathematical ideas that will be encountered. The following categories are in each chapter:

Chapter Goals: Located on the bottom of each introductory page, this section lists the major concepts to be learned.

Chapter Project and Project Activity: Each chapter contains a guided project. This type of group work is not well suited for the Adult Basic Education environment. Therefore, **these sections have been omitted from the course**. However, if there are several students working on the same chapter, instructors may use their discretion in assigning the **Chapter Project**, or some modification of it, for an assessment.

To the Instructor

Exploration: Most of the concepts are introduced, developed and explained in these lessons. In this section, **Examples** and **Solutions** for typical problems are provided. The instructor should ensure that students carefully study and understand each **Example** before proceeding.

Class Discussion, Small Group Discussion and Pairs Activities: As the titles imply, these activities are provided to give students an opportunity to work collaboratively. Some of these sections have been assigned in the Study Guide, especially if they can be completed by a student working alone.

Mental Math: The questions contained in these sections are often calculations that are similar to those required in the **Solutions** to the **Examples**. Although called **Mental Math**, students should not be required to complete these activities without pencil and paper. If students have difficulty with these problems, the instructor should provide practice worksheets. The solutions to **Mental Math** are found in the *Teacher Resource Book 11*.

Notebook Assignment: This section provides a series of problems similar to those in the **Exploration**. Students should attempt these problems only after the **Exploration** problems have been understood and all assigned **Mental Math** and practice worksheets have been completed. The textbook contains only answers to **Notebook Assignment**, but the *Teacher Resource Book 11* has solutions with workings and some explanations.

Chapter Review: This section contains a series of questions that review the chapter outcomes. Answers are in the textbook as well as the *Teacher Resource Book 11*.

Case Study: This section requires students to express their understanding of the skills they have learned. Answers are in the textbook as well as the *Teacher Resource Book 11*.

IV. **Technology**

The use of technology in our society is increasing and technological skills are becoming mandatory in the workplace. It is assumed that all students have a scientific calculator and its manual for their individual use. Ensure that the calculator used has “scientific” on it as there are calculators designed for business and statistics which would not have the functions needed for this course. Although students will sometimes use a calculator, they should first complete most problems using pencil and paper.

To the Instructor

V. Curriculum Guides

Each new ABE Mathematics course has a Curriculum Guide for the instructor and a Study Guide for the student. The Curriculum Guide includes the specific curriculum outcomes for the course. Suggestions for teaching, learning, and assessment are provided to support student achievement of the outcomes. Each course is divided into units. Each unit comprises a **two-page layout of four columns** as illustrated in the figure below. In some cases the four-column spread continues to the next two-page layout.

Curriculum Guide Organization: The Two-Page, Four-Column Spread

| | | | |
|---|--|---|---|
| Unit Title | | Unit Title | |
| Outcomes Specific curriculum outcomes for the unit. | Notes for Teaching and Learning Suggested activities, elaboration of outcomes, and background information. | Suggestions for Assessment Suggestions for assessing students' achievement of outcomes. | Resources Authorized and recommended resources that address outcomes. |

VI. Study Guides

The Study Guide provides the student with the name of the text(s) required for the course and specifies the sections and pages that the student will need to refer to in order to complete the required work for the course. It guides the student through the course by assigning relevant reading and providing questions and/or assigning questions from the text or some other resource. Sometimes it also provides important points for students to note. (See the *To the Student* section of the Study Guide for a more detailed explanation of the use of the Study Guides.) The Study Guides are designed to give students some degree of independence in their work. Instructors should note, however, that there is much material in the Curriculum Guides in the *Notes for Teaching and Learning* and *Suggestions for Assessment* columns that is not included in the Study Guide and instructors will need to review this information and decide how to include it.

To the Instructor

VII. Resources

Essential Resources

Essentials of Mathematics 11, ISBN: 0-7726-4823-9

Essentials of Mathematics 11, Teacher Resource Book 11, ISBN: 0-7726-4878-6

Mathematics 3107B Study Guide

Resources

Math Links: <http://mathforum.org>
<http://www.purplemath.com/index.htm>
<http://edHelper.com>
<http://www.educationindex.com/math/>
<http://learner.org/exhibits/dailymath/resources.html>

VIII. Recommended Evaluation

| | |
|-------------------------------------|------------|
| Written Notes | 10% |
| Assignments | 10% |
| Test(s) | 30% |
| Final Exam (<i>entire course</i>) | <u>50%</u> |
| | 100% |

Relations and Formulas

Relations and Formulas

Outcomes

1.1 Describe linear relations whose graphs pass through the origin ($y = mx$ form).

1.1.1 Define the terms *dependent* and *independent variables* and identify these terms from a description of a linear relation.

1.1.2 Write a linear relation of the form $y = mx$:

- in words
- as a table of values
- as a graph
- as a formula.

1.2 Interpolate and extrapolate values from the graph of a linear relation.

Notes for Teaching and Learning

The main goal of this unit is to equip students with the skills to effectively examine linear relations. Students will learn to express linear relations in words, as a table of values, as a graph, and as a formula. Students will also investigate slope and its meaning in terms of a linear relation as well as interpret graphs and evaluate formulas.

Since the Chapter Project is best suited as a group activity, it is **not** required for this course.

In the Study Guide, students are reminded to read **Hints** and do **Mental Math** problems which are on the bottom of the textbook pages. The instructor should encourage students to complete these activities.

The instructors should ensure that students work through and understand the given solution for each **Example**.

Before completing **Exploration 1** students should be reminded that, when graphing a linear relation, the independent variable is contained on the x -axis (horizontal axis) and the dependent variable is contained on the y -axis (vertical axis).

All graphs must include a title and both axes should be labelled and include units of measure.

The instructor should ensure that students know how to correctly plot a coordinate pair (x, y) . A review may be appropriate.

A review of interpolating data (determining values between known points) and extrapolating data (determine values beyond known points) may be necessary.

Relations and Formulas

Suggestions for Assessment

Study Guide questions 1.1 to 1.3 should meet the objectives of Outcomes 1.1 and 1.2.

The **Chapter Review** on page 312, questions 2 to 4, can also be used for further assessment of Outcomes 1.1 and 1.2.

The Appendix contains a sheet of graph paper that can be photocopied and distributed to students for use when creating graphs of linear relations.

The following questions can be used for further assessment.

1. Timmy works part-time earning \$7 per hour. His earnings depend on how many hours he works. The time, or hours worked, is the independent variable. Express this relationship in words, as a formula, as a table of values, and as a graph.
2. A trucker charges a rate of \$10.50 per kilometre when transporting goods.
 - a) Create a table of values showing the number of kilometres driven and the amount of money paid to the driver.
 - b) State the independent and dependent variables.
 - c) Graph the relation.
 - d) Write a formula to represent this relation.
 - e) Use the graph from part c) to predict the cost for a 25 kilometre truck ride and a 6 kilometre truck ride.

Resources

Essentials of Mathematics 11,
Linear Relations between
Quantities, pages 245, 247 -
255

Chapter Review, page 312

Teacher Resource Book 11,
pages 139 - 146

Appendix, graph paper

Relations and Formulas

Outcomes

1.3 Calculate the slope of a straight line.

1.3.1 State what the slope means in words and explain what it means in terms of the problem context.

Notes for Teaching and Learning

The slope of a line is most commonly defined as:

$$\text{slope} = \frac{\text{rise}}{\text{run}};$$

it refers to the “steepness” of a line.

The instructor should emphasize to students that when calculating slope they should choose points on the line that are at the intersection of gridlines on the graph. These points are easier to name and use in calculations.

The instructor should inform the students that the slope of a line can be written as a decimal, as a fraction, or as an integer.

Note: Only graphs in the first quadrant will be studied in this course.

When completing **Notebook Assignment** on page 263, question 2a, students should be made aware that, when comparing two graphs, the axes must have the same scale. For example, if the horizontal axis of one graph increases by ten, then the horizontal axis of the other graph must also increase by ten.

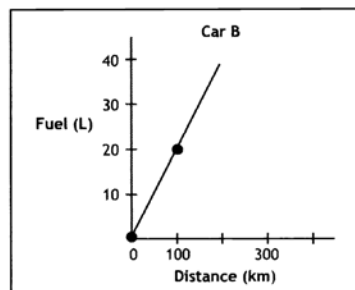
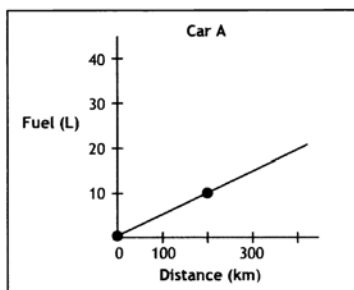
Relations and Formulas

Suggestions for Assessment

Study Guide questions 1.4 to 1.6 should meet the objectives of Outcome 1.3.

The following question can be used for further assessment.

1. Compare the following graphs:



- Which car uses more fuel?
- Find the slope of each line.

Resources

Essentials of Mathematics 11,
Slope of a Line, pages 256 -
264

Teacher Resource Book 11,
pages 148 - 150

Outcomes

1.4 Determine the formula of a linear relation that passes through the origin.

1.4.1 Given the graph of a linear relation, describe it in words and create an equation.

1.4.2 Construct the graph of a linear relation from its description in words and a table of values.

1.5 Substitute appropriate values into formulas and evaluate for the desired variable.

1.5.1 Rearrange formulas to isolate the desired variable.

Notes for Teaching and Learning

A review of drawing graphs of linear relations given the formula and calculating slope may be necessary here. These topics were discussed in **Exploration 1** and **2**.

For a line that passes through the origin, the y -intercept must be 0. A line that passes through the origin has the form $y = mx$, where m is the slope, y is the dependent variable and x is the independent variable.

Note: For the purposes of this course, students will **not** be introduced to the following form of a linear equation:

$$y = mx .$$

Instead they will create linear equations using the general relation:
dependent variable = (slope)(independent variable).

If students are having difficulty with creating the equation of a linear relation, the instructor can outline the procedure using the following steps:

- 1) Determine the independent and dependent variables.
- 2) Find the slope.
- 3) Set:
dependent variable = (slope)(independent variable).

Relations and Formulas

Suggestions for Assessment

Study Guide questions 1.7 to 1.9 should meet the objectives of Outcomes 1.4 and 1.5.

The **Chapter Review** on page 313, question 5, can also be used for further assessment of Outcomes 1.4 and 1.5.

Resources

Essentials of Mathematics 11,
Determining the Equation of
a Line Through the Origin,
pages 265 - 275

Chapter Review, page 313

Teacher Resource Book 11,
pages 151 - 154

Relations and Formulas

Outcomes

1.4 Determine the formula of a linear relation that passes through the origin.

1.4.1 Given the graph of a linear relation, describe it in words and create an equation.

1.4.2 Construct a graph of a linear relation from its description in words and a table of values.

1.5 Substitute appropriate values into formulas and evaluate for the desired variable.

1.5.1 Rearrange formulas to isolate the desired variable.

Notes for Teaching and Learning

Students are not required to complete the **Bouncing Balls Activity** on page 269 as this activity must be done in pairs or groups of three. However, if several students are working on this section, the instructor may assign this activity at his or her discretion or the instructor may help students complete the activity.

Note: Step 11 has been omitted from this activity.

To complete question 3a in **Notebook Assignment** on page 274, a review of substitution and solving formulas may be necessary. The instructor should emphasize to students that they must first isolate the variable that they are trying to solve for, and then substitute in the given values. For example, in question 3a:

$$\frac{V}{100} = \frac{100B}{100}$$

$$B = \frac{V}{100}$$

$$B = \frac{250}{100}$$

$$B = 2.5$$

Note: The equation $V = 100B$ comes from question 2e on page 274.

Relations and Formulas

Suggestions for Assessment

Study Guide questions 1.7 to 1.9 should meet the objectives of Outcomes 1.4 and 1.5.

The **Chapter Review** on page 313, question 5, can also be used for further assessment of Outcomes 1.4 and 1.5.

Resources

Essentials of Mathematics 11,
Determining the Equation of
a Line through the Origin,
pages 265 - 275

Chapter Review, page 313

Teacher Resource Book 11,
pages 151 - 154

Relations and Formulas

Outcomes

1.6 Describe linear relations whose graphs do not pass through the origin ($y = mx + b$ form).

1.6.1 Write a linear relation of the form $y = mx + b$:

- in words
- as a table of values
- as a graph
- as a formula.

1.6.2 Determine the fixed value on the graph of a line that does not pass through the origin.

Notes for Teaching and Learning

Students are not required to complete **Problem Analysis** and **Games** on pages 276 and 277.

The instructor should remind students that to find formulas of linear relations that pass through the origin they should use the general form:

dependent variable = (slope)(independent variable).

This topic was discussed in the previous section,

Exploration 3.

For a line that does not pass through the origin, the y -intercept must be some number other than 0. This number is represented by the letter b . A line that does not pass through the origin has the form $y = mx + b$, where m is the slope, y is the dependent variable, x is the independent variable, and b is the fixed value or y -intercept.

Note: For the purposes of this course, students will not be introduced to the slope-intercept form of a linear equation:

$$y = mx + b .$$

Instead they will create linear equations using the general relation:

dependent variable = (slope)(independent variable) + fixed value.

Relations and Formulas

Suggestions for Assessment

Study Guide questions 1.10 to 1.12 should meet the objectives of Outcome 1.6.

The **Chapter Review** on pages 311 and 313, questions 1, 6, and 7 can also be used for further assessment of Outcome 1.6.

The Appendix contains a worksheet, *Slope Activity*, that should be assigned for homework.

If more work on finding the slope of a line or writing an equation of a line with a fixed value is necessary, then the worksheets *Linear Equations: Slope*, and *Linear Equations: Write the Equation of the Line* are given in the Appendix. It should be noted that both of these worksheets contain lines in Quadrants II to IV. Students may require further explanation on how to find the slope and the equations for these lines.

The following questions can be used for further assessment:

1. The cost to rent a hall for a wedding is a \$500 rental fee plus \$2.50 per person.
 - a) Write a formula to describe this relation.
 - b) Graph the relation.
 - c) Determine the slope using the graph from part b).
 - d) What does the slope represent?
 - e) What does it cost to rent the hall if no one shows up?
2. The cost to rent a car is calculated at \$0.10 per kilometre plus a fixed charge of \$15.00 per day. Create a table of values and a graph for renting a car. Express the relationship as a formula.
3. A repairman works for 2 hours at \$20.00 per hour fixing your plumbing. He charges a service fee of \$50.00. Calculate the cost of his services.

Resources

Essentials of Mathematics 11,
Linear Relations with a Fixed
Value, pages 278 - 284

Chapter Review, pages 311
and 313

Teacher Resource Book 11,
pages 156 - 159

Appendix, Practice Exercise
1, *Slope Activity*

Appendix, Practice Exercise
5, *Linear Equations: Slope*

Appendix, Practice Exercise
6, *Linear Equations: Write
the Equation of the Line*

Relations and Formulas

Outcomes

1.6 Describe linear relations whose graphs do not pass through the origin ($y = mx + b$ form).

1.6.1 Write a linear relation of the form $y = mx + b$:

- in words
- as a table of values
- as a graph
- as a formula.

1.6.2 Determine the fixed value on the graph of a line that does not pass through the origin.

Notes for Teaching and Learning

The instructor should emphasize that when a linear relation has a fixed value, the general formula for the linear relation changes to:

$$\text{dependent variable} = (\text{slope})(\text{independent variable}) + \text{fixed value}.$$

Note: The term **fixed value** refers to where the linear relation crosses the y-axis on the graph.

The instructor should note that when the fixed value is 0, the form of the linear relation changes to:

$$\text{dependent variable} = (\text{slope})(\text{independent variable}) + 0$$

or

$\text{dependent variable} = (\text{slope})(\text{independent variable})$, which agrees with the equation of a line that passes through the origin.

If students are having difficulty with creating the equation of a linear relation with a fixed value, the instructor can outline the procedure using the following steps:

- 1) Determine the independent and dependent variables.
- 2) Find the slope.
- 3) Find the fixed value.
- 4) Set:

$$\text{dependent variable} = (\text{slope})(\text{independent variable}) + \text{fixed value}.$$

Relations and Formulas

Suggestions for Assessment

Study Guide questions 1.10 to 1.12 should meet the objectives of Outcome 1.6.

The **Chapter Review** on pages 311 and 313, questions 1, 6, and 7 can also be used for further assessment of Outcome 1.6.

The Appendix contains a worksheet *Slope Activity* that should be assigned for homework.

If more work on finding the slope of a line or writing an equation of a line with a fixed value is necessary then the worksheets, *Linear Equations: Slope*, and *Linear Equations: Write the Equation of the Line* are given in the Appendix. It should be noted that both of these worksheets contain lines in Quadrants II to IV. Students may require further explanation on how to find the slope and the equations for these lines.

The following questions can be used for further assessment:

1. The cost to rent a hall for a wedding is \$500 rental fee plus \$2.50 per person.
 - a) Write a formula to describe this relation.
 - b) Graph the relation.
 - c) Determine the slope using the graph from part b).
 - d) What does the slope represent?
 - e) What does it cost to rent the hall if no one shows up?
2. The cost to rent a car is calculated at \$0.10 per kilometre plus a fixed charge of \$15.00 per day. Create a table of values and a graph for renting a car. Express the relationship as a formula.
3. A repairman works for 2 hours at \$20.00 per hour fixing your plumbing. He charges a service fee of \$50.00. Calculate the cost of his services.

Resources

Essentials of Mathematics 11, Linear Relations with a Fixed Value, pages 278 - 284.

Chapter Review, pages 311 and 313.

Teacher Resource Book 11, pages 156 - 159

Appendix, Practice Exercise 1, *Slope Activity*

Appendix, Practice Exercise 7, *Linear Equations: Slope*

Appendix, Practice Exercise 8, *Linear Equations: Write the Equation of the Line*.

Relations and Formulas

Outcomes

1.7 Solve problems involving linear relations that have been applied to real-world problems depicted by graphs, tables of values, and/or written descriptions.

Notes for Teaching and Learning

The instructor should emphasize to students that two graphs can be drawn on the same axes for the purpose of comparing two sets of data.

Many realistic situations can be depicted using linear relations. For example, linear relations can be used to compare two companies that provide the same service. Two rental car companies, for instance, offering different rental rates and different rates per kilometre travelled will show two formulas and two different graphs containing different slopes and fixed values.

Note: The instructor should stress to students that when comparing two graphs, the point of intersection represents where the two data sets are equal. In the case of the two rental companies, an intersection point would represent where the cost of renting from both companies is the same.

Relations and Formulas

Suggestions for Assessment

Study Guide question 1.13 should meet the objectives of Outcome 1.7.

The following question can be used for further assessment.

1. The Griswald family arrived in Europe for their holiday. At the car rental agency, they were offered two options:
Option 1: \$250 rental fee plus \$0.15 per kilometre.
Option 2: \$325 rental fee plus \$0.05 per kilometre.
 - a) Write the formulas that represent both relations for Option 1 and Option 2.
 - b) Using a table of values, graph the relations for Option 1 and Option 2 on the same set of axes. Choose your own values to complete the table.
 - c) From your graph, at what distance would Option 2 become the better deal?

Resources

Essentials of Mathematics 11,
Applications of Linear
Relations, pages 285 - 291

Teacher Resource Book 11,
pages 160 and 161

Relations and Formulas

Outcomes

1.8 Describe graphs that are not linear.

1.8.1 Match a non-linear graph with its description.

1.8.2 Define the characteristics of a non-linear graph and answer questions related to the specific problem context.

1.8.3 Draw a graph of a non-linear relation when given its description.

Notes for Teaching and Learning

The instructor should emphasize that a graph is a visual representation of a relation between two variables. A graph provides a picture of the relation.

Note: This course does not explore the equations of non-linear relations. Students will be required only to interpret non-linear graphs.

Relations and Formulas

Suggestions for Assessment

Study Guide questions 1.14 to 1.16 should meet the objectives of Outcome 1.8.

The **Chapter Review** on pages 314 and 315, questions 8 (omit part e), 9 and 10, can also be used for further assessment of Outcome 1.8.

The Appendix contains a worksheet *Hot Air Balloon* that should be assigned for homework.

The Appendix contains a worksheet *Marathon Runner Problem* that should be assigned for homework.

The following question can be used for further assessment.

1. Draw a graph of the following situations. Be sure to identify the dependent and independent variables and label the axes appropriately.
 - a) The height of a rose bush over time.
 - b) The height of a particular seat on a ferris wheel for three revolutions.

Resources

Essentials of Mathematics 11,
Interpreting Graphs, pages
293 - 304

Chapter Review, pages 314
and 315

Teacher Resource Book 11,
pages 163 - 167

Appendix, Practice Exercise
2, *Hot Air Balloon*

Appendix, Practice Exercise
3, *Marathon Runner Problem*

Relations and Formulas

Outcomes

1.9 Substitute appropriate values into formulas and evaluate for the desired variable.

1.9.1 Perform calculations by correctly using the order of operations.

1.9.2 Convert percents to their decimal equivalents.

1.9.3 Rearrange formulas to isolate the desired variable.

Notes for Teaching and Learning

A review of correctly applying the order of operations and changing percents to their decimal equivalents may be necessary.

The instructor should emphasize to students that they must follow the order of operations.

- 1) Brackets
- 2) Exponents
- 3) Division/multiplication in the order they appear.
- 4) Addition/subtraction in the order they appear.

Note: Most calculators use the correct order of operations when doing calculations. However, students should know when it is appropriate to use brackets on a calculator.

A review of the irrational numbers may be necessary. Students should know the term, *irrational numbers*, and be able to identify them. Students should be aware of the π button on their calculator and know how to use it. They should be reminded that if they use the π button they will get slightly different answers than if they use $\pi = 3.14$ in their calculations.

Students should be reminded to show substitution of a variable by enclosing the number they are substituting in brackets.

The textbook does not require students to manipulate formulas to have the unknown variable isolated. The instructor, however, should explore this topic with students and ensure that they know how to isolate the appropriate variable in a formula and find the value of that variable using given values and the order of operations. A worksheet has been assigned that allows students to practise manipulating formulas without substituting any numerical values. If students are having difficulty with this worksheet, the instructor should provide more practice before moving on.

Relations and Formulas

Suggestions for Assessment

Study Guide questions 1.17 to 1.22 should meet the objectives of Outcome 1.9.

The **Chapter Review** on page 315, question 11 can also be used for further assessment of Outcome 1.9.

The **Case Study** on pages 317 and 318, questions 1 to 4, has been assigned for homework. However the instructor may use this as a take-home assignment or some other form of assessment for this unit.

The Appendix contains a worksheet, *Rearranging Formulas*, that should be assigned for homework.

The Appendix contains a worksheet, *Perimeter and Area*, that should be assigned for homework.

The Appendix contains a worksheet, *The Pythagorean Theorem*, that should be assigned for homework.

If more work on the order of operations is necessary, then the worksheet, *Order of Operations*, is given in the Appendix.

If more work on changing percents to their decimal equivalents is necessary, then the worksheet, *Percents*, is given in the Appendix.

Resources

Essentials of Mathematics 11,
Formulas, pages 305 - 310

Chapter Review, page 315

Case Study, pages 317 and 318

Teacher Resource Book 11,
pages 168 - 170, 175 and 176

Appendix, Practice Exercise 4, *Rearranging Formulas*

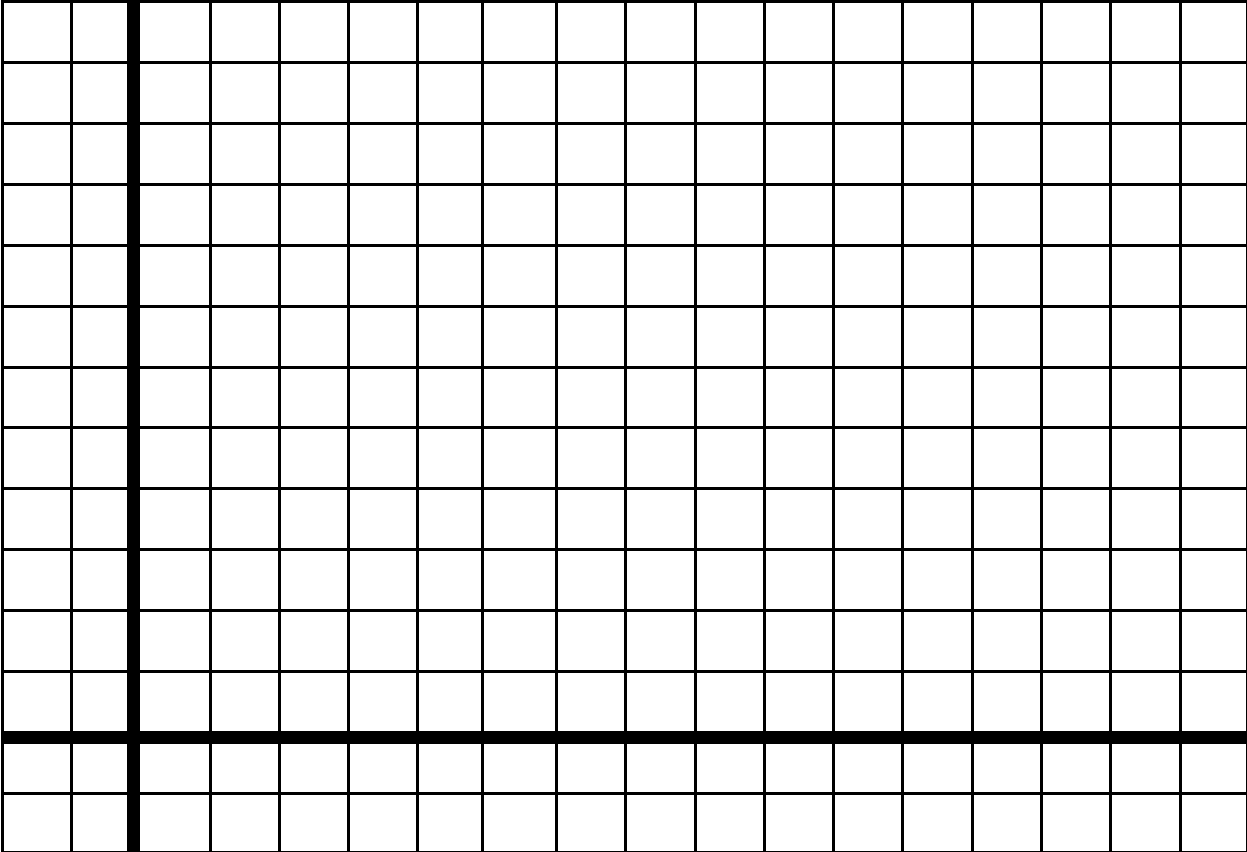
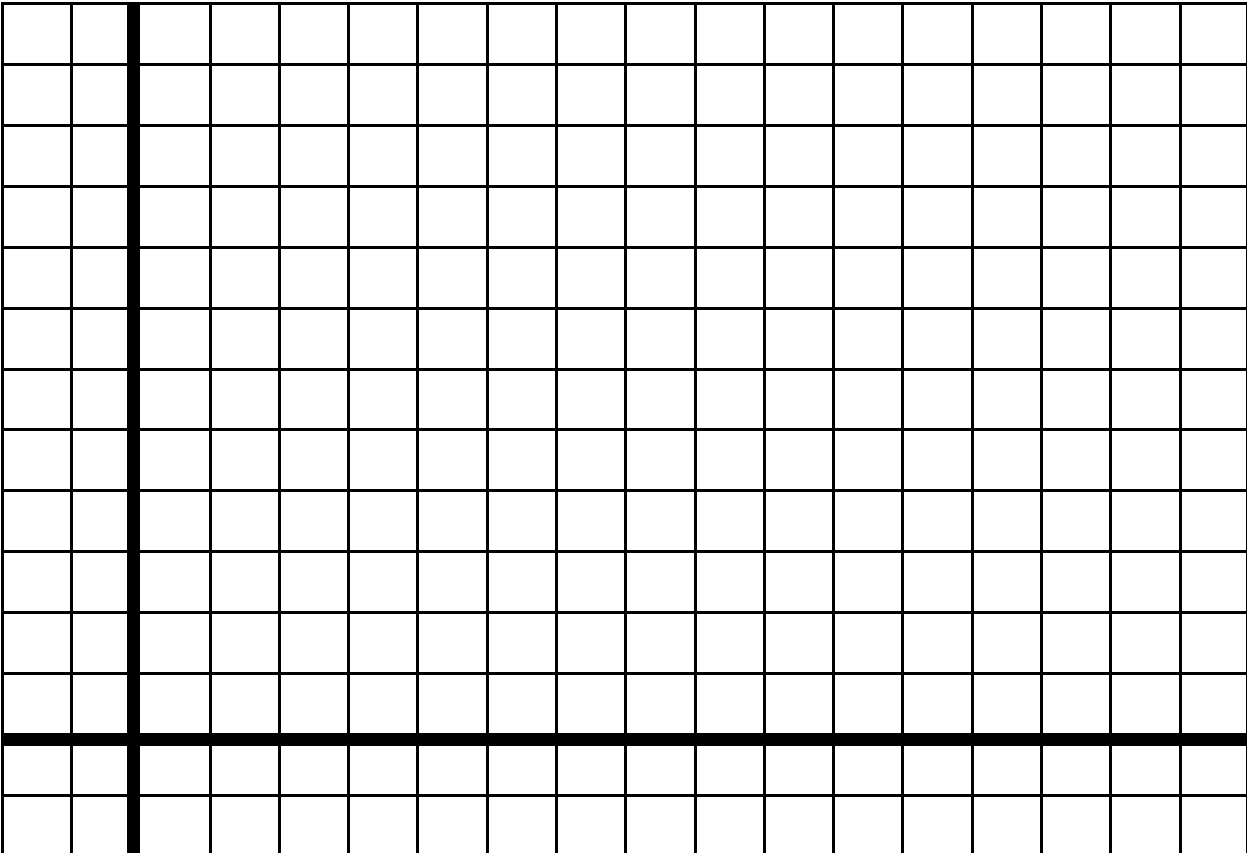
Appendix, Practice Exercise 5, *Perimeter and Area*

Appendix, Practice Exercise 6, *The Pythagorean Theorem*

Appendix, Practice Exercise 10, *Order of Operations*

Appendix, Practice Exercise 9, *Percents*

Appendix

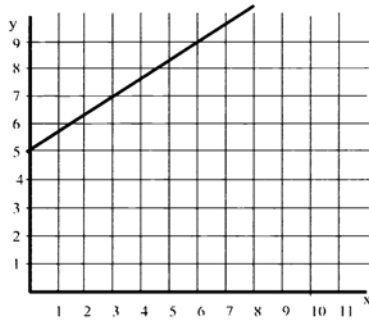


Practice Exercise 1

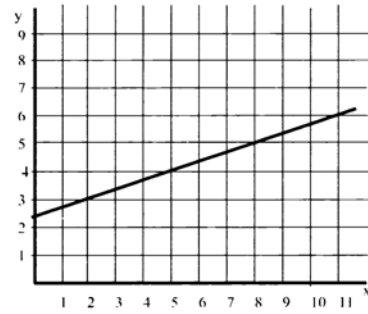
Slope Activity

Name: _____

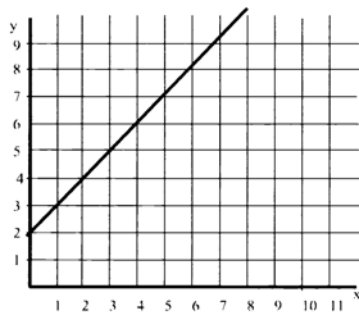
- a) Calculate the slope of each line.
- b) State the fixed value.
- c) Determine the formula for each graph.



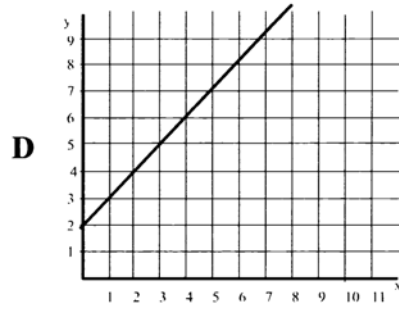
A



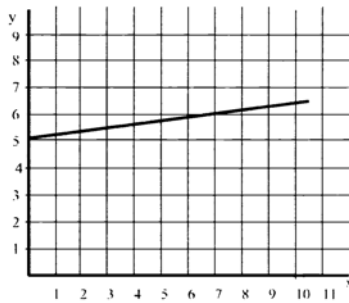
B



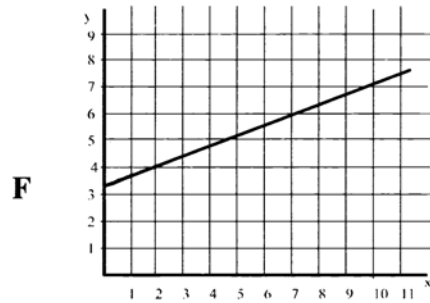
C



D



E



F

Answer Key for Practice Exercise 1 Slope Activity

A. a) $\frac{2}{3}$
b) 5
c) $y = \frac{2}{3}x + 5$

B. a) $\frac{1}{3}$
b) $\frac{5}{2}$
c) $y = \frac{1}{3}x + \frac{5}{2}$

C. a) 1
b) 2
c) $y = x + 2$

D. a) 1
b) 2
c) $y = x + 2$

E. a) $\frac{1}{7}$
b) 5
c) $y = \frac{1}{7}x + 5$

F. a) $\frac{2}{5}$
b) $\frac{3}{2}$
c) $y = \frac{2}{5}x + \frac{3}{2}$

Practice Exercise 2
Hot Air Balloon

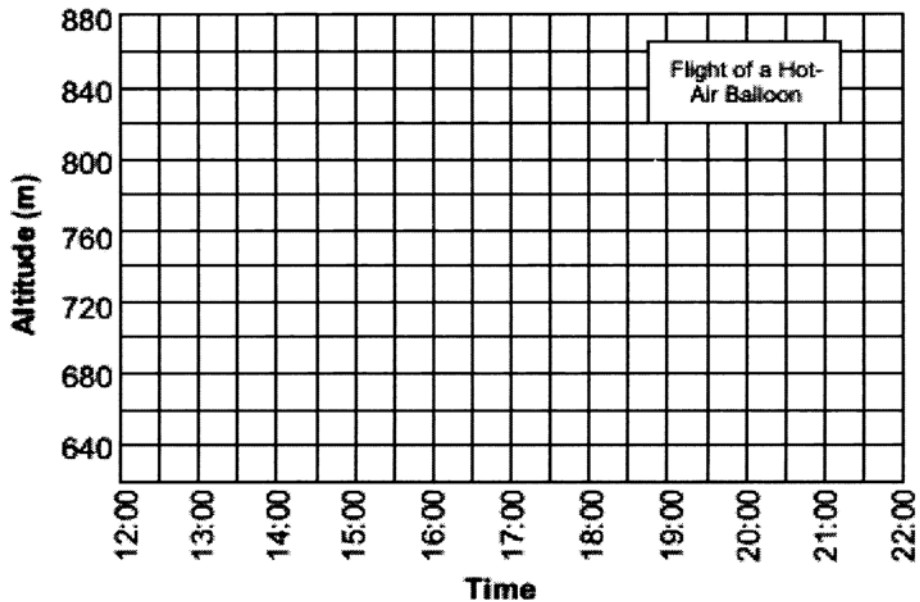
Name: _____

The altimeter on a hot-air balloon recorded the following altitudes over a period of time.

| | | | | | | | | | |
|--------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Time | 12:00 | 13:00 | 14:00 | 15:00 | 16:00 | 17:00 | 18:00 | 19:00 | 20:00 |
| Altitude (m) | 800 | 820 | 840 | 860 | 860 | 860 | 800 | 740 | 680 |

a) State the dependent and independent variables in this problem.

b) Plot these points on the following grid.



c) In words, describe the flight of this hot-air balloon from 12:00 to 20:00.

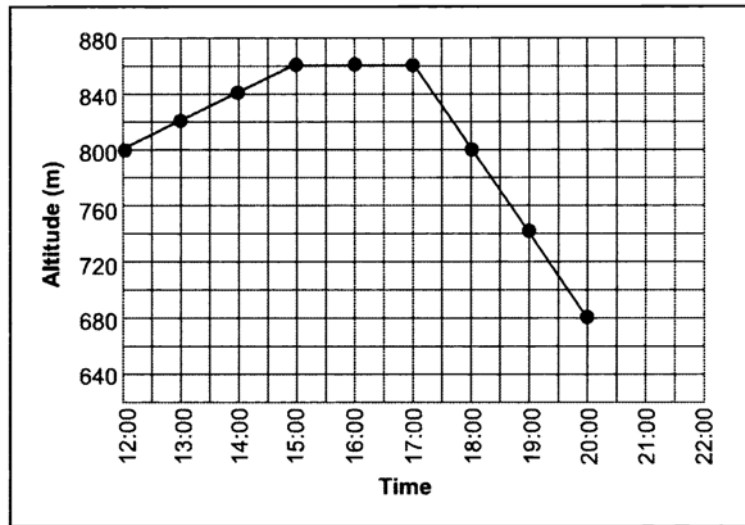
d) Use the graph to determine the missing information.

| | | | | |
|--------------|-------|-----|-------|-----|
| Time | 13:30 | | 16:30 | |
| Altitude (m) | | 720 | | 850 |

Answer Key for Practice Exercise 2 Hot Air Balloon

a) dependent: altitude (m), independent: time

b)



c) From 12:00 to 15:00, the balloon rose at a rate of 20 m/hr. From 15:00 to 17:00, the balloon didn't change height. From 17:00 to 20:00, the balloon started to descend at a rate of 60 m/h.

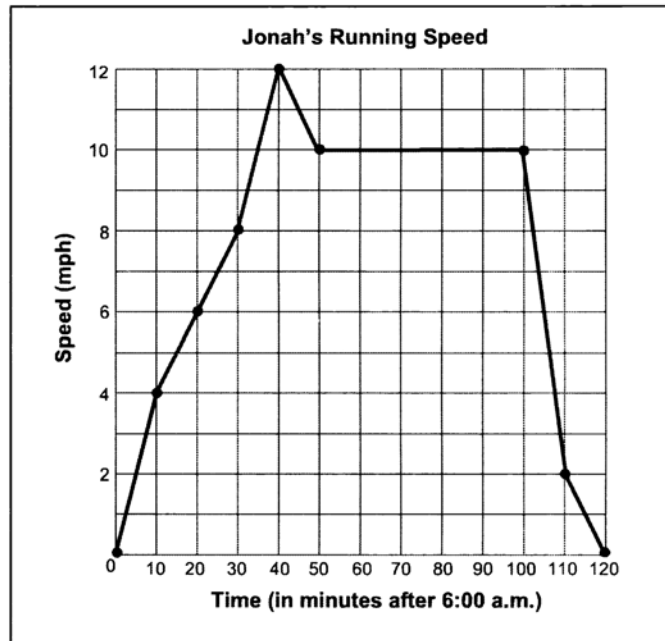
d)

| | | | | |
|--------------|-------|-------|-------|-------|
| Time | 13:30 | 19:20 | 16:30 | 17:30 |
| Altitude (m) | 850 | 720 | 860 | 850 |

Practice Exercise 3
Marathon Runner Problem

Name: _____

Jonah is a marathon runner. On Saturday, he ran a part of his training program. The following graph shows his speed as he ran. He started running at 6:00 a.m.



- What is his speed at 6:30 a.m.?
- At what time is he going the fastest and what is his speed at that time?
- What happens to his speed between 6:55 a.m. and 7:15 a.m.?
- Describe his run.

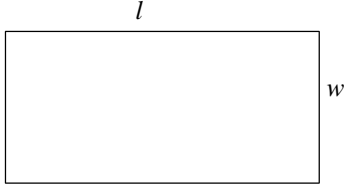
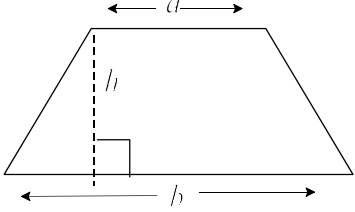
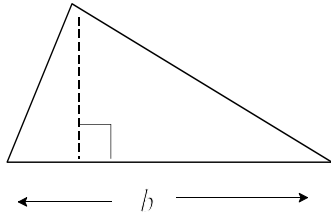
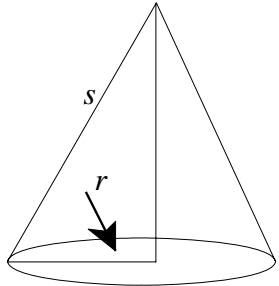
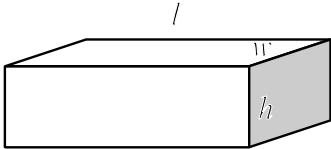
Answer Key for Practice Exercise 3 Marathon Runner Problem

- a) 8 mph
- b) At 6:40 a.m. he is running 12 mph.
- c) He is running at a constant speed of 10 mph.
- d) Jonah starts running at 6:00 a.m. and gradually increases his speed until 6:40 a.m. For the next 10 minutes he decreases his speed slightly. Then, for the next 50 minutes, he runs at a constant speed. In the next 10 minutes he slows down considerably. In the last 10 minutes he slows down less quickly before stopping altogether.


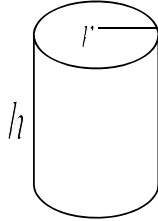
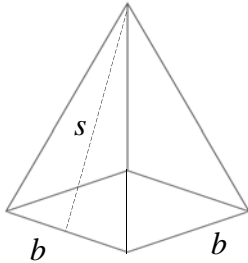
Practice Exercise 4
Rearranging Formulas

Name: _____

Rearrange the following formulas for the variable indicated.

| | | |
|--|--|---|
| <p>1. Perimeter of a rectangle:</p> | <p>$P = 2l + 2w$, solve for w.</p> |  |
| <p>2. Area of a rectangle:</p> | <p>$A = lw$, solve for l.</p> | |
| <p>3. Area of a trapezoid:</p> | <p>$A = \left(\frac{1}{2}\right)(a + b)h$, solve for h.</p> |  |
| <p>4. Area of a triangle:</p> | <p>$A = \left(\frac{1}{2}\right)bh$, solve for b.</p> |  |
| <p>5. Surface area of a cone:</p> | <p>$S = \pi rs + \pi r^2$, solve for s.</p> |  |
| <p>6. Volume of a rectangular solid:</p> | <p>$V = lwh$, for l.</p> |  |

Practice Exercise 4 continued
Rearranging Formulas

| | | |
|-------------------------------------|--|--|
| 7. Surface area of a sphere: | $S = 4\pi r^2$, solve for r . |  <p>A diagram of a sphere with a horizontal radius line labeled 'r' extending from the center to the right edge. A dashed line represents the back part of the sphere's circumference.</p> |
| 8. Surface area of a cylinder: | $S = 2\pi rh + 2\pi r^2$, solve for h . |  <p>A diagram of a cylinder with a radius line labeled 'r' at the top circular face and a vertical height line labeled 'h' on the left side.</p> |
| 9. Surface area of a pyramid: | $S = 2bs + b^2$, solve for s . |  <p>A diagram of a pyramid with a square base. The base length is labeled 'b' at two corners. A dashed line represents the slant height 's' from the apex to the midpoint of one of the base sides.</p> |
| 10. Ohm's Law: | $V = IR$, solve for R . | |
| 11. Power: | $P = VI$, solve for V . | |
| 12. Resistance of a series circuit: | $R_T = R_1 + R_2$, solve for R_2 . | |
| 13. Speed of a Circular Tool: | $s = \pi d n$, solve for d . | |

Answer Key for Practice Exercise 4

Rearranging Formulas

$$1. \quad w = \frac{P - 2l}{2}$$

$$2. \quad l = \frac{A}{w}$$

$$3. \quad h = \frac{2A}{a+b}$$

$$4. \quad b = \frac{2A}{h}$$

$$5. \quad s = \frac{S - \pi r^2}{\pi r}$$

$$6. \quad l = \frac{V}{wh}$$

$$7. \quad r = \sqrt{\frac{S}{4\pi}}$$

$$8. \quad h = \frac{S - 2\pi r^2}{2\pi r}$$

$$9. \quad s = \frac{S - b^2}{2b}$$

$$10. \quad R = \frac{V}{I}$$

$$11. \quad V = \frac{P}{I}$$

$$12. \quad R_2 = R_T - R_1$$

$$13. \quad d = \frac{s}{\pi n}$$

Practice Exercise 5

Perimeter and Area

Name: _____

Find the radius of each circle.

The formula for the circumference of a circle is $C = 2\pi r$.

The formula for the area of a circle is $A = \pi r^2$.

| | | |
|-------------------------------|----------------------------------|-------------------------------|
| 1. $A = 1.78\pi \text{ mm}^2$ | 2. $A = 44.0896\pi \text{ mm}^2$ | 3. $C = 50\pi \text{ m}$ |
| 4. $C = 80.26 \text{ mm}$ | 5. $C = 94.2 \text{ m}$ | 6. $A = 289\pi \text{ cm}^2$ |
| 7. $C = 30.86\pi \text{ m}$ | 8. $A = 1017.36 \text{ m}^2$ | 9. $C = 23.64\pi \text{ mm}$ |
| 10. $C = 3.5\pi \text{ cm}$ | 11. $A = 803.84 \text{ cm}^2$ | 12. $A = 25\pi \text{ cm}^2$ |
| 13. $C = 46.32\pi \text{ m}$ | 14. $C = 2.25\pi \text{ cm}$ | 15. $A = 652.02 \text{ m}^2$ |
| 16. $A = 169\pi \text{ m}^2$ | 17. $A = 0.6\pi \text{ m}^2$ | 18. $A = 576\pi \text{ cm}^2$ |
| 19. $C = 24.78\pi \text{ mm}$ | 20. $C = 41.82 \text{ m}$ | 21. $A = 1765.2 \text{ m}^2$ |
| 22. $C = 33.02\pi \text{ m}$ | 23. $A = 121\pi \text{ mm}^2$ | 24. $C = 0.17\pi \text{ m}$ |
| 25. $A = 576\pi \text{ m}^2$ | 26. $C = 28\pi \text{ cm}$ | 27. $A = 1064.23 \text{ m}^2$ |

Answer Key for Practice Exercise 5
Perimeter and Area

| | | |
|--|--|---|
| 1. $A = 1.78\pi \text{ mm}^2$ 1.33 mm | 2. $A = 44.0896\pi \text{ mm}^2$ 6.64 mm | 3. $C = 50\pi \text{ m}$ 25 m |
| 4. $C = 80.26 \text{ mm}$ 12.78 mm | 5. $C = 94.2 \text{ m}$ 15 m | 6. $A = 289\pi \text{ cm}^2$ 17 cm |
| 7. $C = 30.86\pi \text{ m}$ 15.43 m | 8. $A = 1017.36 \text{ m}^2$ 18 m | 9. $C = 23.64\pi \text{ mm}$ 11.82 mm |
| 10. $C = 3.5\pi \text{ cm}$ 1.75 cm | 11. $A = 803.84 \text{ cm}^2$ 16 cm | 12. $A = 25\pi \text{ cm}^2$ 5 cm |
| 13. $C = 46.32\pi \text{ m}$ 23.16 m | 14. $C = 2.25\pi \text{ cm}$ 1.125cm | 15. $A = 652.02 \text{ m}^2$ 14.41 m |
| 16. $A = 169\pi \text{ m}^2$ 13 m | 17. $A = 0.6\pi \text{ m}^2$ 0.77 m | 18. $A = 576\pi \text{ cm}^2$ 24 cm |
| 19. $C = 24.78\pi \text{ mm}$ 12.39 mm | 20. $C = 41.82 \text{ m}$ 6.66 m | 21. $A = 1765.2 \text{ m}^2$ 23.71 m |
| 22. $C = 33.02\pi \text{ m}$ 16.51 m | 23. $A = 121\pi \text{ mm}^2$ 11 mm | 24. $C = 0.17\pi \text{ m}$ 0.085m |
| 25. $A = 576\pi \text{ m}^2$ 24 m | 26. $C = 28\pi \text{ cm}$ 14 cm | 27. $A = 1064.23 \text{ m}^2$ 18.41 m |

Practice Exercise 6
The Pythagorean Theorem

Name: _____

Find the missing length for each right triangle.

The formula for the Pythagorean Theorem is $c^2 = a^2 + b^2$.

| | | |
|---|--|--|
| 1. $a = \underline{\hspace{2cm}}$ $b = 8$ $c = 10$ | 2. $a = \underline{\hspace{2cm}}$ $b = 24$ $c = 30$ | 3. $a = 9$ $b = 40$ $c = \underline{\hspace{2cm}}$ |
| 4. $a = 22$ $b = \underline{\hspace{2cm}}$ $c = 24$ | 5. $a = 70$ $b = \underline{\hspace{2cm}}$ $c = 75$ | 6. $a = 14$ $b = 20$ $c = \underline{\hspace{2cm}}$ |
| 7. $a = 9$ $b = \underline{\hspace{2cm}}$ $c = 15$ | 8. $a = \underline{\hspace{2cm}}$ $b = 35$ $c = 37$ | 9. $a = 24$ $b = \underline{\hspace{2cm}}$ $c = 26$ |
| 10. $a = \underline{\hspace{2cm}}$ $b = 7$ $c = 13$ | 11. $a = 4$ $b = 11$ $c = \underline{\hspace{2cm}}$ | 12. $a = 18$ $b = 24$ $c = \underline{\hspace{2cm}}$ |
| 13. $a = 2$ $b = \underline{\hspace{2cm}}$ $c = 5$ | 14. $a = \underline{\hspace{2cm}}$ $b = 15$ $c = 20$ | 15. $a = \underline{\hspace{2cm}}$ $b = 15$ $c = 17$ |
| 16. $a = 2$ $b = 24$ $c = \underline{\hspace{2cm}}$ | 17. $a = 7$ $b = 14$ $c = \underline{\hspace{2cm}}$ | 18. $a = 8$ $b = \underline{\hspace{2cm}}$ $c = 17$ |

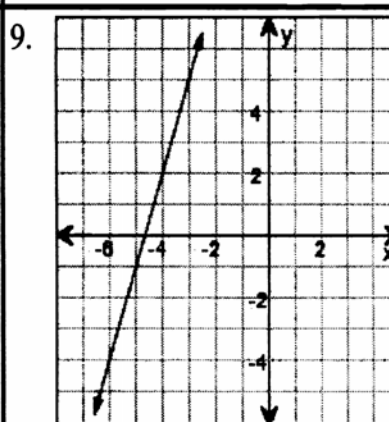
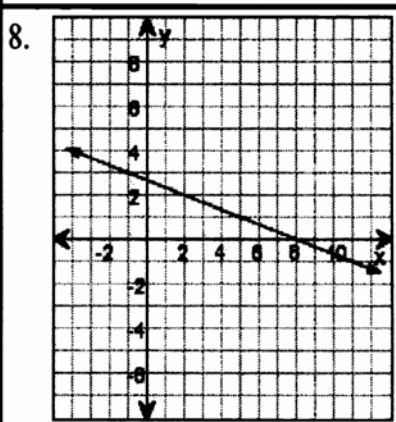
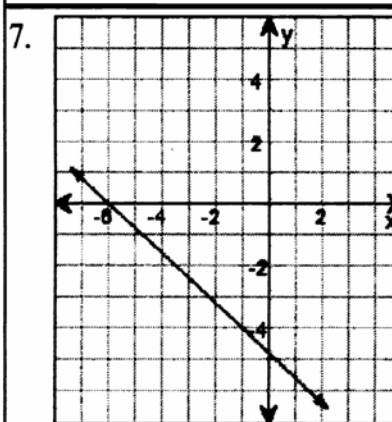
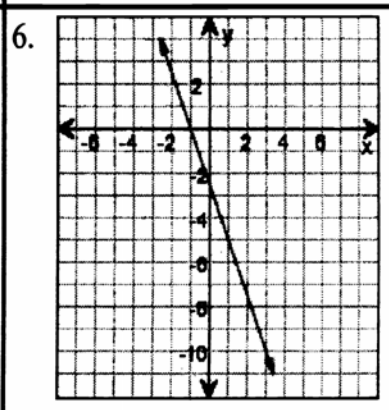
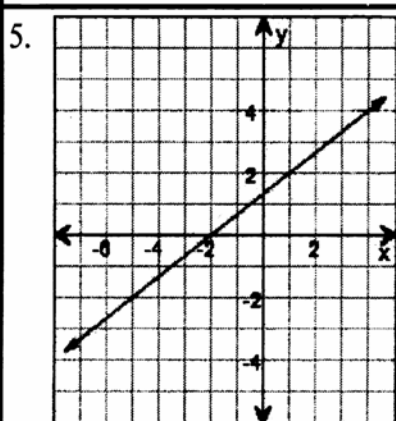
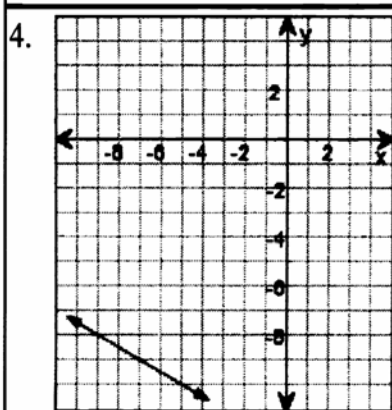
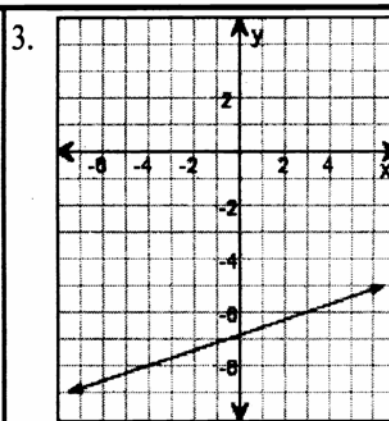
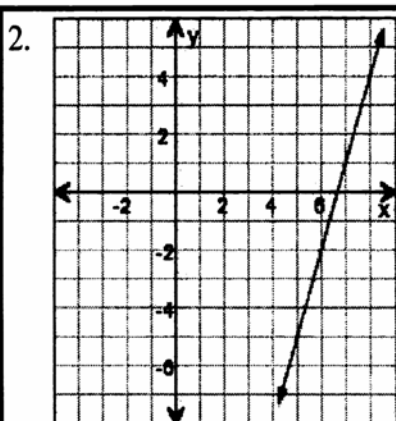
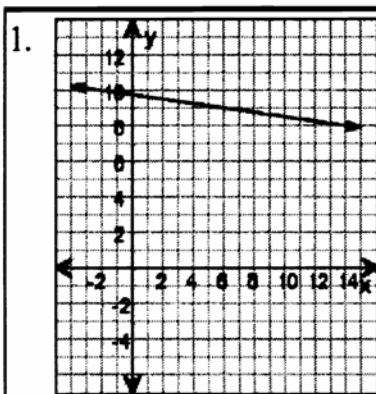
Answer Key for Practice Exercise 6
The Pythagorean Theorem

| | | |
|---|--|---|
| 1. $a = 6$ $b = 8$ $c = 10$ | 2. $a = 18$ $b = 24$ $c = 30$ | 3. $a = 9$ $b = 40$ $c = 41$ |
| 4. $a = 22$ $b = \sqrt{92}$ $c = 24$ | 5. $a = 70$ $b = \sqrt{725}$ $c = 75$ | 6. $a = 14$ $b = 20$ $c = \sqrt{596}$ |
| 7. $a = 9$ $b = 12$ $c = 15$ | 8. $a = 12$ $b = 35$ $c = 37$ | 9. $a = 24$ $b = 10$ $c = 26$ |
| 10. $a = \sqrt{120}$ $b = 7$ $c = 13$ | 11. $a = 4$ $b = 11$ $c = \sqrt{137}$ | 12. $a = 18$ $b = 24$ $c = \sqrt{30}$ |
| 13. $a = 2$ $b = \sqrt{21}$ $c = 5$ | 14. $a = \sqrt{175}$ $b = 15$ $c = 20$ | 15. $a = 8$ $b = 15$ $c = 17$ |
| 16. $a = 2$ $b = 24$ $c = \sqrt{580}$ | 17. $a = 7$ $b = 14$ $c = \sqrt{245}$ | 18. $a = 8$ $b = 15$ $c = 17$ |

Practice Exercise 7
Linear Equations: Slope

Name: _____

Find the slope of each line.



Answer Key for Practice Exercise 7
Linear Equations: Slope

1. $-\frac{1}{8}$

2. 3

3. $\frac{2}{7}$

4. $-\frac{1}{2}$

5. $\frac{2}{3}$

6. $-\frac{5}{2}$

7. $-\frac{4}{5}$

8. $-\frac{1}{3}$

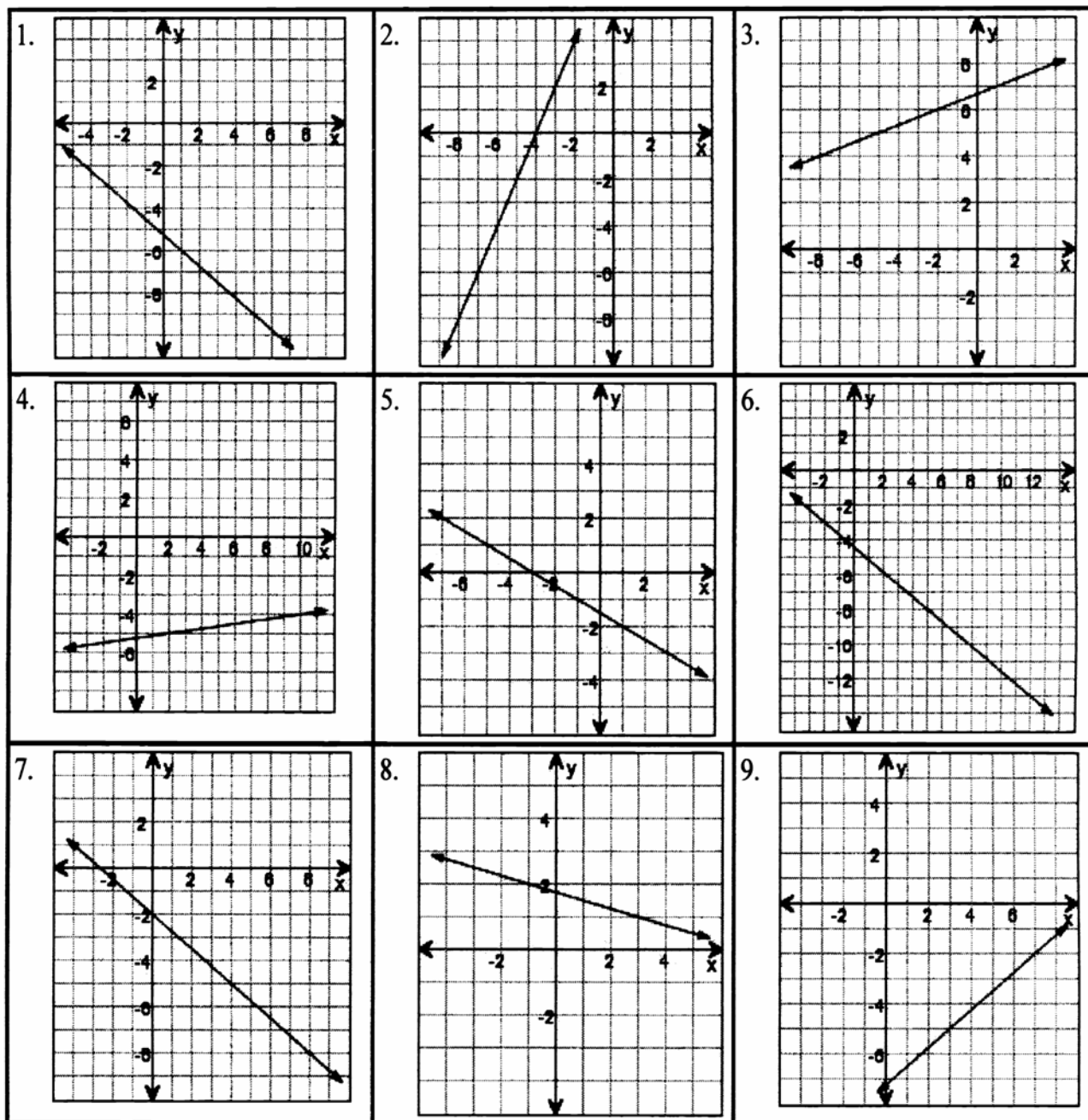
9. 3

Practice Exercise 8

Linear Equations: Write the Equation of the Line

Name: _____

Create a formula for each line.



Practice Exercise 8

Linear Equations: Write the Equation of the Line

1. $y = -\frac{3}{4}x - \frac{21}{4}$

2. $y = 2x + 8$

3. $y = \frac{1}{3}x + \frac{20}{3}$

4. $y = \frac{1}{8}x - \frac{21}{4}$

5. $y = -\frac{1}{2}x - \frac{3}{2}$

6. $y = -\frac{5}{7}x - \frac{31}{7}$

7. $y = -\frac{3}{4}x - 2$

8. $y = -\frac{1}{4}x + \frac{7}{4}$

9. $y = \frac{3}{4}x - \frac{29}{4}$

Practice Exercise 9
Order of Operations

Name: _____

| | |
|---|---------------------------------------|
| 1. $(45 \div 9) + (12 \times 49 - 1)$ | 2. $93 \times 1 + 5 \times 2$ |
| 3. $67 + (52 - 47 - 4 \times 1)$ | 4. $32 \div 8 + 55$ |
| 5. $9 \times 4 + 19$ | 6. $(87 - 32) + 2$ |
| 7. $5 + 4 + 37 - 3$ | 8. $(30 \div 2) \times 48 - (50 + 1)$ |
| 9. $(5 \times 23) + (22 \times 4)$ | 10. $67 - 80 \div 8 - 2$ |
| 11. $(68 \times 41) \times (3 + 20)$ | 12. $56 - 3 \times 4$ |
| 13. $8 \times 12 + 39 + 38$ | 14. $5 - (39 - 52) + 24 \div 3$ |
| 15. $56 \div 4 \times 28 + 3 \times 14$ | 16. $(7 - 41) + (55 - 19)$ |
| 17. $30 \div 5 + 2$ | 18. $9 \times (16 \div 4 - 4)$ |
| 19. $6 + 12 \div 2$ | 20. $93 \div 3 + (3 \times 50)$ |
| 21. $9 \times 2 - 14$ | 22. $54 \times 3 \times 1$ |
| 23. $5 + (60 \div 2)$ | 24. $8 \times 56 \div 8 + 2$ |
| 25. $5 - 19 + (2 \times 5 + 25)$ | 26. $95 - 45 - 1 + 4$ |
| 27. $79 + 2 - 5$ | 28. $(61 \times 2) + 21$ |
| 29. $(9 \times 23) \times (24 \div 4) \times 2$ | 30. $76 + 1 - 25 - 3$ |

Answer Key for Practice Exercise 9

Order of Operations

| | | | |
|---|---------------|---------------------------------------|------------|
| 1. $(45 \div 9) + (12 \times 49 - 1)$ | 592 | 2. $93 \times 1 + 5 \times 2$ | 103 |
| 3. $67 + (52 - 47 - 4 \times 1)$ | 68 | 4. $32 \div 8 + 55$ | 59 |
| 5. $9 \times 4 + 19$ | 55 | 6. $(87 - 32) + 2$ | 57 |
| 7. $5 + 4 + 37 - 3$ | 43 | 8. $(30 \div 2) \times 48 - (50 + 1)$ | 669 |
| 9. $(5 \times 23) + (22 \times 4)$ | 203 | 10. $67 - 80 \div 8 - 2$ | 55 |
| 11. $(68 \times 41) \times (3 + 20)$ | 64 124 | 12. $56 - 3 \times 4$ | 44 |
| 13. $8 \times 12 + 39 + 38$ | 173 | 14. $5 - (39 - 52) + 24 \div 3$ | 26 |
| 15. $56 \div 4 \times 28 + 3 \times 14$ | 434 | 16. $(7 - 41) + (55 - 19)$ | 2 |
| 17. $30 \div 5 + 2$ | 8 | 18. $9 \times (16 \div 4 - 4)$ | 0 |
| 19. $6 + 12 \div 2$ | 12 | 20. $93 \div 3 + (3 \times 50)$ | 181 |
| 21. $9 \times 2 - 14$ | 4 | 22. $54 \times 3 \times 1$ | 162 |
| 23. $5 + (60 \div 2)$ | 35 | 24. $8 \times 56 \div 8 + 2$ | 58 |
| 25. $5 - 19 + (2 \times 5 + 25)$ | 21 | 26. $95 - 45 - 1 + 4$ | 53 |
| 27. $79 + 2 - 5$ | 76 | 28. $(61 \times 2) + 21$ | 143 |
| 29. $(9 \times 23) \times (24 \div 4) \times 2$ | 2484 | 30. $76 + 1 - 25 - 3$ | 49 |

Practice Exercise 10
Percents

Name: _____

Write each percent as its decimal equivalent.

| | | | | |
|----------|---------|---------|---------|---------|
| 1. 42% | 2. 74% | 3. 8% | 4. 50% | 5. 17% |
| 6. 96% | 7. 69% | 8. 38% | 9. 81% | 10. 3% |
| 11. 1% | 12. 25% | 13. 73% | 14. 30% | 15. 97% |
| 16. 7% | 17. 89% | 18. 53% | 19. 41% | 20. 4% |
| 21. 66% | 22. 14% | 23. 18% | 24. 52% | 25. 87% |
| 26. 64% | 27. 6% | 28. 48% | 29. 29% | 30. 2% |
| 31. 100% | 32. 93% | 33. 76% | 34. 85% | 35. 5% |
| 36. 72% | 37. 61% | 38. 0% | 39. 27% | 40. 9% |
| 41. 58% | 42. 19% | 43. 35% | 44. 70% | 45. 13% |

Answer Key for Practice Exercise 10
Percents

| | | | | |
|------------------------|------------------------|------------------------|------------------------|------------------------|
| 1. 42% 0.42 | 2. 74% 0.74 | 3. 8% 0.08 | 4. 50% 0.5 | 5. 17% 0.17 |
| 6. 96% 0.96 | 7. 69% 0.69 | 8. 38% 0.38 | 9. 81% 0.81 | 10. 3% 0.03 |
| 11. 1% 0.01 | 12. 25% 0.25 | 13. 73% 0.73 | 14. 30% 0.3 | 15. 97% 0.97 |
| 16. 7% 0.07 | 17. 89% 0.89 | 18. 53% 0.53 | 19. 41% 0.41 | 20. 4% 0.04 |
| 21. 66% 0.66 | 22. 14% 0.14 | 23. 18% 0.18 | 24. 52% 0.52 | 25. 87% 0.87 |
| 26. 64% 0.64 | 27. 6% 0.06 | 28. 48% 0.48 | 29. 29% 0.29 | 30. 2% 0.02 |
| 31. 100% 1 | 32. 93% 0.93 | 33. 76% 0.76 | 34. 85% 0.85 | 35. 5% 0.05 |
| 36. 72% 0.72 | 37. 61% 0.61 | 38. 0% 0 | 39. 27% 0.27 | 40. 9% 0.09 |
| 41. 58% 0.58 | 42. 19% 0.19 | 43. 35% 0.35 | 44. 70% 0.7 | 45. 13% 0.13 |