

# **Grade 10 Introduction to Applied and Pre-Calculus Mathematics (20S)**

A Course for Independent Study

Field Validation Version





GRADE 10 INTRODUCTION TO  
APPLIED AND PRE-CALCULUS  
MATHEMATICS (20S)

A Course for Independent Study

Field Validation Version

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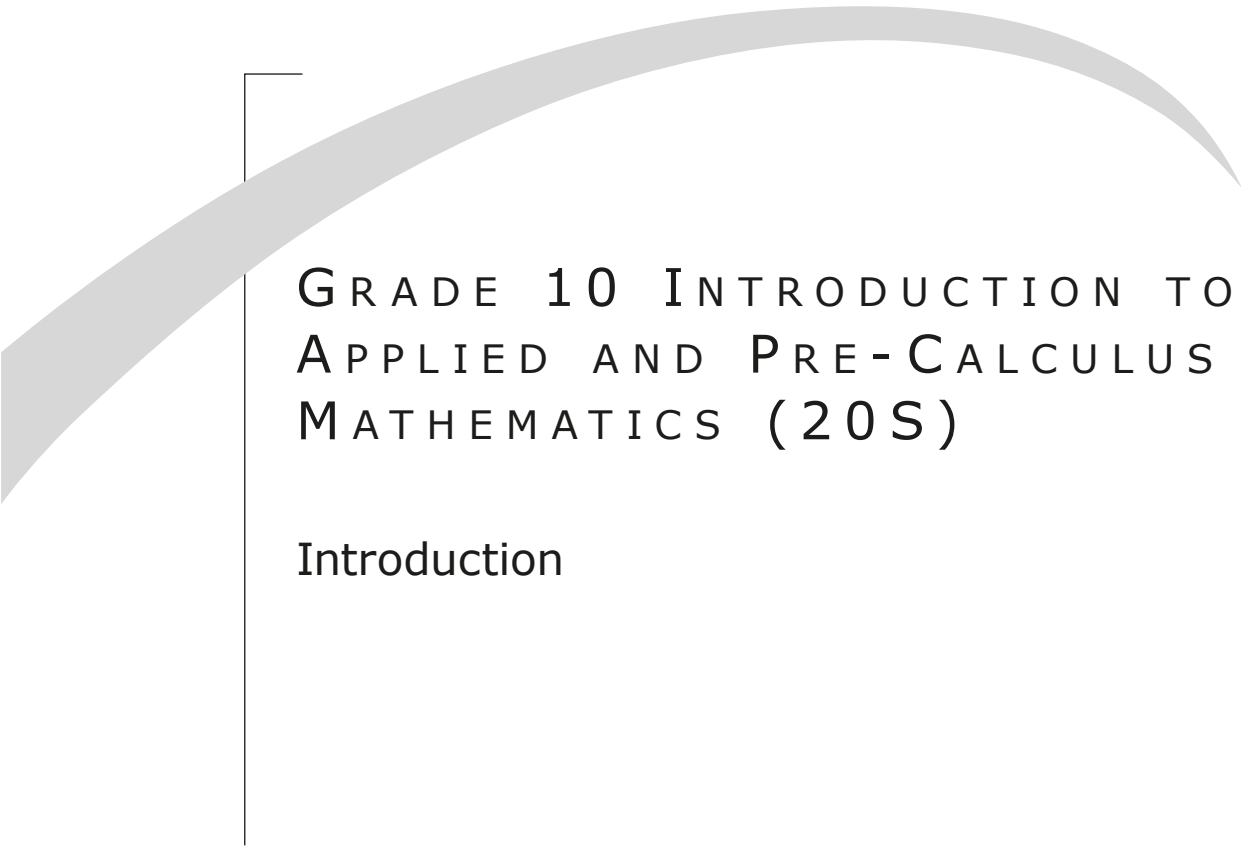
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<b>Writer</b>	Bonnie Hildebrand	Independent Consultant Winnipeg
<b>Manitoba Education</b> School Programs Division Staff	Carole Bilyk Project Leader	Development Unit Instruction, Curriculum and Assessment Branch
	Louise Boissonneault Coordinator	Document Production Services Unit Educational Resources Branch
	Marianne Fenn Consultant	Distance Learning Unit Instruction, Curriculum and Assessment Branch
	Lynn Harrison Desktop Publisher	Document Production Services Unit Educational Resources Branch
	Myrna Klassen Consultant	Distance Learning Unit Instruction, Curriculum and Assessment Branch
	Amanda Konrad Instructional Design Assistant	Development Unit Instruction, Curriculum and Assessment Branch
	Gilles Landry Project Manager	Development Unit Instruction, Curriculum and Assessment Branch
	Susan Lee Coordinator	Distance Learning Unit Instruction, Curriculum and Assessment Branch
	Grant Moore Publications Editor	Document Production Services Unit Educational Resources Branch
	John Murray Consultant	Development Unit Instruction, Curriculum and Assessment Branch
Division du Bureau de l'éducation française	Philippe Leclercq Conseiller pédagogique	Conseiller pédagogique—Mathématiques 9 à 12 Division du Bureau de l'éducation française Division





GRADE 10 INTRODUCTION TO  
APPLIED AND PRE-CALCULUS  
MATHEMATICS (20S)

Introduction



# INTRODUCTION TO THE COURSE

## Course Content

Welcome to *Grade 10 Introduction to Applied and Pre-Calculus Mathematics*! This course is a continuation of the concepts you have been studying in previous years, as well as an introduction to new topics. It lays the foundation for both applied and pre-calculus mathematics courses at the Grade 11 and Grade 12 levels. It also develops the skills, ideas, and confidence that you will need to continue studying math in the future.

Problem solving, communication, reasoning, and mental math are some of the themes you will discover in each module. You will engage in a variety of activities that promote the connections between symbolic math ideas and the world around you.

There are four main areas that you will be exploring: Number, Patterns and Relations, Shape and Space, and Statistics and Probability.

There is one appendix included in this course. Appendix A is a glossary of terms and definitions.

This course is divided into eight modules, organized as follows:

- Module 1 – Graphs and Relations
- Module 2 – Number Sense
- Module 3 – Measurement
- Module 4 – Trigonometry
- Module 5 – Relations and Functions
- Module 6 – Polynomials
- Module 7 – Coordinate Geometry
- Module 8 – Systems of Equations

## What Will You Need?

Please note that you do not need a textbook to complete this course. All of the content is included with this package.

### Required Resources

Here is a list of things that you **must** have to complete this course:

- a scientific calculator
- a metric ruler (15 cm long is fine)
- an imperial ruler (6 inches long is fine)
- other measurement tools such as a protractor, metre or yard stick, tape measure
- graph paper
- a notebook or binder so you can keep your completed learning activities together (Learning activities are activities that you complete and check against the answers provided at the end of each module. You do not send them in for assessment.)

### Optional Resources

- Access to a computer with spreadsheet and graphing capabilities will be an advantage, but not a requirement. Use of the Internet may be suggested as a resource in some places, but if you do not have access to an online computer you can still complete the related learning activities and assignments without it.
- Access to a photocopier would be helpful because it would let you make a copy of your assignments before you send them to your tutor/marker. That way, if you and your tutor/marker want to discuss an assignment, you would each have a copy to refer to.

## Resource Sheet

When you write your exams you will be allowed to take a Resource Sheet with you into the exam. This sheet will be one letter-sized page, 8½" by 11", with both sides in your handwriting or typewritten. It is to be submitted with your exam. The Resource Sheet is not worth any marks.

Many students have found making a Resource Sheet an excellent way to review. It also provides you with a summary of the important facts of each module available when you need it. You are asked to complete a Resource Sheet for each module to help with your studying and reviewing. The lesson summaries are written for you to use as a guide, as are the module summaries at the end of each module.

As you complete each module's Resource Sheet, you will then be able to try to summarize the sheets from Modules 1, 2, 3, and 4, to prepare your midterm exam Resource Sheet. Remember, the midterm is based only on the first four modules of the course.

For the final exam, you will summarize the sheets from Modules 1 to 8 to prepare your final exam Resource Sheet. Remember, the final exam is based on all eight modules of the course.

## How Will You Know How You're Doing?

You will know how well you are learning by your successful completion of the following course components:

### Learning Activities

Each learning activity has two parts—Part A has BrainPower questions and Part B has questions related to the content in the lesson.

**Do not mail learning activities to your tutor/marker.**

### Part A: BrainPower

The BrainPower questions are provided as a warm-up activity for you before trying the other questions. Each question should be completed quickly and without the use of a calculator. You should be able to complete most of them without writing out multiple steps on paper. Some of the questions will directly relate to content you are learning in this course. Some of the questions will be a review of content from previous courses that you will need to be able to answer questions from this course.



Being able to do these questions in a few minutes will be helpful to you as you continue with your studies in mathematics. If you are finding it is taking you longer to do the questions, you can try one of the following:

- work with your learning partner to find more efficient strategies for completing the questions
- ask your tutor/marker for help with the questions

- search online for websites that help you practise the computations so you can become more efficient at completing the questions

None of the assignment questions or exam questions will require you to do the calculations quickly or without a calculator. However, it is for your benefit to complete the questions as they will help you in the course. Also, being able to successfully complete the BrainPower exercises will help build your confidence in mathematics. BrainPower questions are like a warm-up you would do before competing in a sporting event.

## Part B: Lesson Content

One of the easiest and fastest ways to find out how much you have learned is by completing Part B of the learning activities. These have been designed to let you assess yourself by comparing your answers with the answer keys at the end of each module. They are found in every lesson. Some lessons have more than one. You will need a notebook or looseleaf in which to write your answers.

Make sure you complete each learning activity. Besides giving you instant feedback, they will help you practice what you have learned and prepare you to successfully complete hand-in assignments and exams. Many of the questions on the exams will be similar to the questions in the learning activities. So if you were able to answer them correctly, you are likely to do well on your exams. If you did not answer them correctly, you need to go back to the lesson and review the instructions and examples. Don't skip ahead without learning. If you do, you will be wasting your time, and you won't be able to complete later lessons.

## Assignments

The assignments have space provided for you to write your answers on the question sheets. You need to show all your steps as you work out your solutions and make sure your answers are clear (include units, where appropriate). There is no answer key for the assignments included at the end of the module because your tutor/marker will correct these assignments and then return them to you. These assignments make up 55 percent of your final mark. You must complete each assignment in order to receive a final mark in this course. **You will mail these assignments to your tutor/maker along with the appropriate cover page in accordance with the breakdown shown on the cover sheets found at the end of this Introduction.**

## Midterm and Final Exams

The course contains a midterm exam and a final exam. You will write them both under supervision. The midterm exam is based on Modules 1 to 4 and is worth 20 percent of the final mark of the course. You will write it when you have completed Module 4. In order to do well on the midterm exam, you should review all of the work that you have completed from Modules 1 to 4, including all learning activities and assignments. You will require the following supplies to complete the final exam: pen, pencil, paper, metric and imperial rulers, a protractor, a scientific calculator, and your midterm Resource Sheet.

The final exam is cumulative and based on Modules 1 to 8. It is worth 25 percent of the final mark of the course. You will write it when you have completed Module 8. In order to do well on the final exam, you should review all of the work that you have completed from Modules 1 to 8, including all learning activities and assignments. You will require the following supplies to complete the final exam: pen, pencil, paper, scientific calculator, final exam Resource Sheet, and metric and imperial rulers.

You are responsible for applying for the exams and making arrangements to have the exams sent to your proctor from the Independent Study Option office. Before you finish Module 4, you will need to make arrangements to write your midterm exam. Before you finish Module 8, you will need to make arrangements to write your final exam. When you write either of these exams, you will be supervised by a proctor. Contact the Independent Study Option (referred to as ISO) at 1-800-465-9915 if you need help arranging this.

Here is how you apply for an exam:

**If you are attending school**, ask your school's ISO Facilitator to add your name to the ISO exam eligibility list. Do this at *least three weeks prior* to the next scheduled exam week.

**If you are not attending school**, check the **Examination Request Form** for options available to you. The Examination Request Form was mailed to you with this course. Fill in this form and mail or fax it *three weeks before* you are ready to write your exam. The address is:

ISO Registration  
555 Main St.  
Winkler, MB R6W 1C4  
Fax: 204-325-1719  
Phone: 1-800-465-9915

## Practice Exams and Answer Keys

To help you succeed in your midterm and final exams, you need to write the practice exams that are found at <[www.edu.gov.mb.ca/k12/dl/downloads/index.html](http://www.edu.gov.mb.ca/k12/dl/downloads/index.html)>.

These exams are very similar to the actual exams that you will be writing. They also include an answer key, so that you can check your answers when you have finished writing them. This will give you the confidence that you need to do well on your exams. If you do not have access to the Internet, contact the Independent Study Option at 1-800-465-9915 to get a copy of the practice exams and their answer keys.

## What If You Need Help?

Here are two people who can help you be successful in your course.

### Your Tutor/Marker

The first person who can help you is your tutor/marker. Tutor/markers are experienced teachers who tutor ISO students and mark assignments and exams. If you are having difficulty at any time during this course, be sure to contact your tutor/marker by phone or email. They are there to help you. If you are not sure how to contact your tutor/marker, phone the Independent Study Option at 1-800-465-9915.

The first learning activity and assignment for this course will involve contacting your tutor/marker.

### Your Learning Partner

The next person who can help you with your course is a learning partner. A learning partner is someone you choose who will help you learn. It may be someone who knows something about math, but it doesn't have to be. A learning partner could be someone else who is taking this course, a teacher, parent, sibling, a friend, or anybody else who can help you. Most importantly, a learning partner should be someone you feel comfortable with and who will support you as you work through this course.

Your learning partner can help you keep on schedule, check your work, help you make sense of assignments, read your course with you, or look at your learning activities and respond to them. You may even study for your exam with your learning partner.

One of the best ways that your learning partner can help you is by reviewing your midterm and final practice exams with you. These are found here: [www.edu.gov.mb.ca/k12/dl/downloads/index.html](http://www.edu.gov.mb.ca/k12/dl/downloads/index.html), along with their answer keys. Your learning partner can administer your practice exam, check your answers with you, and then help you learn the things that you missed.

## How Much Time Will You Need?

Learning through independent study has several advantages over learning in the classroom. You are in charge of how you learn and can choose how quickly you will complete the course. You don't have to wait for your teacher or classmates, and you can work as quickly as you want. You can also complete as many lessons at a time as you want. Read the next few pages to get an idea of how to pace yourself. You have one full year from the date of your registration to complete this course, but the pace at which you complete the course is up to you.

### Chart A: Semester 1

Here is a **suggested timeline** that you can follow if you start your course in September and need to complete it by the end of January.

<b>Module</b>	<b>Completion Date</b>
Module 1	mid September
Module 2	late September
Module 3	mid October
Module 4 and Midterm Exam	mid November
Module 5	late November
Module 6	early December
Module 7	mid December
Module 8 and Final Exam	mid January

## Chart B: Semester 2

Here is a **suggested timeline** that you can follow if you start your course in January and need to complete it by June.

Module	Completion Date
Module 1	mid February
Module 2	late February
Module 3	mid March
Module 4 and Midterm Exam	late March
Module 5	mid April
Module 6	late April
Module 7	mid May
Module 8 and Final Exam	late May

## Chart C: Full School Year (Not Semestered)

Here is a **suggested timeline** that you can follow if you have registered for this course in September and would like to complete it by June.

Module	Completion Date
Module 1	late September
Module 2	late October
Module 3	late November
Module 4 and Midterm Exam	mid January
Module 5	mid February
Module 6	mid March
Module 7	mid April
Module 8 and Final Exam	late May

Do not wait until the last minute to complete your work, since your tutor/marker may not be available to mark it immediately. Make sure that you leave enough time for your work to travel through the mail, as that might take over a week. It may also take a few weeks for your tutor/marker to mark everything and send the marks to your school.

If you need this course to graduate this school year, remember to schedule and complete your final exam by June 1.

## When Do You Send in Your Assignments?

You'll be mailing your assignments to your tutor/marker in accordance with the breakdown shown on the cover sheets found at the end of this Introduction. Each time you mail something, you must include the appropriate Cover Sheet, found at the end of the Introduction.

## What Are the Guide Graphics For?

Graphics have been placed inside the margins of the course to identify a specific task. Each graphic has a specific purpose to guide you. A description of each graphic is described below:



**Lesson Introduction:** The introduction sets the stage for the lesson. It may draw upon prior knowledge or briefly describe the organization of the lesson. It also lists the outcomes for the lesson. These describe what you will learn.



**Learning Activity:** Complete this learning activity to help you review or practise what you have learned and prepare for your assignment and exam. You will **not** send learning activities to your tutor/marker.



**Assignment:** This is an assignment that you complete and send to your tutor/marker. You will be sending in your assignments at the end of every module.



**Mail-in:** Indicates when it is time to mail in your assignments.



**Tutor/Marker:** Indicates when the tutor/marker is referenced in helping the student.



**Learning Partner:** Indicates when the student may seek help from their learning partner.



**Resource Sheet:** Indicates material that may be valuable to include on your resource sheet.



**Applied Mathematics:** Indicates mathematical approaches that are related to applied math.



**Pre-Calculus Mathematics:** Indicates mathematical approaches that are related to pre-calculus mathematics.

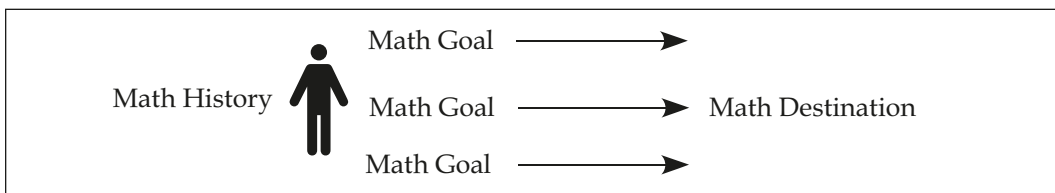
## Math Goals

In Module 1, Lesson 1, you will be asked to contact your tutor/marker to discuss your math goals. Having this conversation with your tutor/marker has two important purposes. First, it introduces you to a very valuable resource—your tutor/marker. He or she is available for you to answer questions, explain concepts, and guide you through this course. You can discuss your math learning and progress. Feel free to contact your tutor/marker by phone or email at any time during this course. The second important purpose of this assignment is to get you thinking about your math goals. You may have a future career in mind, and this course is getting you one step closer to it by filling a prerequisite for a future required course.

There may be specific skills or topics you are interested in learning about, and they are covered in this course. If you are unsure of your math goals or why they are important, consider this:

- goals give you a sense of direction and purpose in taking this course
- goals help motivate you to learn and do your best, even when its tough
- when you accomplish your goals, there is a great sense of achievement and success

Good goals need to be realistic and specific, and they should reflect what is important to you. They should give you direction and take you further down the path from where you have been to where you want to go.



From the diagram, you can see that goals can be long-term or short-term, but they are the pathway that takes you from where you were/are, closer to where you want to go.

## Getting Started

Now that you have contacted your tutor/marker and set some goals, take some time right now to skim through the course material, locate your Cover Sheets, and familiarize yourself with how the course is organized. And get ready to learn!

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## Notes



GRADE 10 INTRODUCTION TO  
APPLIED AND PRE-CALCULUS  
MATHEMATICS (20S)

Module 1  
Graphs and Relations



# MODULE 1: GRAPHS AND RELATIONS

## Introduction



This first module forms a foundation for the mathematical concepts you will use in both pre-calculus and applied mathematics in the future, including upcoming modules in this course. It, in turn, is based on ideas and skills developed in previous math courses you have taken. This module will focus on the relationships among data, graphs, and contexts, and use a variety of ways to describe them. Specific attention will be given to linear relations, and their slope, intercepts, domain, and range. You will use words, ordered pairs, tables of values, graphs, and equations as means to describe the characteristics of linear relations.

### Assignments in Module 1

The following five assignments are to be sent to your tutor/marker when you have completed this module.

Lesson	Assignment Number	Assignment Title
1	Assignment 1.1	Graphing Independent and Dependent Variables
2	Assignment 1.2	Domain and Range
3	Assignment 1.3	Slopes, Intercepts, Domain, and Range
4	Assignment 1.4	What We Can Tell From Slope
5	Assignment 1.5	Slope y-Intercept Equation

Once you have completed all the hand-in assignments, you will need to send them to your tutor/marker for marking to the address below. Note that the Learning Activities in each lesson need not be sent in for marking. Don't forget to include the Module 1 Cover Sheet for identification and for keeping track of your marks.

ISO Tutor/Marker  
555 Main Street  
Winkler, Manitoba  
R6W 1C4

## Resource Sheet

When you write your midterm exam you will be allowed to take a Midterm Exam Resource Sheet with you into the exam. This sheet will be one letter-sized page, 8½" by 11", with both sides in your handwriting or typewritten. It is to be submitted with your exam. The Midterm Exam Resource Sheet is not worth any marks.

Many students have found making a Resource Sheet an excellent way to review. It provides you with a summary of the important facts of each module that is available when you need it. You are asked to complete a Resource Sheet for each module to help with your studying and reviewing. The lesson summaries are written for you to use as a guide, as are the module summaries at the end of each module.

To prepare you for making such a sheet, a list of instructions is provided below for you to complete as you work through Module 1. You might use your Module 1 Resource Sheet for math terms, formulas, sample questions, or a list of places where you often make mistakes. You might write out what you need or you might refer to page numbers in the lessons to be carefully reviewed when studying for the exams.

As you complete each module's Resource Sheet, you will then be able to try to summarize the sheets from Modules 1, 2, 3, and 4, to prepare your Midterm Exam Resource Sheet. The midterm exam is based on the first four modules of the course. Since the final exam is based on all eight modules of the course, you will create a new Resource Sheet for your final exam.

### Resource Sheet for Module 1

1. List the math terms that are introduced in each lesson.
2. List any of the formulas stated in each lesson.
3. What strategies for making calculations were discussed in each lesson?
4. What questions need to be copied onto your Resource Sheet as being representative of the questions in each lesson?
5. What questions were the most difficult? List page numbers on your Module Resource Sheet so that you can redo these questions before the exam. If any of these problems are "sticklers", you could then write the problems and solutions on your Midterm Exam Resource Sheet so that you have them with you during the exam.
6. What other reminders do you need to make to yourself, to help you prepare for the exam?

# LESSON 1: GRAPHING INDEPENDENT AND DEPENDENT VARIABLES

## Lesson Focus

In this lesson, you will

- describe the properties of a good graph and create or sketch graphs
- identify the independent and dependent variables in a graph or context
- identify continuous data in context
- describe the relationships between graphs and contexts

## Lesson Introduction



If you are given a bunch of numbers in a chart and are expected to understand and make sense of how the numbers are related, it can be a really difficult and confusing task. Sometimes organizing the data by graphing can make it easier to see the relationships. Graphs are visual representations of data, and you can use them to describe or explain situations. In this lesson, you will review what makes a good graph, and create scatterplot graphs to represent situations and display data. Using specific contexts, you will identify continuous data, and the dependent and the independent variables in graphs.



## Learning Activity 1.1

This learning activity is the only one that doesn't include a BrainPower section, although it still has two parts.

### **Part A: Contacting Your Tutor/Marker**

Your first task in this course is to contact your tutor/marker by phone (you will have received his/her phone number in the mail with the course), or interview your learning partner.

Be ready to discuss the following topics and the reasons for your answers with your tutor/marker or learning partner. If you like, make some notes below before you call in order to help you feel prepared. Feel free to add any other questions or comments that you may have.

1. I am taking this course by distance education because

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2. What I like about math and can do mathematically is (include favourite topic, skill, where you use math, etc.)

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*continued*

## Learning Activity 1.1 (continued)

3. What I dislike about math or have difficulty doing is

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4. Previous math experiences that influence the way I feel about math are

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5. The next math course I would like to take is

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6. What I am hoping this course will help me accomplish and learn for the future

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*continued*

## Learning Activity 1.1 (continued)

7. What I am doing/how I will organize things to help me succeed in this course

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During your phone conversation, jot down a sentence or two about what you and your tutor talk about, in the spaces above. For example, if you are taking this course because it doesn't fit into your schedule at school or because you travel a lot with your basketball team and this is more convenient, state that in the space below question 1.

### Part B: Where You Want to Go in Math

Use the answers to the questions from the conversation with your tutor/ marker as a starting point and fill in the following diagram. In the Math History box, jot down point-form notes about your prior experience and knowledge about math (questions 2, 3, and 4). In the Math Destination box, jot down what completing this course will help you accomplish in the future (questions 5 and 6).

In between the boxes, write down what you will need to do to move down the pathway from your History to your Destination.

Math History	Pathway	Math Destination

*continued*

## Learning Activity 1.1 (continued)

For example, if your destination includes needing a 75% in this course so that you can feel confident going into Grade 11 Pre-Calculus Mathematics in order to take nursing at college, or you need to learn how to solve equations, what will help you accomplish this? It may mean figuring out how you best learn and study math. It may mean setting up a schedule so you complete the assignments on time. You may need to find your calculator manual and figure out how to use it, set up regular appointments with your learning partner, research a topic on the Internet, or read a textbook about a certain math concept or skill. Your pathway is unique to you.

As you move through this course and work on achieving your goals, self-assessment is important for you to determine whether you are getting closer to your destination. It helps you determine whether the steps along your pathway are taking you in the right direction. You will need to periodically ask yourself: Am I doing my assignments? Are my note-taking skills improving? How often have I contacted my tutor/marker or worked with my learning partner? Have I found useful homework websites? Is my schedule working? What do I need to change or adjust so I can get to my destination?

You will repeatedly go through this cycle of looking at where you have been, where you want to go, and where you currently are. At any time, you may want to revise your goals or set new ones as you evaluate your own progress and learning.

- Look back/history—reflect on what you know, how far you have come.
- Look around/pathway—assess if you are achieving your goals, determine if new learning or understanding has occurred, and check your progress.
- Look forward/destination—determine what you want to know, set goals.

Each time you go through these steps, you will become better at mathematics!

It is important that you keep this diagram handy as you will revisit it at other points in this course.

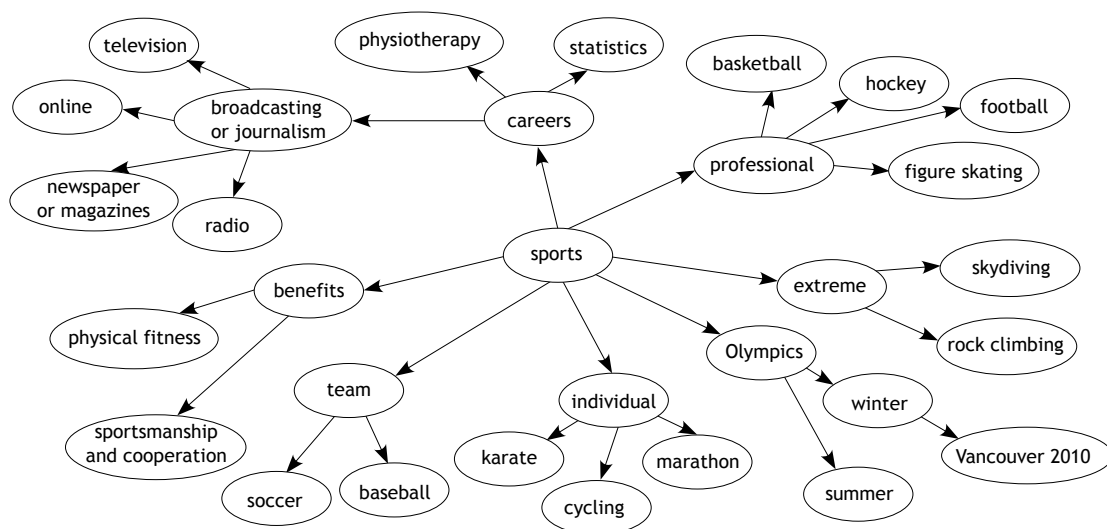
# Graphing

## Graphs

Think about what you know about graphs and where you have used or seen them.

One way to display what you know about a topic is to create a word web. A word web is a diagram that shows how the different parts or ideas related to a topic are connected. It helps you to think about what you already know and can do, and helps you identify any gaps in your knowledge.

If you are unfamiliar with word webs, they are created by starting with a main concept or topic in the centre of your diagram, and then showing related ideas in connected bubbles around it. They can be drawn by hand or with a computer. To give you an idea of how a word web may be constructed, here is an example of a word web about sports.





## Learning Activity 1.2

Complete the following, and check your answers in the learning activity keys found at the end of this module.

### Part A: BrainPower



You should be able to complete the following eight questions in a few minutes without the use of a calculator or pencil and paper. The first few times you do these questions, your learning partner can help you figure out strategies to solve them.

1. There are 22 yard markers on a Canadian football field. Each marker represents five yards. How long is a Canadian football field?
2. If Evan eats  $\frac{3}{5}$  of a pizza and Nick eats  $\frac{4}{5}$  of a pizza, how many pizzas do they have to order so that both can eat as much as they like?
3. Simplify the following fraction to lowest terms:  $\frac{18}{27}$ .
4. You are working at the stadium where they don't have an electronic till. The customer is buying popcorn for \$3.80. If the customer gives you a \$5.00 bill, how much change will you give them?
5. Rank the numbers from highest to lowest: 0.5, 0.05, 0.3, 0.09, and 0.25.
6. Solve for  $m$ :  $2 - m = 14$ .
7. The distance to the mall from your house is 8 km. Your friend lives half as far away from the mall. What is the distance from your friend's house to the mall?
8. Write the percent as a decimal: 62%.

*continued*

## Learning Activity 1.2 (continued)

### Part B: Word Web

Remember, these questions are similar to the ones that will be on your assignments, your midterm, and final exams. So, if you were able to answer them correctly, you are likely to do well on your assignments and exams. If you did not answer them correctly, you need to go back to the lesson and learn them.

Create a word web showing what you know about graphs. Use bubbles to indicate new ideas or characteristics, and lines to show how they are connected.

A large rectangular box for creating a word web. In the center, there is a small oval containing the word "graphs".

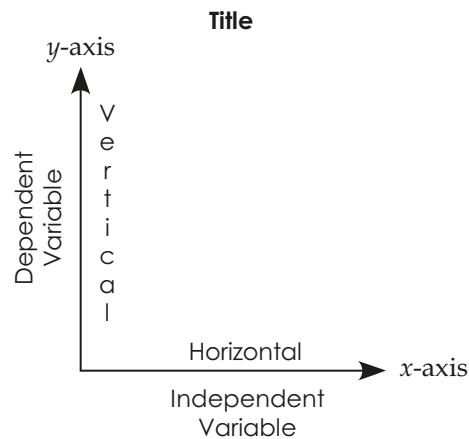
## Dependent and Independent Variables

If you have been shopping for a handheld media device that can play music and videos and surf the Internet, you will have noticed that its cost is affected by many factors. You could describe these relationships or patterns using words (verbally or written), equations (theoretically), or with a graph (visual).

**A graph is a visual representation used to show a numerical relationship.**

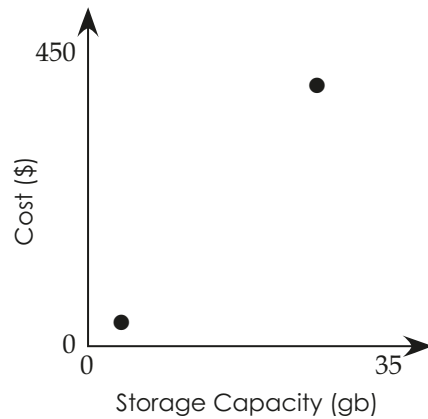
Say you do some online shopping and your comparisons indicate that you could get a device with a capacity between 1 and 32 gigabytes (GB) of memory space at a cost between \$55 and \$430. There is not enough information given to come up with an equation to describe how cost and capacity are related, but you can describe it with words. Verbally, this relationship can be explained by saying that the cost goes up as the capacity goes up. To visually display the relationship between two variables, you need to first determine which of the two variables being compared depends on, or is affected by, the other variable.

The **dependent** variable is the item that is affected by changes in the other, and it is graphed on the vertical or  $y$ -axis. The **independent** variable is the item being compared that is not affected by the other, and it is usually placed along the horizontal or  $x$ -axis.



This graphic may be helpful to include on your Resource Sheet.

When buying a media device, the cost generally depends on the size of the storage space or memory capacity. Using the written description given above, the relationship between cost and capacity in a handheld media device may be represented as:



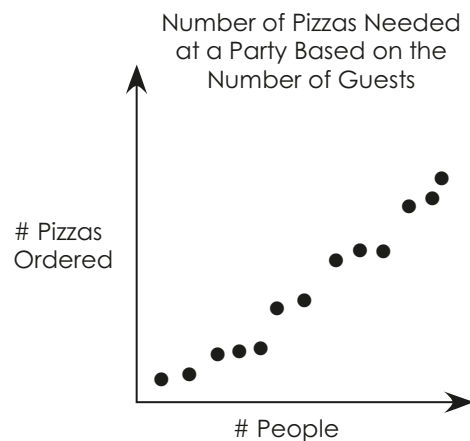
As the capacity goes up, the cost goes up.

### Example 1

Determine which variable is dependent and which variable is independent, and sketch a possible graph to describe the relationship between the number of people at a party and the number of pizzas ordered.

*Solution:*

The number of pizzas ordered depends on the number of people at the party.

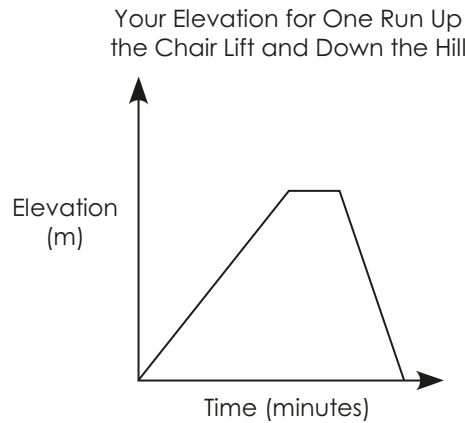


### Example 2

Pretend that you are at your favourite ski hill. You take the chairlift to the top, then ski down as quickly as possible. You want to graph the relationship of how high you are on the hill (elevation) compared to the time from when you get on the chairlift until you get back down the hill. Determine which variable is dependent and which is independent, and sketch a possible graph.

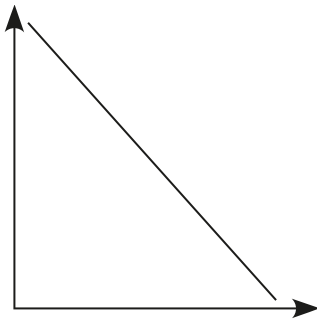
*Solution:*

Your elevation depends on the time (independent).



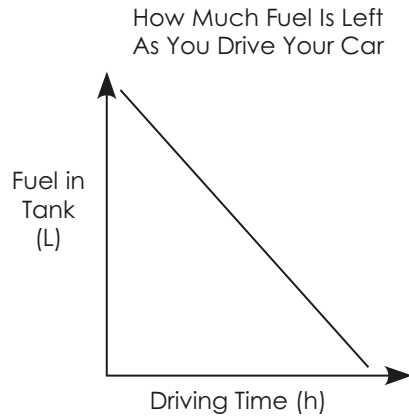
### Example 3

Create and explain a situation with a dependent and an independent variable that would fit the following graph. Label the graph with your variables and units.



*Solution:*

One possible context could be that the number of litres of fuel in a car's tank (dependent) depends on how many hours of driving time (independent) have elapsed since the tank was filled.



### Ordered Pairs

**An ordered pair (also called a coordinate pair) is a set of two numbers named in a specific order, represented by  $(x, y)$ .** The first number,  $x$ , represents the independent variable, graphed along the  $x$ -axis, and the second number,  $y$ , represents the dependent variable, graphed along the  $y$ -axis. When an ordered pair is graphed on a scatterplot, it represents a unique point on the coordinate plane or grid.



Ordered pairs appear in multiple lessons, so you may want to include the definition on your Resource Sheet.

### Constructing Graphs from Data

The following data were collected during your comparison shopping for a handheld media device.

Capacity (GB)	1	2	8	16	32
Cost (\$)	55	75	170	240	430

Create a scatterplot graph to display the relationship between these variables.

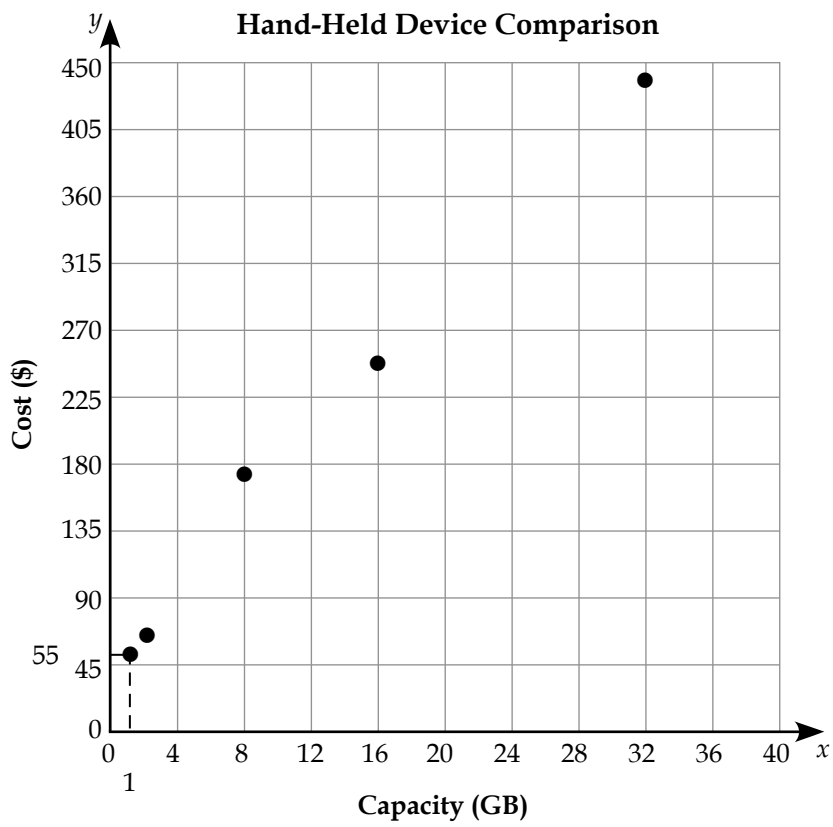
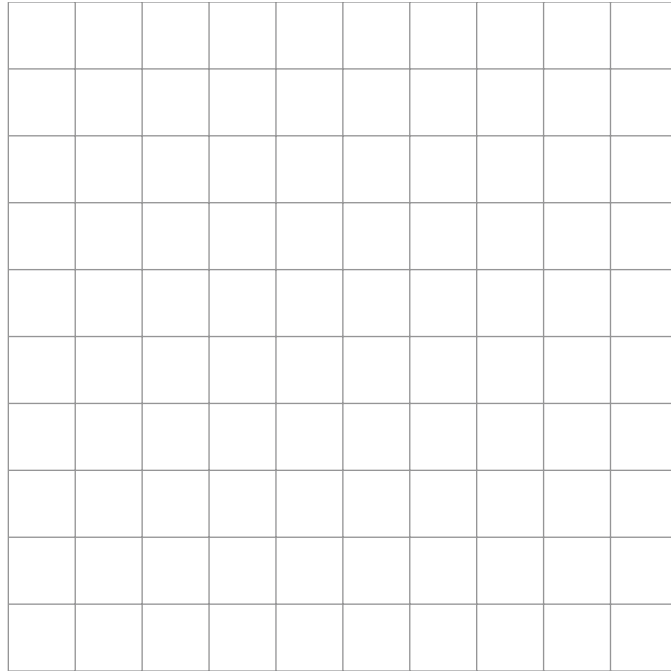
Graphs can be drawn by hand on graph paper, or generated using technology. Spreadsheets or graphing calculators, graphing freeware, or programs like *Graphical Analysis* may be used. In any case, a good graph has the following components:

- **Labels:** The  $x$ -axis and  $y$ -axis have labels to identify the variable and units used.
- **Scale:** Look at the smallest and largest data points given. The values along the axes go slightly beyond these values, and each interval is divided into equal increments. When appropriate, start each scale at zero.
- **Shape and size:** The graph is square, and the data are spread out over most of the space.
- **Title:** A title indicates what the graph is about.

The capacity varies from 1 to 32 GB, so the values along the  $x$ -axis (domain) could be from 0 to 40. There are 10 tick marks along the axis, so  $\frac{40}{10} = 4$ . Use even increments of 4 or 5.

The cost ranges from \$55 to \$430 so you could use values of 0 to 450 along the  $y$ -axis  $\left(\frac{450}{10} = 45\right)$ . Using increments of 45 or 50 would give you a nice square graph, with the data appropriately spread out over the graph area. Remember to include labels, units, and a title.

To plot the data points on the scatterplot, start with one (capacity, cost) pair, like (1, 55). The capacity is the independent variable and so is graphed along the  $x$ -axis, while the cost is the dependent variable and is graphed along the  $y$ -axis. The pairs are always stated as  $(x, y)$ . Find where 1 would be along the  $x$ -axis and slide up from there until you are at about 55 along the  $y$ -axis. Make a mark where these two meet. Continue until you have plotted all the (capacity, cost) pairs.



## Continuous Data

This scatterplot has dots representing the cost and capacity of media players. Would it make sense to connect the dots with a line? Think about what the line would represent. Is it possible to purchase a media device with 71.3 GB? Not likely! You can only buy devices with a specific number of GBs, so the data are not continuous. They must be displayed using individual dots.

In the same way, when graphing the number of pizzas ordered for a party like in Example 1, connecting the dots would be inappropriate, as you cannot order partial pizzas, or have half a person attending a party. On the other hand, the graph above indicating the litres of fuel and time spent driving can be represented using a line, because the values along the line are all valid possibilities. You can have fractions of time and partial litres of fuel. These are continuous data—the data points can be connected with a line, and all values along the line are valid or meaningful.



### Learning Activity 1.3

Complete the following, and check your answers in the learning activity keys found at the end of this module.

#### Part A: BrainPower



You should be able to complete the following eight questions in a few minutes without the use of a calculator or pencil and paper. The first few times you do these questions, your learning partner can help you figure out strategies to solve them.

1. What is the range of the following numbers: 2, 6, 4, 8, 7, 13, 11?
2. You are going to the store to buy a drink with \$2.05 in your pocket. If a drink costs \$1.75, will you be able to buy one?
3. Simplify the fraction  $\frac{6}{2}$ .
4. Write the ratio as a fraction: 5:2.
5. Solve for  $a$ :  $9 + a = 13$ .
6. Write the next two numbers in the pattern: 1, 2, 4, 8, \_\_\_\_\_, \_\_\_\_\_.

*continued*

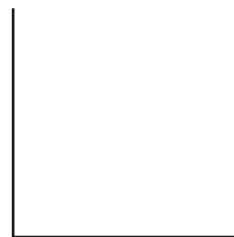
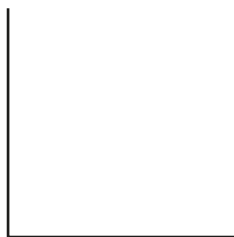
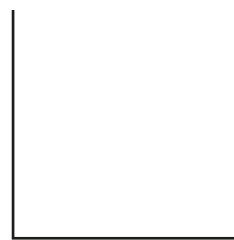
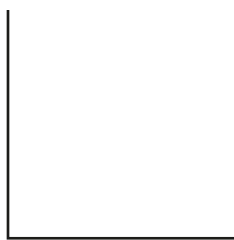
## Learning Activity 1.3 (continued)

7. You want to bring freezies to your last soccer game of the season. You want to have enough so that each player gets two. If you have 18 people on your team, how many freezies do you need?
8. You are helping your dad build a rectangular deck. If it is 2 m long and 3 m wide, what is the area that it takes up in your yard?

### Part B: Independent vs. Dependent Variables and Continuous Data

Remember, these questions are similar to the ones that will be on your assignments, your midterm, and final exams. So, if you were able to answer them correctly, you are likely to do well on your assignments and exams. If you did not answer them correctly, you need to go back to the lesson and learn them.

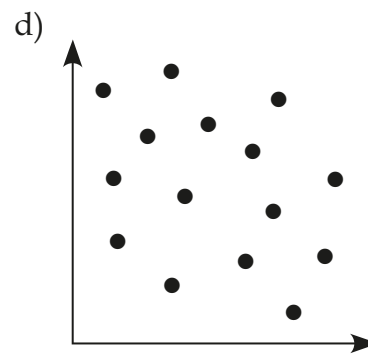
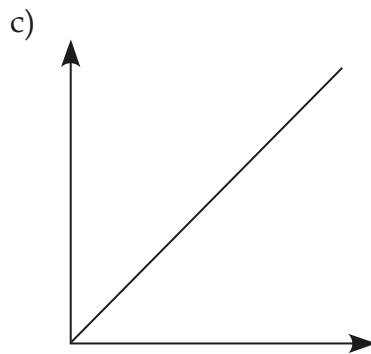
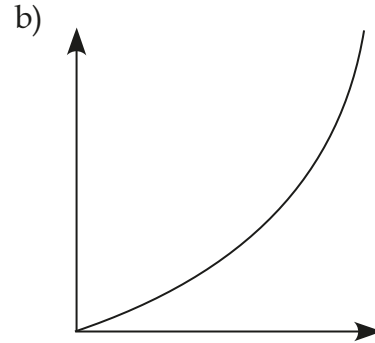
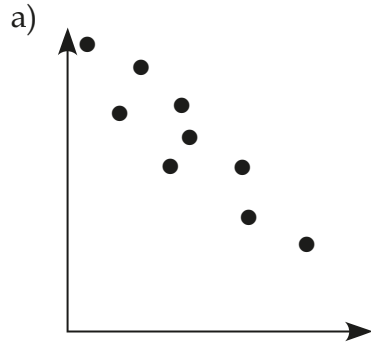
1. State which variable is independent and which variable is dependent in each of the following contexts:
  - a) Hours worked in a week with pay of \$20 per hour
  - b) Final exam mark and average quiz marks for a Grade 10 Math class
  - c) Coffee temperature and the time since the cup was poured
  - d) Average monthly temperature in Manitoba during the months from January to December
2. Are the situations in question 1 continuous? Explain.
3. Sketch a possible graph based on the contexts given in Question 1. Four graph frames are provided below or you may create your own.



*continued*

### Learning Activity 1.3 (continued)

4. Create a possible context that would result in the following graphs. Label each graph with independent and dependent variables, units, appropriate scales (values along the axes), and a title.



5. Construct a good graph of the following data. It may be done by hand on graph paper or with technology.

A random sample of 11 people was drawn from the population of people between the ages of 30 and 40 who were employed full time in Brandon. The number of years of their schooling and annual income in thousands of dollars was recorded for each of the 11 people. The data are given below:

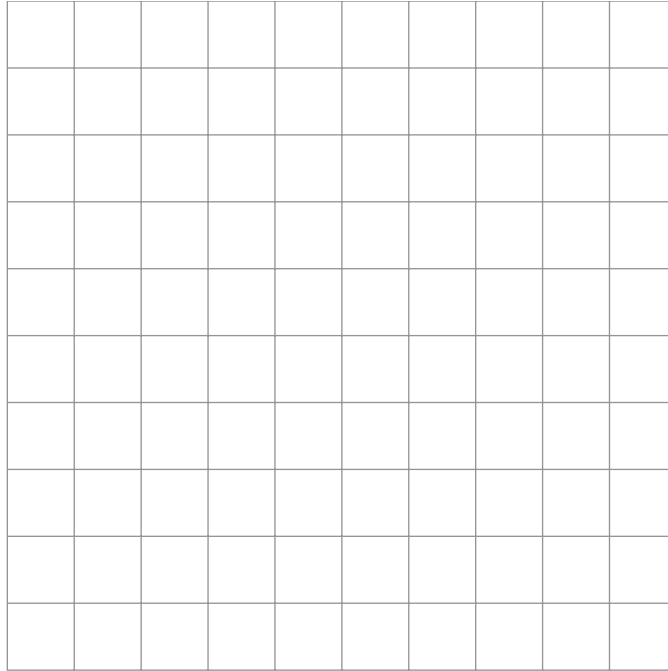
Schooling (years)	10	7	12	11	16	12	18	8	12	14	16
Income (\$1000)	32	20	45	43	65	42	75	28	40	60	65

- a) Which variable, schooling or income, is the independent variable? Which is the dependent variable?

*continued*

## Learning Activity 1.3 (continued)

- b) Graph the data with appropriate scales on the grid below and draw the line of best fit.



- c) Are the data continuous?
- 

## Lesson Summary

Graphs can help you understand data and situations by creating a visual representation of them. You have learned how to create a good scatterplot graph and how to identify continuous data, dependent variables, and independent variables. In the next lesson, you will build on these concepts and look at what linear graphs are, what restrictions there are on the domain and range of the graph, and find other ways to represent relationships between variables.



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