Read and share with your student.

## How to support your student as they learn about Determining Unknown Quantities

Mathematics is a connected set of ideas, and your student knows a lot. Encourage them to use the mathematics they already know when seeing new concepts in this module.

## Module Introduction

In this module your student will learn more about variables and equations. There are 4 topics in this module: Expressions, Equations and Inequalities, Graphing Quantitative Relationships, and Financial Literacy: Accounts, Credit, and Careers. Your student will use what they already know about expressions, patterns, and numeric operations in this module.

## Academic Glossary

Each module will highlight an important term. Knowing and using these terms will help your student think, reason, and communicate their math ideas.

| Term | Estimate |
| :--- | :--- |
| Definition | - To make an educated guess based on the <br> analysis of given data. <br> - Estimating first helps inform reasoning. |
| Questions to Ask <br> Your Student | - Does my reasoning make sense? <br> - Is my solution close to my estimation? |
| Related Phrases | - Predict <br> - Approximate <br> - Expect <br> - About how much? |

Estimate the percentage of the circle graph for each category.


## Math Process Standards

Each module will focus on a process (or a pair of processes) that will help your student become a mathematical thinker. The "I can" statements listed below help your student to develop their mathematical learning and understanding.

Analyze mathematical relationships to connect and communicate mathematical ideas.

## I can:

- identify important relationships in a problem situation.
- use what I know to solve new problems.
- analyze and organize information.
- look closely to identify patterns or structure.
- look for general methods and more efficient ways to solve problems.

Select tools, including real objects, manipulatives, paper and pencil, and technology as appropriate; and techniques including mental math, estimation, and number sense as appropriate, to solve problems.

I can:

- use a variety of different tools that I have to solve problems.
- recognize when a tool that I have to solve problems might be helpful and when it has limitations.
- look for efficient methods to solve problems.
- estimate before I begin calculations to inform my reasoning.

Look for examples of these processes in the Topic Summaries.


## The Carnegie Learning Way

## Problem Types You Will See: Thumbs Up Thumbs Down

## When you see a

## Thumbs Up icon:

- Take your time to read through the correct solution.
- Think about the connection between steps.


## Ask Yourself

- Why is this method correct?
- Have I used this method before?


## Clover

I can determine the unknown number in $8+4=\ldots+5$ by rewriting the expression on the left. I can take I from 8 and give it to the 4 and keep the value of the expression the same.

$$
\begin{aligned}
(8-1)+(4+1) & =\ldots+5 \\
7+5 & =\ldots+5
\end{aligned}
$$

Therefore, the unknown number is 7 .

## When you see a

## Thumbs Down icon:

- Take your time to read through the incorrect solution.
- Think about what error was made.


## Ask Yourself

- Where is the error?
-Why is it an error?
- How can I correct it?


## Rylee

The equals sign tells me to perform the operation on the left in the equation $8+4=-+5$.

$$
\begin{aligned}
8+4 & =12+5 \\
12+5 & =17
\end{aligned}
$$

Therefore, the unknown number is 17 .

## Module Overview

| TOPIC 1 | TOPIC 2 | TOPIC 3 | TOPIC 4 |
| :---: | :---: | :---: | :---: |
| Expressions | Equations and Inequalities | Graphing Quantitative Relationships | Financial Literacy: Accounts, Credit, and Careers |
| 13 Days | 15 Days | 14 Days | 8 Days |
| Your student will use the Order of Operations with numeric expressions to include exponents. | Your student will learn that the equals sign indicates a relationship between two expressions. | Your student will analyze relationships between independent and dependent variables, including nonlinear relationships. | Your student will solve real-world problems focused on financial literacy, including features of checking accounts, debit cards, and credit cards, and learn how education affects career opportunities. |
| Did You Know That? <br> When an expression includes a combination of parentheses, exponents, multiplication, division, addition, and subtraction, the order in which you perform the operation makes a difference in the answer you get. | What In The World? <br> Speed limit signs are designed to communicate a set legal maximum speed that vehicles must travel. Drivers must not exceed the limit that the sign designates. <br> Speed limit signs are examples of inequalities. <br> speed $\leq 55 \mathrm{mph}$ | Did You Know That? <br> Every graph tells a story. <br> a. <br> b. <br> Create a story for each graph. | Did You Know That? <br> Tuition is a fee paid in order to receive instruction at a school. Tuition may be paid through personal savings, student loans, grants, scholarships, or work-study programs. |

## Topic 1: Expressions

| Key Terms |  |  |
| :---: | :---: | :---: |
| - perfect square <br> - perfect cube <br> - evaluate a numeric expression <br> - Order of Operations | - variable <br> - algebraic expression <br> - coefficient <br> - term | - evaluate an algebraic expression <br> - like terms <br> - equivalent |
| To evaluate a numeric expression means to rewrite the expression as a single numeric value. $\begin{gathered} 19-4 \times 3 \\ 19-12 \end{gathered}$ | A variable is a letter or symbol that is used to represent a number. | In an algebraic expression, like terms are two or more terms that have the same variable raised to the same power. <br> no like terms $m+m^{2}-x+x^{3}$ |
| Follow the link to access the Mathematics Glossary: https://www.carnegielearning.com/texas-help/students-caregivers/ |  |  |

## Order of Operations

In this topic, students evaluate numeric expressions, which means to simplify the expression to a single numeric value. There is an Order of Operations, an order in which operations are performed when evaluating any numeric expression.

## Order of Operations Rules

1. Evaluate expressions inside the parentheses or grouping symbols.
2. Evaluate exponents.
3. Multiply or divide from left to right.
4. Add and subtract from left to right.

| Model |  | Expression $3 \cdot(6+4)$ <br> or | Evaluate the expression |  |
| :---: | :---: | :---: | :---: | :---: |
| 6 | 4 |  |  | $3 \cdot(6+4)$ |
|  |  |  | Parentheses first | $3 \cdot(6+4)$ |
| 6 | 4 | $(6+4) \cdot 3$ |  | $3 \cdot 10$ |
| 6 | 4 |  | Then, multiply. | 30 |
|  |  | 3 groups of ( $6+4$ ) |  |  |
|  |  | 3 times the quantity of ( $6+4$ ) |  |  |

There are times when students will see numeric expressions that include both multiplication and division or both addition and subtraction. Remind your student that multiplication and division are of equal importance and evaluated in order from left to right. The same is true for addition and subtraction.

Evaluate each expression using the Order of Operations.

| $-168 \div 2^{3}-3^{3}+20$ |  | $18 \div 2 \cdot 3^{2}$ |  |
| :---: | :---: | :---: | :---: |
| $-168 \div 2^{3}-3^{3}+20$ | Exponents | $18 \div 2 \cdot 3^{2}$ | Exponents |
| $-168 \div 8-27+20$ |  | $18 \div 2 \cdot 9$ |  |
| $-168 \div 8-27+20$ | Division | $18 \div 2 \cdot 9$ | Division |
| $-21-27+20$ |  | 9.9 |  |
| -21-27+20 | Subtraction | 9.9 | Multiplication |
| $-48+20$ |  | 81 |  |
| $-48+20$ | Addition |  |  |
| -28 |  |  |  |



## Variables and Algebraic Expressions

In this topic, students develop their understanding of variables and algebraic expressions. To evaluate an algebraic expression means to determine the value of the expression for a given value of each variable. When you evaluate an algebraic expression, you substitute the given value for the variables and then determine the value of the expression using Order of Operations.

| $h$ | $3 h-2$ |
| :---: | :---: |
| 4 | $3(4)-2=12-2=10$ |
| -2 | $3(-2)-2=-6-2=-8$ |
| $\frac{7}{3}$ | $3\left(\frac{7}{3}\right)-2=7-2=5$ |
| 5.1 | $3(5.1)-2=15.3-2=13.3$ |

## Algebra Tiles

Your student will use algebra tiles and properties of numbers and operations to form equivalent expressions, just as they did in previous lessons with numeric expressions.
Consider the model. Write an addition expression that highlights the different tiles in the model.


$$
2 x+x^{2}+3 x+2 x^{2}
$$

The tiles can be rearranged to combine all the like tiles.


There are now 2 terms in the expression: $x$ and $x^{2}$
The new algebraic expression represented is



## Algebra Tiles and the Distributive Property

Also in this topic, your student will use algebra tiles to multiply expressions.

## MATH PROCESS STANDARDS <br> How do the activities in Expressions promote student expertise in the math process standards?

NOTE: This is an example of the math process standard:

Analyze mathematical relationships to connect and communicate mathematical ideas.

- I can look closely to identify patterns or structure.
- I can look for general methods and more efficient ways to solve problems.

Have your student refer to page 2 for more "I can" statements.

Create a model of an expression using algebra tiles. Then, rewrite the expression using the Distributive Property.

$$
4(2 x+1)
$$

4 times the quantity of $2 x+1$

| $\cdot$ | $x$ | $x$ | 1 |
| :---: | :---: | :---: | :---: |
|  | $x$ | $x$ | 1 |
| 1 | $x$ | $x$ | 1 |
| 1 | $x$ | $x$ | 1 |
| 1 | $x$ | $x$ | 1 |
| $8 x+4$ |  |  |  |

Ask yourself:

- What characteristics of this expression or equation are made clear through this representation?
- How can I use what I know to explain why this works?



## Equivalent Expressions

Students also use tables and graphs to determine if expressions are equivalent. Consider the expressions $2 x+5$ and $2(x+5)$. You can use a table and a graph to determine or verify if the two expressions are equivalent.

| $\boldsymbol{x}$ | $\mathbf{2 x + 5}$ | $\mathbf{2 ( x + 5 )}$ |
| :---: | :---: | :---: |
| 0 | 5 | 10 |
| 2 | 9 | 14 |
| 4 | 13 | 18 |
| 5 | 15 | 20 |

Substitute each value of $x$ into both expressions to determine if they are equivalent.

For $x=0$ :

$$
\begin{array}{cc}
2 x+5 & 2(x+5) \\
2(0)+5 & 2(0+5) \\
0+5 & 2(5) \\
5 & 10
\end{array}
$$

5 does not equal 10 .
The values in the second and third column are different. Therefore, the two expressions cannot be written as the same expression. They are not equivalent.


Because the expressions graph two different lines, the expressions are not equivalent.


## Topic 2: Equations and Inequalities

| Key Terms |  |  |
| :---: | :---: | :---: |
| - equation <br> - Reflexive Property of Equality <br> - solution <br> - Addition Property of Equality <br> - Subtraction Property of Equality <br> - Multiplication Property of Equality | - Division Property of Equality <br> - Symmetric Property of Equality <br> - Zero Property of Multiplication <br> - Identity Property of Multiplication <br> - Identity Property of Addition <br> - graph of an inequality | - solution set of an inequality <br> - bar model <br> - one-step equation <br> - inverse operations <br> - literal equation <br> - inequality <br> - solve an inequality <br> - Properties of Inequalities |
| A solution to an equation is any value for a variable that makes the equation true. <br> The solution to the equation $2 x+4=8$ is $x=2$. | The graph of an inequality in one variable is the set of all points on a number line that make the inequality true. | A bar model uses rectangular bars to represent known and unknown quantities. <br> You can use a bar model to solve the equation $x+10=15$. <br> The top bar can be split into two <br> bars, $x$ and 10 . <br> When this split happens in the bottom bar, with one bar containing 10, it shows that $x$ is the same as 5 , so $x=5$. |
| Follow the link to access the Mathematics Glossary: https://www.carnegielearning.com/texas-help/students-caregivers/ |  |  |

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## Properties of Equality

The Properties of Equality are rules that allow you to maintain balance and rewrite equations.

| Properties of Equality | For all numbers $a, b$, and $c$ |
| :--- | :--- |
| Addition Property of Equality | If $a=b$, then $a+c=b+c$. |
| Subtraction Property of Equality | If $a=b$, then $a-c=b-c$. |
| Multiplication Property of Equality | If $a=b$, then $a \cdot c=b \cdot c$. |
| Division Property of Equality | If $a=b$ and $c \neq 0$, then $\frac{a}{c}=\frac{b}{c}$. |
| Symmetric Property of Equality | If $a=b$, then $b=a$. |

## Using Bar Models to Add

Your student will use bar models to reason about solving one-step addition equations.
Consider the addition equation $14+x=32$.
This equation states that for some value of $x$, the expression $14+x$ is equal to 32 . In other words, some number added to 14 will equal 32. This can be represented using a bar model.

Just like with area models, bar models can be decomposed. The expression $14+x$ can be decomposed into a part representing $x$ and a part representing 14. The number 32 can be decomposed in a similar way: $32=14+18$.

The bar model demonstrates that these two equations are equivalent.

$$
\begin{aligned}
& 14+x=32 \\
& 14+x=14+18
\end{aligned}
$$


$14+x$


Looking at the structure of the second equation, you can see that 18 is the value of $x$ that makes this equation true.

$$
14+x
$$

32

## Using Bar Models to Multiply

Your student will use bar models to reason about solving one-step multiplication equations.
Consider the multiplication equation $3 x=12$.
This equation states that for some value of $x$, the expression $3 x$ is equal to 12 . This can be represented using a bar model.


You can decompose $3 x$ by rewriting it as the equivalent expression $1 x+1 x+1 x$, or $x+x+x$.

To maintain equivalence, decompose 12 in a similar way.
The bar model demonstrates that these two equations are equivalent.

$$
\begin{aligned}
3 x & =12 \\
x+x+x & =4+4+4
\end{aligned}
$$

By examining the structure of the second equation, you can see
 that $x=4$.

Inequalities

Also in this topic, your student will solve inequalities and graph the solutions on number lines. An inequality is any mathematical sentence that has an inequality symbol. To solve an inequality means to determine the solution set, which includes all values of the variable that make the inequality statement true.

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

$$
13<x+11
$$

The inequality can be read as 13 is less than $x$ plus 11 .

| $13<x+11$ | Given |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $13-11<x+11-11$ | Subtract 11 from both sides. | 0 |  |  |  | 7 |  |  |  |
| $2<x$ or $x>2$ |  | 2 is less than $x$. |  |  |  |  |  |  |  |
|  |  | $x$ is greater than 2 . |  |  |  |  |  |  |  |



Your student will also learn that the inequality symbol will stay the same when adding, subtracting, multiplying, and dividing both sides of the inequality by a positive number. However, the inequality symbol reverses when multiplying or dividing both sides of an inequality by a negative number.

For example, solve the following inequalities using the Properties of Inequalities.

$$
\begin{aligned}
x+4 & \geq-9 \\
x+4-4 & \geq-9-4 \\
x & \geq-13
\end{aligned}
$$

The inequality symbol does not reverse since it involves only adding to or subtracting from both sides of the inequality.

$$
\begin{aligned}
\frac{x}{8} & <-7 \\
(8) \frac{x}{8} & <-7(8) \\
x & <-56
\end{aligned}
$$

The inequality symbol does not reverse since it involves multiplying or dividing both sides by a positive number.

$$
\begin{aligned}
-3 x & >-21 \\
\frac{-3 x}{-3} & <\frac{-21}{-3} \\
x & <7
\end{aligned}
$$

The inequality symbol does reverse since it involves multiplying or dividing both sides by a negative number.

The solution to any inequality can be represented on a number line by a ray whose starting point is an open or closed circle. For example, the solution $x<7$ is represented by this number line. Notice that an open circle is used to represent that 7 is not included in the solution. If the inequality $x \leq 7$ was being represented, then a closed circle, or solid black dot, would be used to show that 7 is included in the solution.



## Topic 3: Graphing Quantitative Relationships

| Key Terms |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - discrete graph <br> - continuous graph <br> - dependent quantity <br> - independent quantity <br> - independent variable <br> - dependent variable |  |  |  |  |  |  |  |
| A discrete graph is a graph of isolated points. |  |  |  | A continuous graph is a graph with no breaks in it. |  |  |  |
| Follow the link to access the Mathematics Glossary: https://www.carnegielearning.com/texas-help/students-caregivers/ |  |  |  |  |  |  |  |

## Independent and Dependent Variables

In this topic, your student will match graphs and scenarios, or descriptions. Your student will determine how one quantity depends on another using scenarios, equations, and graphs.

For example, suppose the video kiosk charges $\$ 2.00$ for DVD and game rentals. How many DVDs and games can you rent for different amounts of money?

In this scenario, the independent quantity is the number of rentals, and the dependent quantity is the total cost in dollars. The equation that represents the scenario is $t=2 r$. The independent variable is $r$, which represents the number of DVD and games rented, and the dependent variable is $t$, which represents the total cost.

The independent quantity is plotted on the $x$-axis, and the dependent quantity is plotted on the $y$-axis.


## Using Graphs to Solve Problems

Your student will determine unknown values for a scenario and use the values to write equations.


A graph can be used to determine how many pretzels Nic sold if he collected $\$ 10$.
First, locate 10 on the $y$-axis and draw a horizontal line. This shows that $\$ 10$ is the amount of money collected. The $x$-value of the point where your horizontal line intersects with the graph of $y=1.25 x$ is the number of pretzels sold for $\$ 10$.

Remember, the solution to an equation is any value that makes the equation true. On the graph, a solution is any point on that graph.

The graph shows that Nic sold 8 pretzels and collected $\$ 10$.

## Multiple Representations of Equations

## Equation

$$
d=t+9
$$

$t$ represents the time in minutes, and $d$ represents the distance in miles.

Table

| Time <br> (minutes) | Distance <br> (miles) |
| :---: | :---: |
| 1 | 10 |
| 3 | 12 |
| 5 | 14 |
| 8 | 17 |

Graph
The graph shows the relationship between the distance of a train from the station and the time in minutes.


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## Topic 4: Financial Literacy: Accounts, Credit, and Careers

| Key Terms |  |  |
| :---: | :---: | :---: |
| - checking account <br> - check <br> - statement <br> - account balance <br> - deposit <br> - withdrawal <br> - debit <br> - transfer <br> - overdraft <br> - Annual Percentage Yield (APY) | - debit card <br> - credit card <br> - interest <br> - interest rate <br> - credit report <br> - credit history <br> - credit score <br> - circle graph <br> - post-secondary education <br> - associate's degree | - undergraduate degree <br> - master's degree <br> - vocational school <br> - student loan <br> - tuition <br> - grant <br> - scholarship <br> - work-study program <br> - public school <br> - private school |
| Annual Percentage Yield (APY) is a percentage that is paid to customers based on the account balance in an account for a year. <br> Yvonne opens a checking account with an average monthly balance of $\$ 600$. The account has a $2.5 \%$ APY. $(600)(0.025)=15$ <br> Yvonne will earn \$15 on this checking account over the course of the year. | A check is a written order to a bank to pay a specific amount of money to a person or company out of your checking account. | A circle graph, often called a pie chart, displays categorical data using sectors, or "wedges", of a circle. <br> Favorite Ways to Travel |
| Follow the link to access the Mathematics Glossary: https://www.carnegielearning.com/texas-help/students-caregivers/ |  |  |

## Checking Accounts

Students begin this topic learning about checking accounts, including how to balance a checkbook register, and they compare checking account options from different financial institutions.

| Check | Date | Transaction Description | Payment/ <br> Withdrawal | Deposit | Balance |
| :---: | :---: | :--- | :---: | :---: | :---: |
| 103 | Nov 1 | Electric Company | 72.50 |  | 1227.50 |
|  | Nov 1 | ATM withdrawal: Maple Street | 80.00 |  |  |
|  | Nov 2 | ATM deposit: Elm Street |  | 50.00 |  |

- A withdrawal occurs when money is taken out of the account, usually from a check, online payment, or Automated Teller Machine (ATM).
- A deposit is money put into the account. Deposits may come in the form of cash, checks, or transfers. Paychecks are often deposited directly into a checking account.
- The account balance is the amount of money in the account at a given time.


## Debit Cards versus Credit Cards

Students distinguish between debit cards and credit cards.

| Debit Card | Credit Card |
| :---: | :---: |
| A card that allows a bank's customer to make purchases using money from their account. <br> - Issued by the bank <br> - Generally given to all bank customers when they open a checking account <br> - Funds are taken in full directly from the customer's checking account. <br> - Protected by a security code (PIN, or Personal Identification Number) <br> - Because money is immediately taken out, recovering funds due to fraud or theft may be difficult. <br> - Spending is limited by the amount of money in your account. | A card that allows a person to borrow a certain amount of money and pay the borrowed money back at a later time. <br> - Customer applies for a credit card through a financial company <br> - Money is loaned to the person to cover expenses. <br> - A bill for all purchases charged is sent at the end of the month. <br> - Additional money, based on a percentage of the amount charged, is added to the bill if not paid in full at the end of each month. <br> - Protected by the customer's signature <br> - Customers are protected from fraud or theft. <br> - Often offer rewards for their use <br> - Each card has a limit to the amount that a customer can borrow. |



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## Credit Reports

Your student will learn what a credit report is, how a credit score is determined, and how borrowers and lenders use credit reports. The circle graph below provides a breakdown of the importance of the information in a credit report when determining a credit score.


Paying bills on time and the amount of money owed are the top two factors that affect a credit score.

## Education and Careers

Also in this topic, students will learn that in general, the more education or training you receive, the greater the financial benefit will be. A certain career may require one, two, four, or even eight years of education after graduating from high school.

| Education Level Earned | Financial Benefit |
| :---: | :--- |
| Master's Degree | A person with a master's degree <br> earns approximately 30\% more <br> annually than a person with only an <br> undergraduate degree. |
| Undergraduate Degree | A person with an undergraduate degree <br> earns 84\% more over a lifetime than a <br> person with just a high school diploma. |
| High School Graduate | A high school graduate earns \$350,000 <br> more over a lifetime than a person <br> without a high school diploma. |

College degrees can provide a sense of accomplishment and allow the opportunity to pursue a career in a field of interest. Schooling provides large financial benefits as well.

## Paying for College

Tuition is the fee paid in order to receive instruction at a school. Tuition may be paid in a variety of ways, through personal savings, student loans, grants, scholarships, or work-study programs.

Student Loans
A student loan is money borrowed in order to pay for college or trade school.

## Scholarships

A scholarship is money awarded to a person from the college or a private institution to help a student pay for school.
Scholarships may be academic, athletic, based on financial need, or awarded
from private organizations for a variety of reasons.

## Grants

A grant is money awarded, or given, to a person from the government or school to help pay tuition.

## Work-study Program

A work-study program is a plan set up by the college that allows a student to work while in school to earn money.

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Discuss important dates throughout this module such as assessments, assignments, or class events with your student. Use the table to record these dates and reference them as your student progresses through the module.

| Important Dates |  |
| :---: | :---: |
| Date |  |
|  |  |
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Using the link below, visit the Texas Math Solution Support Center for students and caregivers to access additional resources such as:

- Mathematics Glossaries
- Videos
- Topic Materials
- A Letter to Families and Caregivers

