# Lesson 3: Tools for Building Better Budgets and More

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### **Tips for Being a Successful Online Student**

Finding time to complete your preparation and assignments can be a struggle between work, family, and church responsibilities. By setting a schedule and studying at the same time, you will be able to prioritize your classes. In BYU-Pathway classes, you should expect to spend roughly the same amount of time in each course as you did for the first certificate.

### Budgeting

Budgeting is an essential tool for maintaining financial health. Without a budget, you cannot control your spending or know if you are spending more than you have. Different people have different approaches to budgeting. In order to make any informed decision involving your finances, you must have a budget. Consider the counsel given by President Thomas S. Monson:

“Perhaps no counsel has been repeated more often than how to manage wisely our income . . . Too many in the Church have failed to avoid unnecessary debt. They have little, if any, financial reserve. The solution is to budget, to live within our means, and to save some for the future” (Thomas S. Monson,  Ensign Magazine, Sept. 1986).

In this lesson, you will be learning about some computation tools that can help build a budget. These tools will allow you to carefully monitor the income you receive as well as your expenses. Understanding these tools will be helpful to you, not only in budgeting, but with other aspects of your finances as well.

Step 3 in the Quantitative Reasoning Process is to apply quantitative tools. Applying quantitative tools allows us to do calculations that help us make informed decisions. Some common quantitative tools include percentages and units connected to numbers. Most of the numbers we encounter outside of the classroom come in connection with words and units rather than in disconnected math equations. It is important to be able to translate English words into math symbols to build equations.

### English-to-Math Translations

Understanding how to translate English words into mathematical equations is essential to problem solving. Some common English-to-math translations are found in the following table.

|  |  |  |  |
| --- | --- | --- | --- |
| **English Word** | **Math Symbol** | **English Example** | **Math Example** |
| sum of | $$ + $$ | The sum of seven and nine | $$ 7 + 9 $$ |
| difference of | $$ - $$ | The difference of thirteen and six | $$ 13 - 6 $$ |
| product of | $$ \times \text{or} \cdot $$ | The product of five and two | $$ 5\times2 $$ |
| quotient of | $$ \div \text{or} / $$ | The quotient of eight and four | $$ \frac{8}{4} $$ |
| is (are, was, were, will be) | $$ = $$ | Sixteen is the sum of seven and nine | $$ 16 = 7 + 9 $$ |
| of | $$ \times \text{or} \cdot $$ | Two-thirds of ninety-nine | $$ \frac{2}{3}\times99 $$ |
| per | $$ \div \text{or} / $$ | Ten miles per hour | $$ \frac{10 miles}{hour} $$ |
| percent | divided by 100 (per = divide; cent = 100) | Nine percent | $$ \frac{9}{100} $$ |
| a percentage more than | X (1 + percentage written as a decimal) | Twenty percent more than thirteen | $$ 13\times(1 + 0.20) $$ |
| a percentage less than | X (1 - percentage written as a decimal) | Twenty percent less than thirteen | $$ 13\times(1 - 0.20) $$ |

### Let's look a some examples of converting English words to mathematical symbols.

### English-to-Math Examples

### Example 1

Translate the English words "The sales tax is 6% of the original price" to math symbols.

##### Solution

The key words in this sentence are is, %, and of. By changing is to =, % to division by 100, and of to x, we get:

$$ \text{The sales tax } =\frac{6}{100}\times\text{ the original price.} $$

### Example 2

Translate the English words, "The mortgage on my new home is 10% more than the mortgage on my old home," to math symbols.

##### Solution

 The key words in the sentence are is and 10% more than. Using the information in the table, we change the sentence to

$$ \text{new mortgage=old mortgage}\times(1+0.10.) $$

### Example 3

Translate the English words "The sum of my power bill and my phone bill is 8% of my income" to math symbols.

##### Solution

The key words in the sentence are sum of, is, percent, and of. Using the information in the table, we change the sentence to

$$ \text {power bill}  + \text { phone bill } = \frac{8}{100}\times \text{ income} $$

Once we understand how to translate English words to mathematical symbols, we can use the mathematical equations to do helpful calculations. Here are some examples:

### Solving Examples

### Example 4

The sales tax is 6% of the original price. The original price is $10.00. Find the sales tax.

##### Solution

Knowing that the original price is $10, the equation provides a way to find the sales tax amount (See Example 1).

$$ \text{sales tax }=\frac{6}{100}\times\text{ original price} $$

Since we know the original price is $10, the equation gives us a way to find the sales tax.

$$ \text{sales tax }=\frac{6}{100}\times$10. $$

Now, change the fraction to a decimal:

$$ \text{sales tax }=0.06\times$10. $$

Finally, multiply out the right side of the equation:

$$ \text{sales tax }=$0.60 $$

### Example 5

The sales tax is 6% of the original price. We know the sales tax is $0.90. Find the original price.

##### Solution

Like the previous problem, we start by converting the English sentence to math symbols:

$$ \text{sales tax}=\frac{6}{100}\times\text{original price}  $$

Since the sales tax is $0.90, use that value to solve for the original price.

$$ $0.90=0.06\times\text{original price} $$

Divide both sides of the equation by 0.06 to isolate the original price.

$$ \frac{0.90}{0.06}=\text{original price}  $$

Divide the left side of the equation:

$$ $15.00=\text{original price} $$

### Example 7

After sales tax, the final price of a sweater is 5% more than the price on the price tag. If the final price was $15.25, find the price on the price tag.

##### Solution

Using the same equation as in Example 6:

$$ \text{final price=price tag}\times(1 + 0.05) $$

Since the final price was $15.25, you can substitute the value for the final price and solve the price tag:

$$  $15.25=1.05\times\text{price tag} $$

$$ \frac{$15.25}{1.05}=\text{price tag} $$

$$ $14.52=\text{price tag} $$

### Example 8

Smart shoppers keep track of the regular price of the items that they frequently purchase and wait until they are on sale to buy them. Sometimes, people purchase items that are on sale to keep their expenses within their planned budget.

Suppose you need to purchase a new printer with an original purchase price of $64.99. The sales price is 30% less than the original price of $64.99. Find the sales price and the dollar amount saved.

This example shows there can be more than one way to solve a problem.

##### Solution 1

This sentence translates to the following equation:

$$ \text{sales price}=(1 - 0.30)\times\text{original price} $$

$$ \text{sales price}=0.70\times$64.99 $$

$$ \text{sales price}=$45.49 $$

The total dollars saved would be the difference between the original price and the sales price.

$$ \text{Dollars saved}=\text{original price}-\text{sales price} $$

Substituting the dollar amounts that we know into the math equation yields the following:

$$ \text{Dollars saved}=$64.99-$45.49 $$

$$ =$19.50 $$

##### 

##### Solution 2

You can also say that the savings will be 30% of the original cost. The words in this sentence translate to

$$ \text {savings}=0.30\times\text{original cost}  $$

$$ =0.30\*$64.99 $$

$$ =$19.50 $$

The sales price will be the original price minus the dollars saved.

$$ \text {Sales price}=$64.99-$19.50 $$

$$ =$45.49 $$

### Give It a Try

### Practice Problem 1

Put the choices in the chart below in the correct order to translate the following English sentence to math symbols.

"Thirty percent of the number of girls in the preschool is the sum of the number of boys and the number of teachers."

|  |  |
| --- | --- |
| Thirty percent |  |
| of |  |
| the number of girls |  |
| is |  |
| the number of boys |  |
| sum |  |
| number of teachers |  |

Check your answers.

|  |  |
| --- | --- |
| Thirty percent | 0.30 |
| of | x |
| the number of girls | number of girls |
| is | = |
| the number of boys | number of boys |
| sum | + |
| number of teachers | number of teachers |

### Practice Problem 2

The price of a new pair of shoes is 9% more than the price of a new shirt. If the new shoes cost $24, what is the cost of the new shirt?

Fill in the blank with the correct answer.

$

Check your answer.

The new shirt is $22.02

### Practice Problem 3

A grocery store is offering Roma tomatoes. The sale price is 30% less than the original price. If the original price for one pound of tomatoes is $1.24, how much will you save if you purchase one pound of tomatoes at the sale price?

Fill in the blank with the correct answer.

$

Check your answer.

The savings would be $0.37 (thirty-seven cents).

### Units and Unit Conversions

The units connected to a number tell you what the number counts or measures. Here are some examples.

### Practice Problem 4

**Scenario:**Tuition and books are about $2,000 every semester.

Identify the units in this scenario:

Dollars per semester

Number of books

Semesters

Semesters per dollar

Dollars

### Practice Problem 5

**Scenario:**The exchange rate to convert American dollars to Mexican pesos.

Identify the units in this scenario:

Pesos per dollar

Dollars per peso

Dollars

Pesos

Pesos times dollars

Sometimes you will need to convert an amount of something with one unit to an equivalent amount expressed with different units. You want to change the way you express things so that the actual amount or quantity stays the same even when the units change.

### Example 9

The race car drove 42,000 meters in five minutes. Find how fast it was traveling in kilometers per hour.

##### Solution

To calculate the speed of the car, you need to find the kilometers per hour or distance per time. The word per tells you that you need to divide the distance by the time.

$$ \frac{42000 \text{ meters}}{5\text{ minutes}} $$

You will need to change the units, but the distance the car traveled should not change. You will just be expressing them using different units. To change the units, you will use the multiplicative identity property. This means that when you multiply a number by 1, the quantity remains the same and the answer remains the same as well.

60 minutes = 1 hour. Even though the numbers are different and the units are different, the quantity of time is exactly the same. If you write this equality relationship as a fraction, it looks like this:

$$ \frac{60\text { minutes}}{1\text { hour}}=1. $$

You can reverse the numerator and denominator as shown here:

$$ \frac{1\text { hour}}{60\text { minutes}}=1. $$

This relationship is known as a unit conversion rate. To change units from minutes to hours, do this:

$$ \frac{42000 \text{ meters}}{5 \text { minutes}}\times\frac{60 \text { minutes}}{1 \text { hour}} $$

When you multiply two fractions, you multiply the two numerators and then multiply the two denominators to get the product of the fractions.

$$ \frac{42000 \text{ meters} \times 60 \text { minutes}}{5 \text { minutes}\times1 \text { hour}}. $$

You have the units “minutes”/“minutes” which is equal to 1. Cancel the unit “minutes” in the numerator and in the denominator since multiplying by 1 does not change the quantity of time.

$$ = \frac{42000 \text{ meters}\times 60}{5 \times 1 \text { hour}} $$

$$ = \frac{2520000 \text{ meters}}{5 \text{ hour}} $$

$$ =\frac{504000 \text{ meters}}{1 \text { hour}} $$

The time unit is correct, so you only need to change the distance unit from meters to kilometers. There are 1,000 meters in 1 kilometer, so you will use one of the following as the unit conversion tools:

$$ \frac{1 \text{ kilometer}}{1000\text{ meters}} \text{or} \frac{1000\text{ meters}}{1 \text{ kilometer}} $$

Because “meters” is in the numerator of the fraction that needs to change, you will want to make sure that “meters” is in the denominator of the unit conversion tool. This way you have “meters”/ “meters” and you can cancel the unit “meters.”

$$ =\frac{504000 \text { meters}}{1 \text{ hour}}\times\frac{1\text{ kilometer}}{1000\text{ meters}} $$

$$ =\frac{504000 \text{ meters}\times 1\text{ kilometer}}{1\text{ hour}\times1000\text{ meters}} $$

$$ =\frac{504000\text{ kilometers}}{1000 \text{ hour}} $$

$$ =\frac {504\text{ kilometers}}{1\text{ hour}} = 504 \frac{\text { kilometers}}{\text { hour}} $$

The race car was traveling at a speed of 504 kilometers per hour.

### Practice Problem 8

The school bus traveled at 25 mph. **Choose all of the correct** unit conversion rates needed to be able to find the speed of the school bus in feet per second.

What are your conversion rates?

5280 feet/1 mile

60 minutes/1 hour

1 hour/60 minutes

1 mile/5280 feet

60 seconds/1minute

1 minute/60 seconds

### Practice Problem 9

The price of gasoline in Italy is 1.45 euros per liter. **Choose all of the correct** unit conversion rates needed to be able to find the price of gasoline in Italy in US dollars per gallon.

What are your conversion rates?

1 US dollar/0.92 euros

60 minutes/1 hour

1 euro/1.09 US dollars

3.79 liters/1 gallon

60 seconds/1 minute

1 gallon/3.79 liters

### A Sample Budget

Here is a real-world example that shows how the tools you have learned in this lesson can be used as part of the Quantitative Reasoning Process.

#### 1. Understanding the Problem

Carolina is a BYU-Idaho student who has not been using a budget. On a recent visit to a restaurant with her friend, Carolina realized she did not have enough cash to pay for her meal. Her roommate kindly paid for her meal, but Carolina was embarrassed. Carolina decides that she has to improve her finances and begins by creating a budget.

#### 2. Identify Variables & Assumptions

#### Key Variables

Here are two ways of understanding a budget:

1. A budget is a mathematical model of your finances.
2. A budget is an itemized financial plan that estimates your income and expenses over a specified period of time.

In order to create and use an effective budget, you need to know two essential things:

1. **Income:** The amount of money you have coming in.
2. **Expense:** The amount of money you have going out.

Income and expenses are key variables in a budget. Another variable is the time frame of your individual budget. If your budget tracks your finances for a month, the term to describe the difference between your monthly income and monthly expenses is **net monthly cash flow**.

Sometimes you need to change the time frame for expenses or income in budgeting. People usually find monthly budgets most practical, but sometimes it's better to focus on weekly, yearly, or even a semester for college students. To effectively manage your budget, it's recommended to use the same time frame for both income and expenses. Adapting your budget to different time periods and helps you manage your finances effectively.

You may need to convert income or expenses from weekly to montly to yearly by multiplication or division.

#### Assumptions

To create her budget, Carolina has to make assumptions about her income and her expenses. In her case, she makes the following assumptions:

* Her only income will be from her part-time job. This is an obvious assumption. Carolina cannot count on receiving any unexpected income.
* Her pay rate at her part-time job will stay the same. Carolina is not in line for a promotion or a raise. Only something unexpected might change her salary.
* Her expenses will be fairly constant each month. Carolina makes this assumption with the understanding that there may be unexpected expenses.

### 3. Apply Quantitative Tools

Carolina needs to identify how much money she is spending and how much money is coming in.

#### Carolina's Income

Carolina works for 20 hours each week. Her job pays $11.90 per hour. Carolina uses the following unit conversion to compute her total monthly income.

$$ \frac{$11.90}{1\text{ hour of work}}\times\frac{20\text{ hours of work}}{1\text{ week}}\times\frac{4\text{ weeks}}{1\text{ month}} $$

Notice that the “hours of work” unit and the “weeks” unit will divide to be 1, so the units will be left as dollars ($) per month. When Carolina multiplied the top of the fractions and the bottom of the fractions, she got

$$ $952 \text{ per month} $$

#### Carolina's Expenses

Carolina pays 10% of her income for tithing each month. Based on her past spending, she estimates her expenses:

* $60 dollars a week for groceries
* $1620 a year on car repairs
* $500 a month on rent
* Every other Saturday, she spends $25 for dinner and a movie with friends

The following table summarizes her monthly expenses.

|  |  |  |
| --- | --- | --- |
| **Carolina's Expenses** | **Time Conversions** | **Monthly Expense** |
| Tithing | $$ 0.10\times$952 \text{ per month} $$ |  |
| Groceries | $$ $60/\text{ week}\times4\text{ weeks}/1\text{ month} $$ | $$ $240/\text{ month} $$ |
| Car Repairs | $$ $1620/\text{ year}\times 1\text{ year}/12 \text{ months} $$ | $$ $135/\text{ month} $$ |
| Rent | No time conversion needed | $$ $500/\text{ month} $$ |
| Entertainment | $$ $25/2 \text{ Saturdays}\times 4 \text{ Saturdays}/1 \text{ month} $$ | $$ $50/\text{ month} $$ |
|  | **Total Monthly Expenses** | $$ $1020.20/\text{ month} $$ |

### 4. Make an Informed Decision

After doing her calculations, Carolina realizes that she is spending more money than she is making. Her net monthly cash flow is

$$ $952-$1020.20 = -$68.20 $$

It is clear that Carolina needs to increase her income or decrease her expenses.

Carolina knows that she can’t get more hours at work and doesn’t have time to work another job. Therefore, her best option will be to cut her expenses. She decides to make the following changes:

* Decrease the amount she spends on groceries per week to $50.
* Cut her entertainment spending down to $20 per month.

When she redoes the calculations, she gets the following result:

|  |  |  |
| --- | --- | --- |
| **Carolina's Expenses** | **Time Conversions** | Monthly Expense |
| Tithing | $$ 0.10\times$952 \text{ per month} $$ | $$ $95.20/\text{month} $$ |
| Groceries | $$ $50/\text{ week}\times4\text{ weeks}/1\text{ month} $$ | $$ $200/\text{month} $$ |
| Car Repairs | $$ $1620/\text{ year}\times1\text{ year}/12\text{ months} $$ | $$ $135/\text{month} $$ |
| Rent | No time conversion needed | $$ $500/\text{month} $$ |
| Entertainment | No time conversion needed | $$ $20/\text{month} $$ |
|  | **Total Monthly Expenses** | $$ $950.20/\text{month} $$ |

Carolina realizes that by reducing her expenses to be less than her earnings, she is put in a much better financial situation.

Once you have used the computational tools to understand and calculate your expenses and income, you put yourself in a better position to interpret the information and make an informed decision about how you want to spend your money. You can set budgeting goals and then track your spending to see if you are meeting those goals.

President N. Eldon Tanner of the Quorum of the Twelve stated, “I’m convinced that it is not the amount of money that an individual earns that brings peace of mind, as much as having control of your money” (N. Eldon Tanner,  General Conference, October 1979).

### 5. Evaluate Your Reasoning

Now that Carolina has made a decision about her budget, she needs to take some time to reflect upon and evaluate her decision. She should ask herself these questions:

* Is her budget reasonable?
* Will she be able to stick to the smaller entertainment budget?
* Are her assumptions appropriate and reasonable?

It will also be helpful for Carolina to reflect and evaluate her budget after using it for a few months. Having experience living by the budget will help her determine that the decisions she makes are effective. It is likely she will find areas where her budget needs to be adjusted.

### Practice Problem 10

The Garcia family takes home $42,000 a year. They donate 12% of their take-home pay in tithing and other charitable donations. They spend $180 dollars a week for groceries, $5,700 a year on car payments, and $60 a week for gas and car repairs. Their mortgage payment is $1,260 a month. They spend $3,600 a year traveling to visit family, and $125 each month for entertainment.

Prorate the Garcia's income and expenses to create a model for their current monthly budget. Assume that each month consists of 4 weeks. Complete the spreadsheet below.

**Garcia Family Monthly Budget**

|  |  |
| --- | --- |
| **Category** | **Budget** |
| Tithing and Donations |  |
| Groceries |  |
| Car Payments |  |
| Gas and Car Repairs |  |
| Mortgage |  |
| Travel |  |
| Entertainment |  |

Check your answer.

|  |  |
| --- | --- |
| **Category** | **Budget** |
| Tithing and Donations | $420 |
| Groceries | $720 |
| Car Payments | $475 |
| Gas and Car Repairs | $240 |
| Mortgage | $1260 |
| Travel | $300 |
| Entertainment | $125 |

### Practice Problem 11

The Garcia family takes home $42,000 a year. Compute their monthly income and total monthly expenses.

**Garcia Family Monthly Budget**

|  |  |
| --- | --- |
| **Category** | **Budget** |
| Tithing and Donations | $420 |
| Groceries | $720 |
| Car Payments | $475 |
| Gas and Car Repairs | $240 |
| Mortgage | $1260 |
| Travel | $300 |
| Entertainment | $125 |

Monthly Income = $

Monthly Expenses =

$

Check your answers.

Monthly Income = $3,500

Monthly Expenses = $3,540

### Practice Problem 12

We found that the Garcia family has a take-home income of $3,500 per month and a monthly budget of $3,540 per month.

**Garcia Family Monthly Budget**

|  |  |
| --- | --- |
| **Category** | **Budget** |
| Tithing and Donations | $420 |
| Groceries | $720 |
| Car Payments | $475 |
| Gas and Car Repairs | $240 |
| Mortgage | $1260 |
| Travel | $300 |
| Entertainment | $125 |

What would you suggest to help the Garcia family?

### Conclusion

Are you using a budget? If not, we encourage you to apply the Quantitative Reasoning Process to your personal situation. If so, then now might be a good time to reevaluate your budget and determine if there are improvements that can be made. Living on a budget can help improve your financial situation, no matter how much money you have. As Barbara B. Smith, former General Relief Society President said, “Living on a budget is not a chore. It need not even be a deprivation. Budgeting should be a great learning experience.” (Sister Barbara B. Smith, General Relief Society President,  General Conference, April 1981).

### Lesson Checklist

By the end of this lesson, you should be able to do the following:

* Understand the mathematical meaning of keywords such as per, of, is, more than, and less than.
* Identify the units involved in solving a problem.
* Use appropriate units and unit conversions to solve a problem.
* Solve problems using percentages.
* Create a monthly budget by using unit conversions to prorate costs.

### **Be Joyful**

There are so many demands on our time that it can be hard to decide what to prioritize. Elder M. Russell Ballard (2019), a modern-day prophet, taught about the joy and blessings that come from putting God first. “Living the true, pure, and simple gospel plan will allow us more time to visit the widows, widowers, orphans, lonely, sick, and poor. We will find peace, joy, and happiness in our life when serving the Lord and our neighbors.” As you work to balance your time between school, work, and other commitments, don’t forget to take some time to serve others and then watch to see what blessings come to you.

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