This course of study presents the required sequence of learning steps and activities to help you develop competence in the subject area of Specific Teaching Practices: Mathematics Teaching Topics. This course of study may take up to three weeks to complete depending on your educational background, work experience, and the time you are able to dedicate to your studies. Consult with your mentor if you wish to accelerate through this course of study. Your competence will be assessed as you complete a series of performance tasks (DNT2) and then again on an objective assessment (AYC1 or AYC2), covered by another course of study. The tasks are listed in this course of study at the point in which you should have covered the learning necessary to build the necessary competence to successfully complete the task. Once all tasks are completed at the appropriate level of competence, you will receive a "Pass" on your Degree Plan for the Specific Teaching Practices: Mathematics Teaching Topics assessment.

Introduction

Welcome to Specific Teaching Practices: Mathematics Teaching Topics! This is one of the four assessments that focus on the pedagogy of mathematics. As such, it focuses on how to teach the specific subject area of mathematics. You will now extend and apply that which you have learned about teaching in general to teaching math. Be prepared to develop yourself as a teacher and go beyond your current practices. The knowledge you develop will help you improve as a mathematics teacher.

You have already studied elements of mathematic pedagogy, and now you have an opportunity to add to that knowledge and make it more practical by designing lessons and activities that incorporate best practices of math teaching. DNT2 Specific Teaching Practices: Mathematics Teaching Topics is a performance assessment that focuses on the construction of original lesson plans using appropriate research-based, age-specific pedagogies. This course of study includes tasks covering geometry teaching, equivalence, proportional reasoning, problem solving, probability, and the use of appropriate justifications within pedagogy. Completing these tasks will allow you to practice applying the knowledge and skills necessary to being a successful mathematics teacher. As you engage in these materials, visualize yourself as a math teacher, anticipate questions your students might ask, and be sure to reflect upon how you would go about answering them.

Be a Successful Mathematics Teacher

Whether you are initiating, changing, or expanding your career, what you learn throughout your mathematics program will help you internalize your skills and abilities and transfer your love and knowledge of math to your students in the classroom.

- **Get the Tools You Need**: Enroll in Teaching Mathematics Grades 5-12 from the course of study.
- **Build Your Motivation and Confidence**: If you are not already a teacher of record with your own classroom, spend time substituting and tutoring in schools. Get to know firsthand the challenges and joy of working with young students. As a teacher, you will
need to know how to help your students learn and demonstrate competence in math. If you are interested, view videos to help you develop confidence in your abilities.

- **Apply Math to the Real World**: Enjoy learning how to apply your knowledge and skills. From consumer math to calculus, most students want the question "why do I need to know this?" answered. The texts and resources that you will have in your mathematics programs are rich with applications. Do not skip them. People come to math with different strengths and approaches. Building upon what you already know through your real-life experiences will inspire and enhance your creativity in teaching.

- **Maximize Your Time**: Test your prior knowledge. WGU allows candidates, under certain conditions, to accelerate through the program. This course of study has pacing suggestions to keep you on track with SAP. However, if you already have mastered the concepts and can move faster, please do so. Set goals, make a plan, and reward yourself often. Getting a degree is challenging, so make a plan that works for you.

**Competencies**

This course of study covers the following competency:

**Competency: Teaching Methods-Mathematics (Secondary)**
The graduate provides effective, research-based mathematics curriculum instruction.

**Required Learning Resources**

- Teaching Mathematics Grades 5-12 from Pearson. Enrollment in this resource provides you with access to the following e-texts:

**Teaching Dispositions Statement**
Please review the [WGU Statement of Teaching Dispositions](#).

**Preparing for Success**

To successfully complete Specific Teaching Practices: Mathematics Teaching Topics, you need the appropriate resources to help with your learning. You should also prepare a calendar to schedule time devoted to your studies. Share your calendar with family and friends so they are aware of your obligations.

**Acquire Learning Resources**
Arrange to obtain the learning resources listed in the "Required Learning Resources" section so there will be no delay in your studies. These items are essential for you, as this document will
guide you in the use of these materials.

Enroll in Teaching Mathematics

**URL:** [http://www.coursecompass.com](http://www.coursecompass.com)

Enroll in the Teaching Mathematics Grades 5-12 learning resource found in your Degree Plan.

1. Click on the "Learning Resources" tab. Click "Show Sections" next to "Teaching Math Grades 5-12," and a new window will open.
2. Click "Enroll Now." Once your mentor approves the enrollment, you will be sent a registration e-mail within 30 minutes of that approval.
3. Your registration e-mail will contain a personalized access code, course ID, and instructions on how to create and access your account.
4. The multimedia textbooks are free and contain videos, practice problems, and quizzes. After enrolling in this course, you will be e-mailed access information to the "Pearson CourseCompass" website. You will be sent a link to the site with your username and password. When you log in to this website, you will access the "Teaching Math Grades 5-12" resource, e-books, MyEducationLab, and practice tests.
5. Menus will appear that will allow access to supplemental resources for all textbook chapters. These resources include a "Summary," "Weblinks," "Web Activities," "Review Questions," and "Practice Test" for each chapter. You are encouraged to explore all of the relevant content provided by this website as you read through the required reading for each task for this assessment. Such exploration should serve to enrich your responses within this assessment.

*Note: The resources you are using to master the competencies for this assessment will also be valuable to you as you prepare for future assessments and as you develop lesson plans to be used in your classroom in the future. Therefore, it is highly recommended that you complete each activity contained in this document.*

**Request the DNT Assessment**

**URL:** [http://www.taskstream.com](http://www.taskstream.com)

If you and your mentor have decided that you should attempt this assessment in this term, then you should go ahead and schedule it. Once your mentor has approved your request, our Assessment Delivery Team will open the tasks in TaskStream. You will log in to TaskStream to receive the instructions, see the rubric, and submit your tasks for grading. Follow these steps to schedule the assessment:

1. Log in to your MyWGU Student Portal.
2. Go to the "My Degree Plan" tab.
3. In the list below "Course Details," find the assessment you are working on.
4. In the "Assessment Scheduled Date" column, click "Schedule Now."
5. A new window will come up. If there are other considerations you would like to inform the Assessment Delivery Team about, discuss them in the "Other Considerations" box that appears and then click "Continue." If not, simply click "Continue."
6. A request will be sent to your mentor for approval.

7. Once your mentor has approved your request, our Assessment Delivery Team will open the tasks required for the assessment in TaskStream. You will log in to TaskStream to receive the instructions, see the rubric, and submit your assessment for grading.

**Using the Message Board**

In the lower right-hand corner of the course of study screen there is a message board area. Throughout your studies, you will want to follow the questions, observations, and responses of the other students and the expert advice of the course mentor. If you have questions of your own, do not hesitate to use this resource to get those answered as you develop your competence.

Get into the habit of visiting the message board on a regular basis. Read the posts covering the topics you are studying. Post your ideas about the topics as well as any questions you have. Where other students have posted questions, feel free to reply with any answers or information you have to contribute. This is important for the development of your competence in this course of study.

Take advantage of the learning opportunities through communication with your course mentor and other students. This is a way to ask questions and get concepts clarified by your peers and by the course mentor. Watch for announcements of web conferences and other opportunities to meet your peers online. You can learn substantially more when working with others than you can learn in isolation.

**Best Practices Tool: Get a Study Notebook**

It is suggested that you create a paper or digital notebook for your study notes as you go through this course of study. Use organizers or dividers to separate your work. You may want to include a glossary, study notes, topics to revisit, and helpful websites.

One of the features of the web-enabled course of study is a "Notes" element in the lower right-hand navigation area. This feature allows you to keep notes organized by topic. You should get into the habit of using it throughout the course of study. You have the ability to take these notes online through the web-enabled course of study.

A notebook makes your learning more active. It also provides an excellent source of important materials to review prior to demonstrating your competence through the assessment. Whenever prompted throughout this course of study to reflect upon what you have learned, record your answers, thoughts, and reactions in your notebook.

**Classroom Lesson Planning Overview**

You will now begin to explore how to design lesson plans for mathematics classrooms. How will you teach math? Will you be able to spark student interest? Will you be able to keep their attention? How will you do this? Keep in mind all that you have learned previously about how students learn. Recall how to design appropriate lesson plans; how to sequence activities properly; how to anticipate potential student difficulties; and how to recognize when remediation
may be necessary. All of the knowledge and skills that you have already learned still apply. Now, however, you will begin to apply these more general pedagogical skills in a math classroom.

Competencies covered by this subject
602.5.1 - Teaching Methods-Mathematics (Secondary)
The graduate provides effective, research-based mathematics curriculum instruction

Lesson Planning Overview
You will start by reviewing how to design a good lesson plan with the focus now on what characterizes such a mathematics lesson plan. As you engage in the materials, ask yourself how what you are now learning aligns to that which you already know and, perhaps more importantly, how it differs. Do the texts' authors make any provocative statements? What characterizes their teaching philosophy? Do you agree with that philosophy? Why or why not?

Challenge of Teaching

Read chapter 1 ("The Challenge of Teaching") in Teaching Secondary Mathematics.

Read through the "Enrichment Units" found in Teaching Secondary Mathematics as you seek ideas for how or what to teach. The cross-catalogue of units might be helpful in identifying activities you could choose to incorporate into your lesson plan.

Reflect upon the teaching strategies you are learning. Be sure to include the appropriate state and national standards to which your lesson aligns. Be sure to document your thoughts in your study notebook or post them to the message board for this topic.

Long-Range and Short-Range Planning

Read chapter 2 ("Planning for Instruction") in Teaching Secondary Mathematics.

Can you effectively distinguish between a prerequisite skill and the one that follows? Are you sure that students understand the prerequisite skill? How can you ascertain whether or not they have grasped the concept or mastered the skill? Why do you think that it is important for students to understand prerequisite skills before moving on?

If you can make this a fun lesson, it is predicted that students will be much more likely to be engaged. If you were to implement the lesson plan you created, would your students have fun? How will you construct the desired classroom dynamic so that students enjoy learning?

Geometry Brainstorming

What are ways in which you can help students to discover, develop, and derive the formula for a selected geometric figure? In what ways can you help students construct their own understandings of the desired content and skills?
The best geometric derivations are those that place students in a position to use prior understandings to derive new ones. Typically, students learn about simple geometries, such as rectangles and triangles, before learning about more complex quadrilaterals (e.g., parallelograms, trapezoids, etc.). Can you identify any of the indicated simpler geometries within the parallelogram shown below?

![Simpler Geometries](image)

What prior knowledge may eighth graders have with regard to the derivation of area formulas for such simple geometries? Can you create a lesson plan that builds upon this prior knowledge? Review some of these additional resources that may prove useful as you engage in this activity.

**Geometric Thinking and Geometric Concepts**

Read chapter 20 ("Geometric Thinking and Geometric Concepts") in *Elementary and Middle School Mathematics*. Should you desire a more comprehensive exploration of selected topics, it is recommended that you look through the "References" section in *Teaching Secondary Mathematics*, for this section will provide you with many sources of additional information. Keep this in mind while you work on each of the tasks associated with this assessment.

**Geometry Lesson Planning Videos**

**URL:** [http://www.coursecompass.com](http://www.coursecompass.com)

After you log in to the "Teaching Mathematics Grades 5-12" website, click on the "Teaching Math Resource" link found on the left-hand side of the page. Then click on the "Case 1" link and review all of the material that is provided within this topic. This series of links presents you with snippets of video from a real-world geometry class in action and then asks you to reflect upon various aspects of what you saw in the video.

**Lesson Plan Examples**

**URL:** [http://illuminations.nctm.org/LessonDetail.aspx?ID=U160](http://illuminations.nctm.org/LessonDetail.aspx?ID=U160)

This website provides several examples of lesson plans that have been constructed to help students discover the area formula for a variety of selected geometric figures. This website should get you thinking about how to begin planning to teach a geometry lesson.

**National and State Mathematics Standards**

**URL:** [http://www.taskstream.com](http://www.taskstream.com)

TaskStream provides tools that will allow you to identify national and state mathematics standards. You should be able to make connections between such standards and the lesson plans that you construct. To access these tools, log into TaskStream, click on "Standards Manager" (under "Resources"), and then click "Browse Standards." You now can either choose
"View State Standards" or "View U.S. National Standards" and then proceed to explore the desired standards. Teachers must be able to make connections between the lessons that they construct and the corresponding standards. Be sure to include relevant state and national standards whenever prompted to do so.

**Exploring What It Means To Know and Do Mathematics**

Read chapter 2 ("Exploring What It Means To Do Mathematics") in *Elementary and Middle School Mathematics*.

This reading will help set the stage for making connections between what you have learned about general pedagogy and what you are about to learn in this domain.

**Geometry Study Notebook Activity**

In this study notebook activity, you will need to construct an original lesson plan using appropriate research-based, age-specific pedagogies that infuse selected mathematics topics from geometry. Note: You will not submit this activity in TaskStream.

In your study notebook, create an original lesson plan (for one class period) to teach eighth grade students to discover a formula to find the area of a parallelogram. Use the lesson plan template found at this link for this and for all other tasks found in this assessment: https://web5.wgu.edu/aap/content/lesson%20plan%20format.rtf

How can you include the ideas you just learned in order to make an interesting, pedagogical lesson covering the formula for the area of a parallelogram? Can you design activities that allow students to discover the formula without giving it to them directly? What manipulations or technologies might you employ? Why would you use them—that is, what is your rationale for using them? Consider these questions as you complete the activity.

**Teaching Equivalence**

After engaging in the activities in this section, you will construct an original lesson plan using appropriate research-based, age-specific pedagogies that infuse selected mathematics topics that focus on equivalent relationships. In the lesson, you will be able to

- describe how to teach the concept of equivalence when working with fractions that have unlike denominators,
- infuse selected mathematics models (e.g., area/region model, length/set model) to help students understand mathematics that they might otherwise simply memorize and apply, and
- construct a learning dynamic that has students discover, develop, derive, and conceptually understand the equivalent fraction algorithm.

Competencies covered by this subject

602.5.1 - Teaching Methods-Mathematics (Secondary)
The graduate provides effective, research-based mathematics curriculum instruction.

**Equivalence**
One of the goals of this section is to develop an original lesson plan in which students will derive the equivalent fraction algorithm. You will need to teach your students to manipulate and work with two models that show fraction equivalency: one area/region model and one length/set model.

What are some ways that you can help students discover, develop, and derive concepts related to fraction equivalency? What does it mean for two or more fractions to be equivalent? What connections can you make between the concept of fraction equivalency and the concept of ratios and proportions? What area and length models can you use to demonstrate fraction equivalency? What is an algorithm? What is an equivalent fraction algorithm?

Algebraic Thinking and Developing Fraction Concepts

Read chapters 14 ("Algebraic Thinking: Generalizations, Patterns, and Functions") and 15 ("Developing Fraction Concepts") in Elementary and Middle School Mathematics.

Reflect upon what you have just read. Interact with other students studying these topics via the message board. See what others have written, post responses to questions posed, or ask questions of your own. As you engage in the material, think about what you consider to be the most interesting fact(s) presented. Record your reflections in your study notebook.

Algorithm

Look up the term algorithm and try to make the appropriate connections to the term equivalent fraction algorithm. Interact with other students studying these topics via the message board. See what others have written, post responses to questions posed, or ask questions of your own. As you engage in the material, think about what you consider to be the most interesting fact(s) presented. Record your reflections in your study notebook.

Study Notebook Activity: Equivalence Lesson Plan

Using the lesson plan template you used in the prior study notebook activity, develop an original lesson plan for teaching students to manipulate and work with two models that show fraction equivalency: one area/region model and one length/set model. Have students discover, develop, and derive an equivalent fraction algorithm. Note: You will not submit this activity in TaskStream.

Teaching Proportional Reasoning

In the previous task, you explored the relationship between ratio, proportion, and fraction equivalency. Equivalent fractions are a special type of proportion. In this task, you will need to identify the relationship between the concept of ratios and proportions and percentages. Reflect upon and record your responses to the following questions:

- What is a ratio?
- What is a proportion?
- How do you compute a percentage?
- What connections can you make between the concept of ratios and proportions and percentages?
What is an algorithm?
What is the cross-product algorithm?
What models (e.g., line segment) can you infuse within pedagogy to teach students about the cross-product algorithm?

After engaging in the material and completing the activities in this section, you will be required to construct an original lesson plan using appropriate research-based, age-specific pedagogies that infuse selected mathematics topics that focus on proportional reasoning. You will be able to

- describe how to use proportional reasoning with percentage problems;
- infuse selected mathematics models (e.g., line segment model) to help students understand mathematics that they might otherwise simply memorize and apply;
- construct a learning dynamic that has students explore three types of percentage problems: (1) part unknown, (2) percent/fraction unknown, and (3) whole unknown; and
- construct a learning dynamic that has students discover, develop, derive, and conceptually understand the cross-product algorithm.

Think about these bullet points as you read and reflect on the chapters assigned.

Competencies covered by this subject
602.5.1 - Teaching Methods-Mathematics (Secondary)
The graduate provides effective, research-based mathematics curriculum instruction.

**Ratios, Proportions, and Percentages**

Using the lesson plan template, you will need to design an original lesson plan to teach proportional reasoning when solving percent problems in grades 5-8. In your lesson plan, include activities that will promote the understanding of the cross-product algorithm via concept-based approaches (e.g., a line segment model) and three types of percentage problems (part unknown, percent/fraction unknown, and whole unknown).

**Teaching More Effective Lessons**

Read chapter 3 ("Teaching More Effective Lessons") in *Teaching Secondary Mathematics*.

Read chapters 17 ("Decimal and Percentage Concepts and Decimal Computation") and 18 ("Proportional Reasoning") in *Elementary and Middle School Mathematics*.

Brainstorm ways in which you can help students to discover, develop, and derive concepts related to proportional reasoning. In what ways can you help students construct their own understandings of the desired content and skills?

**Study Notebook Activity: Teaching Ratios, Proportions, and Percentages**

The practical applications of ratio, proportion, and percent in real-world situations are so numerous that students need to acquire the ability to perceive and determine relationships between these concepts.

1. Using the same lesson plan template that you used during the last homework activity,
design an original lesson plan to teach proportional reasoning when solving percent problems in grades 5-8.

2. In your lesson plan, include activities that allow for the following experiences:
   1. Students discover, develop, derive, and conceptually understand the cross-product algorithm via conceptually-based approaches, such as the line segment model.
   2. Students explore three types of percentage problems: (1) part unknown; (2) percent and fraction unknown; and (3) whole unknown.

Write up this lesson plan in your study notebook. Be sure to include supporting details and appropriate activities that would allow your students to derive the cross-product algorithm on their own. **Note: You will not submit this activity in TaskStream.**

### Teaching Problem Solving

After completing the activities in this section, you will be required to describe a variety of appropriate research-based, age-specific problem-solving techniques that can be used to encourage flexibility and persistence in solving mathematics problems. You will be able to

- describe general age-specific problem-solving processes,
- describe certain age-specific mathematics problem-solving strategies, and
- discuss how these processes and strategies encourage students to persist through difficult problems.

**Competencies covered by this subject**
602.5.1 - Teaching Methods-Mathematics (Secondary)
The graduate provides effective, research-based mathematics curriculum instruction.

### Polya and Problem Solving

**URL:** [http://en.wikipedia.org/wiki/George_P%C3%B3lya](http://en.wikipedia.org/wiki/George_P%C3%B3lya)

George Polya was a Hungarian mathematician who is famous for his work in attempting to understand problem-solving processes. There is an immense amount of information on the web about this individual, and you are encouraged to explore as many sites as possible to get a sense of the impact that Polya had on education. A good starting place would be the Wikipedia website above. Focus on Polya's four principles:

- Understand the Problem
- Devise a Plan
- Carry Out a Plan
- Look Back

You should ask yourself whether these principles are describing a general problem-solving process or whether these principles should be used to exclusively describe specific problem-solving strategies employed within selected mathematics problems.
Role of Problem Solving

Read chapter 4 ("The Role of Problem Solving") in Teaching Secondary Mathematics.

Read chapters 3 ("Teaching Through Problem Solving") and 4 ("Planning in a Problem-Based Classroom") in Elementary and Middle School Mathematics.

Consider the fact that every classroom contains a diverse community of learners. In other words, how students construct their own understandings of how to solve selected mathematics problems can vary from student to student and problem to problem. Some of the different ways that students construct such understandings include (but are not limited to)

- guessing, checking, and revising;
- drawing pictures;
- acting out or using objects (e.g., manipulatives);
- making and using organized lists, charts, tables, or graphs;
- looking for discernible patterns;
- using logical reasoning (e.g., deductive versus inductive reasoning);
- working backwards; and
- solving simpler or similar problems.

What is the difference between the principles promulgated by Polya and these methods used by teachers to help students construct their own understandings of selected mathematics content? Are there similarities? Are there differences? Explain.

Can you think of a fifth through eighth- or ninth through twelfth-grade math lesson that would employ the principles promulgated by Polya and one or more of these methods? Explain. You need to be able to properly discern between general problem-solving processes and specific problem-solving strategies. Also, you need to be able to describe how these processes and strategies can be used to encourage students to persist through difficult problems. Interact with other students studying these topics via the message board. See what others have written, post responses to questions posed, or ask questions of your own. As you engage in the material, think about what you consider to be the most interesting fact(s) presented. Record your reflections in your study notebook.

Problem Solving Video and Reflection

**URL:** [http://www.coursecompass.com](http://www.coursecompass.com)

After logging in to the “Teaching Math Grades 5-12” website, click on the "Teaching Math Resource" link found on the left-hand side of the page. Then click on the "Problem Solving" link and review all of the material that is provided within this topic. This series of links presents you with snippets of video from real-world math classes and then asks you to reflect upon various aspects of what you saw in the video.

Can you effectively distinguish between general problem-solving processes and specific problem-solving strategies that can be used to solve mathematics problems? Flexibility and
persistence are extremely important in any classroom for both teachers and students. Why do you think that is important? Record your reflections in your study notebook.

**Problem Solving**

**URL:** [http://www.taskstream.com](http://www.taskstream.com)

Follow the detailed directions found in TaskStream in order to complete task 602.5.1-15 that covers the topic of problem solving in mathematics.

**Probability Lesson Plan**

How are desired experimental probabilities determined? How are desired theoretical probabilities determined? Recall that to effectively perform probability computations, you must use appropriate counting practices in order to ascertain the total number of desired outcomes (observed-experimental, possible-theoretical) and total number of outcomes (observed-experimental, possible-theoretical). Once you have decided which counting practices must be employed for the probability computation under consideration, you can then compute the desired probabilities. What is the difference between experimentally-determined probabilities (experimental probabilities) and those probabilities that are purely based on theory (theoretical probabilities)? You will be able to

- compute experimental and theoretical probabilities using proper counting techniques;
- describe the steps associated with the determination of experimental and theoretical probabilities using proper counting practices;
- distinguish the difference between experimental and theoretical probability;
- test theoretical computations against experimental data; and
- construct a learning dynamic that has students discover, develop, derive, and conceptually understand the cross-product algorithm.

Competencies covered by this subject

602.5.1 - Teaching Methods-Mathematics (Secondary)

The graduate provides effective, research-based mathematics curriculum instruction.

**Experimental vs. Theoretical Probabilities**

You will review experimental probabilities as well as theoretical probabilities. After completing the activities in this section, you will be required to construct an original lesson plan using appropriate research-based, age-specific pedagogies dealing with teaching probability.

**Experimental vs. Theoretical Probabilities**

*Experimental probabilities* are those probabilities which are determined through practice. Essentially, you go out and perform a series of trials with the intent of observing the desired outcomes (or events) and all possible outcomes (or all possible events). Once you have this data, you can then compute the desired experimental probabilities.

*Theoretical probabilities* are those probabilities which are determined using mathematics. Essentially, you use proper counting techniques to mathematically determine the number of possible desired outcomes (or events) and all possible outcomes (or all possible events). Once you have these mathematically determined results, you can then compute the desired
theoretical probabilities. This is purely an intellectual activity, there are no actual trials run.

Experimental Probability Example 1: Using a fair coin, determine the experimental probability of acquiring a heads on a single toss. Perform 30 tosses and then compute the desired experimental probability. Your sample space will contain 30 outcomes (or events). Fill in the table shown below. For each toss, place an X under the observed outcome (Head or Tail). How will you compute the desired experimental probability using this data?

Hint: Count the total number of X's for Heads. Count the total number of X's placed in the table. Now use these two numbers to compute the desired experimental probability.

**Experimental Probabilities-Tossing a Fair Coin**

<table>
<thead>
<tr>
<th>Toss</th>
<th>Heads</th>
<th>Tails</th>
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<td>1</td>
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Experimental Probability Example 2: Using a fair coin, determine the experimental probability of flipping heads twice in two tosses. Perform 30 trials of two tosses each and then compute the desired experimental probability. Your *sample space* will contain 30 trials (or events). Fill in the table shown below. For each toss, write the result ("Heads" or "Tails") in each column for both tosses for each trial. How will you compute the desired experimental probability using this data?

Hint: Count the total number of successful trials resulting in two "Heads" for both tosses. Count the total number of trials in the experiment. Now use these two numbers to compute the desired experimental probability.

**Experimental Probability: Tossing a Fair Coin Twice**
Now compute the theoretical probabilities of flipping a heads on a single toss, and of flipping heads twice in two tosses.

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Hint: How many Heads can one obtain on the first toss? How many total possible outcomes are there on the first toss? Now use these two numbers to compute the desired theoretical probability. Were your experimental and theoretical probabilities similar? Repeat the process to find the theoretical probability for two tosses.

Were your experimental and theoretical probabilities similar? What do you think happens to the experimental probability as the total number of trials becomes arbitrarily large? Although these are relatively simple examples, these concepts are extremely important for you to understand.

**Probability Brainstorming**

To effectively perform probability computations, you must use appropriate counting practices in order to ascertain the total number of desired outcomes (observed-experimental, possible-theoretical) and total number of outcomes (observed-experimental, possible-theoretical). Once you have decided which counting practices must be employed for the probability computation under consideration, you can then compute the desired probabilities. You should have an understanding of basic counting principles and be able to distinguish between the use of permutations and combinations to compute theoretical probabilities.

Read chapters 5 ("Using Technology to Enhance Mathematics Instruction"), 6 ("Assessment"), and 7 ("Enriching Mathematics Instruction") in *Teaching Secondary Mathematics*.

Read chapter 22 ("Exploring Concepts of Probability") in *Elementary and Middle School Mathematics*.

These readings will help to provide useful, additional advice on how to infuse mathematics content into pedagogy.

**Probability Video and Reflection**

**URL:** [http://www.coursecompass.com](http://www.coursecompass.com)

After logging in to the “Teaching Math Grades 5-12” website, click on the "Teaching Math Resource" link found on the left-hand side of the page. Then click on the "Case 4" link and review all of the material that is provided within this topic. This series of links presents you with snippets of video from real-world lessons on probability and then asks you to reflect upon various aspects of what you saw in the video.

Review all of the material that is provided within this topic. Interact with other students studying these topics via the message board. See what others have written, post responses to questions posed, or ask questions of your own. As you engage in the material, think about what you consider to be the most interesting fact(s) presented. Record your reflections in your study notebook.

**Performance Task 602.5.1.30**

**URL:** [http://www.taskstream.com](http://www.taskstream.com)
Follow the detailed directions found in TaskStream in order to complete task 602.5.1-30.

Create a lesson plan that allows students to calculate theoretical and experimental probabilities.

**Justification**

Many times students will generate the correct answer to a mathematics problem without understanding why it is correct. The logic that was employed to arrive at an answer is as important as the answer itself. It is precisely for this reason why you must have students justify their answers. What does it mean to justify an answer? Mathematics is a field of study that is built on axioms (postulates), laws, theorems, corollaries, etc. It is important that students understand how to fuse such foundational aspects to mathematics at all levels when justifying the answers that they arrive at. For instance, students should not learn mathematical laws (e.g., commutative law for addition) just for the sake of memorizing the laws. They must understand how such laws justify the answers that they arrive at. How many different types of justifications can you identify and describe within selected mathematics problems? You will be able to

- describe and explain a variety of appropriate strategies that can be used to encourage students to share their ideas, processes, and procedures used to solve various types of mathematics problems; and

- explain why it is important for students to justify their solutions.

Competencies covered by this subject

602.5.1 - Teaching Methods-Mathematics (Secondary)
The graduate provides effective, research-based mathematics curriculum instruction.

**Justification**

After completing the activities in this section, you will construct a description of a variety of appropriate research-based, age-specific instructional practices that can be employed when students are correct but uncertain about their answers. Such practices should involve asking students to describe the procedures, rules, and definitions that were involved in arriving at a particular result. How many different strategies can you identify and describe that encourage students to share the ideas, processes, and procedures they used to solve various types of problems?

**Teaching the Use of Justification**

**URL:** http://www.dailyteachingtools.com/cooperative-learning.html

Read chapter 8 ("Extracurricular Activities in Mathematics") in *Teaching Secondary Mathematics.*

Read chapter 4 ("Planning in the Problem-Based Classroom") in *Elementary and Middle School Mathematics.*

There are many strategies that can be employed within the classroom to encourage students to share the ideas, processes, and procedures they used to solve various types of problems. There are a variety of cooperative learning techniques that can be used to accomplish this. You should explore the web resource above to identify those strategies that are most commensurate
with the requirements set forth in this task.

Web resources contain very useful and practical information. For instance, the web resource above provides a discussion of each of the cooperative learning techniques shown below.

<table>
<thead>
<tr>
<th>Cooperative Learning Techniques</th>
<th>Examples</th>
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<tr>
<td>Jigsaw</td>
<td>Round Robin Brainstorming</td>
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<tr>
<td>Think-Pair-Share</td>
<td>Three-Minute Review</td>
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<tr>
<td>Three-Step Interview</td>
<td>Numbered Heads</td>
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</table>

These cooperative-learning techniques may be used solely during the course of a lesson or in combination to promote a very lively and effective learning dynamic within a variety of content areas and age groups. Interact with other students studying these topics via the message board. See what others have written, post responses to questions posed, or ask questions of your own. As you engage in the material, think about what you consider to be the most interesting fact(s) presented. Record your reflections in your study notebook.

**Performance Task 602.5.1-36**

URL: [http://www.taskstream.com](http://www.taskstream.com)

Follow the detailed task directions found in TaskStream in order to complete task 602.5.1-36 in which you will describe why it is important that students justify their solutions.

Students are often reluctant to communicate mathematically, and it is important for teachers to employ a variety of strategies to encourage discussion in the classroom.

**Conclusion**

Congratulations! You have completed a rigorous course of study focused on selected mathematics teaching topics. These topics included the pedagogy of how to teach students varied topics, such as the following:

- discovering the area of a parallelogram
- equivalence of fractions with unlike denominators
- ratios, proportions, and percents
- problem solving, persistence, and flexibility
- probability
- justifications

At this point, you should be commended for all of your hard work in making it this far in your program. Great job!

**Transfer and Application to Work**

How does the study of these topics apply to your profession? As a math teacher, you need to know not only the content that you will be required to teach but also you will need to know how to teach that content. You will also need to know how to differentiate instructions for various subgroups of students in your classes. It is also important to be able to encourage your students
to be flexible in problem solving and to justify their solutions. A greater emphasis is being placed on communicating mathematically, so it is important that you be able to do so and encourage your students to do the same. The activities and tasks found in this course of study were designed to help you develop your abilities to do all of these things.

Next Steps

If you have come this far in the course of study, by now you will have submitted responses to the three TaskStream tasks that make up the DNT2 assessment. The full details and instructions for each of the task prompts are found in TaskStream. Your submissions will be evaluated, and if they are found to have met the requirements, a "Pass" will appear on your Degree Plan for the assessment. If your responses are found to need improvement, they will be returned to you for revision.

Accessing Performance Assessments

You should have completed the tasks as you worked through this course of study. If you have not completed the tasks in TaskStream, do so now.

- DNT2

For directions on how to receive access to performance assessments, see the "Accessing Performance Assessments" page.

Feedback

WGU values your input! If you have comments, concerns, or suggestions for improvement of this course, please submit your feedback using the following form:

- Course Feedback

ADA Requirements

Please review the University ADA Policy.