



## Adolescence and Young Adulthood

# MATHEMATICS

### Assessment at a Glance

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- **Understanding the National Board Scoring Process**
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*National Board Certification  
Promotes Better Teaching,  
Better Learning, Better Schools*

## Choosing the Right Certificate

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The National Board Certification® process offers experienced teachers the professional development opportunity to demonstrate their knowledge, skills, and practices against high and rigorous standards. Candidates pursue certification by completing two major assessment components: a portfolio of classroom teaching practice and an assessment of content knowledge administered at a computer-based testing center.

The Adolescence and Young Adulthood/Mathematics certificate is appropriate for teachers who teach students ages 14–18+ and who know the full range of the school mathematics curriculum: algebra and functions; geometry; calculus; discrete mathematics; and statistics and data analysis. Read this document to learn the content and pedagogical knowledge you will be required to demonstrate for this certificate area and to measure your readiness to pursue National Board Certification.

Below is a set of questions to ask yourself about your teaching practice. If you answer “yes” to these questions, you are ready to apply. For eligibility requirements and application instructions, read the *Guide to National Board Certification* on the NBPTS Web site ([www.nbpts.org](http://www.nbpts.org)).

If you answer “no” to one or more of these questions, you may need to discuss your teaching situation with professional colleagues, your school faculty, a National Board Certified Teacher®, your faculty support group, or a local-level administrator who is directing a National Board program.

### **For the portfolio, will you be able to:**

- demonstrate that your teaching practice meets the Adolescence and Young Adulthood/Mathematics Standards?
- have access to a class of at least 6 students, in which 51% of the students are ages 14–18+ during the 12 months prior to the submission of your portfolio entries?
- submit student work samples and video recordings in English and/or Spanish showing your interactions with your students?
- demonstrate how you use assessment to target mathematical understanding and make sense of student performance as you help students build important conceptual connections in mathematics?
- show how you and your students engage in mathematical discourse as the whole class explores a concept, principle, technique, and/or reasoning method of mathematics?
- show how you engage students in learning collaboratively and in mathematical discourse as they explore a mathematics concept in small groups as you use technology or manipulative materials to help students?
- present evidence of how you impact student learning through your work with students' families and community and through your development as a learner and as a leader/collaborator?

### **For the assessment center, will you be able to demonstrate content knowledge in:**

- algebra and functions?
- calculus?
- discrete mathematics?
- geometry?
- statistics and data analysis?
- various mathematical thinking processes?
- using technology and manipulatives?

## Reviewing the Standards

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The requirements for National Board Certification in the field of Adolescence and Young Adulthood/Mathematics (AYA/Math) are organized into the following Standards. The ordering of the Standards is designed to facilitate understanding, not to assign priorities.

### Commitment

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#### I. Commitment to Students and Their Learning

Accomplished mathematics teachers acknowledge and value the individuality and worth of each student, believe that all students can learn and use significant mathematics, and demonstrate these beliefs in their practice.

#### II. Equity, Diversity, and Fairness

Accomplished mathematics teachers have high expectations for all students. They ensure equal access to the mathematics curriculum; model and promote behavior appropriate in a diverse society by showing respect and appreciation for all students; and teach students to treat one another fairly and with dignity.

### Knowledge of Mathematics, Students, and Teaching

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#### III. Knowledge of Mathematics

Accomplished mathematics teachers have a broad and deep knowledge of the concepts, principles, techniques, and reasoning methods of mathematics, and they use this knowledge to set curricular goals and shape their instruction and assessment. They understand significant connections among mathematical ideas and the applications of these ideas to problem solving in mathematics, in other disciplines, and in the world outside of school.

#### IV. Knowledge of Students

Accomplished mathematics teachers know and care about their students. They use their knowledge about adolescents and adolescent development, and their knowledge about how this development affects the learning of mathematics, to guide their curricular and instructional decisions. They understand the impact of home life, cultural background, individual learning differences, student attitudes and aspirations, and community expectations and values on student learning.

#### V. Knowledge of Teaching Practice

Accomplished mathematics teachers have an extensive base of pedagogical knowledge and use it to make curriculum decisions, design instructional strategies and assessment plans, and choose materials and resources for mathematics instruction.

### The Teaching of Mathematics

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#### VI. The Art of Teaching

Accomplished mathematics teachers stimulate and facilitate student learning by using a wide range of formats and procedures and by assuming a variety of roles to guide students' learning of mathematics.

#### VII. Learning Environment

Accomplished mathematics teachers help students learn mathematics by creating environments in which students are active learners, show willingness to take intellectual risks, develop confidence and self-esteem, and value mathematics. This environment fosters students' learning of mathematics.

### **VIII. Ways of Thinking Mathematically**

Accomplished mathematics teachers develop students' abilities to reason and think mathematically—to investigate and explore patterns, to discover structures and establish relationships, to formulate and solve problems, to justify and communicate their conclusions, and to question and extend those conclusions.

### **IX. Assessment**

Accomplished mathematics teachers employ a range of formal and informal assessment methods that are ongoing and embedded to evaluate student learning in light of well-defined goals. They employ multiple methods of assessment—including teacher-designed and external assessments, where appropriate—to diagnose learning; plan instruction; and provide opportunities for students to reflect on their strengths and weaknesses in order to revise, support, and extend their individual performance.

## **Professional Development and Outreach**

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### **X. Reflection and Growth**

Accomplished mathematics teachers regularly reflect on what they teach and how they teach. They keep abreast of changes and learn new content in mathematics and in mathematical pedagogy, continually seeking to improve their knowledge and practice.

### **XI. Families and Communities**

Accomplished mathematics teachers support and promote the involvement of families in their children's education. They help varied communities understand the role of mathematics and mathematics instruction in today's world, and—to the extent possible—they involve these communities in the support of instruction.

### **XII. Contributing to the Professional Community**

Accomplished mathematics teachers collaborate with peers and other education professionals to strengthen their school's programs, advance knowledge, and contribute to improving practice within the field.

Read the Standards on the NBPTS Web site to ensure that you will be able to demonstrate your accomplishments and confidently satisfy the defined expectations for National Board Certification.

## Demonstrating Your Teaching Practice and Content Knowledge

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This section describes the portfolio entries and assessment center exercises for the AYA/Math certificate area.

### Portfolio Entries

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You will be required to submit four portfolio entries. One entry is based on student work samples, and two entries feature video recordings of student–teacher interactions in the classroom. The fourth entry relates to your accomplishments outside of the classroom—with families, the community, or colleagues—and how they impact student learning.

Following is a description of each portfolio entry.

**Entry 1:  
Developing and  
Assessing  
Mathematical  
Thinking and  
Reasoning**

In this entry, you choose two instructional activities and two student responses to each activity that demonstrate how you are able to design a sequence of learning experiences that builds on and gives you insight into students' conceptual understanding of a substantive idea in mathematics, within the context of instruction that enhances students' abilities to think and reason mathematically. You also submit a Written Commentary that provides a context for your instructional choices and describes, analyzes, and reflects on your teaching.

**Entry 2:  
Instructional  
Analysis: Whole-  
Class Mathematical  
Discourse**

In this entry, you provide a 15-minute video recording of a lesson that demonstrates how you use a classroom discussion and targeted questioning to develop student understanding about an important mathematical idea. You provide evidence of your ability to engage students in mathematical discourse as the whole class investigates, explores, or discovers important mathematical concepts, procedures, or reasoning processes within a stimulating and inclusive environment that promotes student development of mathematical power. You also provide a Written Commentary analyzing the video recording and instructional materials.

**Entry 3:  
Instructional  
Analysis: Small-  
Group Mathematical  
Collaborations**

In this entry, you provide a 15-minute video recording of a lesson that demonstrates how you interact with students working in small groups in order to promote mathematical discourse and to develop student understanding about an important mathematical idea. You are required to show how you use manipulative materials or appropriate technology to provide access to or deepen mathematical understanding. You show how you model questioning strategies and mathematical thinking and reasoning processes to promote interactions between you and the students, as well as among the students in small groups. You provide a Written Commentary analyzing the video recording and instructional materials. **Entry 3 is the preselected *Take One!* portfolio entry.**

**Entry 4:  
Documented  
Accomplishments:  
Contributions to  
Student Learning**

In this entry, you illustrate your partnerships with students' families and community, and your development as a learner and collaborator with other professionals by submitting descriptions and documentation of your activities and accomplishments in those areas. Your description must make the connection between each accomplishment and its impact on student learning.

Read the *Portfolio Instructions* on the NBPTS Web site to learn more about the requirements for preparing, developing, and submitting the portfolio component of your assessment.

## Assessment Center Exercises

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This assessment is composed of six exercises that examine content knowledge specified in the NBPTS Standards. You are given up to 30 minutes to respond to each exercise.

Following is a description of each assessment center exercise.

- |                                                         |                                                                                                                                                                                                                                                                                                                                                                                |
|---------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Exercise 1:<br/>Algebra</b>                          | In this exercise, you demonstrate knowledge of theoretical, graphical, and symbolic representations of functions, and the interrelationships that exist between two concepts in algebra.                                                                                                                                                                                       |
| <b>Exercise 2:<br/>Calculus</b>                         | In this exercise, you demonstrate knowledge of limits and continuity, differentiation and integration, and the ability to apply the knowledge to meaningful situations.                                                                                                                                                                                                        |
| <b>Exercise 3:<br/>Discrete<br/>Mathematics</b>         | In this exercise, you demonstrate knowledge of sequence and series, probability, and counting theory.                                                                                                                                                                                                                                                                          |
| <b>Exercise 4:<br/>Geometry</b>                         | In this exercise, you demonstrate the ability to use deductive reasoning to construct a proof, explain the interrelationships between two important concepts in geometry, and apply measurement formulas to a three-dimensional figure generated by the rotation of a two-dimensional figure about an axis.                                                                    |
| <b>Exercise 5:<br/>Statistics and Data<br/>Analysis</b> | In this exercise, you demonstrate knowledge of statistics and data analysis to graph a normal distribution of a given situation and find various probabilities; identify and explain types of association, effects on trend lines, and values of correlation coefficients; graph and provide a numerical analysis of given data; and explain an important statistical concept. |
| <b>Exercise 6:<br/>Technology</b>                       | In this exercise, you demonstrate knowledge of the appropriate use of technology that supports instructional goals, and errors and limitations associated with graphing calculators.                                                                                                                                                                                           |

Read *Assessment Center Policy and Guidelines* on the NBPTS Web site for more information about the assessment center component of the certification process. To locate an assessment center, visit the NBPTS computer-based testing Web site ([www.pearsonvue.com/nbpts/](http://www.pearsonvue.com/nbpts/)).

### Selected Assessment Center Exercises

The following sections contain selected exercises administered in a previous assessment cycle. These exercises present information that candidates saw on screen at the assessment center and include instructions for using the computer, stimulus materials (if applicable), and prompts requiring responses. These exercises have been included to help you become familiar with the structure of assessment center exercises and to help you understand the scoring rubrics. The exercise prompts in this section **do not** represent actual prompts candidates will see at assessment centers in the future.

Please note that assessment center exercises cover the **entire** age range of the certificate. Be aware that you are expected to demonstrate knowledge of developmentally appropriate content across the full range of your certificate.

## Sample Exercise 1: Algebra

Exercise 1: Algebra - Candidate Name

🕒 Time Remaining 29:31

### Introduction

In this exercise, you will use your knowledge of algebra to explain the relationships between two important algebraic concepts. You will also create an algebraic model for a given problem and find its solution, graph the related equation(s) or inequality(ies), and interpret the graph as it relates to the solution of the problem. You will be asked to respond to two prompts.

### Criteria for Scoring

To satisfy the highest level of the scoring rubric, your responses must provide clear, consistent, and convincing evidence of the following:

- a detailed and thorough description of the relationship between two algebraic concepts;
- an accurate algebraic model and solution for a given problem situation;
- an accurate sketch of the graph of the model; and
- a complete and accurate interpretation of the graph as it relates to the solution.

### Directions

You may preview all of the prompts by clicking the "Next" button. The "Previous" button will enable you to return to any of the prompts. Please write your response in The Assessment Center Response Booklet.

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### Retired Prompt 1

*Provide a detailed and thorough description of the relationships that exist between the degree of a polynomial equation and the number of roots of the equation.*

### Retired Prompt 2

*Use the problem described below to respond to Prompts 2(a) through 2(c).*

*A farmer is building a rectangular pen for his cows. Using the side of his barn as one side of the pen, he will use 390 feet of fencing for the remaining three sides. He needs to know the dimensions of a pen with the largest possible area.*

- Create an algebraic model for the problem and find its solution.*
- Provide a graph of the model you created in Prompt 2(a).*
- Interpret the graph as it relates to the solution of the problem.*

## Sample Exercise 6: Technology

Exercise 6: Technology - Candidate Name

🕒 Time Remaining 29:31

### Introduction

In this exercise, you will use your knowledge of mathematics and technology to explain the instructional benefits of technological resources for a given mathematics concept and to identify and explain the appropriate use of graphing calculators. You will be asked to respond to two prompts.

### Criteria for Scoring

To satisfy the highest level of the scoring rubric, your responses must provide clear, consistent, and convincing evidence of the following:

- thoroughly explain a given mathematical concept;
- thoroughly explain the use of technological resources to improve student understanding; and
- accurately identify and thoroughly explain differences in the use of a graphing calculator.

### Directions

You may preview all of the prompts by clicking the "Next" button. The "Previous" button will enable you to return to any of the prompts. Please write your response in The Assessment Center Response Booklet.

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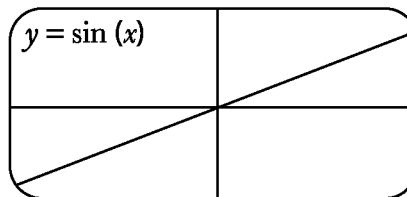
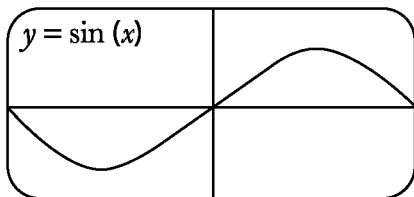
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### Retired Prompt 1

*Explain the concept of dilations. Provide a specific example that demonstrates how you would use geometric software to improve student understanding of the concept, and explain how your example would enhance student learning.*

### Retired Prompt 2

*The images below represent screen shots from two students' graphing calculators as they attempted to graph the equation  $y = \sin(x)$ . The image on the left represents the intended result. Explain what the student whose screen shot is represented on the right might have done to arrive at the result shown, and what the student needs to do differently to arrive at the intended result.*



## Understanding the National Board Scoring Process

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All portfolio entries and assessment center exercises are scored by teachers practicing in the same content area as the assessment they are scoring. The National Board's carefully trained assessors use scoring rubrics to evaluate candidate responses. The rubrics clearly articulate the criteria that are to be applied in the evaluation of your responses. These criteria reflect the Standards that the entry is designed to measure.

Assessors use a four-level rubric to score each candidate's response as shown below.

Rubric Level	Score Range	Quality of Evidence
Level 4	3.75–4.25	Clear, consistent, and convincing
Level 3	2.75–3.74	Clear
Level 2	1.75–2.74	Limited
Level 1	0.75–1.74	Little or no

The Level 4 and Level 3 score ranges represent accomplished teaching practice. You do not have to receive Level 4 or Level 3 scores for every entry and exercise. A high score on one may compensate for a lower score elsewhere. Read the *Scoring Guide for Candidates* on the NBPTS Web site for your assessment.

### Your Total Weighted Scaled Score

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When your portfolio entries and assessment center exercises are completed and scored, your Total Weighted Scaled Score is computed. This is done by applying a set of weights to each of your entry and exercise scores.

For the AYA/Math certificate, these are the weights:

- 16% for each of the three classroom-based portfolio entries
- 12% for the Documented Accomplishments portfolio entry
- 6.67% for each of the six assessment center exercises

Your weighted scaled score for each entry or exercise is calculated by multiplying the raw score by the appropriate weight, shown above. Your Total Weighted Scaled Score is the sum of the weighted scaled scores for all entries and exercises plus a 12-point uniform constant. For example, if your weighted scaled score is 263, you would receive a 12-point uniform constant score, and your Total Weighted Scaled Score would be 275. This number is then compared to 275, the performance standard established by the NBPTS Board of Directors.

A candidate whose Total Weighted Scaled Score is 275 or greater is recognized as an accomplished teacher and is awarded National Board Certification. A candidate whose Total Weighted Scaled Score does not meet 275 is not yet certified and for the following two years has the opportunity to retake certain portfolio entries or assessment center exercises in order to meet the performance standard of 275.

## Things to Keep in Mind

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The National Board Standards for the AYA/Math certificate area are addressed within the portfolio and assessment center process. Therefore, you should keep the following in mind:

- Although the portfolio entries address many of the Standards, they may not address all of them. Standards the portfolio does not address may be included in the assessment center portion of the certification process.
- Each entry is scored independently of the others. When an entry asks for background or contextual information, be complete, since an assessor for one entry will not see your other entries.
- At each of the four levels of the scoring rubric, the same Standards-related criteria are applied. However, each level of the scoring rubric represents a difference in the quality of evidence demonstrated by the entry or exercise. For example, if “Knowledge of Students” is a Standard measured by an entry, the Level 4 rubric will refer to “clear, consistent, and convincing” evidence of that Standard while the Level 2 rubric will refer to “limited” evidence of the same Standard.
- One of the fundamental principles underlying the evaluation is that responses are scored only on what candidates are specifically asked to do. For example, if the directions specifically ask you to demonstrate how to use assessment in the featured instructional sequence, evidence supporting your use of assessment will be evaluated based on the scoring rubric. Conversely, if an entry does not require you to demonstrate how to use assessment, it will not be evaluated.

## Beginning Your Journey toward National Board Certification

The first step on this journey is to make a commitment, but what does this commitment involve? First-time candidates apply and complete their assessments in an initial candidacy period as shown in the timeline below. For candidates who are not successful in their first try, there is a 24-month window, following the receipt of scores, in which to retake assessments and/or resubmit portfolio entries in order to achieve certification.

You may wish to start with the *Take One!* program that requires submission of a single portfolio entry for scoring. The preselected portfolio entry required for *Take One!* is identified as part of the portfolio entry descriptions on page 4. You can choose to transfer your *Take One!* score to National Board Certification within three years of completing the *Take One!* process. Read *Becoming a Take One! Participant* on the NBPTS Web site to learn more about the requirements.

If you choose to pursue National Board Certification, there is also a financial commitment for which support is available. Visit the NBPTS Web site to learn about federal, state, and/or local funds available to support National Board Certification and *Take One!* fees. Be sure to check with your local, district, or state educational officials for incentives (such as salary increases and bonuses) that may be offered for achieving National Board Certification.

The following timeline provides a snapshot of your schedule of commitments. Read the *Guide to National Board Certification* on the NBPTS Web site for complete information.

### Certification Planner

Step	To Do	Year 1	Year 2	Year 3	Year 4
1	<b>Send forms and fees to NBPTS:</b>				
	<ul style="list-style-type: none"> <li>application</li> <li>nonrefundable initial fee (\$500)</li> <li>all eligibility forms</li> <li>balance of full fee (totaling \$2,500)</li> </ul>	Jan. 1 — Dec. 31			
2	<b>Develop portfolio entries and submit them to NBPTS:</b>				
	<ul style="list-style-type: none"> <li>Receive portfolio box <b>after</b> submitting initial fees.</li> <li>Submit all four portfolio entries at once <b>after</b> submitting all fees and eligibility forms.</li> </ul>	Jan. 1 — Mar. 31			
3	<b>Schedule your assessment center exercises:</b>				
	<ul style="list-style-type: none"> <li><b>after</b> submitting all fees and eligibility forms</li> <li>at least 30 days <b>before</b> the test date</li> </ul>		Jan. 1 — Jun. 15		
4	<b>Obtain your scores online:</b>				
	<ul style="list-style-type: none"> <li>Access <i>My Profile</i> to learn about your scores and certification status.</li> </ul>		Dec. 31	Dec. 31	Dec. 31
5	<b>Continue the journey:</b>				
	<ul style="list-style-type: none"> <li>If you did not achieve certification, decide whether to retake assessment center exercises and/or portfolio entries.</li> <li>Submit retake application and fees.</li> </ul>			Jan. 31	Jan. 31
	<ul style="list-style-type: none"> <li>Retake selected assessment center exercises.</li> <li>Submit selected portfolio entries.</li> </ul>			Jan. 1 — Jun. 15	Jan. 1 — Jun. 15
				Jan. 1 — Apr. 15	Jan. 1 — Apr. 15

Having made the commitment, many teachers who pursue National Board Certification become role models and leaders in their schools and districts, earning a greater voice in what happens and having a very positive effect on their students' experiences. On your journey, you will benefit directly from your candidacy, taking part in what many have described as the best professional development experience of their lives.

Produced for the



by

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