



## Early Adolescence

# MATHEMATICS

## Assessment at a Glance

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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 Early Adolescence/Mathematics certificate is appropriate for teachers who teach students ages 11–15 and who know the full range of the school mathematics curriculum: number and operation sense; algebra and functions; geometry; statistics and data analysis; concepts related to discrete mathematics; and concepts related to calculus as described in the Middle Childhood through Early Adolescence/Mathematics Standards. 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 Middle Childhood through Early Adolescence/Mathematics Standards?
- have access to a class of at least 6 students, in which 51% of the students are ages 11–15 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 interaction 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?
- geometry?
- number and operation sense?
- data analysis?
- various mathematical thinking processes?
- using technology and manipulatives?
- connections among mathematical ideas and applications across mathematical domains?

## Reviewing the Standards

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

### Creating a Productive Learning Environment—Commitment to All Students

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#### I. Commitment to Equity and Access

Accomplished mathematics teachers value and acknowledge the individuality and worth of each student; they believe that all students can learn and should have access to the full mathematics curriculum; and they demonstrate these beliefs in their practice by systematically providing all students equitable and complete access to mathematics.

### Knowledge of Students, Mathematics, and Teaching

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#### II. Knowledge of Students

Accomplished mathematics teachers recognize that students are shaped by a variety of educational, social, and cultural backgrounds and experiences that influence learning. They draw on knowledge of how students learn and develop in order to understand students and to guide curricular and instructional decisions.

#### III. Knowledge of Mathematics

Accomplished mathematics teachers draw on their broad knowledge of mathematics to shape their teaching and set curricular goals. They understand significant connections among mathematical ideas and the application of those ideas not only within mathematics but also to other disciplines and the world outside of school.

#### IV. Knowledge of Teaching Practice

Accomplished mathematics teachers rely on their extensive pedagogical knowledge to make curricular decisions, select instructional strategies, develop instructional plans, and formulate assessment plans.

### Advancing Student Learning—The Teaching of Mathematics

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#### V. The Art of Teaching

Accomplished mathematics teachers create elegant and powerful approaches to instructional challenges. Their practice reflects a highly developed personal synthesis of their caring for students, their passion for teaching and mathematics, understanding of mathematical content, ability to apply mathematics, and rich knowledge of established and innovative educational practices.

#### VI. Learning Environment

Accomplished mathematics teachers create stimulating, caring, and inclusive environments. They develop communities of involved learners in which students accept responsibility for learning, take intellectual risks, develop confidence and self-esteem, work independently and collaboratively, and value mathematics.

## **VII. Using Mathematics**

Accomplished mathematics teachers help students develop a positive disposition for mathematics and foster the development of all students' abilities to use mathematics as a way to understand the world around them. They focus instruction on developing students' mathematical power by providing opportunities for students to understand and apply mathematical concepts; investigate, explore, and discover structures and relationships; demonstrate flexibility and perseverance in solving problems; create and use mathematical models; formulate problems of their own; and justify and communicate their conclusions.

## **VIII. Technology and Instructional Resources**

Accomplished mathematics teachers are knowledgeable about and, where available, use current technologies and other resources to promote student learning in mathematics. They select, adapt, and create engaging instructional materials and draw on human resources from the school and the community to enhance and extend students' understanding and use of mathematics.

## **IX. Assessment**

Accomplished mathematics teachers integrate assessment into their instruction to promote the learning of all students. They design, select, and employ a range of formal and informal assessment tools to match their educational purposes. They help students develop self-assessment skills, encouraging them to reflect on their performance.

## **Professional Development and Outreach**

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

Accomplished mathematics teachers regularly reflect on teaching and learning. They keep abreast of changes in mathematics and in mathematical pedagogy, continually increasing their knowledge and improving their practice.

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

Accomplished mathematics teachers work to involve families in their children's education, help the community understand the role of mathematics and mathematics instruction in today's world, and, to the extent possible, involve the community in support of instruction.

### **XII. Professional Community**

Accomplished mathematics teachers collaborate with peers and other education professionals to strengthen the school's program, promote program quality and continuity across grade levels, advance knowledge in the field of mathematics education, and improve 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 EA/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 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 targeted questions or instructive comments designed to encourage students to use and develop appropriate mathematical written communication, reasoning, and thinking; and fully and thoughtfully analyze the practice you have described, reflect on its implications and significance by recognizing the highs and lows, if any, of the instructional sequence, and articulate, where appropriate, well thought-out ideas for improvement or change in practice based on the analysis.

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 and<br/>Functions</b>        | In this exercise, you demonstrate knowledge by using the language of algebra to model problem situations; using algebraic techniques and procedures; and identifying and explaining the links between basic patterns and concepts related to functions.   |
| <b>Exercise 2:<br/>Connections</b>                      | In this exercise, you demonstrate knowledge of intradisciplinary and interdisciplinary connections to describe the relationship between related concepts within mathematics and to describe the application of a given mathematical concept to a topic from another curricular discipline.      |
| <b>Exercise 3:<br/>Data Analysis</b>                    | In this exercise, you demonstrate knowledge of data analysis by creating appropriate graphical representations of given data, and analyzing and interpreting given data.  |
| <b>Exercise 4:<br/>Geometry</b>                         | In this exercise, you demonstrate knowledge of geometry by performing the transformations of dilation, reflection, rotation, and translation on a two-dimensional figure, and analyzing the overall effects on a three-dimensional figure caused by a change in one of the figure's dimensions. |
| <b>Exercise 5:<br/>Number and<br/>Operation Sense</b>   | In this exercise, you demonstrate knowledge of different sets of numbers within the real number system, the ability to evaluate numerical expressions, and the ability to use proportionality to model a variety of situations.   |
| <b>Exercise 6:<br/>Technology and<br/>Manipulatives</b> | In this exercise, you demonstrate knowledge of the appropriate use of manipulative materials to support instructional goals, and the appropriate use of technology to support instructional goals.  |

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 3: Data Analysis

Exercise 3: Data Analysis - Candidate Name

⌚ Time Remaining 29:31

#### Introduction

In this exercise, you will use your knowledge of data analysis to provide various graphical representations and interpretations of a given set of data. 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 complete and accurate graphical representation of a given set of data;
- a meaningful interpretation of the data as seen through the graphical representation;
- an appropriate and accurate alternate graphical representation of the data; and
- a meaningful, accurate, and distinct interpretation of the data as seen through its alternate graphical representation.

#### 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 in order to compose or revise your response in the space provided.

? Help

⦿ Navigator

Next →

#### Stimulus

Below you will find a set of data. Use the data to respond to the prompts.

Top 22 All-Time Highest Grossing Movies  
(Domestic gross ticket receipts in \$millions)

Rank	Total Gross	Movie
1.	\$601	Titanic
2.	\$461	Star Wars
3.	\$435	E.T.
4.	\$431	Star Wars: The Phantom Menace
5.	\$404	Spider-Man
6.	\$357	Jurassic Park
7.	\$340	The Lord of the Rings: The Two Towers
8.	\$333	Finding Nemo
9.	\$330	Forrest Gump
10.	\$329	The Lion King
11.	\$318	Harry Potter and the Sorcerer's Stone
12.	\$313	The Lord of the Rings: The Fellowship of the Ring
13.	\$311	Star Wars: Attack of the Clones
14.	\$309	Star Wars: Return of the Jedi
15.	\$306	Independence Day
16.	\$294	The Sixth Sense
17.	\$290	Star Wars: The Empire Strikes Back
18.	\$286	Home Alone
19.	\$280	The Matrix Reloaded
20.	\$275	Pirates of the Caribbean...Black Pearl
21.	\$268	Shrek
22.	\$262	Harry Potter and the Chamber of Secrets

**Retired Prompt 1**

- a) Create a box-and-whisker plot of the data.
- b) Provide one meaningful interpretation of the data, other than the median, that can be made based on the box-and-whisker plot.

**Retired Prompt 2**

- a) Create a different graphical representation of the same data.
- b) Provide a different interpretation of the data, other than the median, that is shown more clearly through the second graphical representation.

## Sample Exercise 6: Technology and Manipulatives

### Exercise 6: Technology and Manipulatives - Candidate Name

🕒 Time Remaining 29:31

#### Introduction

In this exercise, you will use your knowledge of technology and manipulatives to identify, describe, and justify the use of manipulative and technological instructional resources to support student learning of given concepts. 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:

- the selection and detailed explanation of an appropriate manipulative instructional resource to support student learning; and
- the selection and detailed explanation of an appropriate technological instructional resource to support student learning.

#### 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 in order to compose or revise your response in the space provided.

? Help

🕒 Navigator

Next →

### Retired Prompt 1

NOTE: For the purposes of this exercise, a manipulative instructional resource is defined as a tactile object(s) that is used to support student learning and that is accessible to all students. Manipulative instructional resources do **not** include technological devices such as calculators and computers.

- Identify and describe a manipulative instructional resource to support student learning of the derivation of  $\pi$ .
- Provide a detailed explanation of how the resource you identified supports student learning of the derivation of  $\pi$ .

### Retired Prompt 2

NOTE: For the purposes of this exercise, technological instructional resources include computer software applications, graphing calculators and their programs, and peripheral computer hardware devices and their software.

- Identify and describe a technological instructional resource to support student learning of slope.
- Provide a detailed explanation of how the resource you identified supports student learning of slope.

## 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 EA/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 EA/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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