

## **Mathematics and Middle Grades Exploration Standards Alignment**

In January of 2022, The Delaware Department of Education, with the support of Rodel and partners at Education First, embarked upon the Rethinking Middle Grades project. The overarching goal of this project is to ensure that youth exit grade eight ready for high school, having found success in career and technical education (CTE), academic, and social-emotional (SEL) programming that is equity-centered and inspires student identity and a path to post-secondary success. The creation of CTE exploration standards for middle grades is a product of this project.

Developing these standards was a year-long project that began with a diverse Steering Committee of partners including school and district leaders, teachers, counselors, board members, parents, current and former students, post-secondary educators, employers, community-based organization representatives, and Delaware Department of Education staff. The Steering Committee developed a framework for standards adoption that they then turned over to a diverse subcommittee of educators, to draft the middle school CTE exploration standards.

Both the Steering Committee and the Standards Writing Subcommittee solicited extensive input from Delaware partners that informed the initial drafting (empathy interviews, surveys) as well as informed extensive revisions (focus groups, public input). Standards were also informed by: previous standards work done by Delaware; other state's standards; national research; guidance on best practices in middle school CTE; and interviews of national and Delaware experts.

The content standards within mathematics are cumulative and thus build on the student's previous learning and mastery. The Standards for Mathematical Practice (SMP) detail habits of mind that students should develop and foster through mathematics. Within mathematics, students are asked to not only comprehend theoretical concepts and procedural skills, but also to translate and apply those skills when solving real-world problems. Students demonstrate knowledge of the content standards through the mathematical practices. Mathematics practices align strongly with career and identity exploration through problem solving, modeling, data reasoning, communication, and use of tools. Alignment broadens students' understanding of how mathematical proficiency supports future career exploration and technical skill development. The Crosswalk pairs each **Standard for Mathematical Practice (SMP)** with the **Middle Grades Exploration Domains and Learning Priorities** that most closely match in purpose, skills, or student behaviors.

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### **Standards Resources:**

- [\*Career and Technical Education \(CTE\) Middle Grades Exploration Standards\*](#)
- [\*Common Core State Standards \(CCSS\) for Mathematics\*](#)
- [\*Delaware Department of Education Mathematics Standards\*](#)

<b>Standards for Mathematical Practice 1</b>	<p><b>Make sense of problems and persevere in solving them.</b></p> <p><i>Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, "Does this make sense?" They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.</i></p>
<p align="center"><b>CTE Middle Grades Exploration Standards</b></p>	
<p align="center"><b>Domain</b></p>	<p align="center"><b>Learning Priority</b></p>
<p><b>Domain 2:</b> Increase self-awareness</p>	<p>Learning Priority B: Develops self-efficacy to explore a community/global need and generate solutions.</p>
<p><b>Domain 3:</b> Develop employability skills</p>	<p>Learning Priority B: Exhibits productive workplace behavior, including sound decision-making and conflict resolution.</p>
<p><b>Domain 6:</b> Develop the ability to make informed educational choices</p>	<p>Learning Priority C: Develops effective resolutions for a given problem or decision.</p>

<b>Standards for Mathematical Practice 2</b>	<b>Reason abstractly and quantitatively.</b>  <i>Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.</i>
<b>CTE Middle Grades Exploration Standards</b>	
<b>Domain</b>	<b>Learning Priority</b>
<b>Domain 1:</b> Increase career awareness and exposure	Learning Priority A: Analyzes/compares industries and their economic functions.
<b>Domain 4:</b> Develop foundational technical skills	Learning Priority B: Applies mathematics and critical thinking to career exploration.
<b>Domain 6:</b> Develop the ability to make informed educational choices	Learning Priority A: Monitors academic performance to guide future opportunities.

<b>Standards for Mathematical Practice 3</b>	<p><b>Construct viable arguments and critique the reasoning of others.</b></p> <p><i>Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.</i></p>
<p align="center"><b>CTE Middle Grades Exploration Standards</b></p>	
<p align="center"><b>Domain</b></p>	<p align="center"><b>Learning Priority</b></p>
<p><b>Domain 1:</b> Increase career awareness and exposure</p>	<p>Learning Priority B: Explains connections among career options, education, and lifelong learning.</p>
<p><b>Domain 3:</b> Develop employability skills</p>	<p>Learning Priority C: Works collaboratively and respects diverse viewpoints. Learning Priority B: Uses productive interpersonal interactions (e.g., peer-to-peer critique).</p>

<b>Standards for Mathematical Practice 4</b>	<p><b>Model with mathematics.</b></p> <p><i>Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.</i></p>
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**CTE Middle Grades Exploration Standards**

<b>Domain</b>	<b>Learning Priority</b>
<b>Domain 4:</b> Develop foundational technical skills	Learning Priority A: Explores industry-specific skills and knowledge. Learning Priority B: Applies mathematics and technology skills to career tasks.
<b>Domain 5:</b> Develop an actionable plan for next steps in high-school	Learning Priority A: Prepares academic and career plans using data and requirements.

<b>Standards for Mathematical Practice 5</b>	<p><b>Use appropriate tools strategically.</b></p> <p><i>Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.</i></p>
<b>CTE Middle Grades Exploration Standards</b>	
<b>Domain</b>	<b>Learning Priority</b>
<b>Domain 1:</b> Increase career awareness and exposure	Learning Priority A: Analyzes global industries, often using digital research tools.
<b>Domain 3:</b> Develop employability skills	Learning Priority B: Uses tools responsibly and professionally.
<b>Domain 4:</b> Develop foundational technical skills	Learning Priority B: Applies technology skills to exploration within career clusters.

<b>Standards for Mathematical Practice 6</b>	<p><b>Attend to precision.</b></p> <p><i>Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.</i></p>
<p align="center"><b>CTE Middle Grades Exploration Standards</b></p>	
<p align="center"><b>Domain</b></p>	<p align="center"><b>Learning Priority</b></p>
<p><b>Domain 2:</b> Increase self-awareness</p>	<p>Learning Priority A: Understands personal strengths and develops accuracy in academic work.</p>
<p><b>Domain 3:</b> Develop employability skills</p>	<p>Learning Priority B: Demonstrates workplace behaviors including accuracy, honesty, and integrity.</p>
<p><b>Domain 4:</b> Develop foundational technical skills</p>	<p>Learning Priority A: Explores industry standards that require precision (e.g., engineering, health sciences).</p>

<b>Standards for Mathematical Practice 7</b>	<p><b>Look for and make use of structure.</b></p> <p><i>Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see <math>7 \times 8</math> equals the well remembered <math>7 \times 5 + 7 \times 3</math>, in preparation for learning about the distributive property. In the expression <math>x^2 + 9x + 14</math>, older students can see the 14 as <math>2 \times 7</math> and the 9 as <math>2 + 7</math>. They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see <math>5 - 3(x - y)^2</math> as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers <math>x</math> and <math>y</math>.</i></p>
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**CTE Middle Grades Exploration Standards**

Domain	Learning Priority
<b>Domain 1:</b> Increase career awareness and exposure	Learning Priority A: Analyzes industries and systems within the economy.
<b>Domain 4:</b> Develop foundational technical skills	Learning Priority A: Connects structural understanding to industry-specific processes.
<b>Domain 6:</b> Develop the ability to make informed educational choices	Learning Priority B: Chooses coursework aligned to career-related strengths and patterns.

<b>Standards for Mathematical Practice 8</b>	<p><b>Look for and express regularity in repeated reasoning.</b></p> <p><i>Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation <math>(y - 2)/(x - 1) = 3</math>. Noticing the regularity in the way terms cancel when expanding <math>(x - 1)(x + 1)</math>, <math>(x - 1)(x^2 + x + 1)</math>, and <math>(x - 1)(x^3 + x^2 + x + 1)</math> might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.</i></p>
<p align="center"><b>CTE Middle Grades Exploration Standards</b></p>	
<p align="center"><b>Domain</b></p>	<p align="center"><b>Learning Priority</b></p>
<p><b>Domain 2:</b> Increase self-awareness</p>	<p>Learning Priority B: Builds self-efficacy by developing strategies that improve performance over time.</p>
<p><b>Domain 3:</b> Develop employability skills</p>	<p>Learning Priority B: Prioritizes tasks and uses sound decision-making.</p>
<p><b>Domain 6:</b> Develop the ability to make informed educational choices</p>	<p>Learning Priority A: Monitors performance patterns to inform future opportunities.</p>