# Integrating Social, Emotional and Academic Development (SEAD) within the *Kentucky Academic Standards (KAS) for Mathematics*

# High School

**Purpose:**

The *Integrating Social, Emotional and Academic Development (SEAD) within the Kentucky Academic Standards (KAS) for Mathematics* resource is designed for educators to utilize when planning instruction to meet the needs of all learners. All learning is social and emotional. Integrating explicit attention to social and emotional competencies at the classroom level promotes an academic climate conducive to learning and can support individual students striving toward a collective goal of achieving a more equitable society (Charles A. Dana Center, 2016; The Aspen Institute, 2018).

There are numerous social and emotional learning strategies that can live in our classrooms, regardless of the content area being covered. Educators are encouraged to explore those strategies in depth by visiting KDE’s [Social, Emotional and Behavioral Learning/Health page](https://education.ky.gov/school/sdfs/Pages/Social,-Emotional-and-Behavioral-Learning-Health.aspx). **The focus of this document will be to highlight opportunities for mathematics educators to interweave the development of social emotional competencies with the development of mathematics content**.

**Overview**

This document contains:

* Connections between the social and emotional competencies within the [SEL Framework](https://casel.org/sel-framework/) from the Collaborative for Academic, Social, and Emotional Learning (CASEL) and the expectations set forth within the *KAS for Mathematics,* specifically the Standards for Mathematical Practices (SMPs).
  + The five SEL competencies are self-awareness, self-management, social awareness, relationship skills and responsible decision-making.
* Design considerations and specific examples of what integrating SEAD might look like within the specific grade level.
* Questions to empower teachers to self-reflect on ways to integrate SEAD within effective mathematics instruction.
* Questions teachers can use with students to encourage the development of social and emotional competencies while also engaging students with the SMPs.

**Note: The identified examples and linked resources within the document are possible suggestions; however, they are not the only pathways for integrating SEAD within the *KAS for Mathematics*.**

# Standards for Mathematical Practice

The SMPs support students’ full engagement in mathematical learning. Examining the SMP text below makes it clear that students cannot fully achieve the competencies described in these standards without demonstrating strength in CASEL’s SEL competencies (Charles A. Dana Center, 2016). Mainly, the SMPs reflect the view that learning is a social process, implicitly calling for teaching practices that leverage the power of a positive classroom climate and opportunities for collaborative learning. **This section highlights natural K-12 connections between the CASEL competencies and the SMPs**. Design considerations and specific examples of what integrating SEAD might look like within each grade level are provided in the section that follows.

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| **MP.1. Make sense of problems and persevere in solving them.** | **Connection to Social Emotional Learning Competencies** |
| Mathematically proficient students **start by explaining 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 other approaches to solving complex problems** and identify correspondences between different approaches. | **Self-awareness**   * Students are aware of the personal strengths and knowledge they bring to problem solving. * Students take ownership of where they are in the learning process. * Students embrace opportunities to demonstrate growth mindset.   **Self-Management**   * Students resist impulses and regulate their thoughts and behaviors. * Students manage their time and energy toward a goal while appraising their work.   **Social Awareness**   * Students take on others’ perspectives.   **Responsible Decision-Making**   * Students anticipate and evaluate the consequences of one’s actions. |

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| **MP.2. Reason abstractly and quantitatively.** | **Connection to Social Emotional Learning Competencies** |
| 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. | **Self-Management**   * Students self-regulate and think metacognitively. |
| **MP.3. Construct viable arguments and critique the reasoning of others.** | **Connection to Social Emotional Learning Competencies** |
| 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 also are 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.** | **Social Awareness**   * Students anticipate how their own arguments may be interpreted/received. * Students understand others’ perspectives to effectively interpret their arguments. * Students recognize strengths in others.   **Self-Management**   * Students think metacognitively and organize their own thoughts with given information.   **Relationship Skills**   * Students listen actively to further explore the arguments of others, providing feedback to help move thinking forward.   **Responsible Decision-Making**   * Students make a reasoned judgment after analyzing information, data, facts. |

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| **MP.4. Model with mathematics.** | **Connection to Social Emotional Learning Competencies** |
| Mathematically proficient students can apply the mathematics they know to solve problems that arise in everyday life. 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.** | **Self-awareness**   * Students are aware of their own strengths and limitations.   **Self-management**   * Students self-reflect and self-motivate by recognizing the need to improve and work toward goals.   **Responsible Decision-Making**   * Students identify solutions for personal and social problems. |

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| **MP.5. Use appropriate tools strategically.** | **Connection to Social Emotional Learning Competencies** |
| 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 appropriate tools to make sound decisions about when each of these tools might be helpful, recognizing both the potential for insight and 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 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**. | **Self-management**   * Students think metacognitively to identify when to use what tool. * Students motivate themselves to deepen their current understanding.   **Responsible Decision-Making**   * Students learning how to make a reasoned judgment after analyzing information, data and facts. |

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| **MP.6. Attend to precision.** | **Connection to Social Emotional Learning Competencies** |
| Mathematically proficient students try to **communicate precisely to others**. They try to **use clear definitions in discussions 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 and express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students **provide carefully formulated explanations to each other**. By the time they reach high school, they can examine claims and make explicit use of definitions. | **Social Awareness and Relationship Skills**   * Students take on the perspective of others and are aware of other’s thoughts and feelings in order to strengthen the effectiveness of communication.   **Self-management**   * Students self-regulate thoughts and behaviors. |

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| **MP.7. Look for and make use of structure.** | **Connection to Social Emotional Learning Competencies** |
| 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 7 × 8 equals the well-remembered 7 × 5 + 7 × 3, in preparation for learning about the distributive property. In the expression x2 + 9x + 14, older students can see the 14 as 2 × 7 and the 9 as 2 + 7. 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 are able to shift perspectives.** 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 5 - 3(x - y)2 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 x and y. | **Self-awareness**   * Students understand their strengths and possess confidence/optimism about their ability to look for and make use of structure.   **Self-management**   * Students motivate themselves, persist and regulate against impulses to give up when a pattern or structure is not immediately apparent. * Students manage their own progress. |

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| **MP.8. Look for and express regularity in repeated reasoning.** | **Connection to Social Emotional Learning Competencies** |
| Mathematically proficient students notice if calculations are repeated and look both for general methods and shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations 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 (y - 2)/(x - 1) = 3. Noticing the regularity in the way terms cancel when expanding (x - 1) (x + 1), (x - 1) (x2 + x + 1) and (x - 1) (x3 + x2 + x + 1) might lead to awareness of 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**. | **Self-awareness**   * Students accurately appraise their own abilities and work.   **Self-management**   * Students regulate their thoughts to know when organizational strategies are needed (e.g., writing key facts or organizing information on paper). |

## High School: SEAD Design Considerations

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| **Standards for Mathematical Practice** |

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| [MP.1.](#MP1) Make sense of problems and persevere in solving them.  [MP.2.](#MP2) Reason abstractly and quantitatively.  [MP.3.](#MP3) Construct viable arguments and critique the reasoning of others.  [MP.4.](#MP4) Model with mathematics. | [MP.5.](#MP5) Use appropriate tools strategically.  [MP.6.](#MP6) Attend to precision.  [MP.7.](#MP7) Look for and make use of structure.  [MP.8.](#MP8) Look for and express regularity in repeated reasoning. |

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| SELF-AWARENESS: **The abilities to understand one’s own emotions, thoughts, and values and how they influence behavior across contexts. This includes capacities to recognize one’s strengths and limitations with a well-grounded sense of confidence and purpose. Examples include, but are not limited to, the following:** • Integrating personal and social identities                • Identifying personal, cultural, and linguistic assets           • Having a growth mindset  • Identifying one’s emotions                                         • Demonstrating honesty and integrity                                  • Experiencing self-efficacy  • Linking feelings, values, and thoughts                      • Developing interests and a sense of purpose                    • Examining prejudices and biases |

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| Considerations when designing mathematics instruction that fosters **self-awareness:**   * **Support self-reflection and connection making.** Bring in students’ existing [funds of knowledge](https://modules.nceln.fpg.unc.edu/sites/modules.nceln.fpg.unc.edu/files/foundations/handouts/Mod%204%20Funds%20of%20knowledge.pdf) (culture, contexts, language and experiences), such as when students are reasoning quantitatively and use units to solve problems (Number and Quantity). Students attend to units in real-world problems, reasoning about the level of precision needed and the related error that may be introduced to the problem (MP.2). Consider ways to get to know students, such as asking them to list their favorite musicians, songs, sports, activities, games, food, etc., or by asking deeper questions about their culture, memories and family. Look for structures, such as the one mentioned [here](https://www.edutopia.org/article/daily-ritual-builds-trust-and-community-among-students), that can be embedded into class time to build a sense of trust and community in an authentic way. Use resources that contribute to strengthening students’ mathematical identities, encouraging exploration of the contributions diverse cultures have made to mathematics. Utilize [storytelling](https://go.info.amplify.com/download-ebook-fy20_math_mathebook_national_ebook?utm_campaign=FY20_STEM_virtualforum_National_register&utm_medium=email&_hsmi=96814825&_hsenc=p2ANqtz-_qm8mQZPBYGCZLu22Ov8Ml4eDpOZWNVGzti_t03mCTMrYNZAy4nAkI4XsANGL-c1oCf73hWyhVVvUXixv0ipMspxjFlUbvGB9hiW9jgqtZ5dvlVy8&utm_content=96814825&utm_source=hs_email) to highlight connections to the content students are learning wherever possible. * **Provide age-appropriate authentic feedback that invites students to engage in deeper reflection about their own strengths.** Develop a shared understanding of and expectation for approaching mathematics with a  [growth mindset](https://www.youcubed.org/resource/growth-mindset/) and for how that mindset will manifest within student self-talk and their communications with others. Formative assessment strategies are used to equip and empower students to take ownership of their learning. Consider sharing the questions within [A Family Guide to Understanding Assessment](https://education.ky.gov/curriculum/standards/kyacadstand/Documents/A_Family's_Guide_to_Student_Assessment.pdf) to enable students and families to continue to strengthen student self-awareness in a variety of situations. * **Present students with open-ended questions that offer students individuality and flexibility in how to approach finding solutions.** Engage students in solving and discussing tasks that promote mathematical reasoning and problem solving and allow multiple entry points and varied solution strategies (NCTM, 2014). Consider how to offer all students an entry point into mathematics, such as through the use of [Would You Rather Math](https://www.wouldyourathermath.com/) prompts or [I Notice, I Wonder](https://www.nctm.org/Classroom-Resources/Problems-of-the-Week/I-Notice-I-Wonder/) routines. Throughout classroom discourse, consider ways to encourage active listening among students to further explore the arguments of others, asking useful questions to clarify or improve the arguments (MP3). |

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| Questions for teacher self-reflection when planning instruction to foster student **self-awareness:**   * Why is it important to establish trust with my students to help develop [teacher credibility](http://www.ascd.org/publications/educational-leadership/sept18/vol76/num01/Boosting-Your-Teacher-Credibility.aspx#:~:text=Teacher%20credibility%20is%20students'%20belief,that%20they%20can%20be%20successful.&text=Teacher%20credibility%20has%20four%20components,competence%2C%20dynamism%2C%20and%20immediacy.)? What steps am I already taking to develop trust with my students? Is there anything I might want to shift about my current approach? * How do I offer my students ways to get to know who I am? * How do I utilize formative assessment practices in a way that highlights student knowledge rather than deficit knowledge? * What strategies do I teach my students to apply to assess their own work and that of their peers? What are my students’ strengths and weaknesses at peer-and self-assessment? How do I support students in responding to other’s use of math practices to support their ideas? * What is my understanding of [culturally responsive instruction](http://www.ascd.org/publications/educational-leadership/sept95/vol53/num01/A-Framework-for-Culturally-Responsive-Teaching.aspx)? What [steps am I taking](https://education.ky.gov/curriculum/standards/kyacadstand/Documents/STEM_Teaching_Tool_53_Cautions_for_Culturally_Responsive_Instruction.pdf) to incorporate culturally responsive instruction deeper into my classroom and instruction? Is there anything I might want to shift about my current approach? * How do I share the classroom’s authority and autonomy with students? Is there anything I might want to shift about my current approach? * What would it look like to include more student voice and student choice in my classroom? * What tasks provide [windows and mirrors](https://www.nctm.org/Publications/Teaching-Children-Mathematics/2016/Vol22/Issue6/tcm2016-02-358a/) into student noticings? * What methods do I use to identify problem solving contexts connected to students interests and/or societal topics relevant to students (at the local or global level)? * Utilizing [multilingual resources](https://www.elsuccessforum.org/resources/a-how-to-guide-for-teachers) can help students see themselves and their heritage in the learning, which promotes student agency. How do I use multilingual/multicultural resources to provide additional scaffolds for ELs? Is there anything I might want to shift about my current approach? * How can I elevate mathematical role models from diverse cultures? |

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| Questions to foster **self-awareness** in students:   * When given an example problem involving multiple operations containing a mistake, students answer the question “Where did the mistake occur and how do I know?” (MP.3). * What do you already know about solving this problem? (MP.4) * What are some of your family traditions that you are proud of? Would you be okay if we brought some of those into the classroom? * Encourage students to reflect on their self-awareness with questions such as, “How might my emotions impact the things I do, say, and write?” |

## High School: SEAD Design Considerations

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| SELF-MANAGEMENT: **The abilities to manage one’s emotions, thoughts, and behaviors effectively in different situations and to achieve goals and aspirations. This includes the capacities to delay gratification, manage stress and feel motivation and agency to accomplish personal/collective goals. Examples include, but are not limited to, the following:** • Showing the courage to take initiative                • Identifying and using stress-management strategies       • Setting personal and collective goals  • Exhibiting self-discipline and self-motivation     • Demonstrating personal and collective agency                 • Managing one’s emotions  • Using planning and organizational skills |

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| Considerations when designing mathematics instruction that fosters **self-management:**   * **Provide opportunities for students to think metacognitively and organize their own thoughts with given information**. Have students analyze situations by breaking them into cases and using counterexamples, clarifying misconceptions when appropriate. Cultivate opportunities for students to make conjectures and build a logical progression of statements to explore the truth of their conjectures. One important use of cases and counterexamples is in high school geometry when students might conjecture that the diagonals of a parallelogram bisect each other, after having experimented with a representative selection of possible parallelograms ([KY.HS.G.6](https://education.ky.gov/curriculum/standards/kyacadstand/Documents/Kentucky_Academic_Standards_Mathematics.pdf#page=214)). Another opportunity to elevate the use of counterexamples might be in high school geometry ([KY.HS.G.21](https://education.ky.gov/curriculum/standards/kyacadstand/Documents/Kentucky_Academic_Standards_Mathematics.pdf#page=224)) as students understand how to prove or disprove a figure defined by four given points in the coordinate plane is a rectangle, as well as prove or disprove the given point lies on the circle centered at the origin and containing an additional given point. These opportunities aren’t limited to geometry. As high school students build on middle school understanding about functions, students might analyze cases to determine the effects of transformations on the graph of a function ([KY.HS.F.8](https://education.ky.gov/curriculum/standards/kyacadstand/Documents/Kentucky_Academic_Standards_Mathematics.pdf#page=203)). Students use technology to explore how changing the value a constant impacts the graph of the function (MP.5) and use graphical representations to create plausible arguments about the effects of transformations, instead of relying on computational rules (MP.3). Embedded time and space for student reflection can have a significant impact on how well students are able to manage their emotions and express personal agency around the mathematics being learned. Consider how to support and equip students to take the initiative and move learning forward. * **Routinely ask questions that encourage students to reflect on barriers they may encounter and help them think about ways they can overcome challenges.** Consistently provide students, individually and collectively, with opportunities and support to engage in productive struggle as they grapple with mathematical ideas and relationships (NCTM, 2014). Promote student engagement and identity by embedding systems and routines, such as [Routines for Reasoning](http://www.fosteringmathpractices.com/routinesforreasoning/), to allow students to engage in productive struggle and take ownership of their progress and growth toward intended learning outcomes. In high school, students quantitatively reason to consider the units, limitations and parameters in linear and exponential functions in terms of a context (MP.2). While specific routines may vary among educators and even across different class sessions, routines can help foster a sense of predictability and safety for students as they learn mathematics. Establish clear learning goals that promote mathematical learning as just, equitable and inclusive. Consider engaging students in the development of success criteria, empowering them to evaluate where they are on the learning continuum and advocate for support as learning continues (MP.3). * **Routinely teach students how to use equipment and resources appropriately**. When making mathematical models, students should determine whether technology would be helpful to visualize the results of varying assumptions, explore consequences and compare predictions with data. Students should have opportunities to make sound decisions about when tools might be helpful, recognizing both the potential for insight and limitations (MP.5). In high school geometry, selecting an appropriate tool is important when generating geometric constructions ([KY.HS.G.8](https://education.ky.gov/curriculum/standards/kyacadstand/Documents/Kentucky_Academic_Standards_Mathematics.pdf#page=216)). In high school algebra, when graphing linear inequalities ([KY.HS.A.25](https://education.ky.gov/curriculum/standards/kyacadstand/Documents/Kentucky_Academic_Standards_Mathematics.pdf#page=194)) students may use technology to determine solutions to a system of linear inequalities (e.g., using DESMOS or graphing calculators) (MP.5). An additional element is equipping students to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems (MP5). |

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| Questions for teacher self-reflection when planning instruction to foster student **self-management:**   * How do I utilize formative assessment practices in a way that highlights student knowledge rather than deficit knowledge? How do I embed instructional routines to support students in self-assessing their progress toward the learning goal? Is there anything I might want to shift about my current approach? * What is my reaction when a student makes a mistake in my class? Is there anything I might want to shift about my current approach? How might I use student mistakes as an opportunity for learning? * How might I model self-discipline and self-motivation during my instruction? * What do I look for to see what my students understand and where my students need guidance? * How might I support students in working through problems without taking the thinking away from them? * How can I help students recognize the things they do and say are evidence of their learning? How can I support students in making their ideas visible and public? * How do I offer students the opportunity to make decisions about how to improve as opposed to a way to determine if they are right or wrong based on whether they get a “good” grade or “bad” grade? (For example, this might mean allowing students to revise incorrect or incomplete responses based on formative feedback about their initial work.) * What opportunities for student reflection are embedded within my plan for instruction? Are there specific [reflection prompts](https://ged.com/wp-content/uploads/MathPrompts.pdf) that lend themselves to this learning experience? Is there a specific [writing strategy](https://www.michigan.gov/documents/mde/Writing_to_Learn_Mathematics_306722_7.pdf) I could utilize with students to reflect on their learning in mathematics? |

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| Questions to foster **self-management** in students:   * Students ask themselves, “What is this problem asking me to find?” (KY.6.NS.1) * What examples could prove/disprove your argument? (MP.3, MP.8) * Is this always true, never true or sometimes true? (MP.3, MP.8) * Can you draw a picture to represent the problem? Can you make a chart, table or graph? (MP.2) * Provide sentence stems for students to choose from in their response, such as:   + Analysis: “How would you explain…? What is the importance of …?”   + Clarification: “Explain how … What is meant by …?”   + Cause and Effect: “What connection in there between …?”   + Comparison: “What is the difference between …? How are they alike?” |

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| SOCIAL AWARENESS: **The abilities to understand the perspectives of and empathize with others, including those from diverse backgrounds, cultures and contexts. This includes the capacities to feel compassion for others, understand broader historical and social norms for behavior in different settings, and recognize family, school and community resources and supports. Examples include, but are not limited to, the following:** • Recognizing situational demands and opportunities            • Taking others’ perspectives                    • Demonstrating empathy and compassion   • Identifying diverse social norms, including unjust ones       • Recognizing strengths in others            • Showing concern for the feelings of others  • Understanding the influences of organizations/systems on behavior                                                       • Understanding and expressing gratitude |

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| Considerations when designing mathematics instruction that fosters **social awareness:**   * **Promote a sense of belonging.** Build a safe community where mathematical discourse supports active listening, promotes diverse perspectives and insights, and allows students to consider others’ reasoning to advance their own mathematical understanding. Creating a learning community is essential for mathematical practices that are interpersonal by nature, such as MP.3. Establish that it is good to share opposing views, but views that are hateful, dehumanizing or disrespectful to others’ history, identity or experience are not acceptable. Co-create shared agreements or ground rules about how all members of the learning community will interact with empathy and the desire to understand other perspectives. Consider how to equip students with skills and strategies to [bridge differences](https://greatergood.berkeley.edu/images/uploads/Bridging_Differences_Playbook-Final.pdf). Normalize mistake-making and celebrate intellectual risk-taking using strategies such as [My Favorite No.](https://learn.teachingchannel.com/video/class-warm-up-routine) Engage students in giving and receiving constructive feedback. * **Lead class activities that offer students the opportunity to share their perspectives and learn from the perspectives of others.** Use collaborative structures to ensure learning engagement and equity of voice. Communicate that students’ thinking is valued to build trust and rapport by asking questions that elicit students’ thinking, such as in the KAS-M Cluster: [Make inferences and justify conclusions from sample surveys, experiments and observational studies](https://education.ky.gov/curriculum/standards/kyacadstand/Documents/Kentucky_Academic_Standards_Mathematics.pdf#page=234) when students compare and contrast the different roles randomization plays in data collection (MP.8). Utilize activities, like [Which One Doesn’t Belong](https://wodb.ca/index.html), to engage high school students in explaining their approach to a problem, critiquing the solutions of others and comparing the different approaches in terms of whether they are accurate and efficient (MP.3). Engage groups of students in discussions around how methods of sampling a population affect the reliability and validity of the data gleaned, prepare them to justify their conclusions and make generalizations in a valid way ([KY.HS.SP.11](https://education.ky.gov/curriculum/standards/kyacadstand/Documents/Kentucky_Academic_Standards_Mathematics.pdf#page=234), MP.3). Deconstructing a multiple-choice question might offer students the opportunity to discuss why the incorrect (distractor) answers may have been included and can also be used to highlight common mistakes or misconceptions. Support students in making their thinking visible. Consider how to highlight when one student’s thinking influences others. * **Use cooperative learning and project-based learning strategically (reflecting thoughtfully and intentionally on the composition of groups) to build diverse working groups.** Reflect on student identities and agency to build diverse groups. Position students as competent, and elevate the status of students by valuing different contributions students make when they model a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities and sketch graphs showing key features given a verbal description of the relationship ([KY.HS.F.1.c](https://education.ky.gov/curriculum/standards/kyacadstand/Documents/Kentucky_Academic_Standards_Mathematics.pdf#page=196)). Translating between multiple representations helps students understand each form represents the same relationship and provides a different perspective on the relationship, especially when students compare and contrast different characteristics of functions to connect features of the graph with different real-world contexts (MP.3, MP.6). Engage students in making connections among mathematical representations to deepen understanding of mathematics concepts and procedures as tools for problem solving (NCTM, 2014). For example, when determining groups for a project, consider beginning with a class discussion around what strengths are needed to solve the given problem. From there, consider having students list their personal strengths, and then, without names attached, have students put groups together based on strengths. |

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| Questions for teacher self-reflection when planning instruction to foster student **social awareness:**   * How do I group my students for collaborations and small-group work (ability, homogenous or heterogenous according to a specific criteria)? Is there anything I might want to shift about my current approach? * How is learning typically arranged in my classroom? Is it individual practice, whole-group instruction, collaborative work, exploration? Why or how do I choose these approaches for practice? Are there other strategies and structures I might want to use in the classroom? * How do I determine when whole-class discussion might need to happen? * How might I elevate the importance of exploring math concepts as opposed to seeking the “right” answer? * How might I support students in making their thinking visible? * How deep is my understanding of how the mathematics content standards are connected within and across grade levels? * Do I select the instructional strategies I use according to the target of the standard I am teaching? Is there anything I might want to shift about my current approach? * How might I investigate the social, cultural and historical influences behind different views? Whether or not there is strong disagreement within your group, learning more about those with opposing views can build empathy and improve communication. |

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| Questions to foster **social awareness** in students:   * How is \_\_\_’s way of solving the problem like/different from yours? (MP.1) * What can using a \_\_\_\_ show us that a \_\_\_\_ may not? (MP.5) * What connections do you see? (MP.4) How does this connect to what you’ve learned in the past? How can you use that knowledge today? * When looking at standardized test questions, are there ways to justify other answers by unpacking the assumptions that are made in the problem? * Encourage students to reflect on their social awareness with questions such as, “How might my words impact others?” |

## High School: SEAD Design Considerations

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| **Standards for Mathematical Practice** |

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| [MP.1.](#MP1) Make sense of problems and persevere in solving them.  [MP.2.](#MP2) Reason abstractly and quantitatively.  [MP.3.](#MP3) Construct viable arguments and critique the reasoning of others.  [MP.4.](#MP4) Model with mathematics. | [MP.5.](#MP5) Use appropriate tools strategically.  [MP.6.](#MP6) Attend to precision.  [MP.7.](#MP7) Look for and make use of structure.  [MP.8.](#MP8) Look for and express regularity in repeated reasoning. |

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| RELATIONSHIP SKILLS: **The abilities to establish and maintain healthy and supportive relationships and to effectively navigate settings with diverse individuals and groups. This includes the capacities to communicate clearly, listen actively, cooperate, work collaboratively to problem solve and negotiate conflict constructively, navigate settings with differing social and cultural demands and opportunities, provide leadership, and seek or offer help when needed. Examples include, but are not limited to, the following:** • Seeking or offering support and help when needed           • Communicating effectively             • Developing positive relationships  • Practicing teamwork and collaborative problem-solving    • Demonstrating cultural competency • Resolving conflicts constructively  • Standing up for the rights of others                                       • Resisting negative social pressure                • Showing leadership in groups |

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| Considerations when designing mathematics instruction that fosters **relationship skills**:   * **Recognize power dynamics in play.** Consider what teacher moves might help students [strengthen reasoning and communication skills](http://stem4els.wceruw.org/resources/Student-and-Teacher-moves.pdf), along with ways to empower students to use similar strategies in collaborative groups. Attend to the ways in which students position one another as capable or not capable of doing mathematics and provide opportunities to elevate the voices of marginalized students, such as strategically sharing student work, student thinking and solutions (MP.3). Some students may feel uneasy about sharing their views, especially if they perceive that they are in the minority or that group leaders disagree with them. Leaders do not need to pretend to be neutral but should model interest and a welcoming attitude toward opposing views. Elicit feedback from students on the classroom culture. Encourage students to advocate for structures that would encourage participation and collaboration. * **Use team-based, collaborative teaching practices to provide students with opportunities to develop and practice communication and social skills.** Enhance students’ mathematical agency by including regular collaborative opportunities for students to work together with others as a team on [modeling](http://www.siam.org/Portals/0/Publications/Reports/gaimme-full_color_for_online_viewing.pdf?ver=2018-03-19-115454-057) tasks that provide multiple pathways for success and that require reasoning and problem solving (MP.4). Full-blown modeling tasks require many different skills, including sifting through information and deciding what is relevant, interpreting graphs, locating information needed to solve a problem, and making simplifying assumptions. Students need opportunities to work on these skills a few at a time as well as together. Collaborative learning experiences also can serve to reinforce self-management skills. One way to do this might be to urge students to continually evaluate and talk to their peers about the reasonableness of their results. In high school students practice modeling techniques using a variety of strategies and practices ([KY.HS.G.31](https://www.nctm.org/uploadedFiles/Standards_and_Positions/PtAExecutiveSummary.pdf#page=228)), for example, designing an object or structure to satisfy physical constraints or minimize cost, working with typographic grid systems based on ratios. As students use geometric methods to solve design problems, there should be embedded opportunities to reflect on whether their method and process makes sense for the problem and revise, as needed, until a viable solution has been found (MP.1). A common framework for this is the [3 Act Task](https://tapintoteenminds.com/3act-math/) but there are lots of ways to adapt these tasks to suit the specific needs of your students. * **Intentionally use collaborative work groups to reinforce the importance of working together to solve problems and achieve goals.** Position students as mathematically competent by encouraging students to construct mathematical arguments and engage in the reasoning of others. Empower students to give and receive constructive feedback. As students engage in learning experiences that require them to listen to the argument of others, decide if they make sense and ask useful questions to clarify or improve the argument, it may be useful to implement discussion protocols to provide a safe environment for students to share their developing thinking (MP.3). In high school geometry, there are multiple opportunities for this as students routinely use various forms of proof (formal, informal, direct and indirect) to outline their logic and defend their conjectures (MP.3). Specifically within the [Cluster: Prove geometric theorems](https://education.ky.gov/curriculum/standards/kyacadstand/Documents/Kentucky_Academic_Standards_Mathematics.pdf#page=214), students consider alternate approaches to a proof or a conjecture and debate the alternatives for effectiveness and accuracy (MP.2, MP.3). Use [purposeful questions](https://www.nctm.org/Conferences-and-Professional-Development/Tips-for-Teachers/Asking-Questions-and-Promoting-Discourse/) to assess and advance student’s reasoning and sense making about important mathematical ideas and relationships (NCTM, 2014). By thinking about when misconceptions are likely to arise in the lesson, teachers can plan to use strategies, such as [Talk Moves](https://irp-cdn.multiscreensite.com/7a45b809/files/uploaded/talk_moves_map_oconnor_2017.pdf), that will support students to clarify and advance their learning. Planning to use these strategies allows teachers to be ready to quickly take appropriate pedagogical action for many of their learners. |

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| Questions for teacher self-reflection when planning instruction to foster student **relationship skills:**   * How was I taught math when growing up? Was my experience a balance of conceptual understanding, procedural skills/fluency or application, or did it lean more heavily in one area? How do I typically teach mathematics? Is my instruction a balance of conceptual understanding, procedural skills/fluency or application, or does it lean more heavily in one area? * What steps am I taking to engage students in the mathematical practices as they learn mathematical content? Would I (or my team/PLC) benefit from examining the *KAS for Mathematics* more deeply using the [Breaking Down a Standard protocol](https://kystandards.org/standards-resources/mathematics-resources/breaking-down-a-mathematics-standard/)? Do I (or my team/PLC) understand how the target of the standard and the coherence component inform instruction around the standard? Have I (or my team/PLC) reflected on common preconceptions, misconceptions and challenges/confusions that might arise for my students? * What steps am I taking to ensure all my students get the same [opportunities to communicate and collaborate](http://stemteachingtools.org/brief/35) through classroom discussions? Which student(s) do I typically call on to participate in class discussions? Is there anything I might want to shift about my current approach? * How might I use modeling in my classroom to support students in understanding where they are in their own learning? * What learning experiences am I offering students to allow them to demonstrate flexibility in representing mathematics? Is there anything I might want to shift about my current approach? * How might I utilize and engage with problems that have complex, competing or multiple answers? * What strategies do I have for facilitating [productive mathematics discussions](https://www.nctm.org/Research-and-Advocacy/Research-Brief-and-Clips/Strategies-for-Discussion/)? What steps do I take to plan for sharing student responses according to different methods and solution pathways, instead of randomly calling on students? Is there anything I might want to shift about my current approach? * How might I support students in giving feedback in specific situations? Are there specific strategies I might employ to help students improve their communication skills? |

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| Questions to foster **relationship skills** in students:   * What do you think about what \_\_\_ said? Do you agree? Why or why not? (MP.1, MP.3) * What if you had started with \_\_\_ rather than \_\_\_? (MP.6) * Did you try a method that did not work? Why didn’t it work? Would it ever work? Why or why not? (MP.3) * Encourage students to reflect on their relationship skills with questions such as, “How can I communicate my views authentically and respectfully?” * What would you like to accomplish as a result of being on this team/in this group? * What traits do you value most in a team member? |

## High School: SEAD Design Considerations

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| **Standards for Mathematical Practice** |

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| [MP.1.](#MP1) Make sense of problems and persevere in solving them.  [MP.2.](#MP2) Reason abstractly and quantitatively.  [MP.3.](#MP3) Construct viable arguments and critique the reasoning of others.  [MP.4.](#MP4) Model with mathematics. | [MP.5.](#MP5) Use appropriate tools strategically.  [MP.6.](#MP6) Attend to precision.  [MP.7.](#MP7) Look for and make use of structure.  [MP.8.](#MP8) Look for and express regularity in repeated reasoning. |

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| RESPONSIBLE DECISION-MAKING**:** **The abilities to make caring and constructive choices about personal behavior and social interactions across diverse situations. This includes the capacities to consider ethical standards and safety concerns and to evaluate the benefits and consequences of various actions for personal, social and collective well-being. Examples include, but are not limited to, the following:** • Demonstrating curiosity and open-mindedness                          • Learning to make a reasoned judgment after analyzing information, data, facts  • Identifying solutions for personal and social problems              • Recognizing how critical thinking skills are useful both inside & outside of school  • Anticipating & evaluating the consequences of one’s actions  • Reflecting on one’s role to promote personal, family and community well-being |

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| Considerations when designing mathematics instruction that fosters **responsible decision making:**   * **Provide opportunities for students to make responsible decisions. Give students problem scenarios and ask them to work in groups or pairs to decide what they would do.** Students might be asked to apply proportional reasoning to plan a school event or analyze a problem in the community (MP4). Bring in students’ [funds of knowledge](https://modules.nceln.fpg.unc.edu/sites/modules.nceln.fpg.unc.edu/files/foundations/handouts/Mod%204%20Funds%20of%20knowledge.pdf) by ensuring tasks have a connection with learners while also providing opportunities to learn about the broader world, such as when investigating tasks involving geometric measurement that have a significant modeling component as in KAS-M Cluster [Apply geometric concepts in modeling situations](https://education.ky.gov/curriculum/standards/kyacadstand/Documents/Kentucky_Academic_Standards_Mathematics.pdf#page=228). 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 (MP.4).  As students use geometric methods to solve design problems, they continually reflect on whether their method and process makes sense for the problem and revise, as needed, until a viable solution has been found (MP.1).  Look for opportunities to engage students in [prosocial mathematics](https://ggie.berkeley.edu/academic-instruction/prosocial-math/). “Instead of using word problems that are decontextualized or that always focus on consumerism and profit motives, a middle school math teacher might utilize algebra and geometry problems that incorporate environmental and social issues while covering the same mathematical concepts. For instance, instead of a problem about how a store owner can maximize profit through different kinds of advertising, he asks how the director of a homeless shelter can maximize money going back into the community through different housing plans” (Greater Good in Education., 2020). Have students routinely evaluate how well they worked together with their partner or group to hold students accountable for improving their part in a group learning situation. * **Model good decision-making.** Establish classroom discussion norms that support facilitating discourse among students to build a shared understanding of mathematical ideas by analyzing and comparing student approaches and arguments (NCTM, 2014). Being intentional about the language used when engaging with mathematical applications can be especially impactful. “Attention to the language of uncertainty in problem solving, such as hedging or equivocation (such words as “maybe”, “probably”, “almost”, “wonder”, “sort of”), is an important “think aloud” teaching method that models the process of conjecture and speculation.  Presenting application problems in terms of hesitation, hedging, and ambiguity, and asking students to model their responses on this same language, will teach students to contextualize their solutions in terms of their own authority and social position. Reflecting on the language of uncertainty allows us to reflect on the ethical dimension of our problem solving, to reflect on the implication of our proposed solutions.” (de Freitas, 2008, p. 90). The four-step investigative process students experienced in middle school now provides a foundation for students as they continue to model increasingly complex real-world situations with mathematics (MP.4). Encourage students to reason inductively about data and make plausible mathematical arguments that take into account the context from which the data arose. When making mathematical models, students can use technology to visualize the results of varying assumptions, explore consequences, and compare predictions with data.  Students justify their conclusions, communicate them to others (orally and in writing) and critique the conclusions of others (MP.3). Students should also be aware of most common misinterpretations of correlation ([KY.HS.SP.8](https://education.ky.gov/curriculum/standards/kyacadstand/Documents/Kentucky_Academic_Standards_Mathematics.pdf#page=232)) and should avoid suggesting strong statistical associations imply one causes the other. * **Engage students in learning where they develop voice and perspective to more fully participate in the local context and beyond.** Look for opportunities to utilize primary source documents or lessons, such as graphs, situations, etc., that deal with current world events. Consider facilitating [Data Talks](https://www.youcubed.org/resource/data-talks/), short 5-10 minute classroom discussions to help students develop data literacy. Online tools, such as [CODAP](https://codap.concord.org/), might be options to support students as they work to summarize, visualize, and interpret data, advancing their skills to use data as evidence to support a claim. Utilizing [slow reveal graphs](https://slowrevealgraphs.com/), as demonstrated [here](https://amplify.com/math-teacher-lounge?utm_campaign=FY20_Math_mathteacherlounge.com_National_videoseries&utm_medium=email&_hsmi=105707915&_hsenc=p2ANqtz-9xlfmbHGZa5heYHLkxM7AlAO5XE0Ma7rwjb0tA87X3RK5FW5mj1Nvpali_tSxG9HGdZZL1Brv74ckTeFswFapaxgKMz5SuaxV9HkS7u0ajrP69WK8&utm_content=105707915&utm_source=hs_email), can be a powerful tool in creating curiosity, offering multiple entry points to a discussion on data and eliciting profound noticings from students. When learning to make a reasoned judgment after analyzing information, data, facts, encourage students to consider how making responsible decisions can promote systemic change within their local context and beyond. Attention will need to be given to helping students understand how their role can impact the systems and structures around them. |

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| Questions for teacher self-reflection when planning instruction to foster student **responsible decision making:**   * What steps am I taking to establish a culture that reinforces with students that a mathematical model used to represent a problem’s solution is a “work in progress” and may be revised as needed? Is there anything I might want to shift about my current approach? * How might I [study the community](http://stemteachingtools.org/brief/31) in which I teach and incorporate issues that affect my students into my instruction? * What strengths and values might I highlight from the community in which I teach? * What steps am I taking to offer students opportunities to actively engage and use their voice within my classroom? Is there anything I might want to shift about my current approach? How might I support that same active engagement and voice beyond my classroom and beyond my school? * What process do I use when [designing a learning experience](https://www.edutopia.org/article/bringing-culturally-responsive-lens-math-class) that has students “taking action” as the final product? What might “taking action” look like for students in my classroom and beyond? |

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| Questions to foster **responsible decision making** in students:   * What information do you have? What do you need to find out? (MP.1) * Is this working or do you need to change your model? (MP.4) * What uses of mathematics can you find in current events? What contemporary issues might be addressed through the application of mathematics? (MP.7) * Reflect on your day so far. What math have you already used today? * Encourage students to reflect on responsible decision making with questions such as, “What has been the impact of my decisions so far?” |

\*For additional support integrating the Standards for Mathematical Practice access the [Engaging the SMPs: Look fors and Question Stems](https://education.ky.gov/curriculum/standards/kyacadstand/Documents/SMP_Look_Fors_and_Question_Stems.pdf) resource.

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