Mathlete Nation, AY25

August 12, 2024

Mission

Our Department's mission is to educate and inspire cadets in the mathematical sciences so that each graduate is a commissioned leader of character committed to the Army Values, and to support the development of **Mathletes** for careers of professional excellence and service to the nation.

Mathletes are:

- ∞ Leaders: We lead by Example with Character in all we do, in the classroom, at the Academy, in the West Point community, in the global mathematical sciences community, and in the Army.
- ∞ Teammates: We support, serve, and respect one another (and the organization) in all we do! We shoulder more than our share of the load and seek to do more.
- ∞ Educators & Mentors: We inspire cadets and faculty in the study of mathematics and are passionate about helping them grow and develop as learners and future leaders.
- ∞ Critical Thinkers: We study, innovate, collaborate, explore, and respond to improve as an organization, to advance the discipline, and to solve tough problems.

Vision

When you put a bunch of Mathletes in a 'room' together, great things will happen (because, see Figure 1 and below notes!).

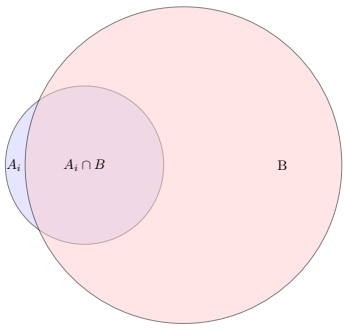

Figure 1: Set A_i represents what faculty member i of N members wants to do (and is good at), while Set B includes departmental needs (cadet development, faculty development, scholarship, teaching, and service). Our goal is to meet these needs, i.e., cover Set B by thoughtfully aligning faculty members $(A_1, A_2, ..., A_n)$ such that we maximize $\sum_{i \in N} |A_i \cap B|$. Doing this puts our faculty in the best position to accomplish the 'inspire' in our mission statement (see MAJ Joe Maxwell for context). Note: we recognize this is somewhat anecdotal and that we may have to ask faculty to do things in B not in $A_i \cap B$, but we also strive to support faculty in doing those things in A_i not in B as well.

In particular, we:

- Recognize leadership is easier when those being led are personally accountable.
- Provide thorough and cordial feedback when asked for help.
- Step out of our comfort zone(s) and encourage each other to persist through frictions.
- Shoulder more than our share of the load and volunteer when able.
- Stay positive and bring energy.
- Give credit and share gratitude appropriately.
- Enforce standards in an endearing way that creates buy-in and inspires commitment to the team.
- Prepare to a high standard by researching and writing to articulate our thoughts.

Key Tasks

We have five key tasks for everyone to keep in mind:

- Treat every engagement with a faculty member and/or cadet as an opportunity to inspire them to live honorably, lead honorably, and/or demonstrate excellence.[1]
- Prioritize and quantify interpersonal engagements, particularly counseling[2] for faculty and PDRs, SLDPs, PL300 mentors, and Character Education for cadets, to promote a professional work environment.[3]
- Create active learning spaces with a goal to create omnidirectional dialogue by viewing our 'lessons' through the eyes of the learner, i.e., focusing on the classroom experience.[4] (*see Enclosure 3 for our AY25 Board Problem Challenge*)
- Seek to integrate generative AI technologies in the classroom to enhance learning; similarly look to integrate and employ associated learning software and apps to improve operations, faculty development, and curricular efforts within the department.[5]
- Avoid PowerPoint; communicate clearly and succinctly in writing (preferably LaTeX) with a 'research mindset' and an eye toward publishing and presenting.

Endstate

USMA graduates instinctively apply their mathematical and analytical education to solve complex problems with integrity.

[1] West Point Leader Development System.
[2] https://cal.army.mil/Resource-Library/Doctrine/ATP6-22.php.
[3] Superintendent's Academic Year 2025 Annual Guidance.
[4] Teaching for Robust Understanding (TRU) Framework, https://truframework.org/.
[5] Dean's Academic Year 2025 Annual Guidance.

What We Do & How We Organize (AY25)

Our Department's efforts, aligned with our educate and inspire mission for cadets, consist predominately of developing the curriculum and teaching three levels of courses: (i) 'core' courses for plebes and yearlings in mathematical modeling, calculus, and statistics as part of the Academic Program's Math, Science, and Engineering sequence within the core curriculum, (ii) 'service' courses in support of other STEM Department majors, and (iii) 'major' courses for three academic majors: Mathematical Sciences (MSC), Operations Research (OR), and Applied Statistics and Data Science (ASDS), which also include research. We demonstrate our character by leading by example and living by the Army Values.

The core teaching requirement represents 70% of our collective teaching mission - it is our main effort. The service teaching component, of which the largest courses include MA205 and our engineering math courses, make up another 15%, while teaching our major(s) courses comprise the remainder. Cadets take many different paths through core and service courses depending on their initial placement and subsequently declared major. There are numerous courses for our Department's majors, and a robust set of independent study, AIAD, and thesis research options. These research opportunities provide the best developmental opportunity we provide for our majors. We have observed a considerable difference in the intellectual development of cadets who engage in research versus those who do not, i.e., there are two distinct trajectories. Thus, to educate well, we must embrace the idea that **teaching and research are indispensable to each other**.

We teach mathematical modeling, calculus, and statistics as core curriculum courses because these subjects provide essential skills for understanding and solving real-world problems, ultimately benefiting the Army. By focusing on how to think critically and analytically (rather than what to think), these courses equip cadets with the tools needed to solve challenging problems.

Mathematical modeling is essential for representing complex systems with mathematical constructs, and it is directly linked to the field of operations research. It allows students to use their analytical skills to represent real-world situations, providing a framework for systematically analyzing and solving problems. The ability to create and interpret these models arms students with the skills to address multifaceted problems and make informed decisions in high-stakes environments. Calculus plays a significant role in understanding change and motion, is essential for modeling and analyzing dynamic systems, and is foundational for studies in the mathematical sciences and other STEM fields. Statistics is essential for making sense of data and drawing informed conclusions to foster effective decision-making. Statistical techniques underpin machine learning algorithms and AI technologies, driving innovations and efficiencies in numerous sectors.

Moreover, multi-faceted mathematics education develops a broad range of reasoning skills through processes such as induction and deduction. Students learn to move from puzzling data to suggested meanings (induction) and then back from those meanings to the data (deduction). This reasoning process, alongside other elements such as approximation with error analysis and data analysis, runs throughout the core mathematics sequence, reinforcing the analytical mindset necessary for future leaders. These mathematical skills are foundational for choosing any major, whether in the humanities or STEM fields. Cadets across disciplines benefit from understanding quantitative reasoning, which enhances their engagement with a wider range of subjects. This interdisciplinary relevance underscores the importance of mathematical modeling, calculus, and statistics as core components of a well-rounded liberal arts education, preparing all cadets—regardless of their chosen field—to think critically and solve problems effectively in a complex world.

For future military officers, these mathematical principles are particularly valuable. Officers often need to make strategic decisions based on quantitative data, evaluating mission parameters, resource allocations, and personnel effectiveness. By teaching students how to think critically about data and situations—rather than merely accepting information at face value—we empower future leaders to rigorously assess challenges and develop informed strategies, i.e., cultivate leaders with an analytical mindset.

We organize our Department into four programs. We have three programs that oversee teaching and curricu-

lar efforts from core course to capstone/thesis in (1) Mathematical Sciences (MSC), (2) Operations Research (OR), and (3) Applied Statistics and Data Science (ASDS). These three programs have the primary tasks of providing oversight and integration of core courses, oversight of courses for D/Math majors, and the integration and assessment of an academic major. The MSC program also has the task of integrating the service courses across the Dean's directorate. The fourth program is the research program which manages the independent studies and thesis courses and coordinates a wide variety of external engagements in support of cadet (and faculty) research across the department, USMA, and the DoD. As part of the research program, we have two outward-facing analytically-focused centers: the Center for Data Analysis and Statistics (CDAS) and the Mathematical Sciences Center and two Programs: NPH AIDE-ML and Insider Threat. The research program also oversees USMA's outreach-focused center, CLD-STEM.

Each program is led by a program director (PD) who is the department's foremost expert in providing intellectual capital in their discipline to the Army and USMA. Our academic PDs play a pivotal role in ensuring the academic excellence, accreditation, and integrity of the program, based on the primary tasks above, while mentoring faculty teaching in the program. They integrate program activities (courses) to provide a coherent experience (across courses) for students. The Research Program Director in the Math Department is responsible for leading and coordinating research initiatives that enhance the Department's reputation and showcase cadet and faculty intellectual capital through funded and non-funded research. This position involves developing strategic partnerships, securing funding, ensuring compliance with Academy regulations, overseeing research projects, and promoting collaboration among faculty and students.

Each program also has Associate Program Directors (APDs). PDs determine the roles of each of their APDs. APDs frequently supervise and provide mentorship to course directors (CDs) of large-enrollment courses. APDs coordinate modifications to course content with stakeholders and connect year-to-year efforts. Alternately research APDs lead centers and align cadets and faculty together to solve problems for a client.

The CD of a course is responsible for the overall management and leadership of the course. CDs develop a plan to enact and execute the PD/APD's vision for a given course. This role involves executing the provided curriculum (from PD), coordinating teaching staff, managing course logistics, and ensuring a high-quality educational experience for all students and faculty. The CD collaborates with program leadership, Department faculty, and administrative staff to effectively prepare the environment for cadets to learn. Key responsibilities include the design and development of course materials, enhancing student engagement and learning outcomes, and developing and administering assessments (formative and summative), including Writs, WPRs, and projects, to assess student learning outcomes. Each CD has a primary program leadership POC, either the PD or an APD. Notably CDs coordinate weekly meetings to educate and inspire assigned faculty and share ideas to ensure continuous learning.

While our primary organizational method is by teaching, faculty also serve the Department as part of a committee led by an APD that specializes in a specific area, predominately (i) coordinating and tracking department training, (ii) organizing social events, (iii) celebrating department efforts on social media, (iv) coordinating faculty and cadet development opportunities, (v) hiring superstar instructors, (vi) determining cadet placement, or (vii) advising and working with admissions. Our Department efforts are supported by a stellar staff that, among other things, oversees and cares for our people, manages our budget, travel, and IT. Many of our Program Directors and Professors also take on large roles supporting Academy-level missions on committees such as promotions & credentials, curriculum, WPLDS, or admissions.

This organizational structure is intended to help integrate and supervise curricular efforts - it does not limit faculty roles. Our faculty educate and inspire cadets by teaching - primarily in the core courses where we have the broadest impact on the Corps of Cadets - and by advising cadet research - where we have the deepest impact on individual D/Math majors. Thus, we reiterate that these two components - **teaching and research** - are indispensable to each other. Diving deeply into a topic with cadets helps our faculty become better teachers, and teaching a broad set of cadets helps our faculty become better advisors - and better scholars. We intend for teaching and advising efforts to position faculty members so that with the addition of marginal time and energy they can transition their work into a peer-reviewed publication and/or conference presentation (at their convenience).

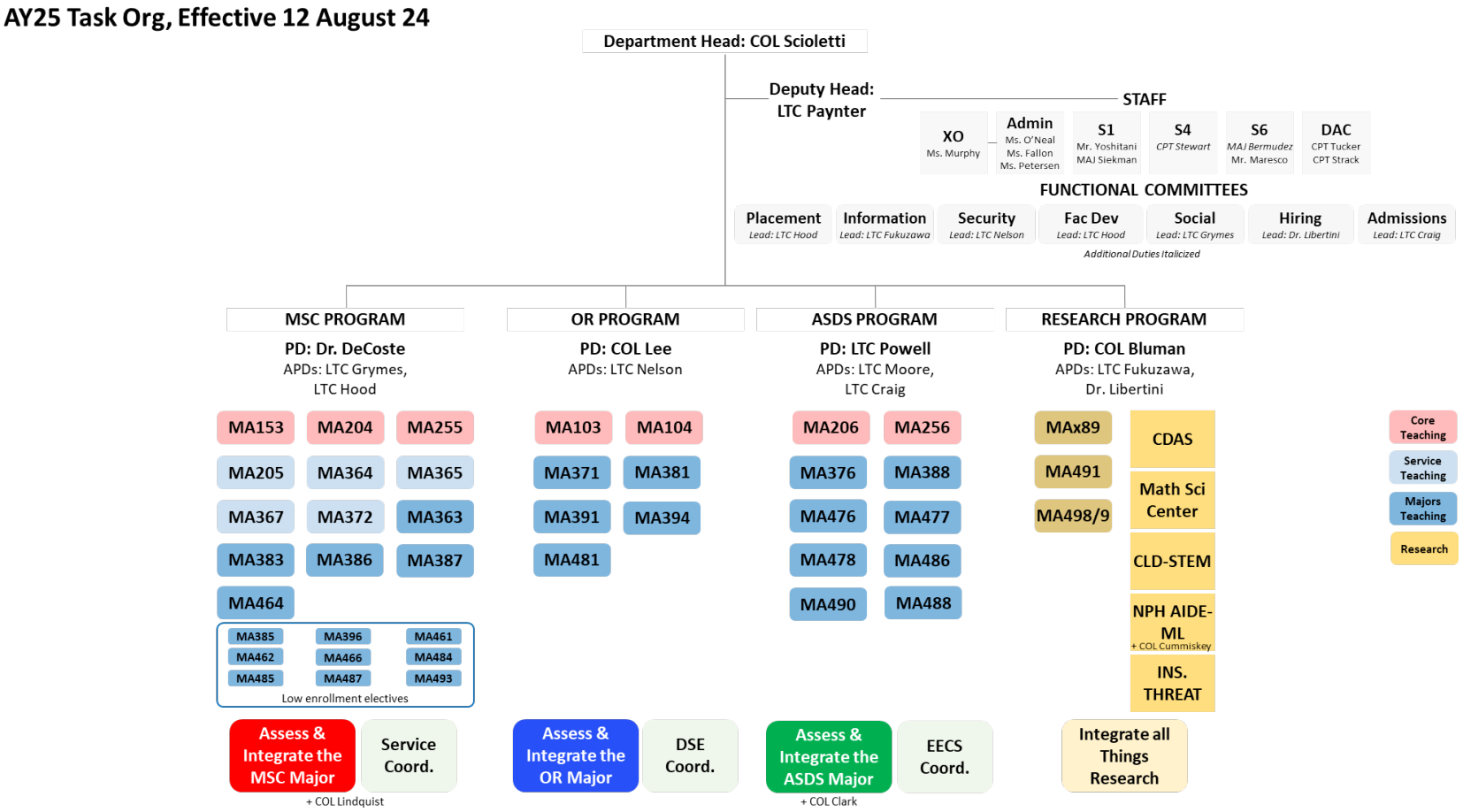

Figure 2: AY25 task organization. While PDs and APDs have enduring leadership requirements for their programs even when teaching a course outside their program, most Mathletes will move between programs as the Department task organizes faculty to programs for teaching and course oversight each semester. This is an organizational feature that helps maintain the Department's culture as it promotes Mathletes working with a wider subset of the faculty. Everyone also has an additional role as part of the functional committee structure supporting the Department's operations. Each Program Director has a specified inter-departmental, i.e., USMA-wide coordination task.

AY25 Priorities

Our 10 AY25 priority activities for the Department will take energy, resourcing, and attention.

a. **Core, Service, Major Course Teaching Requirements & Placement.** Teaching is our driving and most resource-intensive mission. The addition of MA204 and adjustments to MA100 place renewed focus on careful, multi-stage cadet placement. In addition to our placement efforts, we have two other major changes: a revamped MA103 and a reset of MA205 to 55-minute periods. We must socialize this work broadly across USMA; all departments need opportunities to learn and provide feedback. In FDW we introduced the TRU framework to focus our pedagogical efforts and establish a common lexicon to continuously improve the classroom experience for cadets, let's continue its use through the AY and leverage it when conducting class visits and providing feedback.

b. **Major Research Advising and MaRS Planning/Execution (w/ SASMC(T)).** Undergraduate research is the most developmental activity that we can provide for our D/Math majors (and faculty). It is largely coordinated by our research program and its center directors; I need everyone involved as an advisor. MaRS is a heavy Department lift and our summative AY event. The possible combination of other service academies if we add a SASMC component will slightly adjust our prior year's plan.

c. **ASDS ABET Accreditation (w/ advisory board).** Our most important strategic effort in AY25 is the ASDS ABET accreditation effort, with an ABET team and advisory board visit. Part of this effort includes the 'integration not concatenation of ethics' into appropriate courses.

d. **NPH (NIH) Program Requirements.** Nutrition and Precision Health efforts with the AIDE-ML program continue after the June workshop that was the mid-point of the grant; with just over two years remaining on the grant, we may need to surge to finish strong.

e. **ACD & Faculty Development Program(s) (e.g. Mathfest).** We will formalize the three-year junior military development plan focused on course director development and invigorate our civilian faculty development efforts.

f. **MSC/OR + Core/Service Self-Assessment (initiation, execution AY26).** We will be assessment focused in AY26 for the MSC major, OR major, core courses, and service courses. This will require planning in AY25 and will drive possible curricular update efforts in AY27 and AY28.

g. **CLD-STEM Program ICW LEADS.** With the addition of 'build' to the Academy's mission, we will work to more formally integrate CLD-STEM efforts into the Academy's outreach efforts, and to solidify Academy support for summer camps.

h. **AP Search, Title X Faculty Hiring.** Finding the right Mathletes is the most important future-focused effort we undertake. This year the Academy will conduct a search for one math Academy Professor position, and we will conduct civilian faculty job searches and interviews.

i. **Explore a USMA Data/AI Community of Practice(T) and support to existing Communities of Practice.** The Dean will officially open the West Point Werx Innovation Hub to integrate and synchronize engagement and research activities. Part of that effort includes the Space and Sustainability Communities of Practice, which will have Mathlete participants. We will also explore the possibility of a data / AI focused community of practice for future development while continuing support to the Army by executing the third annual Data Literacy - Train the Educator course in June.

j. **Insider Threat MIROR Journal.** The Insider Threat program will publish its second edition of the MIROR journal as part of its continued growth and we will look to expand both InT's staff and range of effort.

Mathlete Development

Faculty Development is part of our mission: *"...support the development of Mathletes"*. That development takes many forms, and depends on the personal interests and desires of each faculty member.

We generally consider five components of development: the on-boarding Faculty Development Workshop, regular counseling, professional development opportunities inside and outside D/Math (e.g. seminars, Master Teacher Program, service opportunities), involvement in cadet advising, and a tailored development path for each faculty member.

That tailored development path is operationalized for most of our rotating junior military faculty as part of the two-year course director model, and individually tailored for other faculty members. Each faculty member meets individually with the Department Head at the end of the year to discuss development and future plans.

- **Rotating Junior Military Faculty**

  This is our largest faculty group, and there is a two year developmental model centered on course directing. The first year in the Department is focused on mastering teaching. Year 2, beginning the development model, includes the preparation of a literature review focused on their course and a course director academy. Year 3 begins with the development of a Course Design and Analysis Report and is focused on running and assessing a course. Non-course directors (e.g. the A/S1, DAC) work with P5 to chart a specific model as they begin their second year.

  We expect each junior faculty member to teach and be involved in advising cadet research, which could be an extension of their research. The intent is to focus appropriately on cadet development, while also positioning the faculty member such that with additional work, as desired, they have an opportunity for a scholarly presentation or publication. This postures the faculty member for promotion to senior instructor, if desired.

- **Rotating Civilian Faculty**

  Our goal is to connect each of the Department's rotating civilian faculty members with opportunities that support that individual's specific future career goals. That includes the teaching plan over time, i.e., core to major progression, major course directing, cadet advising, service opportunities, and scholarly pursuits. This is primarily coordinated through the individual's rater.

- **Rotating Senior Military Faculty**

  Our rotating senior military faculty members develop in each of the five faculty pillars with the goal that they are positioned to apply for associate professor during their third year. Additionally, Departmental research connections with Army and DoD organizations provide an opportunity for these faculty members to stay connected to the force.

- **Permanent Military and Civilian Faculty**

  Our permanent faculty focus their developmental efforts across the faculty pillars with an eye towards academic promotion and contributions to Academy efforts. They serve as our primary representatives to others in our disciplines and to disciplinary groups and societies. We must guard against complacency and seek innovative opportunities, e.g., COL Lindquist OE at IBM.

- **Staff**

  Our Mathlete staff has the opportunity to take on additional responsibilities and learn about other roles through deliberate coordination with the XO and P5.

1 Motivation: Professional Work Culture

The Mathletes in this department are our greatest resource and their development, care, and well-being is our #1 priority. Our efforts in this regard are easily quantifiable if we use the calendar and schedule them. I do appreciate casual collisions and targets of opportunity, but when I schedule these events I'm at the very least setting the floor (lower bound) for my own efforts. I will use the following 'culture' metrics to indicate my efforts to ensure our Mathletes know they are our #1 priority. Leadership is continuous and requires constant messaging.

- Individual Focused (If identified below, please schedule these events directly through Ms. Beck Petersen so she can help me track them appropriately.)
  - Rater Counseling w/ APs, Full Professors: x/8 (Friday afternoons)
  - APD Lunches (or 0600 workouts): x/7 (Thursdays or Fridays)
  - 1st Year Faculty Class Visits (w/follow-on feedback, 20 min): x/17 (Tuesday/Wednesday A,E,F hours)
  - PDRs w/ cadets: x/6 (class hours)
  - Senior Rater Counseling w/ Military and Civilian Faculty (Support Form, CV, AIM portal resume): x/70 (Monday or Friday afternoons)
- Department Sub-Population Focused
  - Program Director Semester Updates (PDs): x/4
  - PD Meetings (P5): x/8 (Wednesdays lunch)
  - XO/S1/P5 Meeting (P5): x/13 (Mondays 0930)
  - Program Lunches/meetings w/ major (PDs): x/4
  - Spirit Lunches w/ Math Majors and Faculty (DACs): x/6
  - EO Lunches w/ Math Majors and Faculty (DACs): x/4
  - PD Time Observations (CDs MA103,MA153,MA206): x/3

2 Counseling

Counseling is a hallmark of great organizations and it is the ultimate investment we can make in faculty development. This year I'd like you to simply provide an interim update via email on your ratees about mid-way through the semester with your observations and anything I should be aware of. Specifically, as you think about the approach you will take, I'd like you to read ADP 6-22.1, focusing on (i) active listening, (ii) powerful questioning, and (iii) feedback. Regarding feedback, Section 1-3 says:

> *Leaders get results and accomplish the mission by providing effective, intentional feedback, as well as by determining the appropriate setting and timing for feedback. Effective feedback that considers the individual's motivation can significantly contribute to development, accelerate learning in day-to-day experiences, and translate into optimal performance. Feedback is a key component of counseling, coaching, or mentoring. Army leaders support each other and enable transparent and effective assessment of the individual's performance and their role in the organization's overall performance. Assessments and feedback are not additional duties extraneous to the mission but are integral to accomplishing the mission.*

The concentrated collaboration between the rater and ratee on (i) the Officer Support Form (for military), (ii) the AIM Portal resume (for military), and (iii) a curriculum vitae (for civilian and military) will improve all of our skills in active listening, asking powerful questions, and providing focused feedback aligned with

ADP 6-22.1. This dedication will not only prepare our junior military instructors for potential academic promotion to senior instructor, should they choose to pursue it, and our civilian assistant professors for highly sought after post-USMA opportunities, but it will enable us accomplish our vision as described in Figure 1. Please discuss professional development and education with your ratees, to include Distance Learning ILE, which the Department supports, but not with remote work during the AY.

3 CCIR

Bad news doesn't get better with time, communicate with your CoC early and often.

- Mathlete hospitalized for any reason.
- Mathlete engagements (or contact) with Com, Supe, higher, or press.
- Mathlete pay, travel, or administrative issue that lags an unreasonable time.
- Any compromise/breach/spill of security involving PII and/or protected data as part of Mathlete Research or operations.
- Perceived honor violations (post approach for clarification) or respect concerns in one of our courses.
- Any cadet that misses more than 8 classes in one of our courses.
- Travel or documentation submitted outside of prescribed lead times that requires Dean/Supe approval.
- Any FOIA request regarding Mathlete research and/or operations.

4 Basic ROE: Be Personally Accountable

- Leadership is easy when people are personally accountable: readiness, training, taskings, attendance.
- Admin/Support operations sit at the heart of of our culture as they take care of Mathletes. Please respond with urgency and kindness to the S1, XO/Admin, IT, and P5, i.e., within < 24 hours. Note: the XO and S1 speak for me when assigning taskings and attempt to do so thoughtfully (see our vision statement).
- Submit travel requests and associated documentation like ETPs, trip sections as early as possible and prior to prescribed deadlines. Track the status of your request, it's not just on the admin staff. Do not assume ETPs will be approved. I'm not inclined to approve last minute travel.
- We use personally identifiable information in collecting and analyzing data as part of research and/or class assessment. This requires IRB approval/engagement and a commitment to storage and/or transport (through certified training) to use. Let's not take any shortcuts here.
- Cloudy boards, messy classrooms, typos on handouts, WPR errata (especially on secondary versions) indicate a lack of quality control.
- Department meetings/coffee calls are mandatory, please do not schedule meetings/AI, etc that are in conflict. There are only four.
- Please route anything you need me to sign through P5, XO, or S1 for tracking.
- When my door is open... come on in (I expect yours to be too, and that you are generally present 0740 to 1615).
- If you are not gonna be at work during the academic day, someone in a leadership position needs to know. We don't do wink-wink 'telework'. We are an in-person department; telework can be arranged, but warrants a discussion w/ PD and P5 approval beyond 1-2 days. If you would like a day off when not teaching, please take leave.
- Please read every YMN email (15 minutes per week, the alternative is FRI 1630 recall presentations...)
- We want to experiment with generative AI and apps that use it; however, we need to be cautious with uploading data and personal information. The department will look to purchase licenses for mass use, but procedurally we treat these requests just like we would software, i.e., we develop an ITR and get a legal review. Please inform P5 and Frank of any AI-specific app you seek to use or are using.

1 Motivation

Course directors (CDs) for large enrollment courses sit at the center of our culture and impact a large population of cadets and faculty; their performance in educating and inspiring as part of our mission is incredibly impactful and we need them to be awesome. Historically, we have offered an "FDW V" for rising CDs in the spring of their second year, consisting of 3-4 hours of discussion and associated exercises with senior faculty.

Moving forward, the department will build on this and deliberately invest additional time and resources in CD development. This document details how we will cultivate our CDs in a two-year framework with the following goals: (a) developing and improving disciplinary expertise, (b) reinforcing institutional, programmatic, and course goals through Student Learning Outcomes (SLOs) to focus and improve assessment efforts, and (c) integrating and not concatenating SLOs to include ethical content.

All 1st year junior military faculty members begin their D/Math tour with our summer Faculty Development Workshop (FDW). This is OUR opportunity as a Department to on-board new Mathletes, and it is the main effort each summer. The three key tasks for FDW are (implies directed at new faculty): 1) *Integrate into USMA*, 2) *Enculturate to D/Math*, and 3) *Learn and practice teaching*. The emphasis during the first year is on mastering **teaching** while exploring the other opportunities for cadet advising, service, and scholarship.

Large enrollment courses include MA103, MA104, MA153, MA204, MA205, MA206/56, and MA255, but we also include our research courses given the volume of cadets and advisors MA491/98/99. These courses typically involve up to 900 cadets and are supported by up to 25 instructors, ranging from assistant to full professor. Large enrollment courses in this department are led by junior military faculty with an MS degree. This provides a developmental opportunity in-line with future military staff work they may encounter, and enables our civilian faculty to teach in the core while sometimes leading 300/400 level courses. Faculty are selected to be CDs by the end of their first year, which starts a two-year effort in which the faculty member serves as assistant course director (ACD) during their second year prior to assuming the CD role their third year (with some timing exceptions).

In this context, "cultivate" means to develop, foster, or nurture a research mindset within CDs over time. It implies a deliberate and sustained effort to enhance their skills, knowledge, and overall effectiveness in their roles. The term suggests a careful and intentional process aimed at bringing out the best in the CDs through training, support, and development opportunities.

2 A Research Mindset to Facilitate Assessment

Running a large enrollment course aligns with steps we use in advising cadet research. We should generally follow such a framework in assessment of our SLOs. I need you to adopt a **'research mindset'** in doing this. I see the following steps applying:

a. **Define Objectives and Conduct Literature Review**

   a.1. Define the specific SLOs to be assessed and research questions.

   a.2. Conduct a literature review to understand existing methods and gaps.

b. **Develop Research Plan**

   b.1. Determine experimental design and methodology, i.e., use provided Course Design and Analysis Report framework.

   b.2. Plan data collection methods and instruments (e.g., formative vs. summative assessments, surveys).

b.3. Obtain necessary approvals especially from the **Human Research Protections Program**.

c. **Prepare and Conduct Experiment**

c.1. Prepare materials and train course instructors.
c.2. Implement the experimental plan and collect data.

d. **Analyze and Interpret Data**

d.1. Process and analyze the collected data.
d.2. Compare findings with the original objectives and research questions.
d.3. Discuss implications and limitations.

e. **Report and Share Findings**

e.1. Write the Course Design and Analysis Report with clear structure and style.
e.2. Review, revise, and seek feedback.
e.3. Present findings to the academic community and publish the research (encouraged).

Note: the Course Design and Analysis Report framework is provided directly to ACDs/CDs by PDs.

3 The 2-Year Course Director Model

3.1 Utilization Tour, Year 2 of 3

During the second year, junior military faculty members serve as ACDs alongside the CD in a two-officer leadership team. ACDs focus on completing steps **a** of the research framework, while CDs (as described in the next section) address steps **b** through **e**. The department kick-starts the ACD developmental process by taking them to MAA's Mathfest (before the start of the fall semester). The goal of the conference attendance is not only to make contacts by introducing ACDs to industry and academic peers but also to help them deeply consider their course by identifying best and current practices to identify gaps and/or opportunities in the field.

ACDs have the fall semester to complete step **a** by writing a literature review focused on improving their course. Generally, the literature review should address the SLOs and the assessment of SLOs, as well as successful pedagogical practices and/or gaps in the research ripe for exploration. Consideration of other service academies and coordinating with respective course leaders is encouraged as it will only provide further awareness. The literature review is due to P6 no later than the end of January. References that might interest you are listed at the end of this document in the bibliography. Literature reviews do not need to be reconstituted from scratch each year, rather updated or focused specifically on something beneficial to the course. For example, if the course already has a current and relevant review of things previously identified, then ACDs are free to investigate things such as rubric development, comparison of technologies, and/or pedagogical techniques associated with the use of AI and/or machine learning. **The goal is for the ACD to demonstrate their knowledge to lead the course, in writing.**

Submitting and discussing the literature review with the department head is a significant developmental opportunity for the ACD. It facilitates focused dialogue between them in shaping future course SLOs and assessments. The department head will work with the ACD to refine the document with an eye toward publication.

At the end of the academic year, the department conducts our CD Academy, a three-day course during grad week. Here, department leaders help educate ACDs on steps **b** and **c** by framing institutional goals, posing ethical considerations, and sharing accreditation details. Departing CDs also share their lessons learned with all ACDs. The CD Academy serves as the official transfer of responsibility between ACD and CD.

3.2 Utilization Tour, Year 3 of 3

Following the CD Academy, CDs should begin drafting their Course Design and Analysis Report (aligned with steps **b** through **c**) with the goal of presenting it to all course instructors during REORGY week. Additionally, CDs should strive to have all WPRs (summative assessments) completed by the first lesson to better focus instructors on their pedagogical efforts for the semester.

At the end of the fall semester, CDs will finalize steps **d** and **e** by completing their Course Design and Analysis Report and submitting it to the department head no later than January 30 (or June 30 for spring courses). As a result of adopting a research mindset in assessing their course, we have positioned **CDs nicely to pursue scholarship opportunities such as presenting their course research at conferences and/or publishing in peer-reviewed journals if desired.** They should also prepare to hand off their research efforts to the next ACD and share their lessons learned with all course ACDs in the CD Academy.

References

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[2] Karen M Bliss, Benjamin J Galluzzo, Kathleen R Kavanagh, and Joseph D Skufa. Incorporating mathematical modeling into the undergraduate curriculum: What the gaimme report offers faculty. *Primus*, 29(10):1101–1118, 2019.

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Solidifying our commitment to boards, i.e., our Bread & Butter!

At the United States Military Academy, using chalkboards is a time-honored cherished tradition and a key pedagogical component of the mathematics curriculum. Active learning by sending cadets to chalkboards to solve problems aligns well with the TRU Framework that we are incorporating into our lesson planning. While some courses still follow historic board-related procedures, such as writing names on the board or briefing using a pointer, these practices are not mandatory in our department. Instructors are encouraged to experiment with the use of boards in a way that is aligned with the TRU Framework—focusing their activity on content; cognitive demand; access; agency, ownership, identity; and/or formative assessment—to enhance learning. **This will be a primary focus of mine as I conduct classroom visits this AY.**

Take Boards! Why?

Board work allows cadets to individually or collaboratively engage with tough concepts, practice fundamentals, and/or explore different methods without constraint in a safe space; and it can and should be enjoyable! It is central to our pedagogical approach and is enabled by class sizes less than 18. By working and then presenting their work on the board cadets are afforded opportunities to articulate their thought processes, explain their reasoning, engage in meaningful discussions, and receive instructor feedback. The success of board work depends significantly on the instructor's choice of problems and their attitude, i.e., packaging matters. Instructors should select problems that promote 'productive struggle,' and encourage deep thinking across multiple dimensions such as graphically, analytically, conceptually, and/or numerically with and without technology and problem-solving while helping cadets develop resilience and critical thinking skills. If problems are not carefully chosen, cadets may resort to plug-and-chug approaches, applying formulas mechanically without grasping the underlying concepts or alternately may give up and do nothing if too difficult. To prevent this, instructors should design problems that require exploration of fundamental principles and avoid providing premature answers or directing a single solution approach. Attempting to guide cadets through their reasoning processes, fosters deeper engagement with the material. Effective teaching involves offering timely, constructive feedback and encouraging peer interactions, while allowing cadets time to think and explore different approaches.

If an instructor chooses to have a cadet brief their board work, clear guidelines on what to include in their presentations—such as methods, rationale, and analysis—ensure that discussions remain focused on key concepts and enhance collaborative problem-solving, rather than simply narrating calculations. **Something to consider:** problem solving on boards should be a little messy if you internalize the above discussion; you may also agree with me when I say 'learning is UGLY'. This is ok in the classroom, but I think you need to realize messy boards are hard to brief to a class. If you want cadets to brief the class, consider providing them a second board to neatly and concisely articulate key concepts, i.e., give them two boards, one to problem solve and one to brief (sometimes they have to try a couple things before they know what works, when they figure that out, then they can write it up nice!) After a cadet presents, the instructor should look to facilitate discussions where peers ask questions or suggest alternative methods. This feedback loop is crucial for refining cadet understanding and developing skills in giving and receiving constructive comments. Involving the class in discussions about board work positively impacts classroom culture by creating an environment where mistakes are seen as opportunities for growth. **Emphasizing that initial attempts may be messy and focusing on the refinement process helps build resilience and positive learning attitudes.** It also reinforces character traits such as perseverance, adaptability, and a commitment to continuous improvement—qualities essential for effective military leadership.

Because these activities take time and classes are limited to 55 or 75 minutes in which cadets do not have time to loiter after class, careful thought should be given to what cadets can walk away from board work with like a receipt of their effort. Boardsheets, notes outlines, or online handouts are departmental norms to address this, but not mandatory.

The Board Problem Challenge!

Each month (aligned with coffee calls) I'd like to have a contest to be voted on, where we showcase examples of cadet board work in a collage of sorts (clearly we seek examples that demonstrate excellence; I'd encourage every instructor to personally engage cadets who demonstrate examples to the contrary). Prior to each coffee call, we will publish a collection plan, but I'd ask everyone to take pictures of awesome cadet board work. The Department will vote on the submissions at coffee call and the owner of the most awesome picture will get my parking pass. Ultimately, I seek to submit a short article with the winners to highlight our pedagogical commitment to showcase this time-proven technique, i.e., our Bread & Butter at the end of the AY to an MAA journal (maybe the A/S1 and DACs will also serve as co-authors)!

Intent

This is a collection of operational notes pertinent to CDs. Much of this was draft published in May, and then again in July with the O/Dean guidance documents, and this version completes the guidance.

Dean's AY25 Operational Guidance

Please read and comply with the Dean's operational guidance. Please carefully review the Dean's scheduling guidance, which drives much of what is listed below.

D/Math Course Scheduling

New term on the buff card: '2 day PRIME' (as in β and β'). This is a 2-day where there is no J2-hour, but there is a Dean's hour (although some cadets will have DPE J2 hour and still attend that and not the Dean's hour). The intent from O/Dean is to provide additional Dean's hours.

- If you plan to not offer a TEE, please confirm with your PD.
- 19 AUG, 30 AUG, and 14 DEC are modified days during 25-1 with draft schedules here.
- If your course has X-hours, place one on 4 OCT (ACFT primary).
- For all courses with more than 3 credit hours, one of the two lessons on 19 AUG and 7 JAN should be an X-hour (don't meet twice in the same day). (Why is it a day with all of Day 1 and Day 2's 55 minute class hours? It gives cadets the MON after Thanksgiving as a non-class day and an April non-class day.)
- If you teach plebes (predominately), don't put an X-hour on the FRI of plebe parent weekend.
- Guidance specific to 75-min courses:
  - No 3 credit hour 75 minute courses meet on 19 AUG and 7 JAN (must be X-hours).
  - For 3 credit hour 75 minute courses, no week can include more than 2 meetings.
  - For courses with J2 hour, '2-Prime' days should be X-hours.
  - For courses with J2 hour, there is no J2 on 30 AUG (modified day); it should be an X-hour.

Course Management

Each course should use Canvas as the learning management system. We shouldn't use other tools when Canvas has a similar option: for posting material, cadet submissions, etc. There are exceptions for e-textbooks and related online homework platforms. PDs should be aware of and approve any other exceptions. When possible, communicate with your course through Canvas and not email.

Writing in the Core

Core courses should meet with the MA206 course leadership, which has our Department's 'writing in the core' requirement, to learn about the process in MA206 and to align writing guidance to cadets, when possible.