

NOV 2020



The Education Trust-West



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**SEEN, HEARD, REFLECTED**

# Building and Sustaining a Diverse STEM Teacher Pipeline

# Building and Sustaining a Diverse STEM Teacher Pipeline

California is a leader in technological innovation and is known across the world for putting forward bold, creative solutions in science, technology, engineering, and math (STEM). Currently, that reputation falls short in California's public education system: Too few students in our pre-K through high school classrooms have access to STEM learning opportunities and well-prepared STEM teachers that reflect the diversity of our state.

## PROMISING PRACTICES

The report highlights four key promising practices:

01. Increasing **financial supports** to candidates by coordinating funding streams.
02. Expanding **partnerships** with local education agencies (LEAs), community colleges, and other Grow Your Own programs in **recruitment and field placement**.
03. Investing in **community learning** among candidates and faculty, including mentorships and professional learning.
04. Training candidates and faculty on **culturally responsive pedagogy** and **culturally sustaining pedagogy**.



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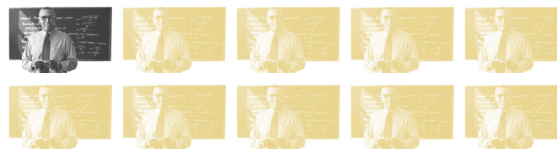
While research shows that all students, especially students of color, learn better and form stronger connections when they have educators of color, **the statistics in California are stark:**



Three-quarters of all secondary students enrolled in STEM courses are students of color, but only one quarter of teachers who teach secondary STEM courses are teachers of color.



9 in 10 White secondary students are taught by a White STEM teacher, but only 3 in 10 secondary students of color are taught by a STEM teacher of color.



Only 1 in 10 candidates who enroll in a teacher preparation program completes a single subject math or science credential.

In recent years, state leaders have made investments to strengthen the STEM teacher workforce, but many have been scaled back or eliminated as a result of the COVID-19 pandemic and economic downturn. To emerge from this crisis stronger than before, we must protect and sustain pipelines for STEM teachers of color to enter and stay in the profession.

This report explores the current state of the STEM teacher pipeline and the disparate impact that shortages have on students of color; uplifts promising practices across teacher preparation programs; and concludes with recommendations for policymakers and preparation programs to better support STEM teacher candidates of color as they enter the classroom to educate our state's future STEM leaders.

## RECOMMENDATIONS IN THE REPORT INCLUDE

01. **Setting goals on diversifying the STEM teaching workforce** at the state and local levels.
02. **Adopting school board resolutions** that commit to recruiting and retaining STEM teachers of color.
03. **Facilitating data sharing between teacher preparation programs, schools, and districts** to better support beginning teachers to thrive in their careers.
04. **Reviving financial assistance** for future STEM teachers.
05. **Reinvesting in research-based models** that lead to higher retention rates of STEM teachers of color.

# A LETTER FROM THE EXECUTIVE DIRECTOR

California is the fifth-largest economy in the world. We are home to the tech industry and the land of innovation, yet the stark truth is Californians live in different realities. Some enjoy a prosperous home and careers on the rise while others endure the effects of systemic racism, displacement, homelessness, and economic struggle. While Silicon Valley booms, its well-paid workforce continues to lack racial and gender diversity and is far from representative of the state's diverse population.

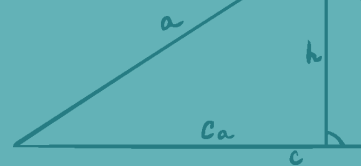
It is a problem that Latinx Californians make up nearly 40% of the state's workforce, but just 5% of the tech industry, and only 2% of tech workers are Black, and less than a third are women. We can begin to turn these numbers around. It starts in the classroom with an explicit intent to recruit more teachers of color that inspire students to learn about science, technology, engineering, and mathematics (STEM).

I became a math major in college because of Yung-Pin Chen, a professor of color who made math fun, spent extra time in office hours, encouraged us to work in groups, and tied our work to real world problems. Throughout college, I sometimes heard those little jabs meant to indirectly—or directly—tell me I couldn't be Black and smart. But thanks to Yung-Pin, I always believed I belonged. I graduated with a bachelor's in math, later earned my master's in survey methodology, and went on to become the third Black person to graduate with a PhD from Woodrow Wilson School of Public Affairs at Princeton University. Representation matters. I lived what we all know and what the research shows: that a single teacher who believes a student can achieve anything is life-changing.

In the Fall of 2020, California voters had a chance to restore affirmative action with Prop 16 and instead decided that race and gender diversity don't need explicit promotion. If we are a state that values diversity and economic prosperity for all, we need to commit to it actively, emphatically, and boldly. I encourage state and education leaders to act on these disparities urgently and to use the recommendations and promising practices in this report to strengthen the pipeline of STEM teachers of color, so they can enter the classroom well-prepared to educate our state's future STEM leaders, just like my college professor did for me.

**DR. ELISHA SMITH ARRILLAGA**

Executive Director

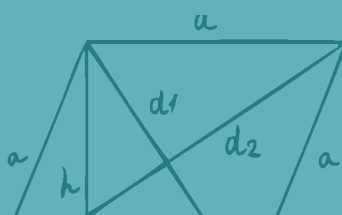


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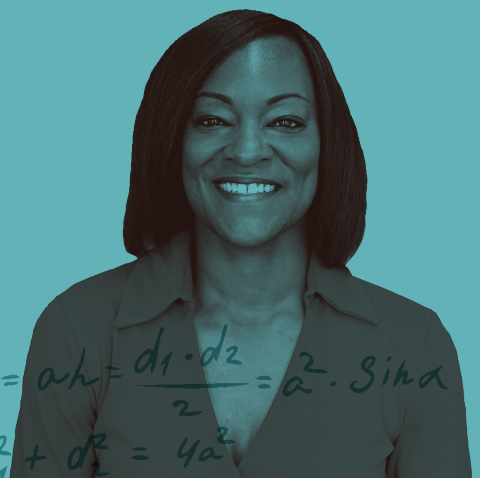
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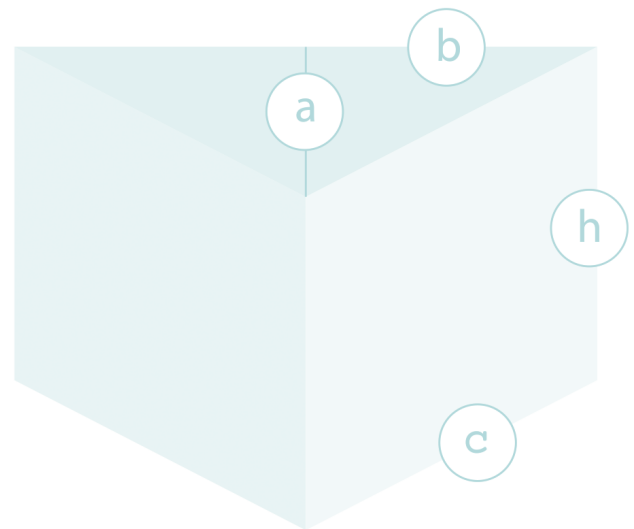


“ I ask myself, ‘If not me, who?’ My purpose in teaching as a teacher of color is to be explicit with students about where teachers come from and why we choose to work where we do. I want to be in a community of predominantly poor Latinx and migrant students because that’s the type of world that influenced my own perceptions of education and the gaps we’re having at the institutional level. I want students to see that they can become assets to our community. ”

**JOSÉ YOBANI LÓPEZ SÁNCHEZ**

Single-Subject Chemistry Teacher Candidate  
University of California, Los Angeles





## IN CALIFORNIA,

**nine of the 10 fastest-growing occupations are in science, technology, engineering, and mathematics (STEM).**<sup>1</sup> By 2022, our state will have the largest share of the STEM workforce and jobs in the country.<sup>2</sup> However, too few students in our pre-K through high school education systems — and in particular, students of color<sup>3</sup> — have access to the rigorous learning opportunities they need and deserve to pursue future careers in STEM. Only 12 percent of California’s high school students of color are enrolled in a higher-level mathematics course,<sup>4,5</sup> and a recent survey found that only 36 percent of California high school students see themselves becoming a scientist, engineer, or mathematician or working with technology.<sup>6</sup>

Teachers, particularly teachers of color, play a key role in reversing these trends. Research shows that teachers who share the same race as their students tend to set higher expectations for them than other teachers.<sup>7</sup> Students of color with a same-race teacher also earn higher GPAs, spend more time on homework, and have higher expectations for themselves attending college.<sup>8</sup>

This is particularly important in STEM, where research has shown that students of color are more likely to pursue STEM fields after high school graduation when they have access to strong mentors and role models.<sup>9</sup> State leaders have recognized the role that the teacher workforce plays in setting students on the path to enter STEM fields after graduation and have made investments to strengthen the workforce. (See the accompanying timeline on recent investments in the STEM teacher pipeline.)

Unfortunately, the economic toll of the pandemic has forced many of these investments to be scaled back.<sup>10</sup> These cuts come at a time when the state is already facing a shortage of STEM teachers that will only be exacerbated by the current economic downturn. As California emerges from the pandemic and economic crisis, we must prioritize equitable access to math and science by expanding pipelines for STEM teachers of color to enter and remain in the profession. We must redouble efforts to recruit and retain teachers who reflect the racial and cultural diversity of our state.

## SCOPE OF THIS REPORT

In 2015, we investigated the shortage of STEM teachers in California's schools in our report, "The STEM Teacher Drought: Cracks and Disparities in California's Math and Science Teacher Pipeline." We found that the STEM teacher shortage had a disparate impact on California's students of color and identified school districts with innovative solutions for retaining teachers of color. This report builds on "The STEM Teacher Drought," and looks at teacher supply through the lens of teacher preparation programs, shining a light on the barriers that teachers of color face before they even enter the classroom. We begin by looking at the current state of the STEM teacher pipeline, then present promising practices across teacher preparation programs that are strengthening the STEM teacher of color pipeline.

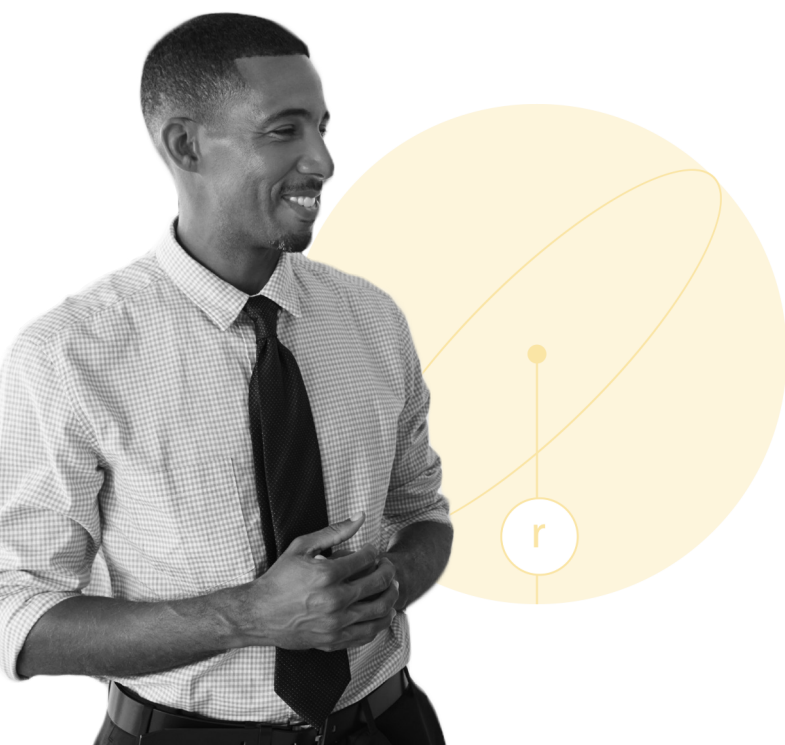
To better understand the current state of the STEM teacher pipeline and its impact on students, we analyzed quantitative data to answer the following questions:

- Is there a shortage of STEM teachers in California?
- Is the STEM teacher workforce reflective of the racial and cultural diversity of the state?

From there, we set out to learn from and highlight programs that create and sustain strong pathways for STEM teachers of color — specifically mathematics and science teachers with single subject credentials. Our qualitative research questions centered on two main themes:

- How are preparation programs creating and sustaining STEM pipelines for teachers of color?
- What practices are emerging from those programs that help to strengthen the STEM teacher of color pipeline?

We end with recommendations for state policymakers and teacher preparation programs to consider in cultivating a STEM teacher workforce that is reflective of California's students.



**SNAPSHOT OF THE PROBLEM**

# The Current State of the STEM Teacher Pipeline and the Impact on California Classrooms

Targeted solutions require an understanding of the scope of the problem. Countless studies illustrate the importance of teachers of color for all students, particularly students of color.<sup>11</sup> Yet across California, the teacher of color workforce remains persistently small; this reality is especially apparent in California's STEM classrooms.

The following infographic explores the current state of the STEM teacher pipeline and makes several revelations:

- California's teacher workforce does not reflect the racial diversity of students across the state.
- California's STEM teachers do not reflect that racial diversity; most students of color enrolled in STEM courses are not taught by a teacher of color.
- There is an overall shortage of STEM teachers in California, and districts that serve a majority of students of color disproportionately feel the impact.

**NOTE ON METHODOLOGY**

These calculations compare data across the following data sources from 2018-19: California Department of Education (CDE) Enrollment Files, CDE Staffing Files (Demographics, Credential, Assignment, and Course Enrollment), and the Commission on Teacher Credentialing Annual Report Card. "Teacher of color" and "student of color" are defined as underrepresented teacher/student groups (see endnote 3). "STEM teacher" and "STEM classroom" are defined as any course designated as science or math by the CDE. A "majority students of color classroom" is defined as any classroom with 50 percent or more students of color enrolled.



## CA's teacher workforce is not reflective of the student population.

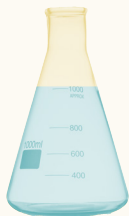


**61%** OF ALL STUDENTS ENROLLED IN CA SCHOOLS ARE STUDENTS OF COLOR...



BUT ONLY **26%** OF THE TEACHER WORKFORCE ARE TEACHERS OF COLOR.

Source: California Department of Education, Enrollment and Staff Credential Files (2018-19)



**75%** OF ALL SECONDARY STUDENTS ENROLLED IN STEM COURSES ARE STUDENTS OF COLOR<sup>12</sup>....



BUT ONLY **25%** OF SECONDARY STEM COURSES ARE TAUGHT BY A TEACHER OF COLOR.

Source: California Department of Education, Staff Credential Files (2018-19)

This means that most students of color enrolled in STEM courses are not taught by a teacher of color.

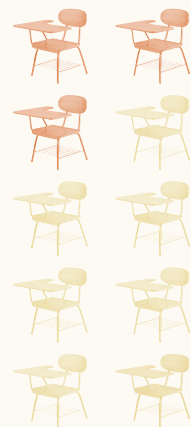
**9** OUT OF **10**

WHITE STUDENTS ARE ENROLLED IN A STEM COURSE TAUGHT BY A WHITE EDUCATOR.



**3** OUT OF **10**

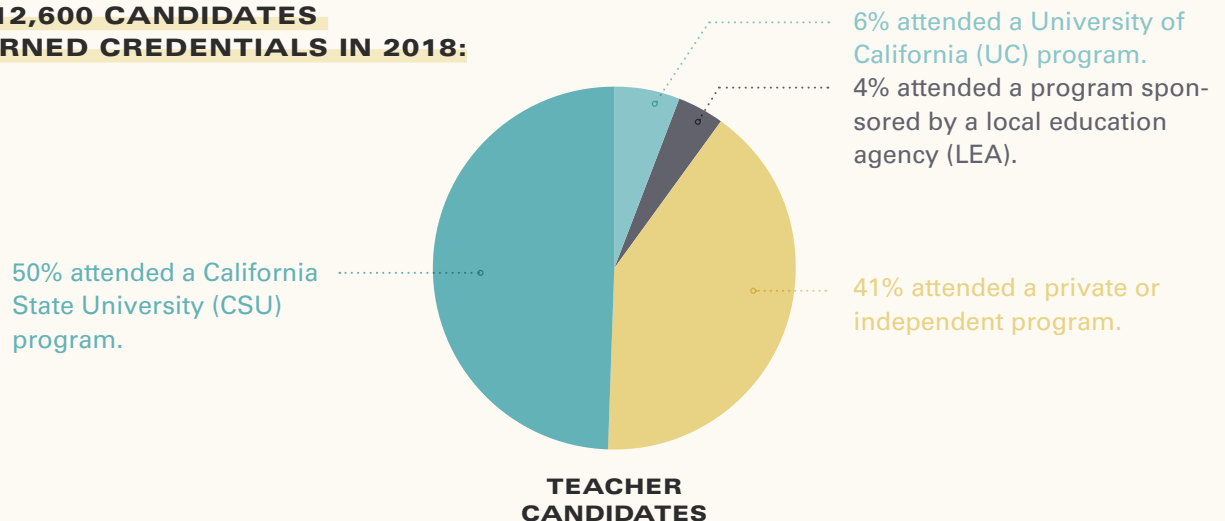
STUDENTS OF COLOR ARE ENROLLED IN A STEM COURSE TAUGHT BY A TEACHER OF COLOR.



**In 2018, there were almost 25,000 teacher candidates enrolled in preparation programs in California.**

**The majority of candidates who complete preparation programs (56%) attend a public university.**

**OF THE 12,600 CANDIDATES WHO EARNED CREDENTIALS IN 2018:**

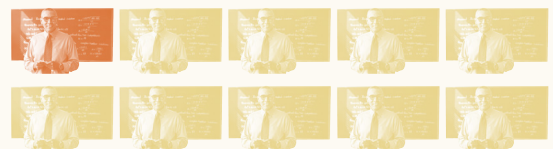


Sources: California Department of Education, Staff Credential Files (2018-19); Commission on Teacher Credentialing, Title II Annual Report Card (2018)

**Growth is slow in the STEM teacher of color pipeline.**

**1 IN EVERY 10**

**CANDIDATES WHO ENROLLS IN A TEACHER PREPARATION PROGRAM GOES ON TO COMPLETE A CREDENTIAL IN A STEM FIELD.**



**1 IN EVERY 3**

**TEACHER CANDIDATES IS A PERSON OF COLOR. "13**



Source: Commission on Teacher Credentialing, Title II Annual Report Card (2018)

On average, for the last four years, one teacher candidate has completed a credential for every two projected open positions in STEM classrooms.



Sources: California Department of Education, Staff Credential Files (2018-19); Commission on Teacher Credentialing, Title II Annual Report Card (2018)

The impact of this shortage is felt more heavily in some parts of the state than others, particularly in districts that serve large numbers of students of color.



In 2018-19, roughly **1 IN EVERY 5** open teaching positions was in a STEM classroom. A disproportionate number of those vacancies (73%) were in districts that serve a majority of students of color.

Sources: California Department of Education, Staff Credential Files (2018-19); California Department of Education, Enrollment Files (2018-19)

That shortage impacts the learning experience that students of color have in STEM classrooms.



In 2018-19, **1 OUT OF 10** STEM teachers in classrooms serving a majority of students of color were not fully certified.

Source: California Department of Education, Staff Credential Files (2018-19)

## SPOTLIGHT ON PRACTICE

# Teacher Preparation Programs That are Strengthening the STEM Teacher of Color Pipeline

The STEM teacher of color shortage is the product of structural barriers across the recruitment and retention continuum. As gatekeepers to the profession, teacher preparation programs play a pivotal role in eliminating those obstacles. Candidates' experiences in preparation programs set the tone for their futures as teachers and may influence whether they decide to stay in the classroom. Unfortunately, the vast majority (88 percent) of teachers feel their programs fail to prepare them for the realities of the profession.<sup>14</sup> Research shows that this has implications for retention: Teachers who enter the field with less preparation are two to three times more likely to leave the classroom.<sup>15</sup> This is particularly true for teachers of color, who move schools or leave the profession at a higher rate than White teachers (19 percent versus 15 percent).<sup>16</sup>

Our path forward requires clear, targeted changes to policy and practice. To explore solutions, we sought out teacher preparation programs creating and sustaining strong pathways for STEM teachers of color. We analyzed teacher preparation enrollment and completion from the California Commission on Teacher Credentialing (CTC) and identified programs that have a proven track record for attracting and supporting teacher candidates to attain a single subject mathematics or science credential at above-average rates. We interviewed deans, program directors, and other faculty administrators at five of these programs to better understand how they are strengthening the STEM teacher of color pipeline.

## NOTE ON METHODOLOGY

**SAMPLING** These programs were identified using three-year enrollment and program completion rate trends (2015-16 to 2017-18) from the Commission on Teacher Credentialing Annual Report Card. A program was considered to have a "proven track record" if they enrolled at least 30% students of color and had STEM credential rates above 11%. Those thresholds were set by calculating the three-year statewide averages for enrollment and completion rates. Only six of the 146 teacher preparation programs in California met those two thresholds.

**INTERVIEW METHODS** Interviews were guided by semi-structured protocols (i.e., questions were prepared in advance, but additional questions were included at researcher discretion). Interviews and focus groups took place virtually (online and over the phone) and were recorded. Open and axial coding was applied to transcripts in order to distill cross-participant themes and patterns. Themes were highlighted as "promising practices" if they emerged as themes in more than one interview.

## Four promising practices surfaced across the conversations we had with leaders at teacher preparation programs.

Below, we describe how teacher preparation programs with the highest enrollment rates of candidates of color and graduation rates among STEM candidates in California leverage **financial support, partnerships, community feedback and mentorship, and Culturally Responsive Pedagogies (CPR)** to encourage candidates to enter preparation programs, help them complete their credential, and set them up for success in the classroom. See program spotlights among our accompanying resources for more detail on each of the promising practices and programs highlighted below.



## PROVIDING FINANCIAL SUPPORTS

When we have tuition conversations, [we start by asking] who are we trying to attract?...Our tuition is highly subsidized...it's a compromise that we make because of our commitment to equity.

**LIZ BAHAM**

Executive Director  
Academic Programs and Accreditation  
Reach Institute for School Leadership

Tuition is cost-prohibitive for many teacher candidates, especially for candidates of color. Two programs we spoke to, Reach Institute and Claremont Graduate University, recognize the importance of financial support, including subsidizing tuition, as a tool for recruiting and retaining STEM candidates of color. Each program takes a different approach to reducing financial burden, given constraints on capacity, availability of grants, and the limitations of affirmative action on California's public institutions. Even with those limitations, these programs are clear about the importance of financial support in recruitment and retention. **Financial supports can include several possibilities:**

### SEEKING TARGETED GRANTS


Program administrators seek state and federal grants geared toward recruiting candidates of color and candidates in hard-to-staff fields like STEM. These grants, described in detail in the recommendations section, allow administrators to expand program access and program offerings.


### FUNDRAISING EFFORTS

Programs fundraise through philanthropy and individual donors as a tactic to subsidize tuition costs and offer rates that are competitive with the lowest-cost preparation programs. This helps fill gaps in financial aid and supports candidates who would otherwise be unable to afford the program.

### OFFERING FLEXIBLE PROGRAM PATHWAYS

Program administrators implement district internships (coursework concurrent with a paid internship, where candidates act as the primary instructor) and/or offer a two-year credential pathway (coursework followed by gradual classroom teaching responsibilities) to minimize the financial burden of attending the program. The district internship pathway in particular allows candidates to work full time and earn an income while completing their credential.



It truly does take a village.  
And so, it's finding new partners.  
It's nurturing relationships.  
It's refreshing relationships. 

**SHIREEN PAVRI**

Dean, College of Education  
California State University Long Beach (CSULB)





## PARTNERSHIPS

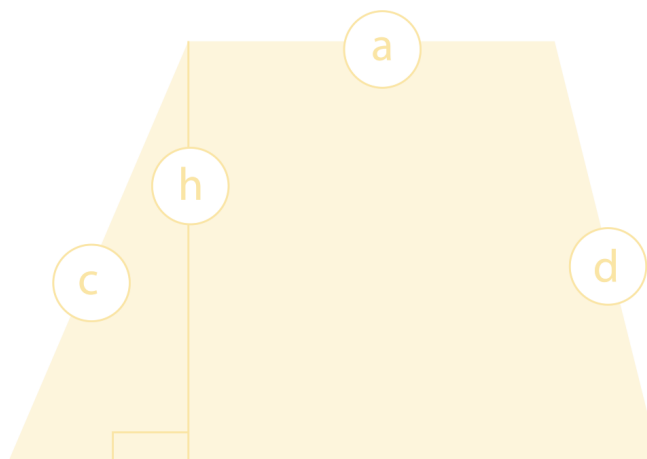
The practices spotlighted here surfaced in our conversations with Reach Institute and CSU Long Beach. Both programs emphasize the importance of internal and/or external partnerships in creating support systems for all students and guiding STEM teacher candidates of color into and through completion of their preparation program. Strong partnerships support outreach and recruitment practices and clinical placements, which are crucial to all candidate experiences and, in some cases, specific to STEM teachers of color. Internal partnerships serve to develop strong institutional recruitment pipelines from undergraduate STEM programs and to collaborate with faculty from mathematics and science departments to build a rich curriculum. External partnerships help to enrich candidates' education and clinical training, and promote alternative pathway programs and field placements that best serve STEM candidates of color. **Partnership-related program practices can include the following:**

### RECRUITMENT AND OUTREACH PARTNERSHIPS

Partnerships with undergraduate mathematics and science departments are a key strategy for boosting outreach and creating pathways into teaching. The programs we spoke with directly recruit undergraduate STEM majors and create opportunities for STEM undergraduates to prepare and implement small group lessons. Investment in relationships with local middle and high schools, community colleges, and districts are also effective at expanding the recruitment pool. In one example, a teacher preparation program hired a liaison to engage local community college students of color. Both efforts strive to attract STEM candidates and candidates of color who might not otherwise consider teaching.

### FIELD PLACEMENT PARTNERSHIPS

Program administrators develop strong local partnerships with LEAs for clinical placements. Leaders develop personal relationships with field placement partners and vet them closely to ensure school and district leaders are committed to providing a rich clinical experience. They also create partnerships with schools and districts with an explicit mission of diversifying their teacher workforce. These efforts ensure that candidates have a strong clinical experience that is aligned with the mission and values of the preparation program.





## COMMUNITY FEEDBACK AND MENTORSHIP

“ [Throughout their training, candidates] have their small groups or pods, they have one mentor teacher, they have faculty that’s going out to support them during that experience, and so even though it’s a tough transition for some, it’s highly structured, highly supported. ”

**EDDIE PARTIDA**  
Claremont Graduate Program

Creating community learning and mentorship opportunities can support candidates, especially those of color,<sup>17</sup> through the completion of their credentialing program. Effective programs, like Claremont Graduate and Reach Institute, provide spaces within seminars, classes, and peer groups for candidates to apply problem-solving strategies to real-world challenges that arise in clinical settings, and to discuss pedagogical issues. They also hire experienced faculty and teachers (in clinical or academic settings) and train faculty to support teaching in diverse classrooms.

**Community feedback and mentorship practices can include:**

### STRUCTURED FACULTY MENTOR PROGRAMS

Program administrators create one-on-one and small-group mentorship opportunities for candidates to connect with faculty. In some cases, these small groups target candidates of color; however, this is an overall good practice from which all candidates can benefit. Leaders carefully place candidates with faculty mentors who reflect their lived experiences and backgrounds in education. Candidates receive ample support as they navigate their first clinical experiences.

### INTENTIONAL FACULTY-CANDIDATE FEEDBACK LOOPS

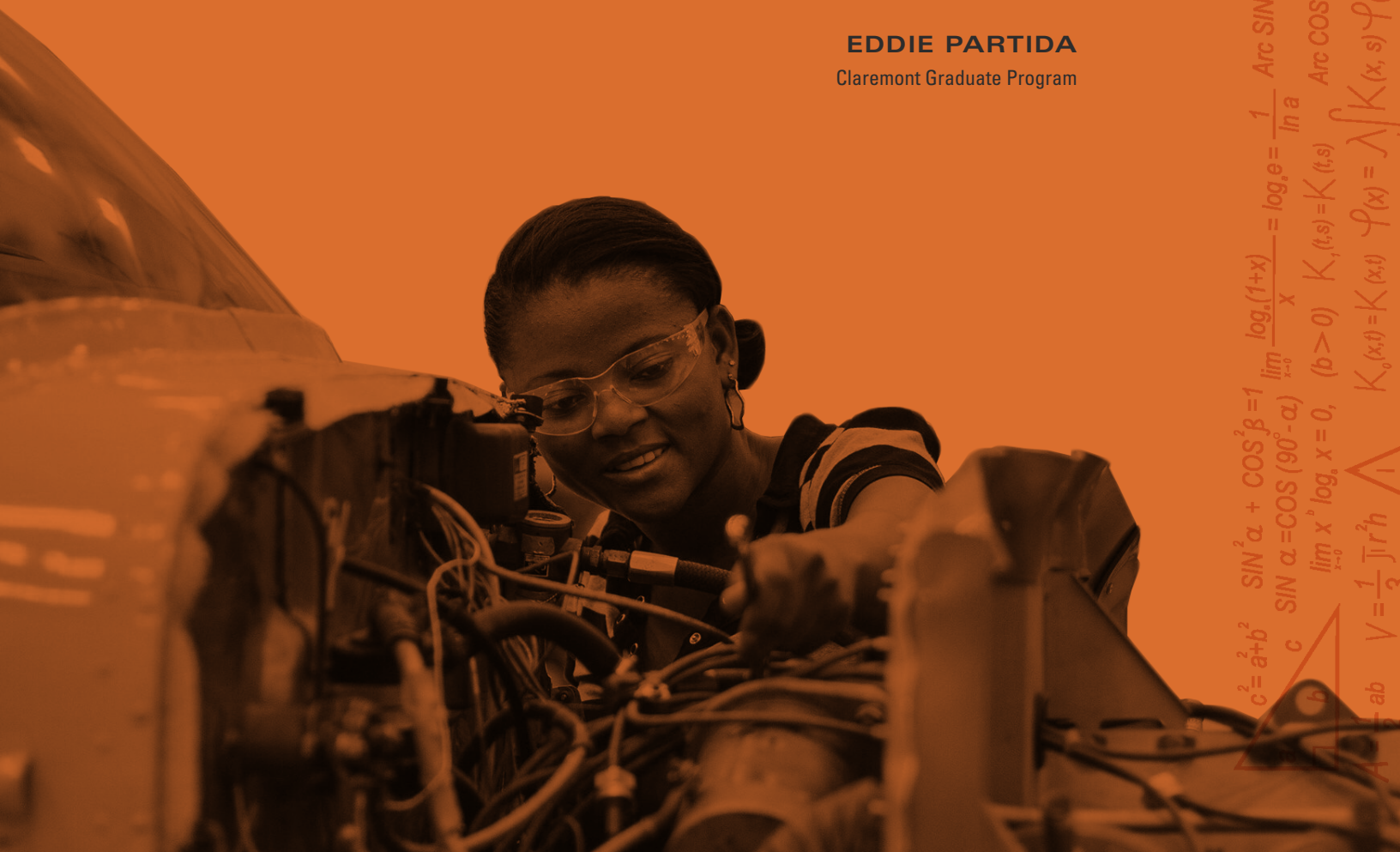
Faculty provide authentic feedback and coaching, and students give feedback to their peers. These feedback loops help candidates and faculty develop meaningful relationships, cultivate self-awareness, and foster community.

a

b

Over the last couple of years, we've really defined what it means to be a teacher that practices culturally responsive pedagogy. So, we have developed a teaching model that is based on some core readings that we have all of our students do early in the program....Those set the stage for the entire program, and for all of our instructors that's required reading, regardless if they're doing a methods class, a theory class, anything.

**EDDIE PARTIDA**  
Claremont Graduate Program



$$c^2 = a^2 + b^2$$
$$\frac{c}{\sin \alpha} = \frac{a}{\sin \alpha} = \frac{b}{\sin \beta}$$
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$$\text{Arc COS } z = -i \text{Ln}(z + i \sqrt{1-z^2})$$
$$K_0(x, t) = K(x, t) \quad \varphi(x) = \lambda \int K(x, s) \varphi(s) ds + f(x) \quad z = re^{i\theta}$$



## CULTURALLY RESPONSIVE PEDAGOGY (CRP)

An important strategy for recruiting and retaining candidates of color is designing programs that address racism and incorporate culturally responsive pedagogies. CSU Long Beach and Claremont Graduate approach this by first training and engaging faculty in conversation around concepts like cultural responsiveness.<sup>18</sup> This allows for a common grounding among faculty that supports them in developing and/or modifying their curriculum to incorporate CRP.

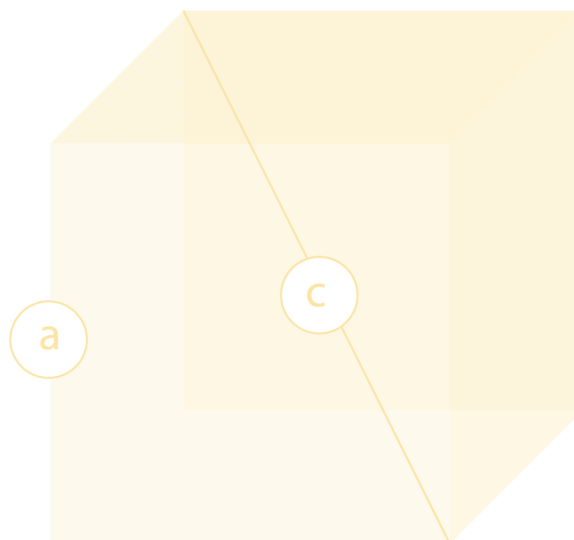
These pedagogies are also infused into program curriculum and assessments to ensure teacher candidates are familiar with the CRP concepts and are comfortable integrating them into their teaching practice. Additionally, providing opportunities for self-reflection around CRP helps candidates better understand how their preconceptions and prior experiences may impact their teaching. **Program practices around CRP include the following:**

### COMMON LANGUAGE

The program lays the CRP groundwork and ensures that all faculty and program staff speak a common language. This includes hiring faculty and staff who are committed to the tenets of CRP and frame the program through the lens of lived experience.

### ALIGNMENT BETWEEN THEORY AND CLINICAL PRACTICE

There is a clear connection between the common language in theory courses and clinical practice. Leaders create tools to operationalize CRP practices and evaluate candidates on how well they implement CRP in the classroom.



## RECOMMENDATIONS

It is clear: We must do more in the coming years to prepare future STEM teachers that reflect the racial, linguistic, and cultural diversity of our state. Based on promising practices from the teacher preparation programs highlighted in this brief, and other leading research, we propose the following recommendations for state and local policymakers and teacher preparation programs to protect and sustain pipelines for STEM teachers of color.

# Recommendations for State and Local Policymakers

### 1. SET STATEWIDE AND LOCAL GOALS FOR DIVERSIFYING THE STEM TEACHING WORKFORCE TO BETTER REFLECT CALIFORNIA'S STUDENT POPULATION.

Given the significant shortage of STEM teachers of color and how vital they are to student success, **CDE should set 10-year goals for recruiting 60,000 additional teachers of color, including in STEM** — prioritized by race, ethnicity, and geographic region — in order to increase the overall diversity of the statewide teacher pool by 20 percent. The CDE should work with County Offices of Education and LEAs to set local goals, track progress, and ensure alignment between local efforts and state goals.

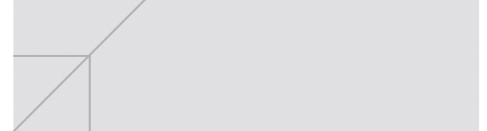
### 2. ADOPT RESOLUTIONS THAT COMMIT TO RECRUITING AND RETAINING STEM TEACHERS OF COLOR.

To complement state-level efforts to diversify the STEM teacher pipeline, local boards of education should adopt resolutions and policies that reflect their commitment to recruiting and retaining STEM teachers of color, as well as policies and practices that promote antiracism and equity. Poway Unified School District<sup>19</sup> and Santa Monica-Malibu Unified School District<sup>20</sup> are two districts that have done so along with others across the country.<sup>21</sup> State leaders should **ensure that the 20 school districts that have the largest gaps in STEM educator versus student of color representation adopt such resolutions in the next five years**. These policies can help create more inclusive and supportive working environments and school cultures for teachers and students of color.<sup>22</sup>

### 3. FACILITATE DATA SHARING THROUGH THE CRADLE-TO-CAREER (C2C) DATA SYSTEM.

Having actionable data on teacher credentialing outcomes, district assignments, and retention are key to improvement efforts. **By 2022, the C2C Data System managing entity should build on the existing provisions of the C2C Data System to:**

- Link teacher preparation pipeline data (from enrollment to classroom placement and first-year outcomes) to better track efforts to recruit and retain more STEM candidates and teachers of color.
- Make that data on placement and outcomes for first-year teachers publicly available to local stakeholders to draw a through line from preparation programs to the classroom.



#### 4. REVIVE STATE FINANCIAL SUPPORTS.

In January 2020, the budget outlook was starkly different and the state had committed to nearly \$1 billion of investment in teacher recruitment and retention. In light of the exacerbated economic challenges caused by the pandemic, the legislature should **protect funding in the 2021-22 budget to alleviate the cost of becoming a teacher by reinvesting in financial assistance** for people interested in becoming STEM teachers. This could include restoring the STEM component of the Golden State Teacher Grant Program and Teacher Residency Grant Programs so they can reach candidates in STEM fields. When possible, financial assistance programs (i.e., GSTG, Assumption Program of Loans for Education) should implement race-conscious guidance such as outreach, targets, and goals for teacher of color participation.

#### 5. REINVEST IN RESIDENCY PROGRAMS.

California has made significant investments in the STEM teacher pipeline over the past decade. (See supplemental timeline.) Teacher residency programs are one of the investments that has gained traction. Pending budget capacity, the legislature should **expand investments in residency models over the next three years** — to attract candidates of color and improve retention rates. It should provide financial incentives to preparation programs that adopt research-based residency models and track candidate completion rates, program expansion, and classroom retention rates to evaluate which components of these programs are most effective.

## Recommendations for Teacher Preparation Programs

#### 1. TRAIN CANDIDATES AND FACULTY ON CULTURALLY RESPONSIVE PEDAGOGY (CRP) AND CULTURALLY SUSTAINING PEDAGOGY (CSP).

Teacher preparation programs should train all teacher candidates and faculty in culturally responsive pedagogy<sup>23</sup> and culturally sustaining pedagogy.<sup>24</sup> This training foundation strengthens recruitment of candidates of color and provides candidates the tools to sustain and affirm the community languages, cultures, and practices that shape the lived experiences of students and their families. Teacher preparation programs should also ensure that their curricula and assessments/grading practices promote responsive, asset-based, and inclusive teaching strategies, including social-emotional learning, and that they are responsive to students from a variety of cultural and linguistic backgrounds. **By 2025, all programs should have identified a CRP/CSP faculty lead, established a faculty training program, and piloted a CRP and CSP course for incoming teacher candidates.**

#### 2. INCREASE FINANCIAL SUPPORT.

To lessen the financial burden on candidates, teacher preparation programs should **identify at least one new public or private funding stream in 2021-22 to maximize tuition support** for STEM candidates of color through opportunities such as the Robert Noyce Teacher Scholarship Program,<sup>25</sup> CSU's Mathematics and Science Teacher Initiative (MSTI),<sup>26</sup> and CSU's Teacher Residency Scholarship Program.<sup>27</sup> This report outlines examples of how teacher preparation programs can achieve this in the section "Providing Financial Supports."

### 3. EXPAND PARTNERSHIPS IN RECRUITMENT AND FIELD PLACEMENT.

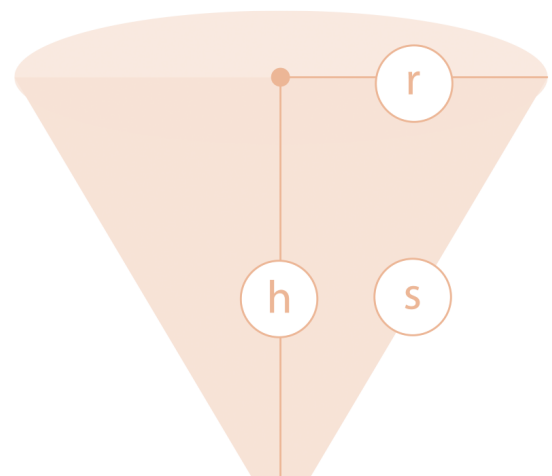
Close ties with the local community can help teacher preparation programs recruit diverse candidates and support them during their field placement. Teacher preparation programs should **identify two new recruitment partnerships by 2025** and collaborate with LEAs, community colleges, and other Grow Your Own programs<sup>28</sup> to build a pipeline of candidates of color from local communities. They should also provide multiple pathways that fit the needs of different profiles of candidates (those who need to work full time, have family care responsibilities, etc.) throughout the credentialing journey. Programs should identify a faculty member to pilot an alternate pathway program for candidates who meet these criteria. For candidates' field placement, teacher preparation programs should prioritize placing them with LEAs that demonstrate a strong commitment to mathematics and science education, ensuring alignment between the candidates' training and the support they receive during their clinical experience.

### 4. COLLABORATE WITH STUDENTS AND FACULTY FROM UNDERGRADUATE STEM DEPARTMENTS.

Teacher preparation programs should leverage their undergraduate mathematics, science, and engineering departments to recruit STEM undergraduates interested in teaching. These partnerships will also help strengthen the curriculum and professional learning opportunities in STEM credential programs. They should also integrate STEM education into other credentialing subjects to ensure that candidates are well prepared to integrate STEM content in other contexts. Programs should aim to **increase representation of undergraduate STEM majors from their math, science, and engineering departments in their candidate pipeline by 10 percent in the next three years.**

### 5. INVEST IN COMMUNITY LEARNING AMONG CANDIDATES AND FACULTY, INCLUDING MENTORSHIPS AND PROFESSIONAL LEARNING.

Candidates and experienced teachers alike can benefit from opportunities to collaborate. Teacher preparation programs should use communities of practice to connect and support in-service STEM teachers and pre-service candidates of color, including affinity-based mentorships<sup>29</sup> and spaces for candidates to dialogue around issues that arise during their clinical practice. Programs should start by conducting a landscape analysis to understand the composition of faculty and students, identify gaps in representation, and better understand student needs. They should use that information to **invest in new professional learning opportunities and build out networks with other preparation programs that are implementing communities of practice.** Preparation programs should look to examples like the CSU Mathematics Teacher Education Partnership.<sup>30</sup>



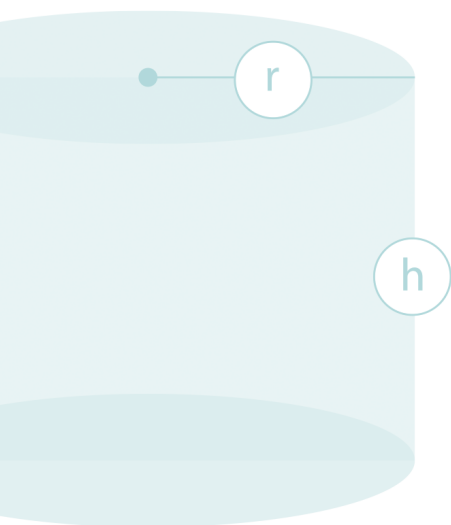
## CONCLUSION

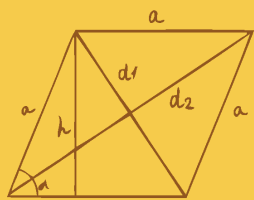
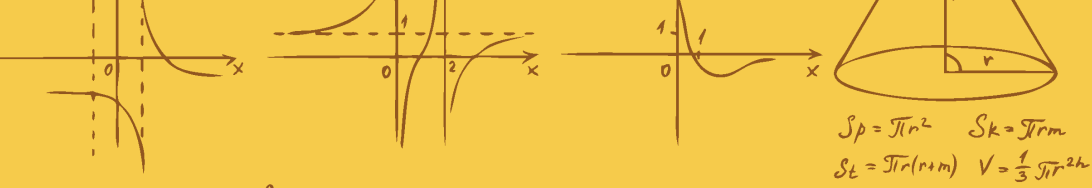
Prior to the COVID-19 pandemic, California policymakers had planned to expand investments in teacher preparation programs and strengthen teacher pipelines to schools with existing STEM inequities. The pandemic has created a new window of opportunity and innovation for teacher preparation programs to rethink how they prepare and retain candidates of color in STEM fields. Well-prepared STEM teachers of color who reflect the diversity of the students they serve are needed to ensure that all students, especially low-income students of color, have access to rigorous and engaging STEM learning opportunities. By learning from the practices featured in this report, state and local policymakers and preparation program leaders can better support STEM teacher candidates of color to educate our state's future STEM leaders.

## ACKNOWLEDGMENTS

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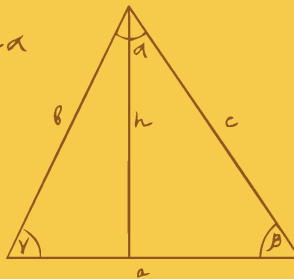
We offer appreciation to the S. D. Bechtel, Jr. Foundation, whose generous support made this report possible. We also offer our gratitude to the individuals who shared their expertise and perspectives with us, including CSU Long Beach, Cal Poly Pomona, Claremont Graduate University School of Education, Loyola Marymount University, and Reach Institute for School Leadership. Lastly, we offer thanks to the following external reviewers for the thoughtful insights they provided to this report: Jennifer Click, Ayanna Davis, Eric Duncan, Rubén González, Anne Hawthorne, Jana Luft, Cara Mendoza, Jacquelyn Ollison, Naomi Ondrasek, Jessica Sawko, Meghann Seril, Vince Stewart, and Fred Uy.





$$S = ah = \frac{d_1 \cdot d_2}{2} = \frac{a^2}{2} \cdot \sin \alpha$$

$$d_1^2 + d_2^2 = 4a^2$$



$$P = a + b + c \quad \alpha + \beta + \gamma = 180^\circ$$

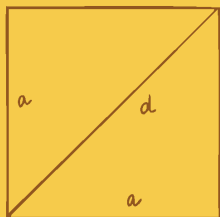
$$S = \frac{ah}{2} = \frac{1}{2} ab \cdot \sin \gamma \quad p = \frac{1}{2} P$$

$$S = \sqrt{p(p-a)(p-b)(p-c)} \quad S = p \cdot r = \frac{abc}{4R}$$

$$ca \cdot cb$$

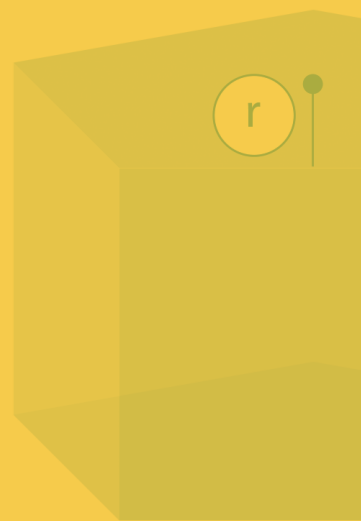
$$= cb \cdot c$$

$$a = \frac{b}{c}$$

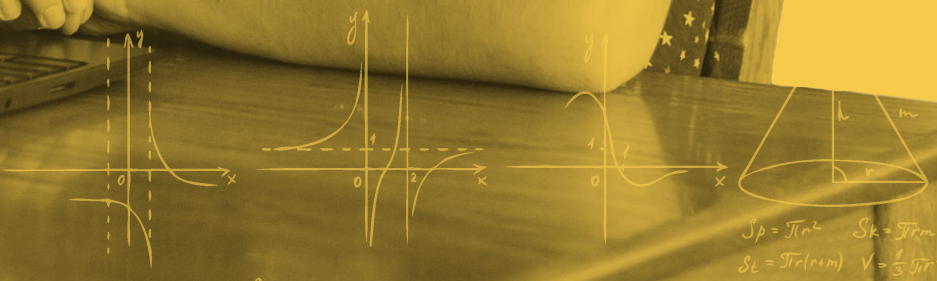


$$S = a^2 = \frac{d^2}{2}$$

$$P = 4a$$



$$S = 2(ab + ac + bc)$$



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