

BEAM

Bridge to Enter Advanced Mathematics

BEAM Alumni Newsletter

September 2019

BEAM's College Support Program

BEAM's College Support Program, which is now entering its second year in New York, is designed to guide you through the challenge of a STEM (Science, Technology, Engineering, or Math) college degree. We can advise you on how to use the resources your college provides and also how to use your BEAM network. We can answer questions like . . .

- How do I pick my classes for the first semester?
- Why should I go to office hours?
- Which Dean or center on campus should I contact for specific questions?
- How do I use both the campus and BEAM networks to search for summer jobs and internships?
- What do I do if I am not sure what the steps are in my major?
- What do I do if I want to study abroad?
- What do I do if I can't find a work-study job?
- How do I stay happy at college?

Each challenge you face, whether it is academic or social, is something that other BEAM students are likely to have dealt with and solved. By using the College Support Program, you can worry less and have academic success!

There are a few different parts of the College Support Program, which is run by our College



Support Coordinator, Ayinde Alleyne. First, you will receive a monthly email, which will include advice based on what is coming up during that time of the year. For example, there could be reminders about . . .

- Meeting with your advisor to plan out your schedule for next semester,
- Filling out FAFSA and other profiles for financial aid,
- How to find places that bring joy and reenergize you in the middle of winter,
- Making the best use of your time around finals,
- When to move out of your dorm after finals are over, so you are not left with a 30-minute window to pack all of your stuff,
- Taking breaks to relax with your friends (valuable advice from current college sophomore Tanasia Gordon!),
- Special opportunities that are available, like being a summer counselor for BEAM!

Another big part of the College Support Program is the opportunity to sign up for individual advising with Ayinde. Each semester you will meet with him one-on-one, either in person or online, to have a more detailed check-in about how the semester is going and whether you are on track. It gives

you a chance to talk about specific classes that you are currently taking or want to take next semester, how things are going with housing, roommates, clubs and programs in which you are participating on campus, financial aid, plans for the summer, and anything else with which he might be able to help. He will also be available by text and email, in case anything comes up between meetings.

Lastly, there are reunions with other BEAM students, which allow you to learn how their experiences in college might be similar to, or completely different from, your own. BEAM students go to colleges all over the United States, so these reunions generally happen around winter break, and again at the beginning of the summer. In June you can also share your experiences with BEAM students who have recently graduated from high school and are about to embark upon their own college adventure. Everyone has a lot of questions at this time in their life, and your experiences can help them feel more comfortable as they move into the next phase of their lives.

John Embaba, who is currently a junior at Fordham University, says, "Ayinde has been there for me whenever I needed help. For example, when I had trouble at the financial aid office, it was Ayinde who advised me to stick up for myself rather than just let it slide."

If you are currently in college, but have not yet signed up for the College Support Program, email Ayinde, at ayinde@beammath.org, to get started!

The College Application Process: A BEAM Alum's Experience



Mayra was at BEAM's (formerly SPMPs's) Siena College site in 2014. This fall she will be attending Lehigh University in Bethlehem, PA!

What surprised you about the college application process?

I felt prepared for the essays, and I knew what to do, but nothing compared with being in the moment and actually doing it. Also, I have been part of a lot of programs like BEAM, so when it came to the application process, I had too many voices telling me what to do, what to say, what to write. I didn't know who to listen to. I decided to work with BEAM and CTY throughout my college process, like when it came to reading my essays.

Did anything surprise you about the financial aid process?

Any minor error could change everything! I had someone who helped me, and they put my mother as my father, which delayed my financial aid. If someone is doing it for you, be right there with them, because you know the information better than they do. Make sure you are looking at the computer or the paper, and make sure you review it before they submit it.

Also, when colleges give you your package, I thought that was an exact number, but it is just an estimate of what you are going to pay. It doesn't include fees, like for me there was a fee just for being an engineering major.

The financial aid came out great, though. I'm grateful. Including my work-study it covers everything. I am taking a subsidized loan for about \$1000 for the first semester, but I know next year I won't need it; if I work during the summer I can cover the gap.

With which parts of the process was BEAM particularly helpful for you?

Everything! They are the reason I am here. I have been preparing for college with BEAM for a long time. Not everything they told me was new, but everything was helpful. I went to workshops during the summer of sophomore (10th grade) and junior (11th grade) year, and I took everything they said into consideration.

They would say: "Start thinking about what you might be interested in"; "You know you have to take the subject tests"; "Prepare for the SATs"; "Think about extracurriculars." Then, when I was applying, they said, "Everything we told you, you should be applying now." They were so helpful! They read all my applications, all my essays. Then, when I dislocated and fractured my knee, Sylvia was like, "Hey it's fine. We can work on the phone, we can message about it." I could send my essay to Ayinde at the last minute and he would work with me on it. I cannot thank them enough. They were there if I had any questions about anything! Even now, I asked Ayinde about a computer, and he said, "Here are some good laptops that are reasonably priced."

Do you have any additional advice?

Something I wish I could tell myself freshman year (9th grade), is that time management is key. Also choose a picture of what you want to do. For example, choose your top five or six extracurriculars. Focus on the ones you really want to be taking part in. Don't wait until you start writing your essays to see which ones you really care about. If you are in the robotics club and you are not into it, that's fine. Colleges want to know **you**. Be true to yourself. Have a plan and reflect on it. After freshman year reflect on what you did and think about what you want to do sophomore year.

More Great College Acceptances

Here are some of the other amazing colleges and universities that BEAM alumni will begin attending this fall!

- Bard College, Annandale-On-Hudson, NY
- Baruch College (CUNY), New York, NY
- City College of New York (CUNY), New York, NY
- Columbia University, New York, NY
- Dartmouth College, Hanover, NH
- Franklin & Marshall College, Lancaster, PA
- Howard University, Washington, DC
- John Jay College of Criminal Justice (CUNY), New York, NY
- Lehigh University, Bethlehem, PA
- Le Moyne College, Syracuse, NY
- New York City College of Technology, Brooklyn, NY
- New York University, New York, NY
- Princeton University, Princeton, NJ
- Southern Connecticut State University, New Haven, CT
- State University of New York (SUNY), New Paltz, NY
- St. John's University, New York, NY
- Stony Brook University (SUNY), Stony Brook, NY
- Syracuse University, Syracuse, NY
- University of Albany (SUNY), Albany, NY
- University of California, San Diego, CA
- University of Pennsylvania, Philadelphia, PA
- Whitman College, Walla Walla, WA
- Worcester Polytechnic Institute, Worcester, MA



Private vs. Public

A **private** college is usually a nonprofit that runs a college. Colleges like Bard, Siena, Harvey Mudd, Union, New York University and the University of Southern California are all private. While tuition is often higher, some private colleges also give a lot of scholarships because they have more money, which means they might be cheaper overall!

A **public** college is run by the government. The University of California system (like UCLA, UC San Diego, or UC Berkeley) are all public colleges in California; in New York there are CUNYs (run by the city, where you usually live at home and commute to college) and SUNYs (run by the state, where you usually live in a dorm on campus). Public colleges are cheaper, specifically for people who live in the state, but may cost more if you do not live in the state.

Challenge Problem Solution for January 2019

Congratulations to Daniel Mintz and Zyan Espinal, who solved the last problem:

Crystal is filling in the blanks in the following addition problem:

$$\begin{array}{r} _ _ \\ + _ _ \\ \hline _ _ _ \end{array}$$

First, she chooses a random two-digit number for the first line. Then, she chooses a random two-digit number for the second line. Finally, she chooses a random three-digit number for the third line.

What is the probability that the addition comes out correct?

Remember: Numbers don't start with 0.

This problem was particularly challenging!

Solution 1:

To figure out the probability, we need to figure out the total number of ways to fill in two two-digit numbers and one three-digit number, and the total number of ways to fill the addition in correctly. Then the probability is

$$\frac{(\# \text{ of ways to fill in correctly})}{(\text{total } \# \text{ of ways to fill in})}$$

The total number of ways to fill it in is not too hard. There are 90 two-digit numbers. You can figure that out either because you have all the options from 10 to 99, or you can think of it as 9 options for the first digit (because you can't use zero), times 10 options for the second digit: $9 \times 10 = 90$. There are 900 three-digit numbers (going from 100 to 999, or $9 \times 10 \times 10$). So in total, you have 90 options for the first two-digit number, times 90 options for the second, times 900 options for the three-digit number: $90 \times 90 \times 900 = 7,290,000$.

Now we need to find the total number of ways to fill it in correctly. Here's one way to do so:

Suppose we fill in a first two-digit number. Then to find an addition that works, all we need to do is fill in a second two-digit number so that the total is a three-digit number. The only thing that could go wrong is the sum might be too small: it might be less than 100. So which ones do work? Well...

- If the first two-digit number is 10, then the second two-digit number can be 90-99 to get a three-digit number as the answer. That's 10 possibilities.
- If the first two-digit number is 11, then 89-99 works, giving 11 possibilities.
- If the first two-digit number is 12, then 88-99 works, giving 12 possibilities.
- And so on . . .
- Until, if the first two-digit number is 90, then every single other two-digit number 10-99 works, giving 90 possibilities.
- It's the same for 91, 92, all the way up through 99: each one gives 90 possibilities, because any two-digit number you add gives a three-digit number.

So there are 10 ways to make the addition work if your first two-digit number is 10. There are 11 ways to make it work if your first two-digit number is 11. The total number of ways to make it work is:

$$10 + 11 + 12 + \dots + 89 + 10 \times 90.$$

The 10×90 comes up because for all ten numbers 90-99, all 90 two-digit numbers make it work.

How do we add these numbers? Well, you can use the "rainbow method" you might have learned sometime, or you can remember the formula

$$1 + 2 + 3 + \dots + n = n(n+1)/2.$$

So...

$$1 + 2 + 3 + \dots + 89 = 89(90)/2 = 4005.$$

$$1 + 2 + 3 + \dots + 9 = 9(10)/2 = 45.$$

And then we subtract these to get $10 + 11 + 12 + \dots + 89 = 4005 - 45 = 3960$.

Add that to $10 \times 90 = 900$ and we get 4860 ways to correctly fill in two two-digit numbers and a three-digit number.

Dan's Challenge Problem



Send in the solution to this problem to win a free book!

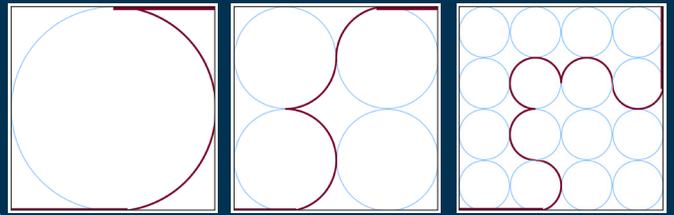
The deadline for submissions is September 15, 2019.

How to submit:

Email your answer to info@beammath.org, text a photo to (217) 649-1100, or hand it in at our next event!

Note that solutions come two issues after each challenge problem.

Below are three 4×4 squares, and three red paths from the bottom-left to the top-right. Order the paths from shortest to longest and give their lengths.



The probability is then $4860/7,290,000 = 0.06667\%$. That translates to $1/1500$; so about one out of every 1500 times, Crystal will randomly fill in the addition correctly!

Solution 2:

There's another way to figure out the total number of ways to fill in the addition correctly.

Consider options for the three-digit number:

- If it's 199 or bigger, it doesn't work, because the largest possible number we can get is $99+99=198$.
- If it's 198, there is exactly one way to fill in the 2-digit numbers: $99+99$.
- If it's 197, there are exactly two ways: $99+98$ or $98+99$.
- If it's 196, there are exactly three ways: $99+97$, $98+98$, or $97+99$.
- If it's 195, there are exactly four ways: $99+96$, $98+97$, $97+98$, or $96+99$.
- And so on . . .
- Until with 109, there are 90 ways to do it: $99+10$, $98+11$, $97+12$, ... , $10+99$.
- For 108, there are 89 ways to do it: $99+11$, $98+12$, ..., $11+99$
- And so on . . .
- Until 100, where there are 81 ways to do it: $90+10$, $89+11$, ... , $10+90$
- Below 100, it is no longer a three-digit number.

So to find all the ways that work, the final step is to add up all of the ways we've found so far. That means we must add

$$1 + 2 + 3 + 4 + \dots + 90 + 89 + 88 + \dots + 81.$$

There are lots of ways to do this addition. You could use the "rainbow method," for example. However, there is also a formula that you might have learned at BEAM:

$$1 + 2 + 3 + \dots + n = n(n+1)/2.$$

So we can add $1 + 2 + 3 + \dots + 90$ like this:

$$90(91)/2 = 4095.$$

We still need to add $89 + 88 + \dots + 81$. To do this, we can add $1 + 2 + \dots + 89 = 89(90)/2$, and subtract $1 + 2 + 3 + \dots + 80 = 80(81)/2$. That gives $4005 - 3240 = 765$.

So in total, there are $4095+765=4860$ ways to correctly fill in the addition.

For an extra challenge, what would the probability be if Crystal instead chose two random three-digit numbers and a random four-digit number?

BEAM Summer Away begins near Los Angeles!

This year, for the first time, BEAM Summer Away welcomed 41 students to Harvey Mudd College in Southern California! In keeping with BEAM tradition, students took classes like Number Theory, Graph Theory, and Probability, they attended field trips to a hike, a water park, and Six Flags, and they participated in weekly relays, daily activities, and a talent show on the last night. However, there were a few differences. For one thing, Los Angeles does not have anything like the SHSAT for admission to high school, so the problem solving courses (Math Team Strategies and Solving Big Problems) ran for three weeks, rather than two. In addition, the entire program ran two weeks earlier, from mid-June to mid-July. Since students were at BEAM for



the Fourth of July, they attended a local fireworks show in Claremont. This year's group was also very creative: we had several musicians and artists, so there was music and beautiful drawings everywhere, and they even invented a new game called Lechuga!

Please help us welcome our first group of Los Angeles students to the BEAM Pathway Program!!



BEAM

Bridge to Enter Advanced Mathematics

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BEAM's Career Advisory Board

Through BEAM, you can meet professionals who can help you . . .

- Learn about different career paths and explore what jobs are like,
- Find job shadow opportunities,
- Find internship and research opportunities.

Building your network is an important part of career success. Anyone can get advice. Email us at info@beammath.org to get started!



Questions? Comments?

We want to hear from you! Is there something that excites you that you want to know more about? Have you had an experience that you think others could learn from? Tell us about it by sending an email to: newsletter@beammath.org. We might write about it!

Moving?

If your address has recently changed, or if you are planning to move soon, please let us know by sending an email to info@beammath.org.
Thank you!