

$2+2=4$

+  
x

42:9

$\sqrt[n]{x}$

# Epsilon Presentation

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$x/2y$

a

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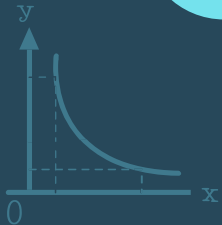
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$$2+2=4$$

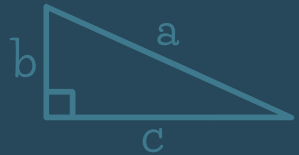
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$$x/2y$$

# Introduction

Context and Problem Statement



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# Problem

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The student body population of the Epsilon School of Mathematics and Science will be increased from 490 to 630 for the 2024-2025 school year.

Historically, the size of the incoming sophomore class has been equal to that of the graduating senior class (plus any students who dropped out during the year).

Next year, the new sophomore class will have 140 more students than the graduating senior class.

To accommodate this increase, seven additional faculty will be hired.

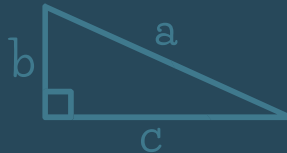


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# Question! (Shaurya)<sup>+</sup>

## How should we hire the new faculty?

Should every major discipline (English, Social Studies, Mathematics, Physics, Biology, Chemistry, and Foreign Language) each receive one new teacher, or does the demand for courses argue that some departments should receive two new teachers while others receive none?



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# Assumptions Made:

- Each teacher has 5 classes with no duty period and a prep or 4 with a duty period and a prep.
- Each foreign lang teacher teaches two languages.
- Each teacher has 20 kids per class.
- The incoming sophomore class is equal to the size of the graduating senior class, and we are assuming that no students drop out senior year.
- One language teacher teaches three German classes and one French class.
- Each student has 6 classes a day.
- Art has 25 students per class.
- Each teacher teaches all the grades for their course.
- No 9th graders at the school.
- If there are not 140 students added then the grade would have the same amount of students as the seniors.
- New 140 students follow the same trends.
- Dropouts occur during 10th and 11th grade.
- Some students double up on certain classes and some students had free periods (because the total number of enrollments was divided by 6, it didn't come out to 490).

# Process

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$x/2y$



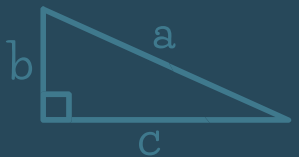
Find amount of Students



Find teacher-student-class ratio



Use what's given and add help.



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# Given Enrollment Data 2023-2024

	CURRENT	CURRENT	CURRENT	CURRENT	CURRENT
Subject	Teachers	10th	11th	12th	Total
Math	6	184	201	262	647
Chem	3	59	126	109	294
Physics	3	50	58	183	291
Bio	4	198	95	26	319
Social Studies	5	183	131	59	373
ELA	5	183	155	152	490
Spanish	1	51	26	33	110
German	1	19	22	10	51
French	1	41	32	49	122
Music	1	50	56	49	155
Art	1	31	33	35	99

Looking at the data, we can't tell how many students there are per grade. Some students can double up on courses or have free periods

English has 490 enrollments, which is the total student body population.

Every student in the school takes English, and we can look at the number of English enrollments to see the number of students per grade.

183 10th graders  
graders

155 11th graders

152 12th

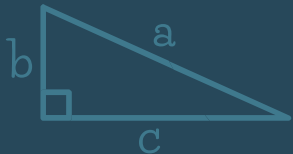


# How many Incoming Sophomores?

Historically, the size of the incoming sophomore class has been equal to that of the graduating senior class (plus any students who dropped out during the year).

Next year, the new sophomore class will have 140 more students than the graduating senior class.

If there are 152 seniors graduating, there should be 292 incoming sophomores.



$$152 + 140 = 292$$

x

$x/2y$

# Step 1: Find Ratios

	CURRENT	CURRENT	CURRENT	CURRENT	CURRENT
Subject	Teachers	10th	11th	12th	Total
Math	6	184	201	262	647
Chem	3	59	126	109	294
Physics	3	50	58	183	291
Bio	4	198	95	26	319
Social Studies	5	183	131	59	373
ELA	5	183	155	152	490
Spanish	1	51	26	33	110
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Music	1	50	56	49	155
Art	1	31	33	35	99

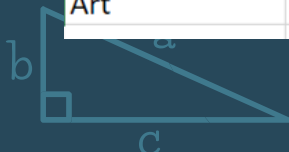
We assumed that the incoming sophomores would follow the same trend as the current sophomores in terms of subject-demand.

We found the ratio of the enrollments to the total number of students for each subject in each grade:

Number of Enrollments

Total Number of Students

$x/2y$



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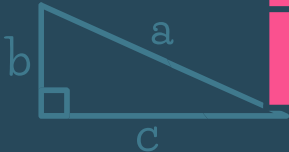
x

x

# Step 1 Ratio Example:

The ratios of each grade for the Math Department 2023-2024

	10th	11th	12th
Total Students	183	155	152
Math Enrollments	184	201	262
Calculation	$184/183$	$201/155$	$292/152$
Ratio	1.005	1.297	1.724



$x/2y$

x

x

	CURRENT	CURRENT	CURRENT
Subject	10th Ratio	11th Ratio	12th Ratio
Math	1.005	1.297	1.724
Chem	0.322	0.813	0.717
Physics	0.273	0.374	1.204
Bio	1.082	0.613	0.171
Social Studies	1.000	0.845	0.388
ELA	1.000	1.000	1.000
Spanish	0.279	0.168	0.217
German	0.104	0.142	0.066
French	0.224	0.206	0.322
Music	0.273	0.361	0.322
Art	0.169	0.213	0.230
Sum	6	6	6

# All Ratios

x

y

After summing all of the ratios, we got 6 for each grade

This means that each students takes around 6 classes, which is realistic.

# + Incoming Sophomore Enrollment

	2024-2025
Subject	10th Grade
Math	293
Chem	94
Physics	80
Bio	316
Social Studies	292
ELA	292
Spanish	81
German	30
French	65
Music	80
Art	49
Total	1673

Based on the ratios, we can predict the enrollments for the 2024-2025 school year

If there are 292 incoming sophomores, we can multiply 292 by each of the ratios to find the enrollment data for the new school year

**Ex: Math ratio: 1.005**

**$1.005 * 292 = 293$  sophomores in math 2024-2025**

# Incoming Junior Enrollment

183 current sophomores

$$183 \times \frac{9}{100} = 9 \text{ students drop out}$$

before they graduate

4 ppl. drop out 2023-2024

5 ppl. drop out 2024-2025

179 juniors in 2024-2025

We are assuming that the teachers would teach students from all 3 grades.

Therefore, we have to make our decision based on the enrollments of the incoming junior (current sophomore) and the incoming senior (current juniors).

We assumed that an equal number of students would drop out each year. To find the number to current sophomores that enroll next year, we must subtract the students that drop out during 2023-2024:

# Incoming Junior Enrollment

	2024-2025	
Subject	11th Grade	
Math	232	
Chem	146	
Physics	67	
Bio	110	
Social Studies	151	
ELA	179	
Spanish	30	
German	25	
French	37	
Music	65	
Art	38	
Total	1080	

Based on the ratios, we can predict the junior (current sophomores) enrollments for the 2024-2025 school year

If there are 179 incoming juniors, we can multiply 179 by each of the ratios to find the enrollment data for the new school year

**Ex: Math ratio: 1.297**

**$1.297 * 179 = 232$  juniors in math 2024-2025**

155 current juniors

$x$  = initial junior class

$\frac{5x}{100}$  =  $y$  total dropouts

$$x - \frac{y}{2} = 155$$

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$$x = 20y$$

$$20y - \frac{y}{2} = 155$$

$$39y = 310$$

$y = 8$  dropouts  $x = 160$  total

4 ppl. dropped out 2022-2023

4 ppl. dropped out 2023-2024

151 seniors in 2024-2025

# Incoming Seniors

Calculating the incoming seniors is different than calculating the incoming juniors. Based on our assumptions, there were some students that dropped out prior to this year, and there will be some dropouts after.

To calculate the initial class size and the total number of dropouts, we made an algebraic system of equations and solved for the number of current juniors that would move up to senior year.



	2024-2025
Subject	12th Grade
Math	260
Chem	108
Physics	182
Bio	26
Social Studies	59
ELA	151
Spanish	33
German	10
French	49
Music	49
Art	35
Total	961

# Incoming Senior Enrollment

x

y

Based on the ratios, we can predict the junior (current sophomores) enrollments for the 2024-2025 school year

If there are 179 incoming juniors, we can multiply 179 by each of the ratios to find the enrollment data for the new school year

**Ex: Math ratio: 1.724**

**$1.724 * 151 = 260$  seniors in math 2024-2025**

# 2024-2025 Total Enrollment

	2024-2025	2024-2025	2024-2025	2024-2025
Subject	10th Grade	11th Grade	12th Grade	Total
Math	293	232	260	786
Chem	94	146	108	348
Physics	80	67	182	329
Bio	316	110	26	452
Social Studies	292	151	59	502
ELA	292	179	151	622
Spanish	81	30	33	144
German	30	25	10	65
French	65	37	49	151
Music	80	65	49	193
Art	49	38	35	122
				0
Total	1673	1080	961	3714

# Student-Teacher-Class Ratio

2024-2025 Data Before Adding New Teachers				
Subject	Teachers	Total	Kids/Teacher	Class/Teacher
Math	6	786	131	7
Chem	3	348	116	6
Physics	3	329	110	5
Bio	4	452	113	6
Social Studies	5	502	100	5
ELA	5	622	124	6
Spanish	1	144	144	7
German	1	65	65	3
French	1	151	151	8
Music	1	193	193	10
Art	1	122	122	6
Total	31	3714		

We found the student-teacher ratio by dividing the total number of enrollments by the number of teachers.

We assumed there were around 20 kids per class, so we divided the ratios by 20 to see how many classes each teacher would have.

Each teacher should have around 4-5 classes to make it fair for all of the teachers.

x

# Our<sup>+</sup>Solution

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2024-2025 Data Before Adding New Teachers				
Subject	Teachers	Total	Kids/Teacher	Class/Teacher
Math	6	786	131	7
Chem	3	348	116	6
Physics	3	329	110	5
Bio	4	452	113	6
Social Studies	5	502	100	5
ELA	5	622	124	6
Spanish	1	144	144	7
German	1	65	65	3
French	1	151	151	8
Music	1	193	193	10
Art	1	122	122	6
Total	31	3714		

If want all the teachers to have around 5 classes each, we need to add teachers such that dividing the total enrollments by the number of teachers will be around 100 kids per teacher ( $20 \times 5 = 100$ ).

Ex. Total math enrollments=786

X = number of teachers

$$786/x = 100$$

X = 8 teachers (add 2 teachers)

**FINAL**  
 Add 2 math  
 Add 1 Chem  
 Add 1 Bio  
 Add 1 ELA  
 Add 1 Music  
 Add 1 Language

# Final Ratios

2024-2025 Data After Adding New Teachers				
Subject	Teachers	Total	Kids/Teacher	Class/Teacher
Math	8	786	98	5
Chem	4	348	87	4
Physics	3	329	110	5
Bio	5	452	90	5
Social Studies	5	502	100	5
ELA	6	622	104	5
Spanish	1	144	144	7
German	1	65	65	3
French	1	151	151	8
Music	2	193	97	5
Art	1	122	122	6

NOTE: Art has 6 classes, but if there are 24-25 students per class, the art teacher would have 5 classes.

$x/2y$ 

# Foreign Language Current

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	Spanish	German	French	Total
Enrollments	110	51	122	283
Class	5	3	6	14
Teachers	1	1	2	3

There are 3 teachers currently. There are 283 students total, so 94 students per teacher, and there are 5 classes per teacher.

1 Spanish teacher (5 classes), 1 French teacher (5 classes), and 1 German-French Teacher (3 German classes and 1 French class)



x/2y

# Foreign Language 2024-2025

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x

	Spanish	German	French	Total
Enrollments	144	65	151	283
Class	7	3	8	18
Teachers	1	1	2	3

**Before:** 1 Spanish teacher (5 classes), 1 French teacher (5 classes), and 1 German-French Teacher (3 German classes and 1 French class)

**After:** 1 Spanish teacher (5 classes), 1 French teacher (5 classes), and 1 German-French Teacher (3 German classes and 1 French class), 1 Spanish-French Teacher (2 Spanish classes and 3 French classes)

# Error Analysis(Weaknesses)

Weaknesses:

1. Calculation Errors
2. Measurement Errors
3. Experimental Errors
4. Data Entry Errors
5. Assumptions and Models
6. Communication Errors
7. There aren't enough teachers to add, so some classes will have more or less students. Specifically art, the overall structure would have been messed up if an art teacher was hired, there wasn't an art teacher hired. This resulted in there being more students per class in art.

Strength: Minimized this with:

Feedback from Mrs. Burns, checking each others math, and double checking our work.



# Strengths(Stability of Model)

## Strengths:

- Great Communication
- Amazing math skills
- Accounting for everything to make it like an ideal model
- Regardless of the number of students being added, our model still works in terms of the number of classes, and the student to teacher ratio in each class.

## To Minimize the errors:

Feedback from Mrs. Burns, checking each others math, and double checking our work.

x

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x

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# Future Works

-Future extensions of this project could include looking back at the school a year later, 2 years later, etc., and seeing how effective the current number of teachers is, and in what ways it could be changed if necessary. Specifically looking at the new class size of the sophomores for future years.

-An extension of this model would be to take into account more factors, such as teachers going on leave, substitute teachers, students dropping individual classes, students moving (not dropping out).

x

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x

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y

# Acknowledgements

- Mrs. Burns

THANK YOU!

Any Questions?