

# The Epsilon School

A new wing is being added to the Epsilon School of Mathematics and Science so that the student population can be increased from 490 to 630 for the 2025-2026 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. There is a great deal of discussion on campus about which departments should get the extra teachers. At the time of the increase there are:

6	Mathematics faculty	5	English faculty
3	Chemistry faculty	3	Foreign language faculty
3	Physics faculty	1	Music instructor
4	Biology faculty	1	Art instructor
5	Social studies 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?

It is possible to hire a foreign language instructor who can teach two different languages, but other faculty teach only in their discipline.

How would you hire the new faculty? Explain why your decision is **fair**.

## Departmental Enrollment Totals: September 2024

<u>Department</u>	<u>10th</u>	<u>11th</u>	<u>12th</u>	<u>Total</u>
Art	31	33	35	99
Biology	198	95	26	319
Chemistry	59	126	109	294
English	183	155	152	490
French	41	32	49	122
German	19	22	10	51
Spanish	51	26	33	110
Mathematics	184	201	262	647
Music	50	56	49	155
Physics	50	58	183	291
Social Studies	183	131	59	373

All courses are year-long. Information from the Registrar's office suggest that 5% of the incoming class drop out prior to graduation.

### **Outline for Each Presentation (Group)**

- A clarification or restatement of the problem and summary of work.
- A clear exposition of all assumptions, variables, and hypotheses. Even if the assumptions seem obvious to you, they should be stated in your presentation.
- An analysis of the problem, justifying or motivating the modeling to be used.
- The design of the model.
- Justification of the model, including a discussion of how the model can be tested. If appropriate, use your model to predict an outcome and then conduct an additional trial to demonstrate that your model gives predicted results.
- Your solution to the problem.
- A discussion of the strengths and weaknesses of the model.

**Due:** Monday, September 30<sup>th</sup>

**Format:** pdf, pptx, url link

# EPSILON SCHOOL

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## PROBLEM STATEMENT

The Epsilon school wants to increase the school population from 490 to 630 students. Hence, 7 new teachers will be hired, so we devised a fair solution to hire them. We aimed to keep the student-teacher ratio the same in their respective classes.



## ASSUMPTIONS

- Those who drop out drop between Junior and Senior year
- All students are enrolled in an English Class
- New sophomores will have the same class interests as previous sophomores
- All new students are added to sophomore classes
- All students take six classes
  - 490 students in the school, 2951 class seats. The average student takes six classes

## ASSUMPTIONS II

- Teachers teach 4 classes per day
  - Based on arbitrarily assuming 25 students per class
  - Then, dividing the seat-to-teacher ratio by ~93 by 25
- Language teacher assumptions:
  - Language teacher 2 teaches 3 classes of French and 1 class of Spanish
  - Language teacher 2 teaches 2 classes of French and 2 classes of German
  - Language teacher 3 teaches teaches 4 classes of Spanish

# DATA GIVEN

Class	Faculty	Class	10th	11th	12th
Math	6	Art	31	33	35
Chemistry	3	Bio	198	95	26
Physics	3	Chem	59	126	109
Biology	4	English	183	155	152
Social Studies	5	French	41	32	49
English	5	German	19	22	10
Foreign Language	3	Spanish	51	26	33
Music	1	Math	184	201	262
Art	1	Music	50	56	49
		Physics	50	58	183
		Social Studies	183	131	59
		<b>TOTAL</b>	<b>1049</b>	<b>935</b>	<b>967</b>

# OUR METHODS

Class	9th	10th	11th	12th	SUM	Sum w/ 9th
Art	49.5	31	33	35	99	113.5
Bio	315.9	198	95	26	319	608.9
Chem	94.1	59	126	109	294	279.1
English	292.0	183	155	152	490	630.0
French	65.4	41	32	49	122	138.4
German	30.3	19	22	10	51	71.3
Spanish	81.4	51	26	33	110	158.4
Math	293.6	184	201	262	647	678.6
Music	79.8	50	56	49	155	185.8
Physics	79.8	50	58	183	291	187.8
Social Studies	292.0	183	131	59	373	606.0
<b>TOTAL</b>	<b>1673.8</b>	<b>1049</b>	<b>935</b>	<b>967</b>		



## OUR METHODS II

Data Analysis	Seat to Teacher Ratio New	Ratio Old	Sections currently are
Art	113.5	99.0	3.96
Bio	152.2	79.8	12.76
Chem	93.0	98.0	11.76
English	126.0	98.0	19.60
French	92.3	97.6	4.88
German	142.6	102.0	2.04
Spanish	158.4	88.0	4.40
Math	113.1	107.8	25.88
Music	185.8	79.8	6.20
Physics	62.6	97.0	11.64
Social Studies	121.2	74.6	14.92
Avg ratio	123.70	92.87	

# OUR METHODS III

Data Analysis	Sections should be with 9	Teachers needed	Teachers had	Teachers needed	Sections should be base on current teacher #'s
Art	4.54	1.13	1.00	0	4.0
Bio	24.36	6.09	4.00	2	16.0
Chem	11.17	2.79	3.00	0	12.0
English	25.20	6.30	5.00	1	20.0
French	5.54	1.38	1.25	0	5.0
German	2.85	0.71	0.50	0.5	2.0
Spanish	6.34	1.58	1.25	0.5	5.0
Math	27.14	6.79	6.00	1	24.0
Music	7.43	1.86	1.00	1	4.0
Physics	7.51	1.88	3.00	0	12.0
Social Studies	24.24	6.06	5.00	1	20.0

# FINDINGS

- We would like to hire
  - 2 Biology Teachers
  - 1 English Teacher
  - 1 Language Teacher
    - Teaching two classes of German and two classes of Spanish
  - 1 Math Teacher
  - 1 Music Teacher
  - 1 Social Studies Teacher