LESSON MAKER PRO

Who Gets Seats?

Use apportionment methods to divide representation.

HIGH SCHOOL · FM.FDV.A.27

FM.FDV.A.27 "Identify and apply historic methods of apportionment for voting districts including Hamilton, Jefferson, Adams, Webster, and Huntington-Hill. Identify issues of fairness and paradoxes that may result from methods."

NAME _____ DATE _____

ASSIGNING SEATS

For Hamilton, find each group's quota (population / total population × seats). Give each group the whole-number part of its quota, then give leftover seats to the largest fractional parts. For divisor methods, divide each population by a chosen divisor: Jefferson rounds down, Adams rounds up, and Webster rounds to the nearest whole number, with .5 rounded up. Huntington-Hill rounds a value between n and n + 1 up when its square is greater than n(n + 1), and down otherwise. For each divisor method, choose a divisor that makes the seats add to the required total.

WORKED EXAMPLE

Use Hamilton to divide 9 seats among groups A, B, and C with populations 48, 32, and 20.

1. Total population: 48 + 32 + 20 = 100.
2. Quotas: A = 48/100 × 9 = 4.32, B = 32/100 × 9 = 2.88, C = 20/100 × 9 = 1.80.
3. Assign whole-number parts: 4, 2, and 1 seats. This uses 7 seats.
4. The two largest fractional parts are 0.88 and 0.80, so give the remaining seats to B and C.

Answer: A: 4 seats, B: 3 seats, C: 2 seats.

PRACTICE 6 problems

1 Use Hamilton to divide 6 seats among groups A, B, and C with populations 60, 25, and 15.

ANSWER _____

2 Groups A, B, and C have populations 70, 40, and 25. Use Jefferson with divisor 15 to assign 7 seats.

ANSWER _____

3 Groups A, B, and C have populations 25, 14, and 7. Use Adams with divisor 12 to assign 6 seats.

ANSWER _____

4 Groups A, B, and C have populations 29, 19, and 11. Use Webster with divisor 8 to assign 7 seats.

ANSWER _____

5 Groups A, B, and C have populations 35, 24, and 15. Use Huntington-Hill with divisor 10 to assign 8 seats.

ANSWER _____

6 A Jefferson divisor assigns 5 seats, but the goal is 6 seats. Should you increase or decrease the divisor? Explain briefly.

ANSWER _____

APPLY IT Show your work

1 Three school clubs have 115, 55, and 30 members. The clubs will share 8 seats on a student planning council. Use Hamilton to find each club's number of seats.

WORK SPACE

ANSWER _____

2 Three esports teams have 26, 17, and 12 players. They will share 6 seats on a tournament rules council. Use Huntington-Hill with divisor 10 to find each team's number of seats.

WORK SPACE

ANSWER _____

CHALLENGE One step up

Groups A, B, and C have populations 5, 3, and 1. Use Hamilton to divide 4 seats, then divide 5 seats. Which group loses a seat when the total increases? Name this paradox.

WORK SPACE AND ANSWER

Who Gets Seats?

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Use Hamilton to divide 6 seats among groups A, B, and C with populations 60, 25, and 15.	**A: 4, B: 1, C: 1.**
2	Groups A, B, and C have populations 70, 40, and 25. Use Jefferson with divisor 15 to assign 7 seats.	**A: 4, B: 2, C: 1.**
3	Groups A, B, and C have populations 25, 14, and 7. Use Adams with divisor 12 to assign 6 seats.	**A: 3, B: 2, C: 1.**
4	Groups A, B, and C have populations 29, 19, and 11. Use Webster with divisor 8 to assign 7 seats.	**A: 4, B: 2, C: 1.**
5	Groups A, B, and C have populations 35, 24, and 15. Use Huntington-Hill with divisor 10 to assign 8 seats.	**A: 4, B: 2, C: 2.**
6	A Jefferson divisor assigns 5 seats, but the goal is 6 seats. Should you increase or decrease the divisor? Explain briefly.	**Decrease the divisor. Dividing by a smaller number raises the values before they are rounded down.**

PART 2 · APPLY IT

1. **The clubs receive 5, 2, and 1 seats, respectively.** The total is 200, so the quotas are 4.6, 2.2, and 1.2. Assign 4, 2, and 1 seats first, then give the remaining seat to the club with 115 members.
2. **The teams receive 3, 2, and 1 seats, respectively.** Dividing by 10 gives 2.6, 1.7, and 1.2. Compare their squares with 2 × 3, 1 × 2, and 1 × 2 to round them to 3, 2, and 1.

CHALLENGE

With 4 seats: A = 2, B = 1, C = 1. With 5 seats: A = 3, B = 2, C = 0. Group C loses a seat. This is the Alabama paradox.

Accept seat counts listed in group order. For the challenge, students may identify the Alabama paradox by explaining that C loses a seat even though the total number of seats increases.