Investigation

Richie's Restaurant

Equipment required: 1 brain

Richie has just bought 30 new rectangular tables for his restaurant. One table can seat six people. He needs to arrange them according to two conditions.

- The tables must be set up so that he can seat at least one group of 6, 8, 10, 12, 14, 16 and 18 people all at the same time.
- He wants to seat the maximum number of people possible.

The Big Question

How should Richie arrange his tables to fulfil both of the conditions?

Engage

To seat more than six people, there are two ways in which Richie can join the tables together:

Lengthways or widthways

1 How many people can be seated around two tables if they are joined together:

(a) lengthways (b) widthways?

2 For each of the two ways of joining the tables, copy and complete the following table of values. Draw the tables and count the number of people around them if necessary.

Number of joined tables (t)	1	2	3	4	5	6	7
Number of people seated (p)							

Explore

3 If Richie had no restrictions on the way he could set up his tables, what is the maximum number of people he could seat?

4 If Richie now sets up his tables to fulfil the given conditions, draw up a seating plan of Richie's restaurant, showing your arrangement of the 30 tables. How many people can be seated using this arrangement?

Strategy options

- Draw a diagram.
- Guess and check.
- Make a table.
- Look for a pattern.
- Test all possible combinations.

Explain

5 Consider the two ways of joining the tables in order to seat 10 people. Which type of arrangement (lengthways or widthways) is more efficient (uses fewer tables)? Is this type of arrangement always more efficient?

6 Why does the way in which the tables are joined together (lengthways or widthways) affect the number of people that can be seated around them?

7 For each of the two arrangements, write the rule that connects the number of tables (t) to the number of people that can be seated (p).

Elaborate

8 Consider the coefficient and the constant that appears in each of your rules. Explain where they come from.

9 How do the two rules show that one type of table arrangement is more efficient than the other?

10 Given what you now know about the efficiency of different table arrangements, modify your plan from Question 4, if necessary, to seat a greater number of people, while still fulfilling Richie's condition.

11 Draw your improved seating arrangement to answer the Big Question.

Evaluate

12 Consider the way in which you worked on this problem. How did you approach it? Could you have gone about it a different way?

13 Did you use your tables of values (from Question 2) or the algebra rules to help you solve the problem?

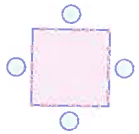
14 How confident are you that your final solution is the best solution?

15 Make a list of all the other factors you would need to consider if you were setting up tables in your own restaurant.

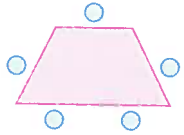
Extend

16 For his next restaurant, Richie would like to use some different-shaped tables. He could use:

(a) square tables that sit 4 people

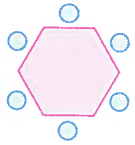


(b) trapezoidal tables that seat 5 people

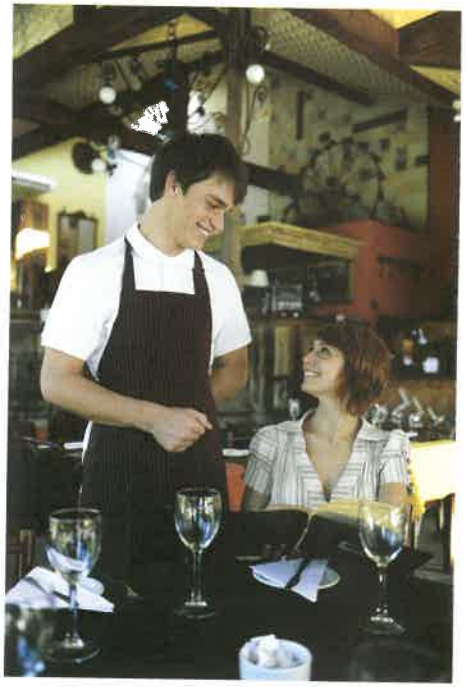


(c) pentagonal tables that seat 5 people or

(d) hexagonal tables that seat 6 people.



Write a report to explain to Richie why none of these different table shapes would be suitable if he wants to seat the maximum number of people while fulfilling the given conditions and using no more than 30 tables.



Answers

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1 **(a)** 10 **(b)** 8

2 Seating capacity—tables joined lengthways

Number of joined tables (t)	1	2	3	4	5	6	7
Number of people seated (p)	6	10	14	18	22	26	30

Seating capacity—tables joined widthways

Number of joined tables (t)	1	2	3	4	5	6	7
Number of people seated (p)	6	8	10	12	14	16	18

3 $30 \times 6 = 180$

4 Answers will vary.

The solution that seats the most people is:

Table arrangement	People seated
9 single tables	9×6
2 tables lengthways	10
2 tables widthways	8
3 tables lengthways	14
4 tables lengthways	18
4 tables widthways	12
6 tables widthways	16
30 tables	132 people

5 2 tables lengthways or 3 tables widthways. Joining tables lengthways will always seat more people for fewer tables.

6 Joining lengthways eliminates one seating position.

Joining widthways eliminates two seating positions.

7 p (lengthways) $= 4t + 2$

p (widthways) $= 2t + 4$

8 The coefficient in p (lengthways) is the number of seats on the sides and the constant is the number of seats on the ends. The coefficient in p (widthways) is the number of seats on the sides and the constant is the number of seats on the ends.

9 The higher coefficient of t in the p (lengthways) formula indicates that this will give a higher result.

10–11 The arrangement given in the answer to Question **4** is the most efficient.

12–16 Students' own answers.

Teaching Strategies

For students experiencing difficulty with the Investigation

It would be beneficial to have students experiment with tables cut out of paper, and chairs represented by counters.

notes: