



6th
Basic

7th
Advanced

Helping With Math

GRADES

Data Collection and Representation Skills: Tape Diagrams

Suitable for students
aged 10-12



This pack is suitable for learners aged 10-12 years old or 6th to 7th grades. The content covers fact files and relevant basic and advanced activities of tape diagrams that aim to develop and strengthen the learners' data collection and representation skills.

Happy St. Patrick's Day!



*St. Patrick's Day is celebrated annually on **March 17**. It is a celebration in honor of Ireland's patron saint. Nowadays especially in North America, this has become more of a secular holiday to celebrate Irish traditions and culture.*

Originally, St. Patrick's Day was a celebration to commemorate the arrival of Christianity in Ireland. It was St. Patrick who converted Ireland to Christianity. He was said to have died on March 17. Therefore, it has become a tradition to celebrate St. Patrick's on the same day. This holiday is celebrated in the United Kingdom, North America, parts of South America, Australia, and New Zealand, mostly by Irish communities. People would gather together in parades, festivals, eat traditional Irish food, and wear green attire or shamrocks. Some people would also attend church services.



DATA COLLECTION & REPRESENTATION SKILLS

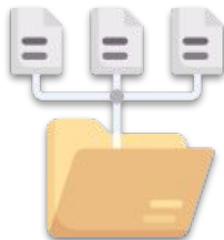
Data Collection & Representation Skills

This is classified under the data analysis and probability discipline of math. When we pose any question, we collect data. If we need to understand a certain topic, we deal with more complex questions by looking at the situation from different aspects to be able to collect appropriate data.

Once we have collected data, we organize this and represent the data in ways that can be easily absorbed and understood. We can interpret the data into visuals or graphics that give us an overview of the relationships among the data collected.



Collect Data



Organize Data



Represent Data



Analyze Data

Uses of Our Data Collection & Representation Skills

Decisions and discoveries are made based on data collected in the aspects of research, education, science, technology, and business. When we need to understand, create, or improve things, we can ask a specific group of people questions on who they are and what they think or observe situations.

The data collected once organized are then interpreted into graphs and charts that make it easier to visualize the relationships of the categories and values.

From the data we see in the graphs and charts, we gain new insights and conclusions to decide our next steps.



DATA COLLECTION

What is data collection?

Data collection is the process of gathering information, measurements, or observations.

Before collecting data, first, determine these important points:

- Clarify the question you would like to answer or the focus of your research.
- Identify the type of data you will need to collect.
 - Is this quantitative data that involves numbers or statistics?
 - Is this qualitative data about personal opinions or views?
 - Or both quantitative and qualitative data?
- Identify the best method for collecting your data.
 - Surveys
 - Experimentations
 - Interviews
 - Observations
 - Research

Once you have clarified your data collection process, begin to collect your data and make sure to properly document the information, and double-check the entries to ensure data quality.



DATA REPRESENTATION

What is data representation?

Data representation is the process of representing a summary of the collected data into graphics or visual form.

There are many methods of representing data that we could use. Depending on the data you have collected, there are graphs, charts, tables or diagrams that can best showcase the points that you have realized from the data gathered.



- Graphs or Charts - these help show relationships between values, categories, and data sets.

Some common graphs or charts:

- Pie Graphs
- Bar Graphs
- Line Graphs



- Tables - these help provide an organized view of data.
- Diagrams - these help provide a simplified overview of history, systems, and processes.



Some common diagrams:

- Tree Diagrams
- Triangular Diagram
- Timeline

As with the process of data collection, make sure to double-check the accuracy of the data being presented. Label your presented data accordingly and note the specific categories and values so that others may easily understand the visual presentation.



TAPE DIAGRAM

What is a tape diagram?

A **tape diagram** is a visual representation used to simplify mathematical equations. We use squares or rectangles arranged side by side and are assigned specific values. These are useful for breaking down mathematical word problems especially those based on ratio and proportion or showcasing number relationships.

Example: Dan harvests an average of 20 apples per day at the orchard. How many apples can he harvest in five days?

| | | | | | |
|----------------------------------|------------|-----------|-----------|-----------|--|
| <i>Apples harvested per day</i> | 20 apples | 20 apples | 20 apples | 20 apples | 20 apples |
| <i>Dan's 5-day Total Harvest</i> | 100 apples | | | |  |

- To create the tape diagram, we start by assigning one rectangle for each day.
- Each rectangle is assigned the value of the average number of apples that Dan can harvest in a day, which is 20 apples. Since he picks about the same number of apples per day, each rectangle is the same size.
- Below the diagram of apples harvested per day, we include another tape that showcases the total number of apples that Dan will harvest for the whole five days, which is 100 apples. This shows the equation: $20 \text{ apples} \times 5 \text{ days}$. As the total of the harvest is the total of the five days, the size of the rectangle will be the same as the five rectangles for each day harvested.

Using the tape diagram, we can see here a simplified overview of each day versus the total of five days.



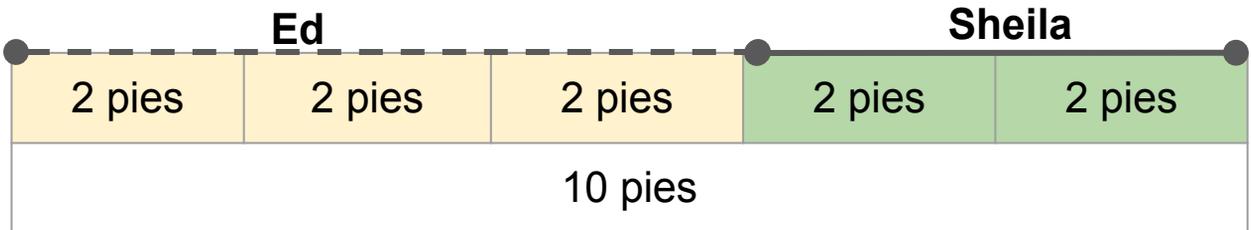
TAPE DIAGRAM

Equations and Tape Diagrams

When using the tape diagram to solve equations, we have to clarify what the rectangles represent and the values assigned to them. After clarifying, we may proceed to solve the equation.

For example: *If Ed brought eight pies to the celebration and Sheila brought four pies. How many pies in total do they have?*

- **Question:** How many pies in total do they have?
- **Collect Data:** Ed = 8 pies, Sheila = 4 pies
- **Representing data:**



- **Analyze:** In this example, we are assigning one rectangle to two pies that Ed and Sheila brought. Each rectangle is a pie with a value of two. When combined together, we can see that the total amount of pies is ten ($2 \times 5 = 10$).
- **Solution:** From the data in the tape diagram, we can conclude that the total number of pies in this celebration is ten.

Total Number of Groups



Total Number of Objects

| | | | | |
|---------------------|---|------------------------------|---|----------------------|
| Total No. of Groups | × | No. of Objects In Each Group | = | Total No. of Objects |
|---------------------|---|------------------------------|---|----------------------|

This overview of solving equations using tape diagrams is helpful to use as a reference for solving all types of equations.



TAPE DIAGRAM

Ratios and Tape Diagrams

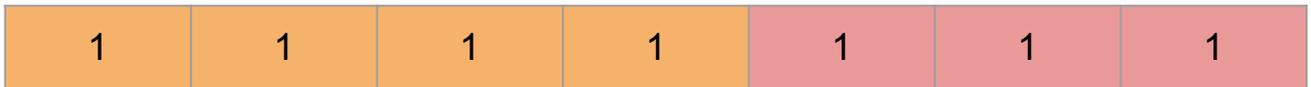
We can represent ratios or fractions as a tape diagram. When we create a tape diagram to show the ratio, we basically represent this as equal-sized parts.

For example: Ratio of oranges to apples is 4 : 3



Oranges (4)

Apples (3)



If the fruit basket contains a total of 28 fruits. Using the ratio in the above example, how many are oranges and how many are apples?

Question: How many oranges and apples are in the fruit basket?

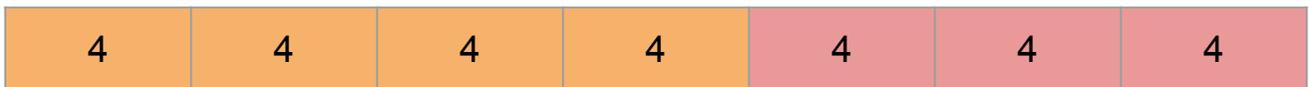
Collect Data: Ratio of oranges to apples: 4:3, Total fruits: 28 fruits

Representing data: We use the same tape diagram above to represent the data for 28 fruits.



Analyze: 28 fruits divided by 7 segments (based on the total rectangles in the tape diagram ratio). Each rectangle will contain 4.

The factor for each segment: 28 fruits / 7 segments = 4



Calculate the no of fruits using the factor of 4.

Calculate No. of Oranges: 4 segments x 4 = 16 oranges

Calculate No. of Apples: 3 segments x 4 = 12 apples

Conclusion: In the fruit basket with 28 fruits, there are 16 oranges and 12 apples based on the ratio of 4 oranges is to 3 apples.

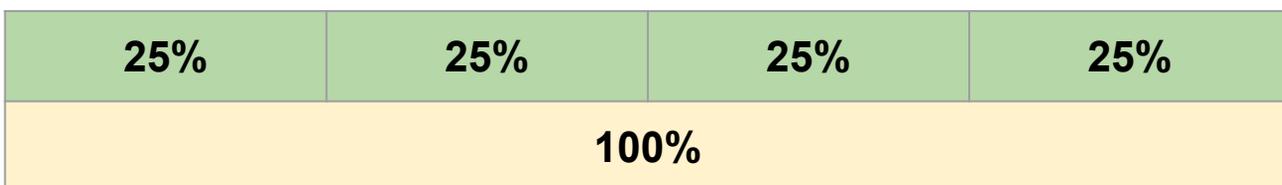


TAPE DIAGRAM

Percentages and Tape Diagrams

We can also show percentages using tape diagrams the same way we represent a ratio. Percentage means per centum in Latin, which translates to “by a hundred” or “per one hundred”. It is the concept of a part and a whole where the value of the whole is always 100%.

For example: *The total value of all segments or the yellow region is 100%. As there are four green segments, we know that 100% divided by four is 25% each.*

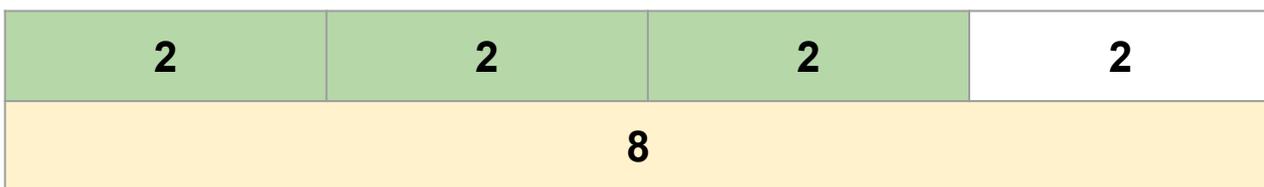
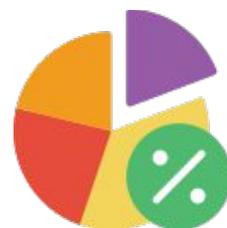


Using the above framework, when we assign 8 as the value of 100%, what is the value of three green segments?

Question: What is the value of three green segments?

Collect Data: Total value: 8, 4 segments

Representing data:



Analyze: Since the total value is 8 and there are four segments, we divide 8 by 4 and know that each segment value is 2.

Solution: The value of three segments is six. (2×3 segments = 6)
From the first tape diagram, we know that three segments is 75%.

Let us test if 6 is 75% of 8. To get the percentage, we divide 6 by 8.

$$(6 / 8 = .75) \square .75 \times 100 = 75\% \checkmark$$



EXERCISES ON TAPE DIAGRAM

1. For every 6 boxes of cookies that Allan sold, Mike was able to sell 4 boxes of cookies. Draw a tape diagram for this ratio including labels.

2. Based on the below tape diagram, what is the percentage value of the segments shaded in green?

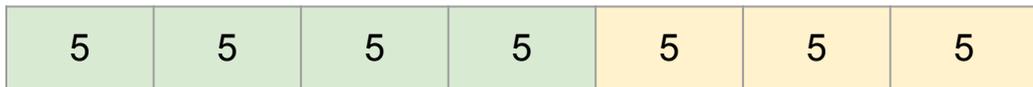


TABLE OF ACTIVITIES

| Ages 10-11 (Basic) | | G6 |
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| 5 | The Legend of St. Patrick | |
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| 7 | Gather the Shamrock | |
| 8 | The Tricky <i>Lobaircin</i> | |
| 9 | Celebrating Irish Traditions | |
| 10 | World of St. Patrick's Day | |



THE POTATO FAMINE

G6
Basic

It was the potato famine or the Great Hunger in Ireland that triggered a mass migration of the Irish to the US and Canada. Connect the migrating ships assigned to problems on the left to their matching tape diagrams on the right.

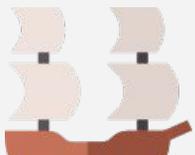
1



$$5 + 4 = x$$

| | |
|----|---|
| x | x |
| 10 | |

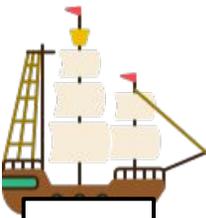
2



$$\begin{array}{l} 5:3 \\ 15:9 \end{array}$$

| | | | | |
|----|----|----|----|----|
| 10 | 10 | 10 | 10 | 10 |
| | | | | |

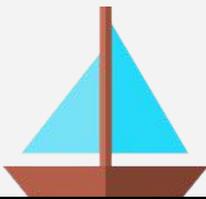
3



$$50\%$$

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| x | | | | | | | | |

4



$$10 \times 5 = x$$

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |



HARSH REALITIES

G6
Basic

When the Irish celebrated the first St. Patrick's Day parade in the US, they were deemed unruly. As the Irish arrived in the US and Canada, their hopes and dreams of a better life were placed on hold as they experienced discrimination. Answer the questions by creating tape diagrams.

1. For every five Irish person that applied for a job, only two were accepted. There were 25 people that applied for a job, how many people were accepted?



Answer:

2. There were 80 Irish that applied for a job that day and only 20% of them were accepted. How many is 20% of 80?



Answer:



CHICAGO RIVER

G6
Basic

A lot of Irish immigrants settled in Boston. During St. Patrick's Day, the Chicago River is dyed with green vegetable dye, and it stays for hours. Use the tape diagrams to showcase the problem in every number. Make sure to color the specific portion mentioned in every number green.

1. Show the ratio 3:5. (Color the 5 green)

| | | | | | | | |
|--|--|--|--|--|--|--|--|
| | | | | | | | |
|--|--|--|--|--|--|--|--|

2. Show the percentage 25% out of 100%. (Color 25% green)

| | | | |
|--|--|--|--|
| | | | |
|--|--|--|--|

3. Show the equation: $2+3 = 5$ (Color the 5 green)

| | | | | |
|--|--|--|--|--|
| | | | | |
| | | | | |

4. Show the equation $5 \times 6 = 30$ (Color the 30 green)

| | | | | |
|--|--|--|--|--|
| | | | | |
| | | | | |

5. Show the ratio for 5:6 (Color the 5 green)

| | | | | | | | | | |
|--|--|--|--|--|--|--|--|--|--|
| | | | | | | | | | |
|--|--|--|--|--|--|--|--|--|--|



THE LEGEND OF ST. PATRICK

G6
Basic

Who is St. Patrick? He is known as the patron saint of Ireland for bringing Christianity to the country. There have been legendary stories made about him. Learn about them by drawing tape diagrams for the situation in each number below.

1. *It was said that St. Patrick banished all the snakes in Ireland.* Let's say 10 snakes were banished in Connacht. 20 snakes in Leinster. 40 snakes in Munster. 30 snakes in Ulster. Show the percentage of snakes banished in each Irish province.



2. *Another legend about St. Patrick was that he helped hungry sailors by making a litter of pigs appear miraculously after praying for food.* There are two groups of sailors, Group A were given three pigs and Group B five pigs. Show the total number of pigs per group.



3. *They said that St. Patrick taught the idea of the Holy Trinity to the Irish using the shamrock.* For every 3 shamrocks that Ben gathered, Dan gathered 2. If there are a total of 25 shamrocks, how many did Ben and Dan gather? Show the total number of shamrocks gathered by each person.



ST. PADDY'S DAY PARADE

G7
Advanced

The first St. Patrick's Day parade was in 1762 in New York City and not in Ireland. Several major cities around the world also celebrate St. Patrick's Day with a parade showcasing floats and marching bands. Calculate the percentage of the shaded portions of the tape diagram parades in each number.

1.



Solution:

2.



Solution:

3.



Solution:



GATHER THE SHAMROCK

G7
Advanced

The shamrock comes from the Irish word *seamróg*. It is used as a symbol of Ireland. It was said that St. Patrick used the three leaves of the shamrock to explain the *Holy Trinity* to the Irish. Cut out the items in a dashed line and rearrange them to show a properly labeled tape diagram based on the data provided.

Data:

- 1 - Two pairs of people gathering shamrocks for St. Patrick's Day. The ratio of shamrocks gathered by each pair is the number assigned to each person.
- 2 - The total number of shamrocks gathered by each pair.
- 3 - Shamrocks that you can use to create the tape diagram

1



2

40 : 24

35 : 25

3



THE TRICKY LOBAIRCIN

The Leprechaun or its Irish name, *Lobaircin*, is a fairy in the form of a tiny man usually wearing a green hat and attire. He loves to play jokes on people and is said to be hiding a pot of gold! Don't let the *Lobaircin* fool you! Find the mistakes in each tape diagram. Recreate the tape diagram with the correct values using the empty tape diagrams provided.

1. 

| | | | | | | | |
|-----|---|-----|---|---|---|-------|-------|
| 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 25% | | 45% | | | | 12.5% | 12.5% |

| | | | | | | | |
|--|--|--|--|--|--|--|--|
| | | | | | | | |
| | | | | | | | |

2. 

| | | | | | | | |
|---|---|----|---|----|---|----|---|
| 2 | 5 | 10 | 5 | 21 | 2 | 45 | 2 |
| 7 | | 15 | | 22 | | 47 | |

| | | | | | | | |
|--|--|--|--|--|--|--|--|
| | | | | | | | |
| | | | | | | | |

3. 

4:5

20:25

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |

| | | | | | | | | |
|--|--|--|--|--|--|--|--|--|
| | | | | | | | | |
| | | | | | | | | |



CELEBRATING IRISH TRADITIONS

G7
Advanced

St. Patrick's Day is a day to enjoy festive Irish culture and traditions. Learn about a few of them in the word problems below. Create a tape diagram for each problem and provide the solution.

1. One popular tradition during St. Patrick's Day is eating corned beef and cabbage. For every five guests, you cook 3 pounds of beef brisket. If there are 40 guests, how much beef brisket do you cook?

Solution:



2. A silly tradition during St. Patrick's Day is pinching someone not wearing green. It was said that wearing green makes you invisible to leprechauns. If they can see you, then the "leprechauns" will pinch you! In the parade, for every 8 persons, there are 2 people not wearing green. If there is a crowd of 200 people, how many are not wearing green?

Solution:



St. Patrick's Day is celebrated by some cities all over the world where there have been a lot of Irish immigrants. Learn about some of those celebrations by solving the word problems. Create a tape diagram and encircle the letter of the correct answer.

1. In England, British royals present bowls of fresh shamrock flown in from Ireland to the Irish guards. If every bowl contains 25 small bouquets of the shamrock and there are 175 guards to give a shamrock bouquet to, how many bowls are needed?

Tape Diagram:

a. 5 bowls

b. 7 bowls

c. 8 bowls

d. 6 bowls



2. In Barcelona, they hold an International Currach Regatta as a way to celebrate St. Patrick's Day. A *currach* is an Irish boat. In this regatta, 8 boats are competing. Each currach will contain three participants. What is the total number of participants?

Tape Diagram:

a. 12 participants

b. 34 participants

c. 20 participants

d. 24 participants



ANSWER GUIDE

Activity 1

1 
 $5 + 4 = x$

2 
 $5:3$
 $15:9$

3 
50%

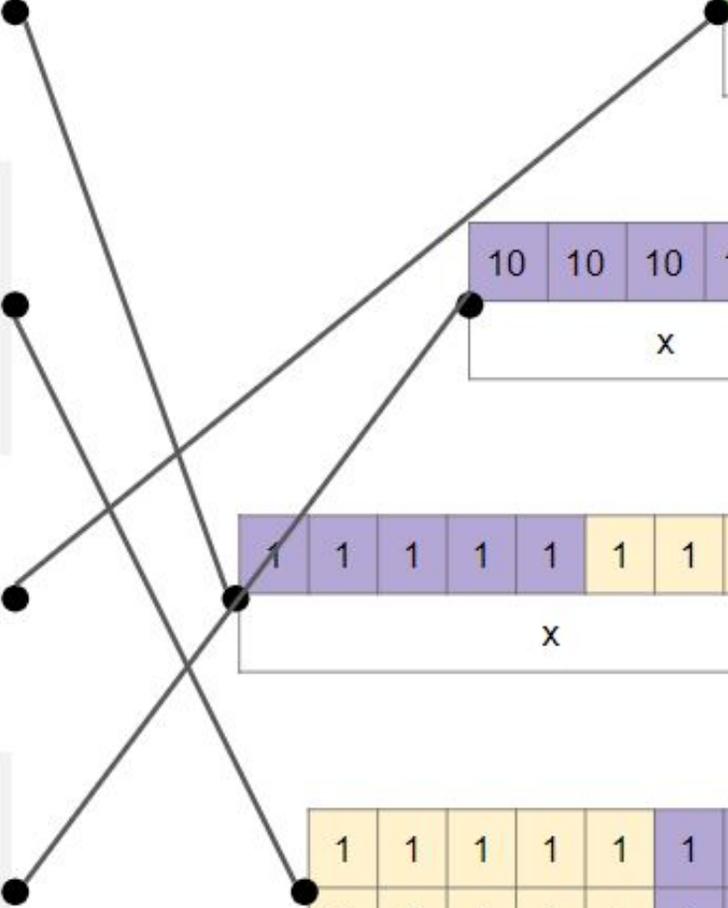
4 
 $10 \times 5 = x$

x x
10

10 10 10 10 10
 x

1 1 1 1 1 1 1 1
 x

1 1 1 1 1 1 1 1
3 3 3 3 3 3 3 3



ANSWER GUIDE

Activity 2

1.

| | | | | | | | | | | | |
|-------------------------------|---|---|---|---|---|---|---|--|--|--|--|
| 5:2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | | | |
| $35 / 7 \text{ segments} = 5$ | | | | | | | | | | | |
| 25:10 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | | | | |

Answer:

Out of 35 people based on the ratio of 5:2, only 10 people were accepted.

5 rejected x 5 = 25 rejected
2 accepted x 5 = 10 accepted

2.

| | | | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% |

Answer: 20% of 80 is 16.

$80 / 10 \text{ segments} = 8$

Percentage of one segment with value of 8.

$8 / 80 = .1$

$.1 \times 100 = 10\%$

Each segment is 10% of 80. Therefore, two segments is 20%.

$16 / 80 = .2$

$.2 \times 100 = 20\%$

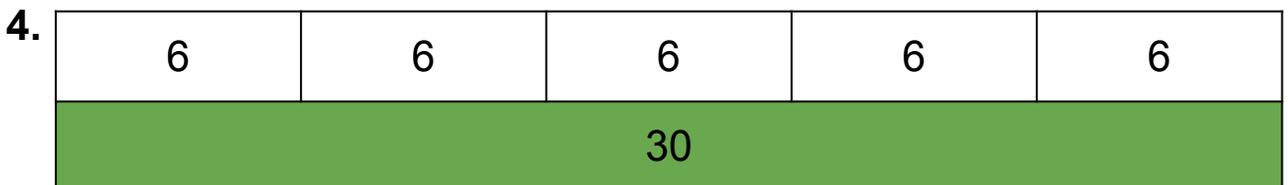
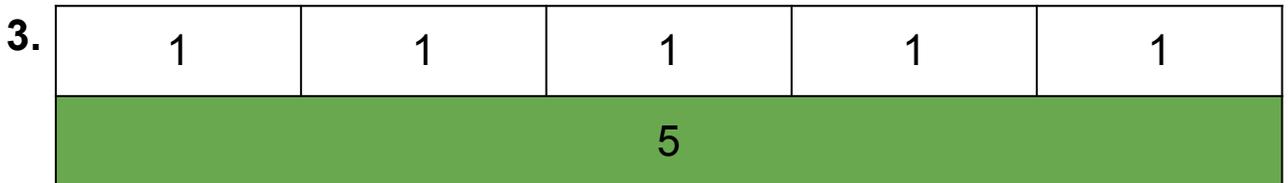


ANSWER GUIDE

Activity 3

1. B
2. C
3. B
4. C

Activity 4



ANSWER GUIDE

Activity 5

1.

| | | | | | | | | | |
|------------|------------|----|------------|----|----|----|------------|----|----|
| 10% | 20% | | 40% | | | | 30% | | |
| 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| C | L | | M | | | | U | | |

2.

| | | | | | | | | |
|---------|---|---|---------|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 3 | | | 5 | | | | | |
| Group A | | | Group B | | | | | |

3.

| | | | | |
|-----|---|---|-----|---|
| 1 | 1 | 1 | 1 | 1 |
| 5 | 5 | 5 | 5 | 5 |
| 15 | | | 10 | |
| Ben | | | Dan | |



ANSWER GUIDE

Activity 6

- 3×8 segments = 24 (Total Value)
 3×6 shaded segments = 18 (Shaded Value)
Percentage: $18 / 24 = .75$ | $.75 \times 100 = 75\%$
The shaded portion is 75%.
- 12×8 segments = 96 (Total Value)
 12×3 shaded segments = 36 (Shaded Value)
Percentage: $36 / 96 = .375$ | $.375 \times 100 = 37.5\%$
The shaded portion is 37.5%
- 50×5 segments = 250 (Total Value)
 50×2 shaded segments = 100 (Shaded Value)
Percentage: $100 / 250 = .4$ | $.4 \times 100 = 40\%$
The shaded portion is 40%

Activity 7

35 : 25



7



5



5



40 : 32



4



ANSWER GUIDE

Activity 8

1.

| | | | | | | | |
|-----|---|-----|---|---|---|-------|-------|
| 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 25% | | 50% | | | | 12.5% | 12.5% |

2.

| | | | | | | | |
|---|---|----|---|----|---|----|---|
| 2 | 5 | 10 | 5 | 21 | 2 | 45 | 2 |
| 7 | | 15 | | 23 | | 47 | |

3.

| | | | | | | | | | |
|-------|---|---|---|---|---|---|---|---|---|
| 4:5 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 20:25 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |

Activity 9

1.

| | | | | | | | |
|--------|---|---|---|---|------------|---|---|
| 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| Guests | | | | | Beef (lbs) | | |

Total no. of guests: 40

$40 / 5$ segments (Guests) = 8

Factor of 8

Ratio of guests to beef (lbs): 5:3

8×5 guest segments = 40

8×3 beef segments = 24

Answer: For every 40 guests, you have to cook 24 lbs of beef.

2.

| | | | | | | | | | |
|-------|----|----|----|----|----|----|----|-----------|----|
| 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| Green | | | | | | | | Not Green | |

Total no. of people: 200

$200 / 10$ segments (Not Green) = 20

Factor of 20

Ratio of green to not green: 8:2

20×8 green segments = 160

20×2 not green segments = 40

Answer: There are 40 people not wearing a green attire.



ANSWER GUIDE

Activity 10

Tape Diagram:

| | | | | | | |
|-----|----|----|----|----|----|----|
| 25 | 25 | 25 | 25 | 25 | 25 | 25 |
| 175 | | | | | | |

1. **Answer: B. 7 bowls**

175 Irish guards divided by 25 shamrocks per bowl = 7 bowls

Tape Diagram:

| | | | | | | | |
|----|---|---|---|---|---|---|---|
| 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 24 | | | | | | | |

2. **Answer: D. 24 participants**

8 boats x 3 participants in each boat = 24 participants



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