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Understanding how many beaded stars the fabric designer will place on her fabric involves a clear analysis of the problem, including the placement pattern, the total length of fabric, and how the placement intervals work. This article provides a comprehensive explanation of the problem, including step-by-step calculations, relevant mathematical concepts, and practical applications of the problem-solving process.

Understanding the Problem

Before diving into calculations, it's essential to understand the core elements of the problem.

Key Details

- The fabric length to be decorated is 8 yards.
- The designer places one beaded star at the middle point of every 3 yards.
- Placement is based on dividing the fabric into segments of 3 yards each, with stars placed in the middle of these segments.

What is Being Asked?

The question is: How many beaded stars will the designer place on 8 yards of fabric following these rules?

Breaking Down the Placement Pattern

To determine the number of stars, we need to understand the placement pattern and how it relates to the length of fabric.

Placement Rule

- For every 3 yards of fabric, place one star.
- The star is placed at the exact middle point of that 3-yard segment.

Visual Representation

Suppose the fabric starts at position 0 yards and extends to 8 yards. The placement points are determined based on dividing the fabric into segments:

- First segment: from 0 to 3 yards
- Second segment: from 3 to 6 yards
- Remaining segment: from 6 to 8 yards

The middle points of these segments are:

- First segment: at 1.5 yards
- Second segment: at 4.5 yards
- Remaining segment: from 6 to 8 yards, which is only 2 yards long, so the middle is at 7 yards.

Calculating the Number of Beaded Stars

The core task is to figure out where these middle points are located within the 8 yards of fabric, and how many such points exist.

Step-by-Step Calculation

1. **Identify the segments of 3 yards:** Divide 8 yards into segments of 3 yards each.
 - First segment: 0 to 3 yards
 - Second segment: 3 to 6 yards

- Remaining segment: 6 to 8 yards

2. Find the middle points of each full segment: For each complete 3-yard segment, determine the middle point where a star is placed.

- First segment middle point: at 1.5 yards
- Second segment middle point: at 4.5 yards

3. Assess the remaining segment: Since the last segment is only 2 yards long (from 6 to 8 yards), determine its middle point.

- Middle point: at 7 yards (midpoint of 6-8 yards)

4. Count the total number of stars: Each of these middle points corresponds to a star placement.

- Stars at 1.5 yards
- Stars at 4.5 yards
- Star at 7 yards

Therefore, the total number of beaded stars placed on 8 yards of fabric is 3.

Generalization and Mathematical Explanation

To better understand this problem, it's helpful to consider the general case and the underlying mathematical principles.

Pattern Recognition

- The pattern involves placing a star at the midpoint of each 3-yard segment, beginning from 0 yards.
- The placement points follow a consistent pattern: starting at 1.5 yards, then adding 3 yards for each subsequent star.

Mathematical Formula

Let's denote:

- (L) as the total length of fabric (in yards).
- (d) as the segment length (here, 3 yards).
- (n) as the number of stars.

The placement points occur at:

$$x = 1.5 + k \times 3$$

where (k) is an integer starting from 0.

To find how many stars are placed within (L) , solve for $(x \leq L)$:

$$1.5 + k \times 3 \leq L$$

$$k \leq \frac{L - 1.5}{3}$$

Since (k) must be a non-negative integer:

$$k_{\max} = \left\lfloor \frac{L - 1.5}{3} \right\rfloor$$

The total number of stars:

$$n = k_{\max} + 1$$

(since (k) starts from 0).

Applying this to $(L = 8)$:

$$k_{\max} = \left\lfloor \frac{8 - 1.5}{3} \right\rfloor = \left\lfloor \frac{6.5}{3} \right\rfloor = \left\lfloor 2.166\ldots \right\rfloor = 2$$

$$n = 2 + 1 = 3$$

This confirms our earlier manual calculation.

Practical Implications and Applications

Understanding this pattern is not only important for this specific problem but also demonstrates how mathematical reasoning can be applied to various

real-world scenarios involving spacing, placement, and segmentation.

Design and Crafting

- Artists and designers can plan spacing of decorative elements precisely.
- Ensures uniformity and aesthetic appeal in fabric design.

Manufacturing and Production

- Automating placement of decorative features along fabric or other materials.
- Optimizing material usage and visual balance.

Educational and Learning Purposes

- Demonstrates the application of arithmetic sequences.
- Reinforces understanding of division, flooring functions, and pattern recognition.

Summary and Conclusion

To summarize:

- The fabric length is 8 yards.
- Beaded stars are placed at the midpoint of every 3-yard segment, starting from 0 yards.
- The placement points are at 1.5, 4.5, and 7 yards within the 8 yards of fabric.
- Therefore, the fabric designer will place 3 beaded stars on 8 yards of fabric.

This problem illustrates how a combination of segmentation, pattern recognition, and basic arithmetic can solve practical design questions efficiently. By applying the formula derived, similar problems involving spacing and segmentation can be approached systematically, ensuring accuracy and clarity.

Final Answer: The fabric designer will place 3 beaded stars on her 8 yards of fabric.

Frequently Asked Questions

How many beaded stars will the fabric designer place in 8 yards of fabric if she places one star every 3 yards?

She will place 2 stars because 8 divided by 3 is approximately 2.66, and she only places a star at every full 3-yard segment.

What is the total number of beaded stars on 8 yards of fabric?

The total number of stars is 2.

If the designer places one star every 3 yards, how many full 3-yard segments are in 8 yards?

There are 2 full 3-yard segments in 8 yards since 2 times 3 is 6, leaving 2 yards remaining.

Does the remaining 2 yards after 6 yards count for an additional star?

No, since the star is only placed at the middle of each full 3-yard segment, the remaining 2 yards do not count for another star.

If the fabric length increases to 9 yards, how many beaded stars will be placed?

In 9 yards, there would be 3 stars, one in the middle of each 3-yard segment.

What is the general rule to find the number of stars for any length of fabric?

Divide the total length of fabric by 3, and take the integer part (floor) of the result to determine the number of stars.

Is it necessary to place a star if the remaining fabric is less than 3 yards?

No, a star is only placed at the middle of each full 3-yard segment, so leftover fabric less than 3 yards does not get a star.

How many yards of fabric are covered by the stars on 8 yards of fabric?

Stars are placed at the middle of each 3-yard segment, but since they are points, they don't cover any length of fabric; only their placement counts.

Can the number of stars be calculated by dividing the total length by 3 and rounding down?

Yes, the number of stars is equal to the integer part of the total length divided by 3.

Additional Resources

A fabric designer is placing beaded stars on her fabric. She decides to place one star in the middle of every 3 yards. How many beaded stars will she place on 8 yards of fabric? This seemingly simple question opens the door to a fascinating exploration of scaling, division, and spatial planning in fabric design. Whether you're a seasoned designer, a mathematics enthusiast, or just someone interested in the practical application of basic arithmetic, understanding how to approach such problems can be incredibly insightful.

In this article, we'll break down the problem step-by-step, analyze the underlying principles, and provide a comprehensive guide to solving similar questions. We'll also explore related considerations such as spacing, uniformity, and adjustments for different fabric lengths. Let's dive into the details.

Understanding the Problem

Before jumping into calculations, it's essential to clearly understand what the problem is asking:

- The fabric designer plans to place beaded stars on a piece of fabric.
- She decides to place one star in the middle of every 3 yards.
- The total length of fabric available is 8 yards.
- The question: How many beaded stars will she place on the 8 yards of fabric?

At first glance, this may seem straightforward—divide the total length by the interval, and you get the number of stars. But, as with many real-world scenarios, there are nuances to consider, especially regarding placement and boundary conditions.

Key Concepts and Assumptions

To approach this problem methodically, we need to clarify some assumptions:

1. Placement rule: The star is placed at the middle of each 3-yard segment.
2. Starting point: The first star is placed at the middle of the first 3-yard segment, starting from the beginning of the fabric.
3. Uniform spacing: The stars are evenly spaced at every 3 yards along the fabric.
4. Boundary considerations: How do we handle the last segment if it's shorter than 3 yards? Are we only placing stars at full intervals, or also at partial segments?

Given these considerations, we can now formulate a plan to find the total number of stars.

Step-by-Step Breakdown

Step 1: Visualize the placement

Imagine a fabric 8 yards long. Mark points every 3 yards:

- 0 yards (start)
- 3 yards
- 6 yards
- 9 yards (beyond the fabric length, but useful for conceptual understanding)

The stars are to be placed at the middle of each 3-yard segment. That means:

- The first star is at the midpoint of the segment from 0 to 3 yards: at 1.5 yards.
- The second star is at the midpoint of the segment from 3 to 6 yards: at 4.5 yards.
- The third star would be at the midpoint of the segment from 6 to 9 yards: at 7.5 yards.

Step 2: Determine which stars are within the fabric length

Since the fabric is only 8 yards long, any star placed beyond 8 yards is outside the fabric boundary.

- The first star at 1.5 yards: within 8 yards.

- The second star at 4.5 yards: within 8 yards.
- The third star at 7.5 yards: within 8 yards.
- The potential fourth star at 10.5 yards: outside the fabric, so it is not placed.

Step 3: Count the number of stars

Based on the above, the stars are at 1.5 yards, 4.5 yards, and 7.5 yards.

Total number of beaded stars on 8 yards of fabric: 3.

Mathematical Formulation

To generalize this process:

- The position of each star can be represented as:

$$\text{Position of star}_i = (i - 1) \times 3 + 1.5$$

where $(i \geq 1)$.

- To find all stars within the fabric length (L) , we need:

$$(i - 1) \times 3 + 1.5 \leq L$$

- Solving for (i) :

$$(i - 1) \times 3 \leq L - 1.5$$

$$i - 1 \leq \frac{L - 1.5}{3}$$

$$i \leq \frac{L - 1.5}{3} + 1$$

- The total number of stars (N) is the greatest integer less than or equal to this value:

$$N = \left\lfloor \frac{L - 1.5}{3} + 1 \right\rfloor$$

$$N = \left\lfloor \frac{L - 1.5}{3} + 1 \right\rfloor$$

Applying this formula for $(L=8)$:

$$\begin{aligned} N &= \left\lfloor \frac{8 - 1.5}{3} + 1 \right\rfloor = \left\lfloor \frac{6.5}{3} + 1 \right\rfloor = \left\lfloor 2.166\ldots + 1 \right\rfloor \\ &= \left\lfloor 3.166\ldots \right\rfloor = 3 \end{aligned}$$

Thus, the calculation confirms our earlier answer.

Additional Considerations

Handling Partial Segments

If the designer considers placing stars at the start (0 yards) or end (8 yards), the calculation might change. For example, if placing a star at the very beginning (0 yards) or at the final point (8 yards), we need to adjust the formula accordingly.

Adjusting the Placement Interval

Suppose the placement interval changes from 3 yards to another length. The formula can be adapted:

$$N = \left\lfloor \frac{L - \text{offset}}{\text{interval}} \right\rfloor + 1$$

where offset accounts for initial positioning, and interval is the distance between stars.

Real-world Application

In actual fabric design, physical constraints such as seam allowances or fabric edges might influence placement. Using precise measurements and planning ensures a symmetrical and aesthetically pleasing pattern.

Summary and Practical Tips

- To determine how many beaded stars (or any decorative elements) to place along a length of fabric, identify the placement pattern and boundaries.
- Use algebraic formulas for precise calculation, especially when dealing with large lengths or multiple placements.
- Always consider whether the pattern starts at the very beginning or midpoint, as this affects the total count.
- For irregular lengths, adjust the calculation accordingly, and consider partial segments.

Final Answer

On 8 yards of fabric, the fabric designer will place 3 beaded stars if she places one star in the middle of every 3 yards, starting at the beginning of the fabric. The stars will be located at approximately 1.5 yards, 4.5 yards, and 7.5 yards along the length of the fabric.

Whether you're designing a new pattern or solving similar mathematical problems, understanding the relationship between placement intervals, fabric length, and boundary conditions is essential. This approach ensures a harmonious and well-executed design, whether for textiles, craft projects, or educational purposes.

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