

## Costuming and Mathematical Terms

Grade Level(s): 7th
Duration: 45-50 Minutes

Objectives: Students will use mathematical concepts to measure, plan, and understand the construction of the costumes from A Christmas Carol, while also analyzing and interpreting costume vocabulary and descriptions.

Materials: Worksheets, Pencils, rulers or tape measure, calculator (if desired)


## Costuming and Mathematical Terms

## Florida Standard:

1. MAFS.7.RP.1.3 - Use proportional relationships to solve multistep ratio and percent problems.
2. MAFS.7.RP.3.3 - Use proportional relationships to solve multistep ratio and percent problems.
3. MAFS.7.NS.1.2 - Understand that integers can be divided, provided that the divisor is not zero.
4. MAFS.7.NS.2.3 - Solve real-world and mathematical problems involving the four operations with rational numbers.
5. MAFS.7.G.2.4 - Know the formulas for the area and circumference of a circle and use them to solve real-world and mathematical problems
6. MAFS.7.G.1.2 - Draw geometric shapes with given conditions and describe their properties.
7. MAFS.7.EE.2.4 - Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve real-world problems.
8. MAFS.7.G.1.1 - Solve problems involving scale drawings of geometric figures.
9. MAFS.7.EE.1.2 - Understand that rewriting an expression in different forms in a problem context can shed light on the problem and how the quantities in it are related. 10. MAFS.7.G.1.3 - Describe the two-dimensional figures that result from slicing three-dimensional figures, as in plane sections of right rectangular prisms and right rectangular pyramids.
10. MA.7.G.2.2: Describe the relationships between the radius, diameter, and circumference of a circle.
11. MA.7.G.2.3: Use ratios and proportions to solve problems related to similar figures, including finding missing lengths and areas.
12. MAFS.7.EE.2.4 - Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve real-world problems.
13. MA.7.G.3.4: Apply the formulas for the area and circumference of a circle to solve problems.
14. MA.7.G.3.5: Find the surface area and volume of right prisms, right circular cones, and right circular cylinders.

# Costuming and Mathematical Terms 

Name: $\qquad$ Date: $\qquad$

## Fun Fact About A Christmas Carol

There are 15 adult actors and 8 child actors cast in this production. The 8 child actors are split cast meaning they understudy for each other and only 4 perform in each performance. The actors rehearse for 40 hours a week 4 weeks including a half week of preview shows for a total of 136 hours.

## Instructions:

Discuss the terms and how they are applied to create the costumes. The terms provided below can help students understand and solve the word problems from the actual costuming process of Orlando Shakes' A Christmas Carol.

Costuming involves various mathematical terms and concepts related to measurements, proportions, and calculations.

## Here is a list of costuming mathematical terms:

1. Scale Factor: A number that relates the size of an object in real life to its size in a scale drawing.
2. Measurements: The dimensions (length, width, height, circumference, etc.) of various costume elements, typically taken in inches or centimeters.
3. Conversion Factor: A ratio used to convert measurements from one unit of measurement (e.g., inches to centimeters) to another.
4. Area: The amount of space inside a two-dimensional costume element (e.g., fabric for a vest or cape), typically measured in square inches or square centimeters.
5. Volume: The amount of space inside a three-dimensional costume element (e.g., a hat or crutch), typically measured in cubic inches or cubic centimeters.
6. Diameter: The distance across a circular costume element, such as a hat or belt, passing through its center.
7. Circumference: The distance around the edge or outer boundary of a circular or curved costume element, such as a collar or cuff.
8. Proportions: The comparative sizes of different costume elements in relation to each other, ensuring that they look balanced and harmonious when worn.

## Costuming and Mathematical Terms

## Here is a list of costuming mathematical terms:

9. Percentages: Used to calculate discounts or price adjustments when purchasing fabric or materials for costumes.
10. Geometry: Mathematical principles related to the shapes and angles of costume elements, including triangles, rectangles, circles, and more.
11. Ratio: A comparison of two quantities (e.g., length to width) that can be used to maintain accurate proportions in costume design.
12. Perimeter: The total length of the outer boundary of a costume element, such as a skirt or cape.
13. Fabric Yardage: The amount of fabric needed for a costume, calculated based on the measurements and design.
14. Seam Allowance: The extra fabric added to the measurements to account for sewing seams and hems.
15. Pattern Scaling: Adjusting the size of a costume pattern to fit different measurements, often using a scale factor.
16. Costume Budgeting: Using math to plan and manage the cost of materials and labor for costume construction.
17. Patterning and Layout: Organizing pattern pieces on fabric efficiently to minimize waste and ensure all pieces fit.
18. Sewing Measurements: Precise measurements and calculations are needed to sew seams, pleats, tucks, and gathers accurately.
19. Alterations: Adjusting the size or fit of a costume to accommodate different actors, often involving mathematical calculations.
20. Geometry in Costume Draping: Using geometric principles to create folds and drapes in fabric for costume design.

These mathematical terms and concepts play a crucial role in costume design and construction, ensuring that costumes fit well, are visually appealing, and stay within budget constraints.

# Costuming and Mathematical Terms 

Name: $\qquad$ Date: $\qquad$

## Fun Fact About A Christmas Carol

There are 400 costume pieces in The Orlando Shakes' production of A Christmas Carol this year. Many of these costumes are from previous productions and the costume shop in the theater has an exquisite collection and team in their workshop to construct and modify each piece for the individual actor. Less than 5 costumes were built from scratch this year, so imagine how much longer the costuming process would take if each piece were created brand new for the production.

## Word Problems:

Next, move on to solve the word problems below about the actual creation of the costumes you saw on stage.

1. The costumes were prepared by 5 people, and it took approximately 575 total hours this year. What is the average number of hours each person spent preparing costumes?
2. For each performance, there are 2 costumers who assist with dressing, laundry, and wig maintenance. If there are 9 performances per week and each performance has 2 costumers working and assisting for 2 hours before the show, present for 2 hours during the show, and 1.5 hours after the show, how many hours in total are spent on these activities in a week by costumers?

## Costuming and Mathematical Terms

Name: $\qquad$ Date: $\qquad$
3. In A Christmas Carol, the costume designer, Amanda, created a beautiful gathered skirt for Mrs Cratchit. She used three panels of fabric, and each panel measured 58 inches wide. She gathered the skirt 2.5 times to achieve the desired look.

- What was the total width of the skirt after it's gathered 2.5 times?
- If they wanted to add a decorative lace trim to the bottom of the skirt and want it to go all the way around the skirt's hem, and the trim is sold by the yard (1 yard = 36 inches), how many yards of lace trim did she need to purchase?
- She went on to cut the skirt's length to 30 inches, what will be the total area of fabric (in square inches) needed for the skirt, including the gathering?
- Lastly, the costume designer had a roll of elastic band that she used as a waistband for the skirt. If the elastic band is 1 inch wide and she needed it to fit comfortably around her waist, which is 28 inches, how much elastic band did she need in total (in inches)?


## Costuming and Mathematical Terms

Name: $\qquad$ Date: $\qquad$
4. Recall the costumes of the Cratchit women during their dinner scene. The 3 daughters and mother each wear an apron with bows as decor to signify celebration and happy times for the family. Each costume required 12 bows. Each bow needed a ribbon that is 10 inches long. There are 4 costumes to make in total. They buy spools of ribbon, and each spool contains 3 yards of ribbon.

- How many spools of 3-yard ribbon need to be purchased in total to make all the bows for the costumes?
- Instructions:
- Calculate the length of ribbon needed for one costume.
- Convert the ribbon length to yards.
- Calculate the total ribbon needed for all costumes.
- Determine the number of 3 -yard spools of ribbon required.


## Costuming and Mathematical Terms

Name: $\qquad$ Date: $\qquad$
5. Amanda, the Costumer, needs to replace the buttons on 8 jackets with quickrigged snaps to allow for speedy costume changes. Each jacket has 7 buttons, and it takes Amanda 8 minutes to sew one snap onto a button. If Amanda starts working on the jackets, how long will it take her to replace all the buttons with snaps on all the jackets?
6. Mrs. Fezziwig's red dress required 7 yards of fabric, and her petticoat underneath the skirt, which has 3 layers of ruffles, took 12 yards of fabric. How many yards of fabric were used in total for Mrs. Fezziwig's costume?
7. The ruffles on Mrs. Fezziwig's petticoat, if laid out flat, would extend for 75 feet. The fabric is 42 inches wide, how many square feet of fabric are used for the petticoat?
8. The skirt of the Ghost of Christmas Past has 500 LED lights twinkling in it. The skirt is roughly 120 inches in circumference, what is the average spacing between the LED lights (in inches)?

## Costuming and Mathematical Terms

Name: $\qquad$ Date: $\qquad$
9. If the skirt of the Ghost of Christmas Past is 42 inches in length, what is the total surface area of the skirt in square inches?
10. The actor who plays the character Mr Marley in the production does some heavy lifting in his role. His costume, which is quite elaborate, weighs 31 pounds. During each show, he wears this costume for 9 minutes while performing. This costume has 12 chains, 5 hanging boxes and 19 locks on the costume. There are a total of 32 shows in the production.

Now, let's calculate:

- How many pounds of weight does Mr. Marley carry in total during all 32 shows?
- How many minutes in total does Mr. Marley spend wearing his costume throughout the entire production?

Costuming and Mathematical Terms

## Directors Notes: Orlando Shakes’ A Christmas Carol

When asked what is the hardest part of bringing A Christmas Carol to the stage, Jim Helsinger replied, "keeping the audience interested and engaged in a story that has already been told so many times."

To the question, what is the most fun part of directing this show, Jim's eyes lit up as he described "The most fun part is watching the marriage of lighting, set, sound, performers in a magic of coming together."

When asked what is the most important part of bringing this story to the stage again, Jim again lit up to describe the following: "A Christmas Carol is a story of redemption. Young Scrooge clearly loves Belle, so why, why does he give her up? And for what? Money? Why does he do this and what is more important in life than love?"

Jim's take on this beautiful classic tale that teaches us, young and old, to reflect on our own hearts and choices in life.

Happy Holidays!

## Costuming and Mathematical Terms

## Answer Key

1. 575 total hours were spent by 5 people. To find the average hours per person, divide the total hours by the number of people: 575 / 5 = 115 hours per person.
Answer: 115 hours per person
2. For each performance, there are 2 costumers present for 2 hours before and 1.5 hours after, totaling $2+1.5=3.5$ hours. With 9 performances a week, the total hours spent on these activities in a week are $9 \times 3.5=31.5$ hours.
Answer: 31.5 hours
3. Each panel of the skirt is 58 inches wide. The skirt is gathered 2.5 times, multiply the original width of each panel by 2.5 to get the final width of each gathered panel. Then, multiply that width by 3 to account for all three panels.
Here's the equation:
Total Width $=($ Width of Each Gathered Panel) $\times$ (Number of Panels)
Total Width $=(58$ inches $\times 2.5) \times 3$
Total Width $=145$ inches $\times 3$
Total Width $=435$ inches
So, the total width of the gathered skirt is 435 inches.
Answer: 435 inches

## Costuming and Mathematical Terms

## Answer Key

4. Ribbons equation steps and answer

Step 1: Calculate the length of ribbon needed for one costume.
Each costume requires 12 bows, and each bow needs 10 inches of ribbon.
12 bows * 10 inches/bow = 120 inches of ribbon for one costume.

Step 2: Convert inches to yards.
Since there are 36 inches in a yard, you need to convert the ribbon length from inches to yards: 120 inches / 36 inches/yard $=3.33$ yards of ribbon for one costume (rounded to the nearest whole yard).

Step 3: Calculate the total ribbon needed for all 4 costumes. Now, you want to find out how much ribbon is needed for all 4 costumes: 4 costumes * 3.33 yards/costume $=13.32$ yards of ribbon in total for all costumes.

Step 4: Determine the number of 3-yard spools needed.
To find out how many 3 -yard spools of ribbon you need, divide the total ribbon length by the length of each spool:
13.32 yards / 3 yards/spool $\approx 4.44$ spools.

Since you can't purchase a fraction of a spool, you would need to round up to the nearest whole spool.

Answer: You would need a total of 5 spools of 3 -yard ribbon to make 10inch bows for 12 bows on each of the 4 costumes.

## Costuming and Mathematical Terms

## Answer Key

5. Total time (in minutes) $=$ Number of jackets $\times$ Number of buttons per jacket $\times$ Time to sew one snap per button
Total time $=8$ jackets $\times 7$ buttons per jacket $\times 8$ minutes per snap
Total time $=8 \times 7 \times 8=448$ minutes
Answer: 448 minutes to replace all the buttons with snaps on all 8 jackets.
6. Mrs. Fezziwig's dress required 7 yards of fabric, and her petticoat took 12 yards. So, the total fabric used for her costume is $7+12=19$ yards. Answer: 19 yards
7. The ruffles on the petticoat extend for 75 feet, which is equivalent to $75 \times$ $12=900$ inches. If the fabric is 42 inches wide, the total square feet of fabric used is $(900 / 42)=21.43$ square feet (approximately). Answer: 21.43 square feet (approximately)
8. The average spacing between the LED lights on the skirt is found by dividing the circumference ( 120 inches) by the number of LED lights (500): $120 / 500 \approx 0.24$ inches.
Answer: Approximately 0.24 inches
9. To find the surface area of the skirt, you can use the formula for the lateral surface area of a cylinder, which is $2 \pi r h$, where $r$ is the radius and $h$ is the height (length of the skirt). Given that the circumference is 120 inches, the radius $(r)$ is $120 /(2 \pi) \approx 19.1$ inches. The height $(h)$ is 42 inches. The surface area is $2 \pi(19.1)(42) \approx 5055.96$ square inches.
Answer: Approximately 5055.96 square inches

## Costuming and Mathematical Terms

## Answer Key

10. To find the total weight Mr. Marley carries during all 32 shows, you can simply multiply the weight of the costume ( 31 pounds) by the number of shows (32)
Total Weight $=31$ pounds/show $\times 32$ shows $=992$ pounds
Answer: Mr. Marley carries a total weight of 992 pounds during all 32 shows.

To find the total time Mr. Marley spends wearing his costume throughout the entire production, you can multiply the time he wears the costume per show ( 9 minutes) by the number of shows (32)
Total Time $=9$ minutes $/$ show $\times 32$ shows $=288$ minutes Answer: Mr. Marley spends a total of 288 minutes (almost 5 hours) wearing his costume throughout the entire production.

