'GEOMETRICS' PROJECT - Day 1

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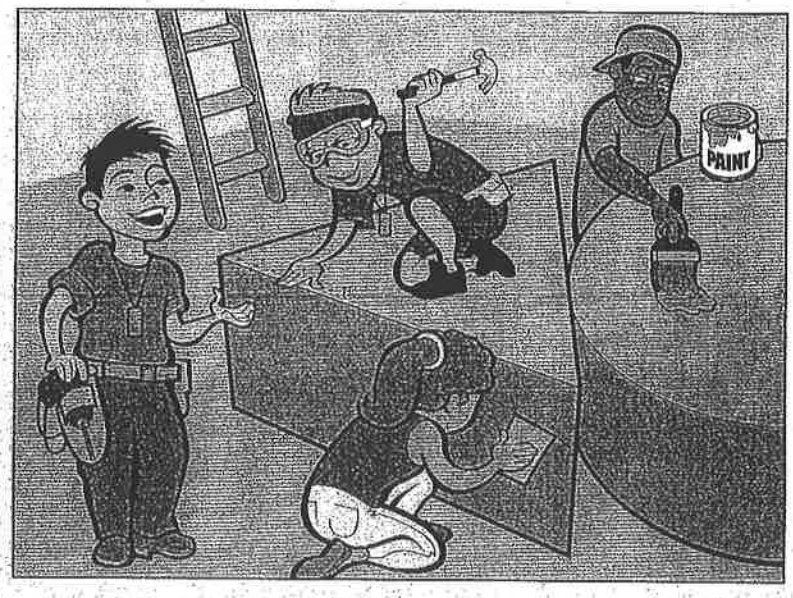
Geometry Works!

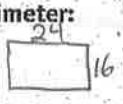
The Stage Takes Shape

The popular band The Geometrics wants to play a special concert at your school, but they need a stage crew to help. The first step for the Geometrics Stage Crew is **building an elaborate stage featuring differently shaped sections.**



1 First, they want a main stage that is rectangular-shaped, measuring a length of 24 feet and a width of 16 feet. What are the perimeter and area of that stage?

Perimeter: $P = 24+24+16+16$



$P = 80\text{ ft}$

Area: $A = L \times W$

$= (24)(16) = 384\text{ ft}^2$

2 Second, the band's lead guitarist wants the Geometrics Stage Crew to build a smaller circular stage in front of the main stage that he can step onto and play a solo. The diameter has to be one-third of the length of the main stage. What is the circumference and area? Round your answer to the nearest foot.

Circumference: $D = \frac{1}{3}L = \frac{1}{3}(24) = 8\text{ ft}$, $r = 4\text{ ft}$

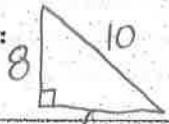
$C = 2\pi r = 2\pi(4) = 25\text{ ft}$

Area: $r = 4\text{ ft}$

$A = \pi r^2 = \pi(4)^2 = 50\text{ ft}^2$

3 The bass player has a thing for triangles and sees herself on a triangular platform off to the left of the stage. When viewed from above, the right triangle has a height of 8 feet, a base of 6 feet, and a third side (called the ***hypotenuse***) of 10 feet. What is the perimeter and area?

Perimeter:

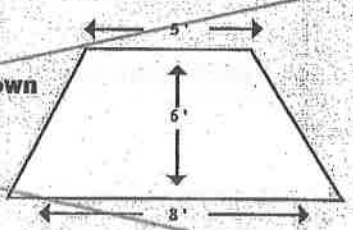


$P = 6+8+10$

$P = 24\text{ ft}$

Area: $A = \frac{bh}{2} = \frac{(6)(8)}{2} = 24\text{ ft}^2$

BONUS: **The drummer wants to be on a raised trapezoid-shaped platform. This requires the Geometrics Stage Crew to learn a new formula for the area of trapezoids [$A = 1/2 \cdot (b1 + b2) \cdot h$]. The trapezoid is shown in the diagram here with the measurements indicated. Base 1 ($b1$) = 8 feet. Base 2 ($b2$) = 5 feet. The height measures 6 feet. What is the area?**



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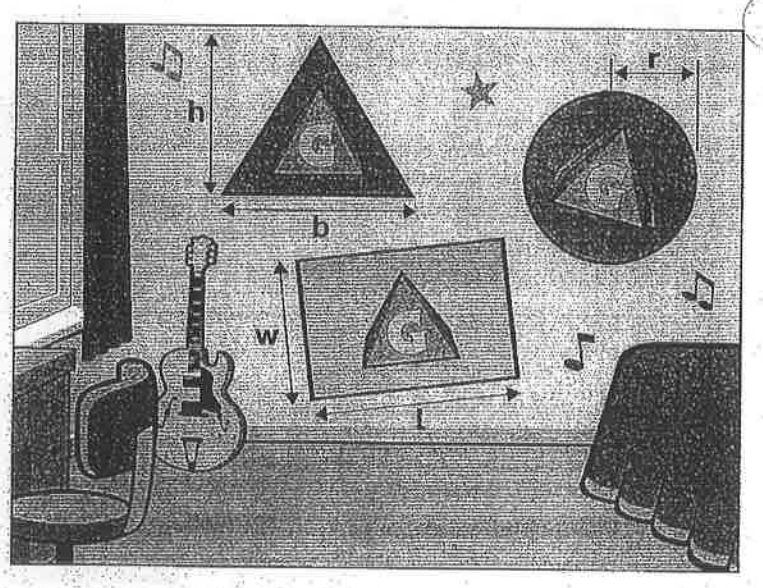
Poster-Crazy



Use what you've learned about perimeter and area to take some measurements in your home. Assume you're going to hang a few Geometrics posters in your room. You'll need a ruler and a calculator.

1 Suppose your biggest wall is 12ft × 9ft.

Perimeter: $P = 12+12+9+9$

$P = 42\text{ ft}$

Area: $A = L \times W = (12)(9)$

$A = 108\text{ ft}^2$

2 **The Geometrics Stage Crew gives you 10 rectangular posters that measure 8 1/2 inches by 11 inches, plus 5 circular posters with a 1-foot radius, and one triangular poster with a base of 3 feet and a height of 3 feet. What is the total area of these posters, and can you estimate how many will fit on your wall at home? *Note:* The conversion box below of feet to inches will help when calculating measurements for this activity and for Activities 2 and 3.**

$8.5 \times 11 = 93.5\text{ in}^2 \times 10\text{ posters} = 935\text{ in}^2 \div 144 = 6.5\text{ ft}^2$

	Area of rectangular posters: $\text{in}^2 \rightarrow \text{ft}^2$, ÷ by 144! (L×W)	6.5 ft²
+	**Area of circular posters:** $5 \times \pi r^2 = 5 \times \pi(1)^2 = 15.7$	15.7 ft²
+	**Area of triangular poster:** $A = \frac{bh}{2} = \frac{(3)(3)}{2} = 4.5$	4.5 ft²
=	**Total area of posters:**	26.7 ft²
	Area of your bedroom wall:	
-	**Total area of all posters:**	
=	**Total remaining area on your wall:**	

CONVERTING FEET TO INCHES

Linear Measurement
1 foot = 12 inches

Area Measurement
1 square foot = 144 square inches

Volume/3D Measurement
1 cubic foot = 1,728 cubic inches

FEATURED FORMULAS

Area of 2D Shapes:
Rectangle: $A = l \cdot w$
Triangle: $A = 1/2 \cdot (b \cdot h)$
Circle: $A = \pi \cdot r^2$

NOW TRY THIS: **The Geometrics Stage Crew wants to make some circular welcome mats that promote the band.** They have to be the size of a doorway. The width of your doorway is 36 inches. **Using that measurement as the diameter, what would be the circumference and area of these rugs?**

36

$r = 18\text{ in}$ $C = 2\pi r = 2\pi(18) = 113.1\text{ in}$; $A = \pi r^2 = \pi(18)^2 = 1017.9\text{ in}^2$

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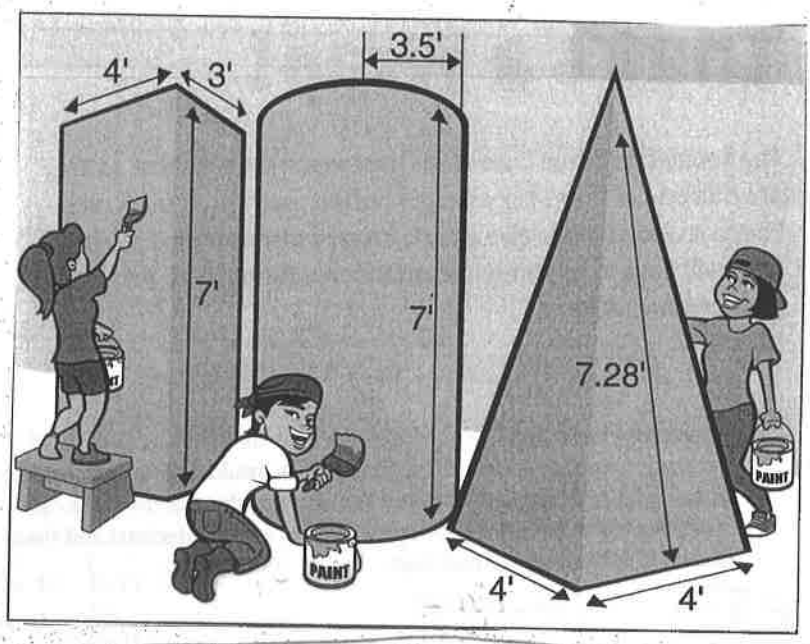
That Should Cover It!



The Geometrics love shapes. For the upcoming concert, the three main players each want to emerge from human-size shapes of a rectangular prism, a cylinder, and a square pyramid. While they already have these props built, the band asks the Geometrics Stage Crew to paint over them completely (even the bottom of each object). The stage crew knows that 1 gallon of paint covers 350 square feet. To buy the right amount of paint, the stage crew has to calculate the surface area of each shape.

1 The dimensions of the rectangular prism for the lead guitarist are height = 7 feet, width = 4 feet, and length = 3 feet.

Surface Area = $2LW + 2LH + 2WH$

rect. prism $= 2(3)(4) + 2(3)(7) + 2(4)(7)$

$= 24 + 42 + 56$

$= 122 ft^2$

2 The dimensions of the cylinder for the drummer are radius = 3.5 feet and height = 7 feet. Solve with a decimal, then also round to the nearest half foot.

Surface Area = $2\pi r^2 + 2\pi rh = 2\pi(3.5)^2 + 2\pi(3.5)(7)$

cyl. $= 76.93 + 153.86$

$= 231 ft^2$

3 The dimensions of the square pyramid for the bass player are base length = 4, base width = 4, and a slant height of 7.28 feet. Solve with a decimal, then also round to the nearest half foot.

Surface Area = $b^2 + 2bs$

Sq. pyr. $= (4)^2 + 2(4)(7.28)$

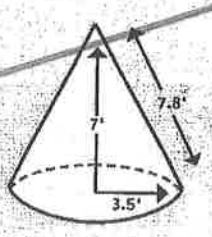
$= 16 + 58.24$

$= 74 ft^2$

4 Can the stage crew paint the surface area of all three shapes with just one can of paint?

* crew needs $122 + 231 + 74 = 427 ft^2$, but one can only covers $350 ft^2$, so they need more than one can!

BONUS: **The drummer says that he'd also like to have a backup cone with the same height and radius as the cylinder and a slant of 7.8 feet. The stage crew needs a new formula to figure out the surface area of a cone: $SA = (\pi \cdot r^2) + (\pi \cdot r \cdot slant)$.**



a. What is the surface area? Express as a decimal and then round to the nearest foot.

b. If one gallon of paint covers 350 square feet, about how much of a gallon is needed to paint the cone?

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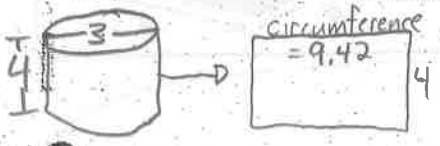
That's a Wrap!

The Geometrics Stage Crew needs to promote the big show, so they are thinking of clever places to put posters, such as on trash cans. They are also going to give away CDs wrapped in sparkling paper. They will have to rely on some surface area formulas to get their promotion underway.

$C = 2\pi r$ or $C = \pi d$

1. The school has a lot of cylindrical trash cans that have a diameter of 3 feet and height of 4 feet. **What dimensions would a rectangular poster have to be to fit perfectly around the outer surface of the trash cans (not the top or bottom)? Give your answer using a decimal and then round it to the nearest half foot.**



$d = 3$, $C = \pi d$ or $2\pi r$

$= \pi(3) = 9.42$ ft

dimensions: 4 ft by 9.42 ft

2. **What is the surface area of the outer surface of the trash cans (not the top or bottom)? Give your answer using a decimal and then round it to the nearest square foot.**

SA of outer surface (shell) is A of [9.42 × 4],

which is $(9.42)(4) =$ **38 ft²**

3. The Geometrics Stage Crew is going to give away 100 CDs wrapped in sparkling paper to promote the big concert. To comfortably wrap a CD, they need paper to cover a length of 6 inches by a height of 5 inches and a width of .25 inches. **How many square inches of paper would be needed to wrap 100 CDs?**

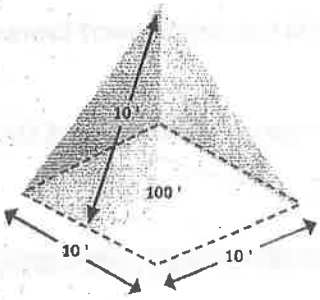
$SA_{rect\ prism} = 2LW + 2LH + 2WH$

$= 2(6)(0.25) + 2(6)(5) + 2(0.25)(5)$

$= 3 + 60 + 2.5$

$= 65.5\ in^2 \times 100\ CDs =$ **6550 in²**

4. Finally, The Geometrics' last album had a picture of a pyramid from Egypt on the cover. To promote this show, the stage crew wants to construct a pyramid tent in front of the school with a perfect square base of 100 square feet and a slant height measuring 10 feet. **How much square feet of fabric would the stage crew need to cover the structure, not including the base?**



$SA = \cancel{b^2} + 2bs = 2bs$

$= 2(10)(10)$

$= 200$ ft²

(don't include base!)