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Perimeter, Area, Volume, and Ratios

Perimeter: the distance around the exterior of a shape

Circumference: the perimeter of a circle \( C = \pi \times \text{diameter} \) or \( C = \pi \times 2 \times \text{radius} \)

Ex. 1 A rectangular lot that measures 150 ft by 200 ft is completely fenced. What is the approximate length, in feet, of the fence?

F. 300
G. 350
H. 400
J. 700
K. 1,400

Ex. 2 In the figure shown below, each pair of intersecting line segments meets at a right angle, and all the lengths given are in inches. What is the perimeter, in inches, of the figure?

\[ 14 + 26 + 14 + 26 = 70 \text{ in} \]

Ex. 3 If the radius of a circle is 3 cm, what is the circumference? Leave your answer in terms of \( \pi \).

\[ C = 2\pi(3) = 6\pi \]

Area of a parallelogram: \( A = \text{base} \times \text{height} \)

Ex. 4 Parallelogram ABCD, with dimensions in inches, is shown in the diagram below. What is the area of the parallelogram, in square inches?

A. 18
B. 36
C. 39
D. 45
E. 72

\[ A = 9(4) = 36 \text{ in}^2 \]
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Ex. 5 Shannon is planning to tile a rectangular kitchen countertop that is 24 inches wide and 64 inches long. She determined that 1 tile will be needed for each 4-inch-by-4-inch region. What is the minimum number of tiles that will be needed to completely cover the countertop to its edges?

A. 44  
B. 88  
C. 96  
D. 176  
E. 384

\[ A_{\text{counter}} = 24 \times (64) = 1536 \]
\[ A_{\text{tile}} = 4 \times 4 = 16 \]

Area of a circle: \( A = \pi \times \text{radius}^2 \)

Ex. 6 The diameter of a circle is 16. What is the area, in terms of \( \pi \)?

\[ d = 16 \]
\[ \text{radius} = 8 \]
\[ A = \pi (8)^2 = 64\pi \]

Ex. 7 A 6-inch-by-8-inch rectangle is inscribed in a circle as shown below. What is the area of the circle, in square inches? HINT: Make a triangle to find the radius!

F. \( 5\pi \)  
G. \( 16\pi \)  
H. \( 25\pi \)  
J. \( 48\pi \)  
K. \( 96\pi \)

Area of a triangle: \( A = \frac{\text{base} \times \text{height}}{2} \) or \( A = \frac{1}{2} \times \text{base} \times \text{height} \)

Ex. 8 The vertices of a right triangle are located at the coordinates \((0,0)\), \((4,0)\), and \((4,5)\). What is the area of that triangle?
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Ex. 9 The area of a triangle is 45 square inches. If the height is 5 inches, what is the length of the base?

A. 4.5 inches
B. 9 inches
C. 18 inches
D. 20 inches
E. Cannot be determined

Area of a trapezoid: \( A = \frac{1}{2} \times (\text{base}_1 + \text{base}_2) \times \text{height} \)

Ex. 10 What is the area, in square inches, of the isosceles trapezoid below?

\[
A = \frac{1}{2} (6 + 12) \times 4 \\
= \frac{1}{2} (18) \times 4 \\
= 9 \times 4 \\
= 36
\]

Ex. 11 The area of the trapezoid below is 20 square inches, the altitude is 2 inches, and the length of one base is 3 inches. What is the length, \( b \), of the other base, in inches?

A. 7
B. 10.5
C. 13
D. 17
E. 23

Area of a “Cut-Out”: \( A = \text{Area of Large Shape} - \text{Area of Small Shape} \)

Ex. 12 The figure below shows 2 tangent circles such that the 10-centimeter diameter of the smaller circle is equal to the radius of the larger circle. What is the area, in square centimeters, of the shaded region?

F. 10
G. 75
H. 5\pi
J. 10\pi
K. 75\pi
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Volume of a "Box": \( V = \text{length} \times \text{width} \times \text{height} \) or \( V = \text{area of the base} \times \text{height} \)

Ex. 13 What is the volume of a box in cubic feet with length 8 feet, width 6 inches and height 4 feet?

\[ V = 8 \times 6 \times 4 = 192 \text{ ft}^3 \]

Ex. 14 After a snowstorm, city workers removed an estimated 10,000 cubic yards of snow from the downtown area. If this snow were spread in an even layer over the entire rectangular football field shown below, about how many yards deep would the layer of snow be?

\[ V = \ell \times w \times h \]

A. Less than 1
B. Between 1 and 2
C. Between 2 and 3
D. Between 3 and 4
E. More than 4

\[ \begin{align*}
10,000 &= 120 \times 53.5 \times h \\
1000 &= 6420h \\
h &= 1.56
\end{align*} \]

Volume of a Cylinder: \( V = \pi \times r^2 \times \text{height} \) or \( V = \text{area of the base} \times \text{height} \)

Ex. 15 The end-on view of a cylindrical milk tank on its support is shown in the figure below. The interior radius of the tank’s circular end is 4 feet. The interior length of the tank is 25 feet. Which of the following is closest to the tank’s volume, in cubic feet?

A. 310
B. 630
C. 1,300
D. 2,500
E. 5,000

\[ V = \pi \times r^2 \times h \]

\[ \begin{align*}
V &= \pi \times 4^2 \times 25 \\
V &= 400 \pi \\
V &= 1256
\end{align*} \]

Volume of a cone or pyramid: \( V = \frac{1}{3} \times \pi \times r^2 \times \text{height} \) or \( V = \frac{1}{3} \text{area of the base} \times \text{height} \)

Ex. 16 Culver’s makes a waffle cone with radius of 3 inches and height of 5 inches. What is the volume (in cubic inches) of the cone? Leave your answer in terms of pi.

\[ V = \frac{\pi \times r^2 \times h}{3} \]

\[ V = \frac{\pi \times 3^2 \times 5}{3} \]

\[ V = \frac{45 \pi}{3} = 15 \pi \text{ in}^3 \]
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Ex. 17 King Tut's car lot wants to make a replica pyramid with a square base. The owner wants to make sure that the volume of the pyramid is exactly 6000 cubic feet and the height is exactly 45 feet tall. What is the length (in feet) of one side of the base? DRAW A PICTURE!

\[
V = \frac{\text{area of base} \times \text{height}}{3} \quad \Rightarrow \quad 6000 = \frac{45x}{3} \quad \Rightarrow \quad 45x = 16000 \quad \Rightarrow \quad x = 40 \quad \text{ft}
\]

Volume of a Sphere: \( V = \frac{4}{3} \pi r^3 \)

Ex. 18 A formula for the volume \( V \) of a sphere with radius \( r \) is \( V = \frac{4}{3} \pi r^3 \). If the radius of a spherical rubber ball is \( \frac{1}{4} \) inches, what is its volume to the nearest cubic inch?

A. 5
B. 7
C. 8
D. 16
E. 65

Ratio of Sides/Perimeter: \( a : a \)  
Ratio of Areas: \( a : a^2 \)  
Ratio of Volumes: \( a : a^3 \)

Ex. 19 The ratio of the radii of two circles is 4:9. What is the ratio of their circumferences?

F. 2:3
G. 4:9
H. 16:81
J. 4:8π
K. 9:18π

Ex. 20 A large cube has edges that are twice as long as those of a small cube. The volume of the large cube is how many times the volume of the small cube?

A. 2
B. 4
C. 6
D. 8
E. 16

\[
\frac{\text{Volume of large cube}}{\text{Volume of small cube}} = a^3 \quad \Rightarrow \quad \frac{a^3}{b^3} = \frac{2^3}{1^3} = 8 \quad \Rightarrow \quad 2.8 \quad \text{times}
\]