Measurement and Geometry: Perimeter and Circumference of Geometric Figures*

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Denny Burzynski

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Abstract

This module is from Fundamentals of Mathematics by Denny Burzynski and Wade Ellis, Jr. This module discusses perimeter and circumference of geometric figures. By the end of the module students should know what a polygon is, know what perimeter is and how to find it, know what the circumference, diameter, and radius of a circle is and how to find each one, know the meaning of the symbol π and its approximating value and know what a formula is and four versions of the circumference formula of a circle.

1 Section Overview

- Polygons
- Perimeter
- Circumference/Diameter/Radius
- The Number π
- Formulas

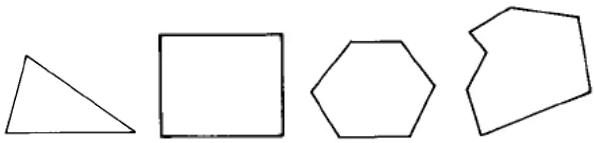
2 Polygons

We can make use of conversion skills with denominate numbers to make measurements of geometric figures such as rectangles, triangles, and circles. To make these measurements we need to be familiar with several definitions.

Polygon

A **polygon** is a closed plane (flat) figure whose sides are line segments (portions of straight lines).

Polygons



*Version 1.2: Aug 18, 2010 8:40 pm -0500

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Not polygons

3 Perimeter

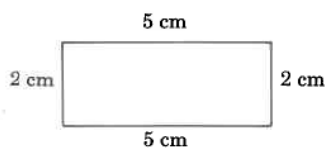
Perimeter
The **perimeter** of a polygon is the distance around the polygon.

To find the perimeter of a polygon, we simply add up the lengths of all the sides.

3.1 Sample Set A

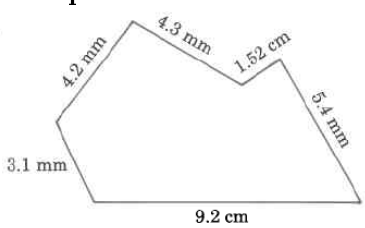
Find the perimeter of each polygon.

Example 1



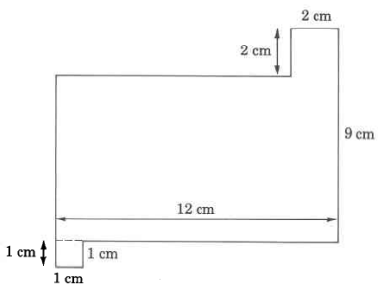
$$\begin{aligned} \text{Perimeter} &= 2\text{ cm} + 5\text{ cm} + 2\text{ cm} + 5\text{ cm} \\ &= 14\text{ cm} \end{aligned}$$

Example 2

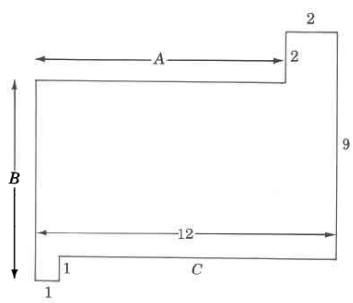


$$\begin{aligned} \text{Perimeter} = \; & 3.1 \text{ mm} \\ & 4.2 \text{ mm} \\ & 4.3 \text{ mm} \\ & 1.52 \text{ mm} \\ & 5.4 \text{ mm} \\ & \underline{+9.2 \text{ mm}} \\ & 27.72 \text{ mm} \end{aligned}$$

Example 3



Our first observation is that three of the dimensions are missing. However, we can determine the missing measurements using the following process. Let A, B, and C represent the missing measurements. Visualize



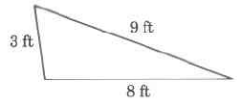
$A = 12\text{m} - 2\text{m} = 10\text{m}$
$B = 9\text{m} + 1\text{m} - 2\text{m} = 8\text{m}$
$C = 12\text{m} - 1\text{m} = 11\text{m}$

$$\begin{aligned} \text{Perimeter} \quad = \quad & 8 \text{ m} \\ & 10 \text{ m} \\ & 2 \text{ m} \\ & 2 \text{ m} \\ & 9 \text{ m} \\ & 11 \text{ m} \\ & 1 \text{ m} \\ & \underline{+\ 1 \text{ m}} \\ & 44 \text{ m} \end{aligned}$$

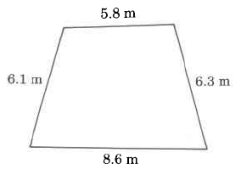
3.2 Practice Set A

Find the perimeter of each polygon.

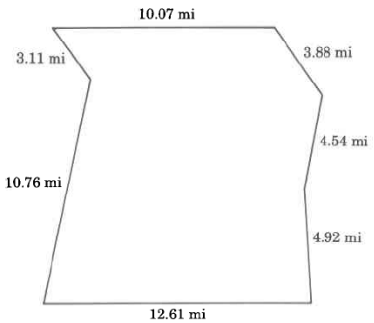
Exercise 1 ***(Solution on p. 12.)***



Exercise 2 *(Solution on p. 12.)*

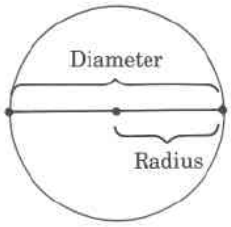


Exercise 3 *(Solution on p. 12.)*



4 Circumference/Diameter/Radius

Circumference
The **circumference** of a circle is the distance around the circle.
Diameter
A **diameter** of a circle is any line segment that passes through the center of the circle and has its endpoints on the circle.
Radius
A **radius** of a circle is any line segment having as its endpoints the center of the circle and a point on the circle.
The radius is one half the diameter.



5 The Number π

The symbol π, read "pi," represents the nonterminating, nonrepeating decimal number 3.14159 . . . . This number has been computed to millions of decimal places without the appearance of a repeating block of digits.

For computational purposes, π is often approximated as 3.14. We will write $\pi \approx 3.14$ to denote that π is approximately equal to 3.14. The symbol "$\approx$" means "approximately equal to."

6 Formulas

To find the circumference of a circle, we need only know its diameter or radius. We then use a formula for computing the circumference of the circle.

Formula

A **formula** is a rule or method for performing a task. In mathematics, a formula is a rule that directs us in computations.

Formulas are usually composed of letters that represent important, but possibly unknown, quantities.

If C, d, and r represent, respectively, the circumference, diameter, and radius of a circle, then the following two formulas give us directions for computing the circumference of the circle.

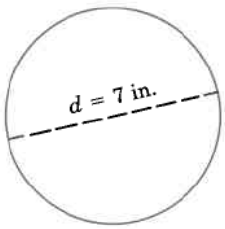
Circumference Formulas

1. $C = \pi d$ or $C \approx (3.14)\, d$
2. $C = 2\pi r$ or $C \approx 2\,(3.14)\, r$

6.1 Sample Set B

Example 4

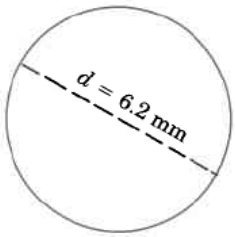
Find the exact circumference of the circle.



Use the formula $C = \pi d$.
$C = \pi \cdot 7\text{in.}$
By commutativity of multiplication,
$C = 7\text{in.} \cdot \pi$
$C = 7\pi\text{in.}$, exactly
This result is exact since π has not been approximated.

Example 5

Find the approximate circumference of the circle.



Use the formula $C = \pi d$.
$C \approx (3.14)\,(6.2)$
$C \approx 19.648 \text{ mm}$
This result is approximate since π has been approximated by 3.14.

Example 6

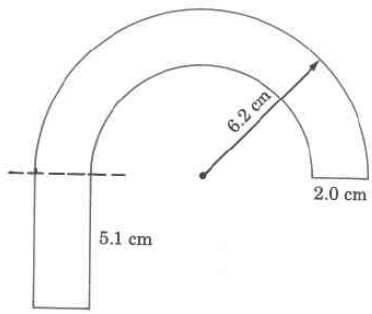
Find the approximate circumference of a circle with radius 18 inches.

Since we're given that the radius, r, is 18 in., we'll use the formula $C = 2\pi r$.
$C \approx (2)\,(3.14)\,(18 \text{ in.})$

$C \approx 113.04$ in.

Example 7

Find the approximate perimeter of the figure.



We notice that we have two semicircles (half circles).
The larger radius is 6.2 cm.
The smaller radius is 6.2 cm - 2.0 cm = 4.2 cm.
The width of the bottom part of the rectangle is 2.0 cm.

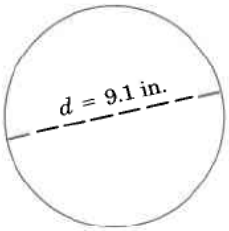
Perimeter	=	2.0 cm	
		5.1 cm	
		2.0 cm	
		5.1 cm	
		$(0.5) \cdot (2) \cdot (3.14) \cdot (6.2 \text{ cm})$	Circumference of outer semicircle.
	+	$\underline{(0.5) \cdot (2) \cdot (3.14) \cdot (4.2 \text{ cm})}$	Circumference of inner semicircle
			$6.2 \text{ cm} - 2.0 \text{ cm} = 4.2 \text{ cm}$
			The 0.5 appears because we want the perimeter of only half a circle.

Perimeter	≈	2.0	cm
		5.1	cm
		2.0	cm
		5.1	cm
		19.468	cm
		+13.188	cm
		48.856	cm

6.2 Practice Set B

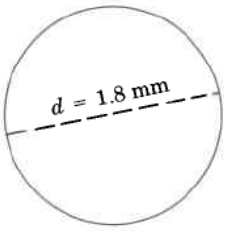
Exercise 4 ***(Solution on p. 12.)***

Find the exact circumference of the circle.



Exercise 5 *(Solution on p. 12.)*

Find the approximate circumference of the circle.

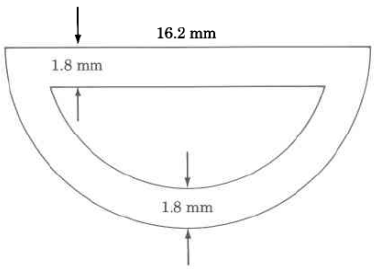


Exercise 6 *(Solution on p. 12.)*

Find the approximate circumference of the circle with radius 20.1 m.

Exercise 7 *(Solution on p. 12.)*

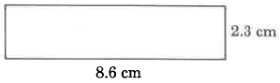
Find the approximate outside perimeter of



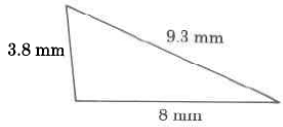
7 Exercises

Find each perimeter or approximate circumference. Use $\pi = 3.14$.

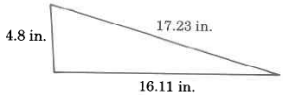
Exercise 8 *(Solution on p. 12.)*



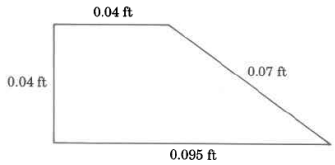
Exercise 9



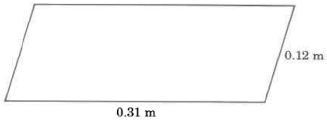
Exercise 10 *(Solution on p. 12.)*



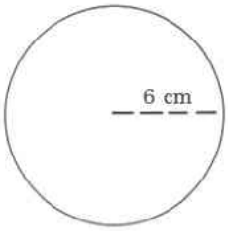
Exercise 11



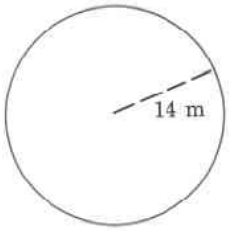
Exercise 12 *(Solution on p. 12.)*



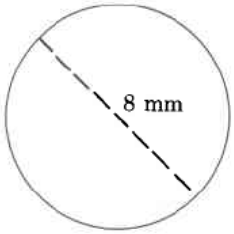
Exercise 13



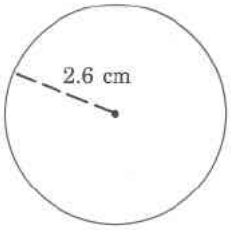
Exercise 14 *(Solution on p. 12.)*



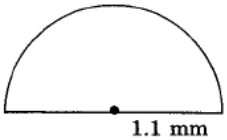
Exercise 15



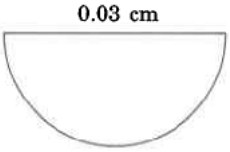
Exercise 16 *(Solution on p. 12.)*



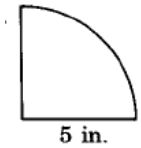
Exercise 17



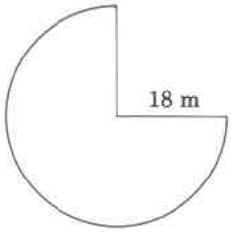
Exercise 18 *(Solution on p. 12.)*



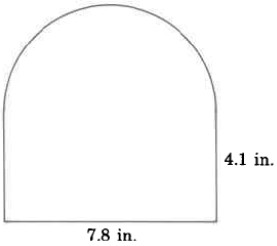
Exercise 19



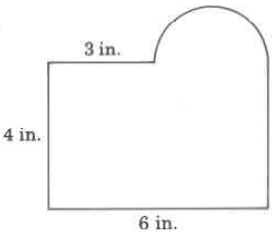
Exercise 20 *(Solution on p. 12.)*



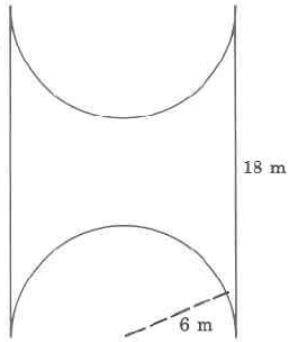
Exercise 21



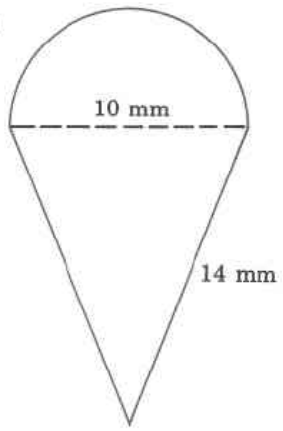
Exercise 22 *(Solution on p. 12.)*



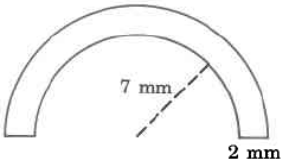
Exercise 23



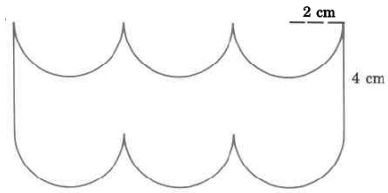
Exercise 24 *(Solution on p. 12.)*



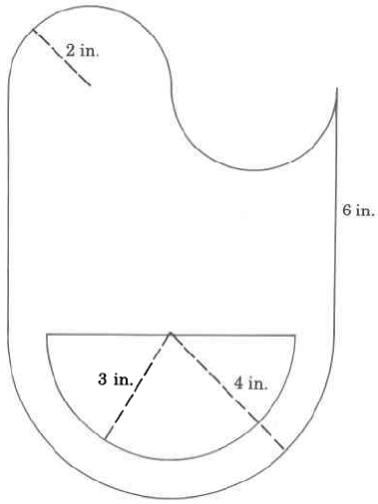
Exercise 25



Exercise 26 *(Solution on p. 12.)*



Exercise 27



7.1 Exercises for Review

Exercise 28 ***(Solution on p. 12.)***

(here[1]) Find the value of $2\frac{8}{13} \cdot \sqrt{10\frac{9}{16}}$.

Exercise 29

(here[2]) Find the value of $\frac{8}{15} + \frac{7}{10} + \frac{21}{60}$.

Exercise 30 ***(Solution on p. 12.)***

(here[3]) Convert $\frac{7}{8}$ to a decimal.

Exercise 31

(here[4]) What is the name given to a quantity that is used as a comparison to determine the measure of another quantity?

Exercise 32 ***(Solution on p. 12.)***

(here[5]) Add 42 min 26 sec to 53 min 40 sec and simplify the result.

[1] "Introduction to Fractions and Multiplication and Division of Fractions: Multiplication of Fractions" <http://cnx.org/content/m34928/latest/>

[2] "Addition and Subtraction of Fractions, Comparing Fractions, and Complex Fractions: Addition and Subtraction of Fractions with Unlike Denominators" <http://cnx.org/content/m34935/latest/>

[3] "Decimals: Converting a Fraction to a Decimal" <http://cnx.org/content/m34970/latest/>

[4] "Measurement and Geometry: Measurement and the United States System" <http://cnx.org/content/m35018/latest/>

[5] "Measurement and Geometry: Simplification of Denominate Numbers" <http://cnx.org/content/m35021/latest/>

Solutions to Exercises in this Module

Solution to Exercise (p. 3)
20 ft
Solution to Exercise (p. 4)
26.8 m
Solution to Exercise (p. 4)
49.89 mi
Solution to Exercise (p. 6)
9.1π in.
Solution to Exercise (p. 7)
5.652 mm
Solution to Exercise (p. 7)
126.228 m
Solution to Exercise (p. 7)
41.634 mm
Solution to Exercise (p. 7)
21.8 cm
Solution to Exercise (p. 7)
38.14 inches
Solution to Exercise (p. 8)
0.86 m
Solution to Exercise (p. 8)
87.92 m
Solution to Exercise (p. 8)
16.328 cm
Solution to Exercise (p. 9)
0.0771 cm
Solution to Exercise (p. 9)
120.78 m
Solution to Exercise (p. 9)
21.71 inches
Solution to Exercise (p. 10)
43.7 mm
Solution to Exercise (p. 10)
45.68 cm
Solution to Exercise (p. 11)
8.5 or $\frac{17}{2}$ or $8\frac{1}{2}$
Solution to Exercise (p. 11)
0.875
Solution to Exercise (p. 11)
1 hour 36 minutes 6 seconds