

# Geometry Unit 1, part b: Area

## Bronx Early College Academy

Christopher J. Huson PhD

19-23 September 2022

1.8 Area	19 September
1.9 Rounding and circle area	20 September
1.10 Precision	21 September
1.11 Review	22 September
1.12 Unit test: Segments, length, area	23 September

# Learning Target: I can calculate areas

CCSS: HSG.CO.A.1 Know precise geometric definitions

1.8 Monday 19 Sept

## Do Now: Practice unit conversion

1. How many days are in a week?
2. Find the number of weeks in 365 days.  
(show calculation with units)

## Quiz results

Lesson: Rectangle, triangle, parallelogram area formulas

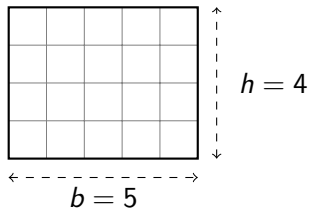
Extension: Scientific notation

The *area* of a rectangle is its base  $\times$  height.

We also say “length times width”

Formula for the area of a rectangle:

$$A = b \times h$$



$$A = 5 \times 4 = 20$$

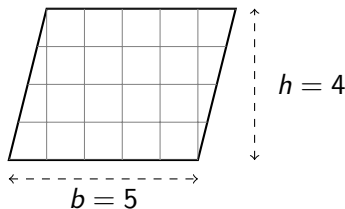
**Area** the quantity of unit squares that fill a shape

A parallelogram's area has the same formula as a rectangle.

Use the height, not the length of the slanted side.

Formula for the area of a parallelogram:

$$A = b \times h$$



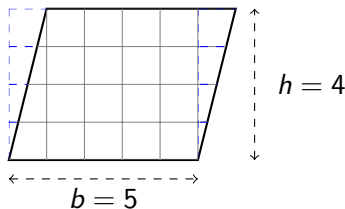
$$A = 5 \times 4 = 20$$

A parallelogram's area has the same formula as a rectangle.

Use the height, not the length of the slanted side.

Formula for the area of a parallelogram:

$$A = b \times h$$



$$A = 5 \times 4 = 20$$

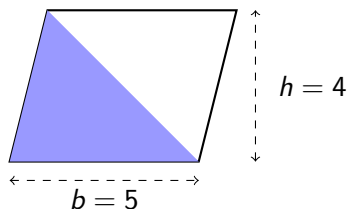
The two blue triangles match

A triangle has half the area of its base times height.

Use the height, not the side length.

Formula for the area of a triangle:

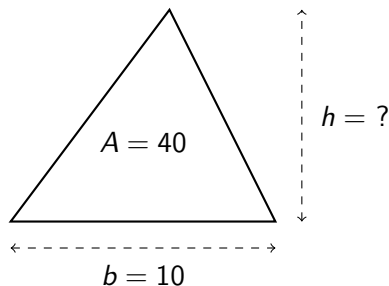
$$A = \frac{1}{2}b \times h$$



$$A = \frac{1}{2}(5 \times 4) = 10$$

## Find a missing dimension using the area formula

Given the area of a triangle is 40 and its base is 10, find its height.



$$A = \frac{1}{2}(10 \times h) = 40$$



# Write formulas in notebook

**Rectangle**  $A = b \times h$  (base times height or length times width)

**Parallelogram**  $A = b \times h$

**Triangle**  $A = \frac{1}{2}(b \times h)$

**Area** the quantity of unit squares that fill a shape

**Units** We say “square units”, i.e. square inches (abbreviated  $\text{in}^2$ ), square miles, etc.

## Extension (optional): *Scientific notation*

Use for very large or small numbers instead of decimals

Exponents mean repeated multiplication:

$$10^5 = 10 \times 10 \times 10 \times 10 \times 10 = 100,000$$

1. The distance to the sun is 150,000,000,000 meters  $= 1.5 \times 10^{11}$
2. The population of NYC is 8,000,000 =
3. The area of the earth is  $2 \times 10^8$  square miles =

**Scientific notation** Compact notation for big numbers,  $a \times 10^k$

**Exponent** Repeated multiplication. The number of decimal places in base 10

**Base 10** The system of place value we use for numbers

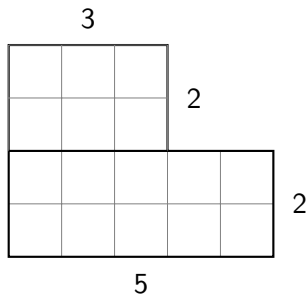
**Mantissa** The coefficient in scientific notation

# Learning Target: I can calculate the area of a circle

CCSS: HSG.CO.A.1 Know precise geometric definitions

1.9 Tuesday 20 Sept

Do Now: Two rectangles are shown. Calculate the area of each and the combined total area.



Lesson: Area of a circle,  $\pi$ , rounding

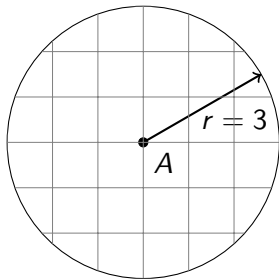
Extension: Significant figures

The *area* and *circumference* of a circle are multiples of  $\pi$ .

$\pi$  is an *irrational* number

Area of a circle:

$$A = \pi r^2$$



Circumference (distance around):

$$C = 2\pi r$$

Circle A with radius  $r = 3$

$$A = \pi \times 3^2 = 9\pi = 28.2743\dots$$

$$C = 2\pi \times 3 = 6\pi = 18.8495\dots$$

**Radius** Segment from the center to the edge of a circle,  $r$

**Diameter** Segment/length across the whole circle,  $D = 2r$

# Numbers don't always need to be exact

Round up when the next digit is 5 or more

Round down otherwise

Is  $\pi$  closer to three or four?

$$\pi = 3.\textcolor{red}{1}415926\dots$$

# Numbers don't always need to be exact

Round up when the next digit is 5 or more

Round down otherwise

$\pi = 3.\textcolor{red}{1}415926... \approx 3$  to the nearest whole number

# Numbers don't always need to be exact

Round up when the next digit is 5 or more

Round down otherwise

$\pi = 3.\textcolor{red}{1}415926... \approx 3$  to the nearest whole number

$\pi = 3.1\textcolor{red}{4}15926... \approx 3.1$  to the nearest tenth

$\pi = 3.14\textcolor{red}{1}5926... \approx 3.14$  to the nearest hundredth

$\pi = 3.141\textcolor{red}{5}926... \approx 3.14\textbf{2}$  to the nearest thousandth

# Numbers don't always need to be exact

Round up when the next digit is 5 or more

Round down otherwise

$\pi = 3.\textcolor{red}{1}415926... \approx 3$  to the nearest whole number

$\pi = 3.1\textcolor{red}{4}15926... \approx 3.1$  to the nearest tenth

$\pi = 3.14\textcolor{red}{1}5926... \approx 3.14$  to the nearest hundredth

$\pi = 3.141\textcolor{red}{5}926... \approx 3.14\textcolor{black}{2}$  to the nearest thousandth

**Whole** The ones place, e.g. 3, 14, -15

**tenths** First digit after the decimal, 0.3, 6.8

**hundredths** Second decimal digit, 5.45

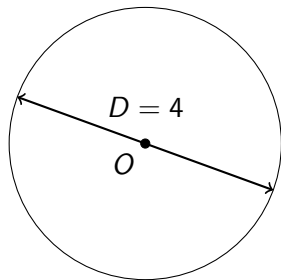
**thousandths** Third decimal place, 18.123

**Rounding** Writing an approximation of a number

**Approximate** About equal to, not exact,  $\approx$



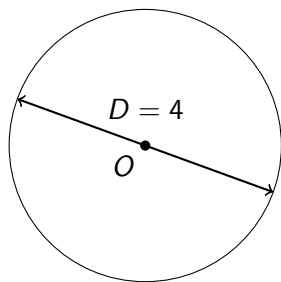
Use the symbol  $\pi$  for an *exact* answer



Circle  $O$  with diameter  $D = 4$

1. Find the radius of the circle.
2. Find the exact circumference.
3. Round to the nearest hundredth.

## Use the symbol $\pi$ for an *exact* answer



Circle  $O$  with diameter  $D = 4$

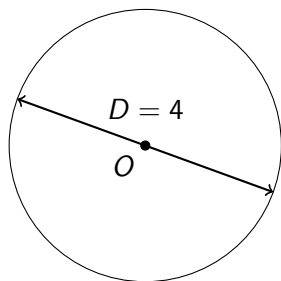
1. Find the radius of the circle.

$$r = \frac{1}{2}D = \frac{4}{2} = 2$$

2. Find the exact circumference.

3. Round to the nearest hundredth.

## Use the symbol $\pi$ for an *exact* answer



Circle  $O$  with diameter  $D = 4$

1. Find the radius of the circle.

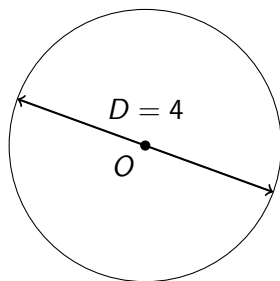
$$r = \frac{1}{2}D = \frac{4}{2} = 2$$

2. Find the exact circumference.

$$C = 2\pi r = 2\pi 2 = 4\pi$$

3. Round to the nearest hundredth.

## Use the symbol $\pi$ for an *exact* answer



Circle  $O$  with diameter  $D = 4$

1. Find the radius of the circle.

$$r = \frac{1}{2}D = \frac{4}{2} = 2$$

2. Find the exact circumference.

$$C = 2\pi r = 2\pi 2 = 4\pi$$

3. Round to the nearest hundredth.

$$C = 4\pi = 6.2831853... \approx 6.28$$

**Exact solution** Written with symbols or an ellipse (...).

Also said as “give your answer *in terms of*  $\pi$ ”.

## Write formulas in notebook

**Circle** All points with equal distance from the circle center

**Radius** Distance from the circle center to its edge,  $r$

**Diameter** Length across the whole circle,  $D = 2r$

**Circle area** Formula  $A = \pi r^2$

**Circumference** The distance around a circle (i.e. perimeter),  
 $C = 2\pi r$

**Semi-circle** Half of a circle

$\pi$  A special number,  $\pi = 3.14159265358\dots$

**Irrational** Number that can not be written as a fraction,  $\pi$ ,  $\sqrt{2}$

**Exact solution** Written with symbols or an ellipse (...).  
Also said as “give your answer *in terms of*  $\pi$ ”.

## Extension: Three digits is usually exact enough

Scientists and engineers say *significant figures*, or in IB, “sig figs”

Round to three digits

- ▶  $\pi = 3.14159265358... \approx 3.14$
- ▶  $\sqrt{2} = 1.4142135... \approx 1.41$
- ▶ Dr. Huson's height  $h \approx 67.5$  inches
- ▶ 365 days in a year (actually 365.2421897, source)
- ▶ Avogadro's number  $N_A \approx 6.02 \times 10^{23}$

**Sig figs** Significant figures, the number of digits required for the desired precision. In IB mathematics and most practical matters, the convention is 3 sig figs.

# Learning Target: I can quantify error in calculations

CCSS: HSG.CO.A.1 Know precise geometric definitions

1.10 Wednesday 21 Sept

Do Now: Find the area of a circle with radius  $b = 10$  centimeters, rounding to the nearest whole number.

circle image

Lesson: Percent error formula

Extension: Confidence intervals

# Learning Target: I can study together with my classmates

CCSS: HSG.CO.A.1 Know precise geometric definitions

1.11 Thursday 22 Sept

Do Now: Find the area of a circle with radius  $b = 10$  centimeters, rounding to the nearest whole number.

circle image

Lesson: Peer review, notebook check, homework inventory due

Unit test tomorrow



# Groupwork review for test tomorrow

“Roundtable” of four students, with four topics assigned

## Geometry skills to study / teach

1. Line segments, length, number lines
2. Perimeter and area
3. Precision, percent error
4. Modeling situations and solving with algebra

# Learning Target: I can quantify length and area

CCSS: HSG.CO.A.1 Know precise geometric definitions

1.12 Friday 23 Sept

Unit test