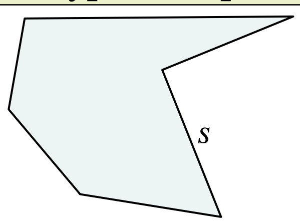
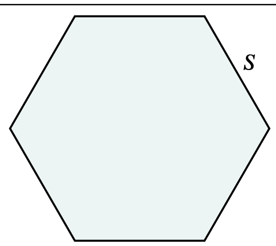
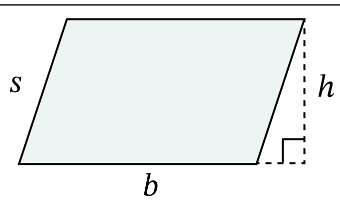
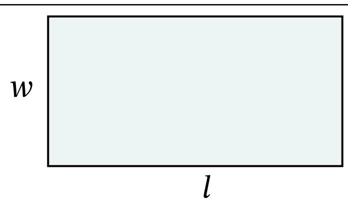
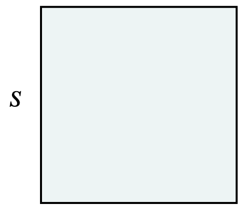
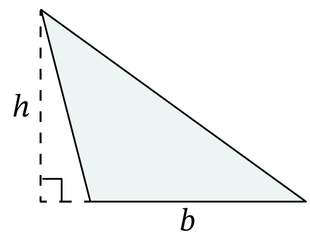
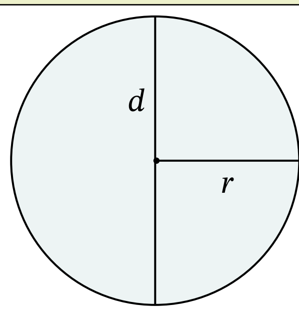
Appendix B
Reference Section

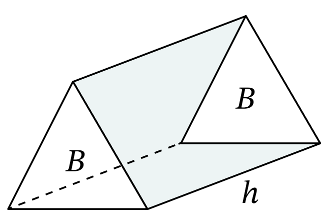
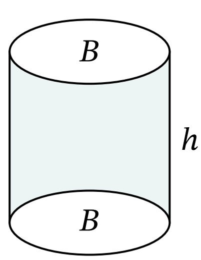
Geometric Formulas

Shape Name	Type of Shape	Perimeter	Area
Polygons *closed, two-dimensional figure with straight lines*		$P =$ *sum of all side lengths* $P = s_1 + s_2 + s_3 + \ldots + s_n$	View as multiple triangles or other simple polygons.
Regular Polygon *All sides equal and all angles congruent.*		$P = (\text{number of sides}) \times (\text{length of a side})$ $P = ns$	View as multiple triangles or other simple polygons.
Parallelogram *four-sided polygon with both pairs of opposite sides parallel*		$P = 2b + 2s$	$A = bh$
Rectangle *parallelogram with right angles*		$P = 2l + 2w$	$A = lw$

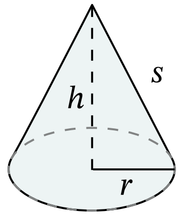
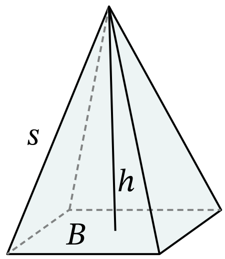
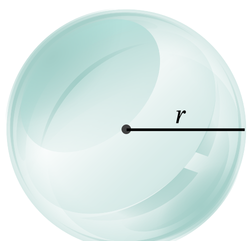
$P =$ *perimeter*
$C =$ *circumference*
$A =$ *area*
$B =$ *area of the base*
$C_{base} =$ *circumference of base*
$r =$ *radius*
$d =$ *diameter*

Shape Name	Type of Shape	Perimeter	Area
Square *parallelogram with equal-length sides and right angles*		$P = 4s$	$A = s^2$
Triangle *three-sided polygon*		$P =$ *sum of all side lengths* $P = s_1 + s_2 + s_3$	$A = \frac{bh}{2}$

Shape Name	Type of Shape	Circumference, Diameter, and Radius	Area
Circle *closed, two-dimensional figure; each part of the edge is equally distant from the center*		$C = \pi d = 2\pi r$ $d = 2r$ $r = \frac{1}{2}d$	$A = \frac{\pi d^2}{4}$ $A = \pi r^2$

Solid Name[1]	Type of Solid	Volume	Area
Prism *solid with two bases that are parallel polygons and faces (sides) that are parallelograms*		$V = Bh$	$A_{\text{surface}} = 2B +$ *Area of each side*
Cylinder *Solid with two bases that are equal parallel circles, having an equal diameter in any parallel plane between them*		$V = Bh$	$A_{\text{surface}} = C_{\text{base}}h + 2B$

1 Definitions of solids were based on *Ray's New Higher Arithmetic*, Revised (Cincinnati: Van Antwerp, Bragg & Co., 1880), p. 390-391.

Solid Name	Type of Solid	Volume	Area
Cone *solid whose base is a circle, and whose other surface comes to a common vertex*		$V = \pi r^2 \frac{h}{3}$	$A_{\text{surface}} = \pi rs + \pi r^2$
Square Pyramid *solid with square base whose faces are triangles with a common vertex*		$V = \frac{1}{3}Bh$	$A_{\text{surface}} = B +$ *sum of area of all faces* (sides) Or $A_{\text{surface}} = B + 2s\sqrt{B}$
Sphere *solid bounded by a curved surface, every point of which is at the same distance from the center*		$V = \frac{4}{3}\pi r^3$	$A_{\text{surface}} = 4\pi r^2$

$P =$ *perimeter*

$B =$ *area of the base*

$r =$ *radius*

$C =$ *circumference*

$C_{\text{base}} =$ *circumference of base*

$d =$ *diameter*

$A =$ *area*

Units of Measure

Area – Other

1 acre = 43,560 ft^2

Capacity – Dry

- *U.S. Customary*

  2 pints (pt) = 1 quart (qt)

  8 quarts = 1 peck (pk)

  4 pecks = 1 bushel (bu) = 32 quarts (qt)

- *Conversion Between Systems*

  1 quart ≈ 67.201 $inches^3$

  1 bushel = 2,150.420 $inches^3$

Note: The pint and quart here represent a larger capacity than the ones measuring liquid — they should not be used interchangeably. Unless the problem specifically states otherwise, you can assume pint and quart in this course refer to the liquid units.

Capacity – Liquid

- *U.S. Customary*

  3 teaspoons (tsp) = 1 tablespoon (Tbsp)

  16 tablespoons = 1 cup (c)

  2 cups = 1 pint (pt)

  2 pints = 1 quart (qt)

  4 quarts = 1 gallon (gal)

  2 tablespoons (Tbsp) ≈ 1 fluid ounce (fl oz)

  8 fl oz = 1 cup (c)

  16 fl oz = 1 pint (pt)

  32 fl oz = 1 quart (qt)

  128 fl oz = 1 gallon (gal)

- *Metric*

  10 milliliters (ml *or* mL) = 1 centiliter (cl *or* cL)

  10 centiliters = 100 milliliters = 1 deciliter (dl *or* dL)

  10 deciliters = 100 centiliters = 1,000 milliliters = 1 liter (l *or* L)

  10 liters = 1 dekaliter (dal *or* daL)

  10 dekaliters = 1 hectoliter (hl *or* hL)

  10 hectoliters = 1,000 liters = 1 kiloliter (kl *or* kL)

- *Conversion Between Systems*

  1 teaspoon ≈ 4.929 milliliters

  1 gallon ≈ 3.785 liters

  1 pint = 28.875 in^3

  1 quart = 57.75 in^3

  1 gallon = 231 in^3

Distance

- *Distance – U.S. Customary*

  12 inches (in) = 1 foot (ft)

  3 feet = 36 inches = 1 yard (yd)

  1,760 yards = 5,280 ft = 1 mile (mi)

- *Distance – Metric/SI*

  10 millimeters (mm) = 1 centimeter (cm)

  10 centimeters = 1 decimeter (dm)

  10 decimeters = 100 centimeters = 1,000 millimeters = 1 meter (m)

  10 meters = 1 decameter (dam)

  10 decameters = 1 hectometer (hm)

  10 hectometers = 1,000 meters = 1 kilometer (km)

- *Conversion Between Systems*

  1 inch (in) = 2.540 centimeters (cm)

  1 foot (ft) = 30.480 centimeters (cm)

  1 yard (yd) ≈ 0.914 meter (m)

  1 mile (mi) ≈ 1.609 kilometers (km)

Mass

- *U.S. Customary*

  $1 \text{ slug} = \dfrac{1 \text{ lb}}{1 \dfrac{\text{ft}}{\text{s}^2}}$

- *Metric*

  10 milligrams (mg) = 1 centigram (cg)

  10 centigrams = 100 milligrams = 1 decigram (dg)

  10 decigrams = 100 centigrams = 1,000 milligrams = 1 gram (g)

  10 grams = 1 dekagram (dag)

  10 dekagrams = 1 hectogram (hg)

  10 hectograms = 1,000 grams = 1 kilogram (kg)

- *Conversion Between Systems*

  1 ounce ≈ 28.350 grams

  1 pound ≈ 453.592 grams

  1 U.S. ton (called a short ton) ≈ 0.907 metric ton

  Note: These ounces are different than the fluid ounces listed under liquid capacity. These conversions assume weights as measured on the earth (as English units don't usually measure true mass but just weight).

Time

60 seconds (s) = 1 minute (min)

60 minutes = 1 hour (hr)

24 hours = 1 day (d)

7 days = 1 week (wk)

365 days = 1 year (yr *or* y)

10 years = 1 decade

100 years = 10 decades = 1 century

1,000 years = 10 centuries = 1 millennium

Temperature

F = Temperature in Fahrenheit $(°\text{F}) = \frac{9}{5}C + 32$

C = Temperature in Celsius $(°\text{C}) = \frac{5}{9}(F - 32)$

Weight – U.S. Customary

16 ounces (oz) = 1 pound (lb)

2,000 pounds = 1 ton (called a short ton)

Other Units of Measure (*See Lesson 2.5 for a reminder on converting between some of these units.*)

- Electrical Charge

  C = **Coulombs**

  Charge of an electron $= -1.602 \times 10^{-19}$ C

- Electrical Resistance

  Ω = **Ohms** $\left(1\ \Omega = 1\frac{\text{V}}{\text{A}} = 1\frac{\text{J} \cdot \text{s}}{\text{C}^2}\right)$

- Electrical Voltage

  V = **Volt** $\left(1\ \text{V} = 1\frac{\text{J}}{\text{C}}\right)$

- Energy

  1 **Joule** (J) $= 1\ \text{kg} \cdot \frac{\text{m}^2}{s^2}$

- Force

  Pounds (lb)

  1 **Newton** (N) $= 1\ \text{kg} \cdot \frac{m}{s^2}$

  1 lb ≈ 4.448 N

- Frequency

  1 **Hertz** (Hz) $= 1\ \text{s}^{-1}$

- Pressure

  Pa = **Pascal** $\left(1\frac{\text{N}}{\text{m}^2} = 1\ \text{kg} \cdot \frac{\text{m}}{\text{m}^2 \cdot \text{s}^2} = 1\frac{\text{kg}}{\text{m} \cdot \text{s}^2}\right)$

  1 **millimeter of mercury** (mm Hg) ≈ 133.322 Pa

- Power

  $W = \textbf{Watt} \left(1\ W = 1\frac{J}{s} = 1\ kg \bullet \frac{m^2}{s^3}\right)$

  1 **Horsepower** (hp) = 745.7 W

Other Reference

Prime Numbers Under 100

2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47,
53, 59, 61, 67, 71, 73, 79, 83, 89, 97

Fundamental Constants/Concepts

- ϕ Phi (the golden ratio) = $\left(\frac{1}{2} + \frac{\sqrt{5}}{2}\right) \approx 1.61803398875$
- e (Euler's Number) ≈ 2.718281828459
- π Pi (the ratio of the circumference of a circle to its diameter) ≈ 3.14159265359 (To calculate, use your calculator's button or whatever rounded value you have memorized.)

Greek Alphabet

Α, α	Alpha	Η, η	Eta	Ν, ν	Nu	Τ, τ	Tau
Β, β	Beta	Θ, θ	Theta	Ξ, ξ	Xi	Υ, υ	Upsilon
Γ, γ	Gamma	Ι, ι	Iota	Ο, ο	Omicron	Φ, ϕ	Phi
Δ, δ	Delta	Κ, κ	Kappa	π, π	Pi	Χ, χ	Chi
Ε, ϵ	Epsilon	Λ, λ	Lambda	Ρ, ρ	Rho	Ψ, ψ	Psi
Ζ, ζ	Zeta	Μ, μ	Mu	Σ, σ	Sigma	Ω, ω	Omega

Symbols – Comparison

$\approx$ Approximately equals

$=$ Equals

$>$ Greater than

$<$ Less than

$\geq$ Greater than or equals

$\leq$ Less than or equals

Symbols – Sets

$\in$ Is an element of

$\notin$ Is not an element of

$\subset$ Subset of

$\varnothing$ Empty set

$\cap$ Intersection of (think "AND")

$\cup$ Union of (think "OR")

Complex Numbers $\mathbb{C}$

"…numbers of the form $x + iy$, where x and y are real numbers and i is the imaginary unit equal to the square root of -1, $\sqrt{-1}$ . . . complex numbers are useful abstract quantities that can be used in calculations and result in physically meaningful solutions."[1]

Real Numbers $\mathbb{R}$

"The field of all rational and irrational numbers."[2]

Rational Numbers $\mathbb{Q}$

Rational numbers can be expressed as a ratio (i.e., division) of one integer to another. $\{\ldots, -\frac{1}{2}, -1, -0.3, 0, \frac{1}{2}, 0.75, 1, \ldots\}$

Integers $\mathbb{Z}$

Non-fractional numbers. $\{\ldots, -1, 0, 1, \ldots\}$

Even Integers $\{-4, -2, 0, 2, 4, \ldots\}$

Integers that can be divided by 2.

Natural (Whole or Counting) Numbers $\{1, 2, 3, \ldots\}$ $\mathbb{N}$

Integers 1 and greater.
(Some definitions include 0.)

Prime Numbers

Whole numbers that can't be evenly divided by any whole number but themselves and 1.

The prime numbers under 100 are 2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53, 59, 61, 67, 71, 73, 79, 83, 89, and 97.

Odd Integers $\{-3, -1, 1, 3, \ldots\}$

Integers that cannot be divided by 2.

Irrational Numbers $\mathbb{P}$

Example: π (3.14159265. . .) Irrational numbers have decimal digits that go on and on for infinity without ever repeating. They cannot be expressed as a ratio (i.e., division) of one integer to another.

Imaginary Numbers[3] $\mathbb{I}$

The imaginary unit (i.e., $\sqrt{-1}$) times some real number other than 0

1 Complex number definition is from Eric Weisstein, "Complex Number," from *MathWorld*—A Wolfram Web Resource, http://mathworld.wolfram.com/ComplexNumber.html.

2 Real number definition is from Eric Weisstein, "Real Number," from *MathWorld*—A Wolfram Web Resource, http://mathworld.wolfram.com/RealNumber.html.

3 Imaginary Number definition is based on *Merriam-Webster.com Dictionary*, (Merriam-Webster), s.v. "pure imaginary," https://www.merriam-webster.com/dictionary/pure%20imaginary.