Craig Hane, Ph.D., Founder

Workforce Development:

Module 5

1.1 Lessons Abbreviation Key Table

C = Calculator Lesson
P = Pre-algebra Lesson
A = Algebra Lesson
G = Geometry Lesson
T = Trigonometry Lesson
S = Special Topics

The number following the letter is the Lesson Number.

E = Exercises with Answers: Answers are in brackets [ ].
EA = Exercises Answers: (only used when answers are not on the same page as the exercises.)
ES = Exercises Supplemental: Complete if you feel you need additional problems to work.

1.2 Exercises Introduction

Why do the Exercises?

Mathematics is like a "game." The more you practice and play the game the better you will understand and play it.

The Foundation's Exercises, which accompany each lesson, are designed to reinforce the ideas presented to you in that lesson's video.

It is unlikely you will learn math very well by simply reading about it or listening to Dr. Del, or anyone else, or watching someone else doing it.

You WILL learn math by "doing math."

It is like learning to play a musical instrument, or write a book, or play a sport, or play chess, or cooking.

You will learn by practice.

Repetition is the key to mastery.

You will make mistakes. You will sometimes struggle to master a concept or technique. You may feel frustration sometimes "**WE ALL DO**."

But, as you learn and do math, you will begin to find pleasure and enjoyment in it as you would in any worthwhile endeavor. Treat it like a sport or game.

These exercises are the KEY to your SUCCESS!

ENJOY!

G8 LESSON: AREA OF TRIANGLES AND RECTANGLES

The **Area** of any **polygon** is a measure of its size.

The **Rectangle** is the simplest **polygon** and its **Area** is defined to be:

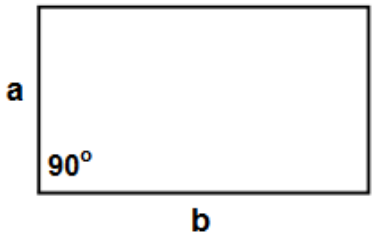
Area = ab where a and b are the lengths of its two sides.

A **Parallelogram** is a "**lopsided**" rectangle whose two adjacent sides have an angle **X°** instead of 90°.

Its **Area** can be calculated with a "**Correction Factor**" which is **SIN(X°)**

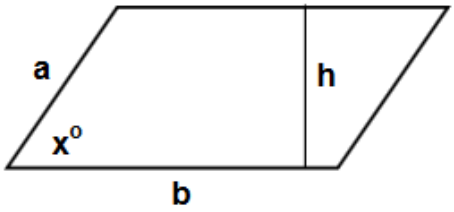
A **Triangle** is one-half of a **parallelogram**. So, its **Area** can be expressed with this same correction factor. **See Below.**

Of course, if one does know the "**height**" then one can use an alternative formula for the **Area**, which is usually given.

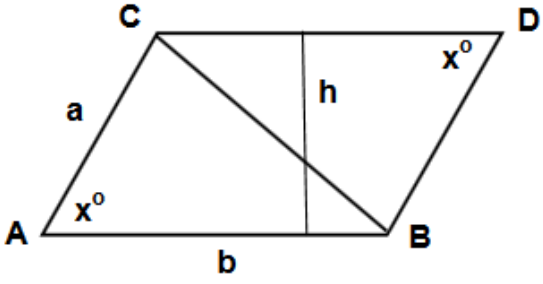


Area = ab

h = height



Area = abSIN(x°)
Area = hb



Triangle ABC = Triangle BDC

Area = .5abSIN(x°)

Area = (1/2)hb

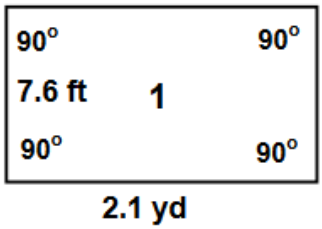
G8 Area of Triangles and Rectangles Problems

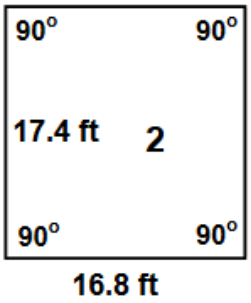
Calculate the areas of the triangles and rectangles.

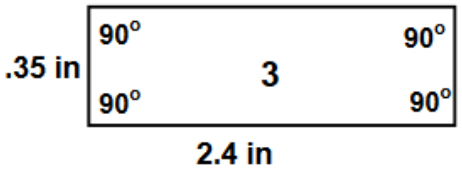
Note: The lateral units of measurement must be the same.

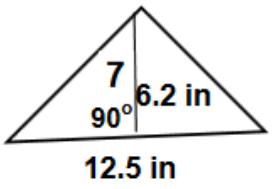
DO NOT multiply **ft** times **yd** for example.

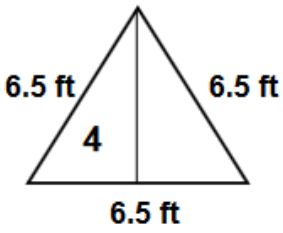
Answers: # Area.

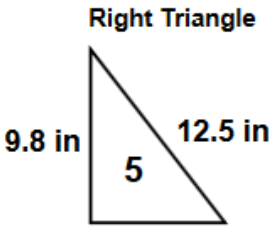


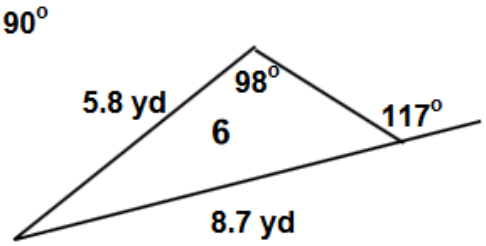












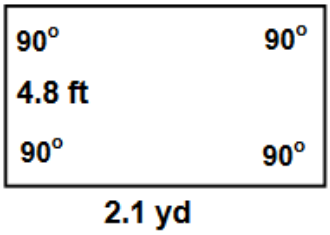
Answers: 1. 47.9 ft^2 or 5.3 yd^2 2. 292 ft^2 3. .84 in^2
4. 18.3 ft^2 5. 76 in^2 6. 8.2 yd^2 7. 38.8 in^2

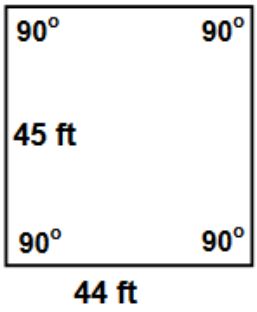
G8E

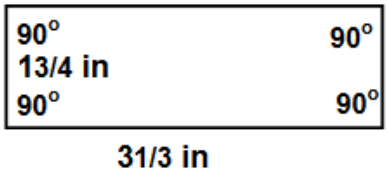
AREA OF TRIANGLES AND RECTANGLES

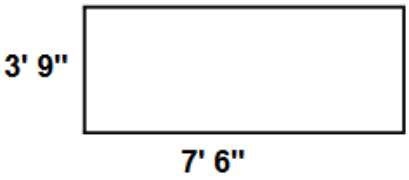
Calculate the areas of the triangles and rectangles.

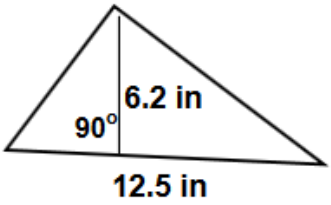
Note: The lateral units of measurement must be the same.

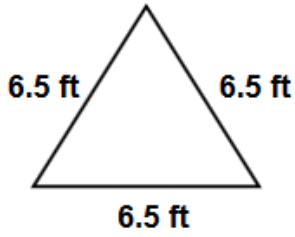


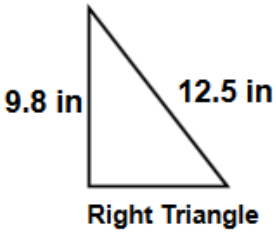


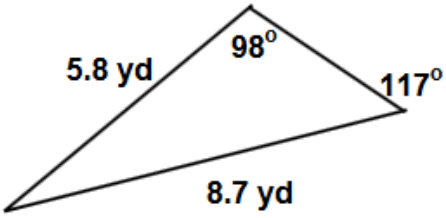












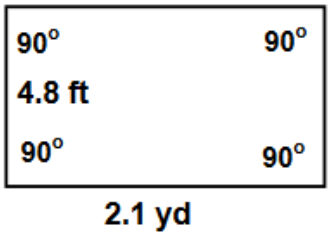
G8EA

AREA OF TRIANGLES AND RECTANGLES

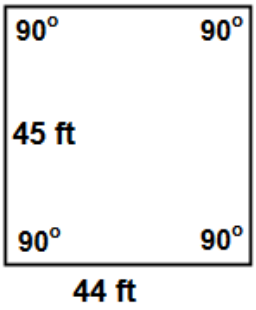
Calculate the areas of the triangles and rectangles.

Note: The lateral units of measurement must be the same.

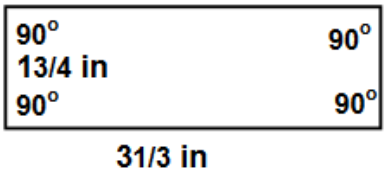
$A = 30.2\ ft^2 = 3.4\ yd^2$



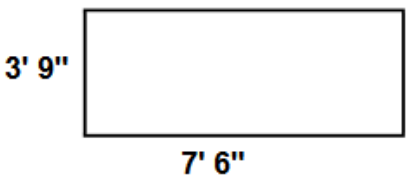
$A = 1980\ ft^2$



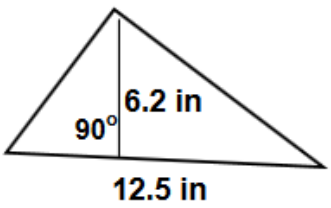
$A = 5\frac{5}{6}\ in^2$



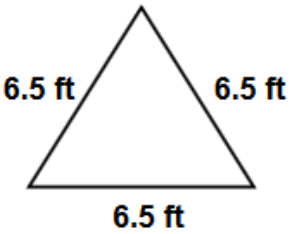
$A = 28\frac{1}{8}\ ft^2 = 28.125\ ft^2$



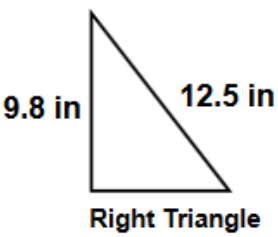
$A = 38.75\ in^2$



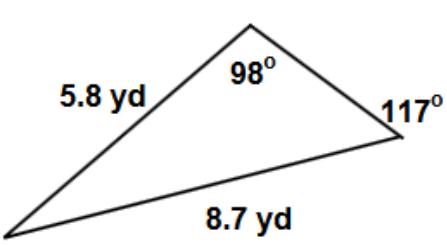
$A = 18.3\ ft^2$



$A = 38.0\ in^2$

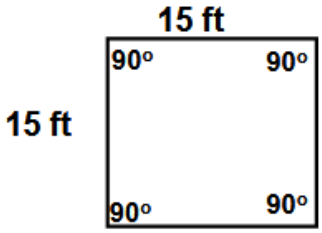


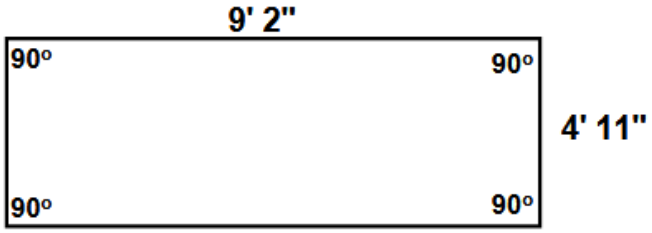
$A = 8.2\ yd^2$

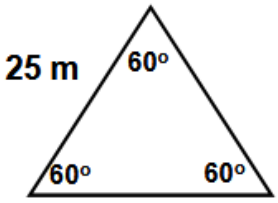


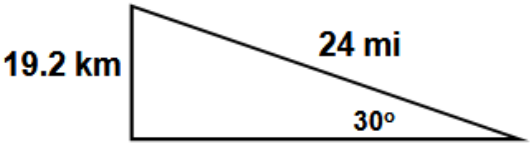
AREA OF TRIANGLES AND RECTANGLES

Identify the figures and calculate their areas. Be sure to check units and convert all numbers to the same unit where necessary.



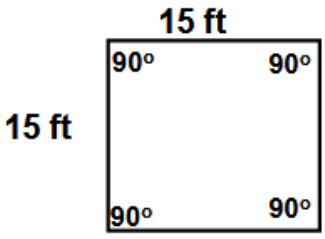




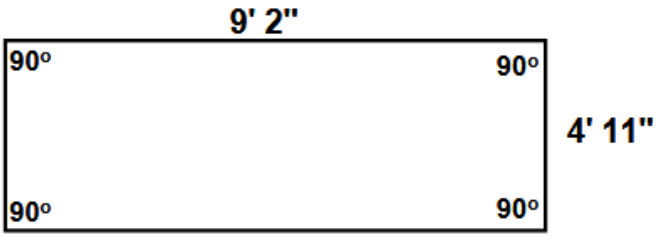


AREA OF TRIANGLES AND RECTANGLES

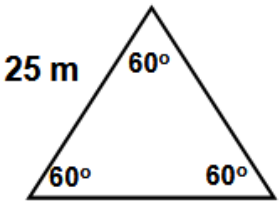
Identify the figures and calculate their areas. Be sure to check units and convert all numbers to the same unit where necessary.



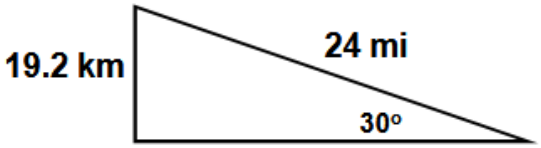
Square, A = 225 ft²



Rectangle, A = 45.07 ft²



Triangle, A = 270.6 m²



Right triangle, A = 124.7 mi² = 199.5 km²

G9 LESSON: FORMULAS FOR POLYGONS

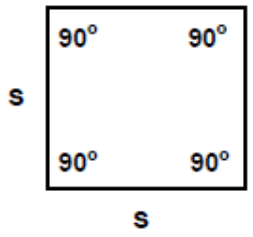
The **Area** of any geometric object is a measure of its size.

The basic unit of **Area** measure is a **square** which measures **one linear unit (U) per side**. Then, by definition, the **Area** of such a **square is 1 U^2** of **1 Square Unit**.

The **Area** of any other closed geometric figure is defined to be the sum of **areas** of inscribed, non-overlapping, squares which are so small they fully fill up the figure.

A rigorous definition is possible, but challenging. However; intuitively, the idea of **Area** is pretty easy.

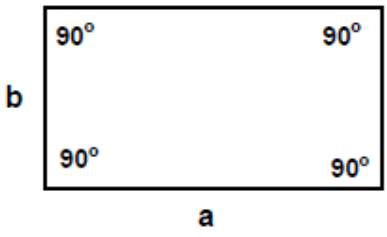
Square



$P = 4s$

$A = s^2$

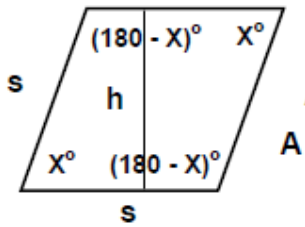
Rectangle



$P = 2(a + b)$

$A = ab$

Rhombus

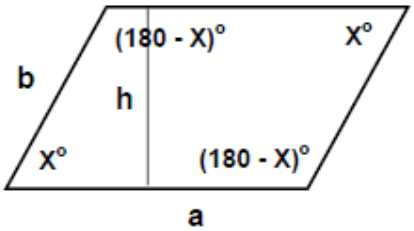


$P = 4s$

$A = sh$

$A = s^2 SIN(x^\circ)$

Parallelogram



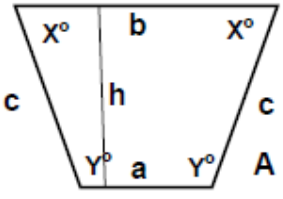
h = height

$P = 2(a + b)$

$A = ha$

$A = abSIN(x^\circ)$

Trapezoid



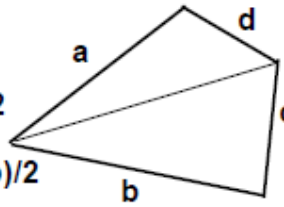
$X^\circ + Y^\circ = 180^\circ$

$P = a + b + 2c$

$A = h(a + b)/2$

$A = SIN(x^\circ)c(a + b)/2$

Quadrilateral



$P = a + b + c + d$

A = Sum 2 Triangles

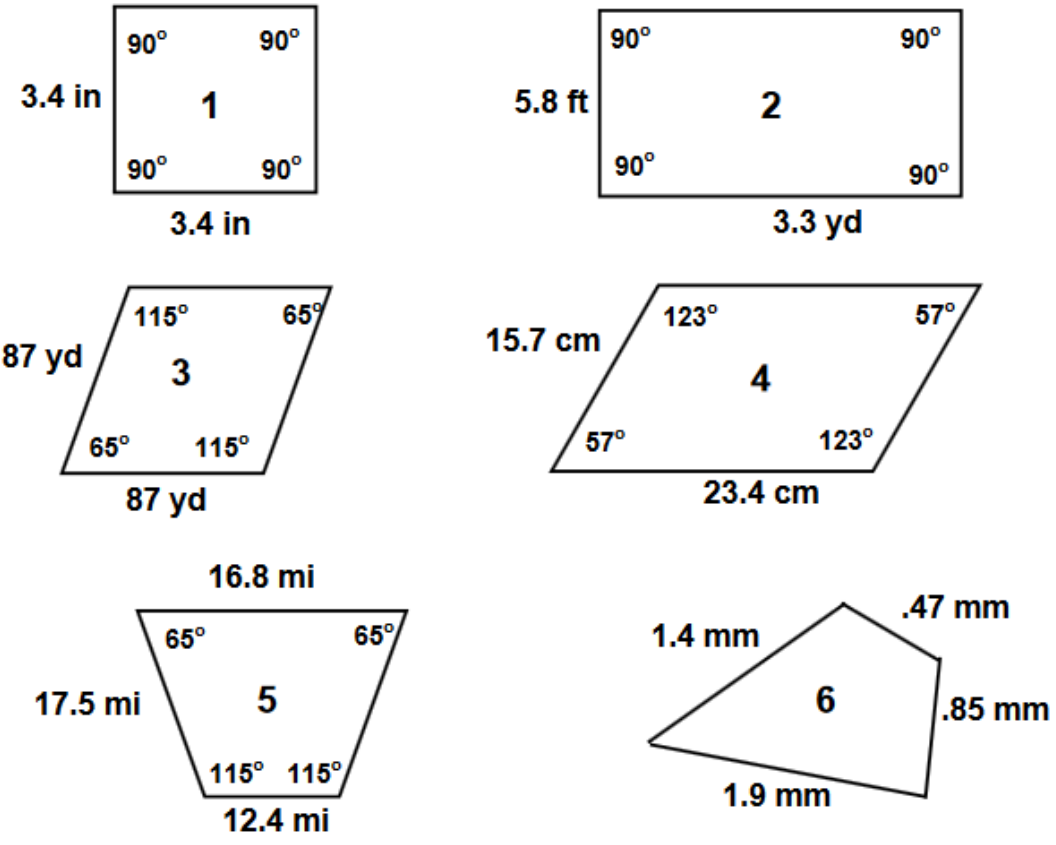
G9 Formulas for Polygons Problems

Identify the figures below and compute their Areas

Note: The Units of measure of the sides must be the same for all sides. For example, if one side is given in feet and the other side in inches, then you must convert one of the side's units accordingly. Must use same units for both sides.

Suppose a rectangle has one side 11/2 feet, and the other side 8 inches. Then, convert feet to inches.

Answers are at bottom of page # Name, Area.

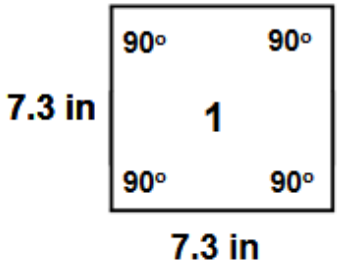


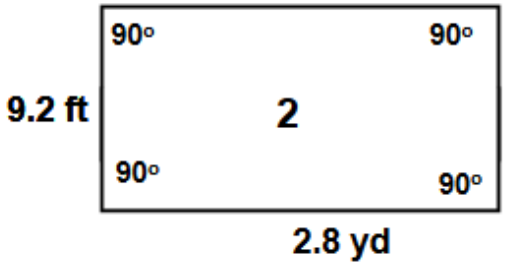
Answer: 1. Square 11.6 in^2 2. Rectangle 57.4 ft^2 or 6.4 yd^2 3. Rhombus 6860 yd^2
4. Parallelogram 308 cm^2 5. Trapezoid 231 mi^2 6. Quadrilateral Not enough Info

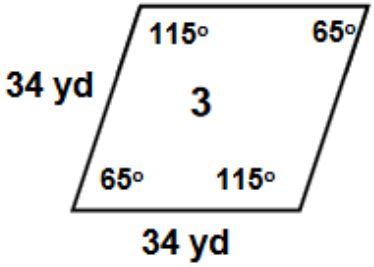
G9E

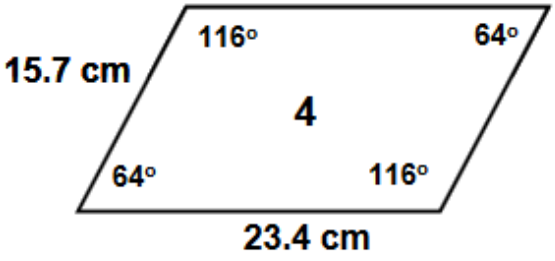
FORMULAS FOR POLYGONS

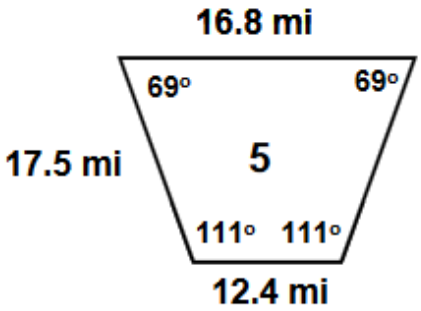
Identify the figures and calculate their areas.

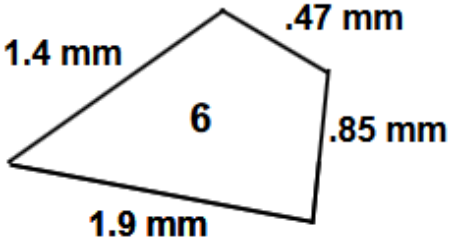


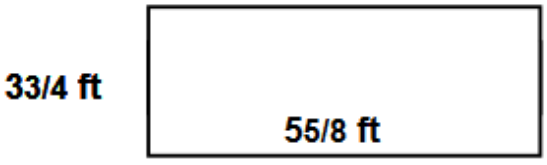


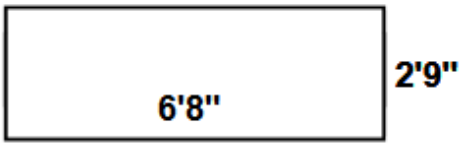










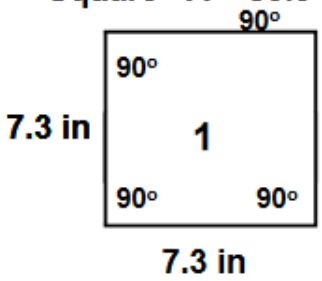


G9EA

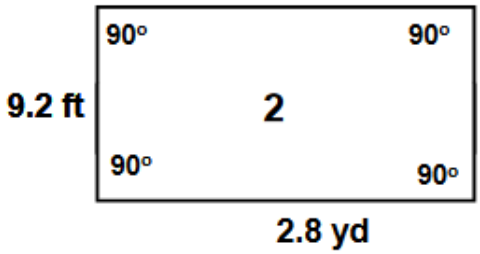
FORMULAS FOR POLYGONS

Identify the figures and calculate their areas.

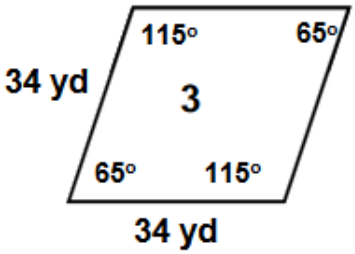
Square $A = 53.3\ in^2$



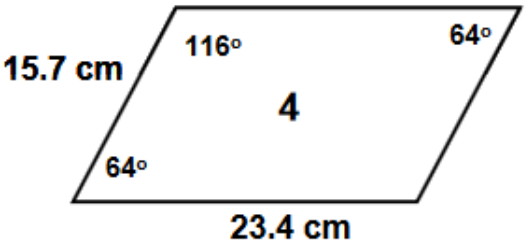
Rectangle $A = 8.6\ yd^2 = 77.3\ ft^2$



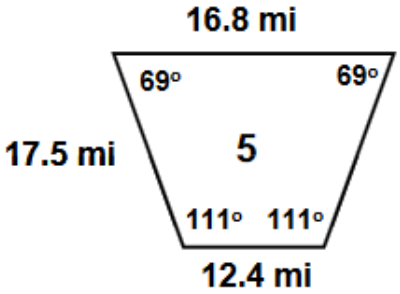
Rhombus $A = 1048\ yd^2$



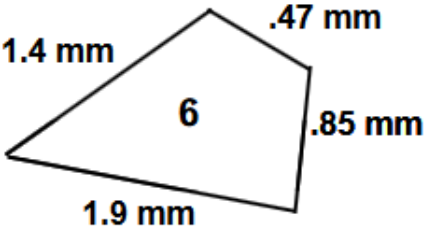
Parallelogram $A = 330.2cm^2$



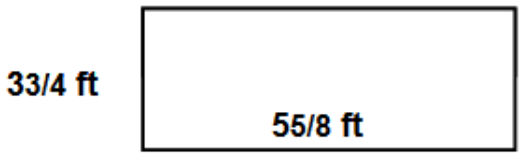
Trapezoid $A = 238.5\ mi^2$



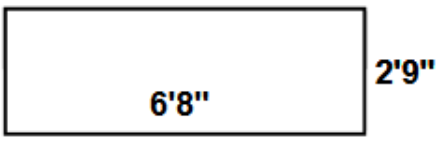
Polygon $A =$ Insufficient Information



Rectangle $A = 213/32\ ft^2 = 21.1ft^2$

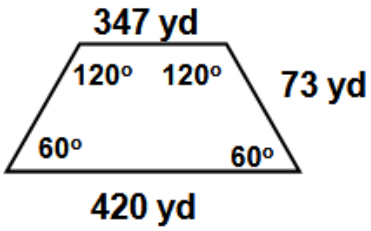


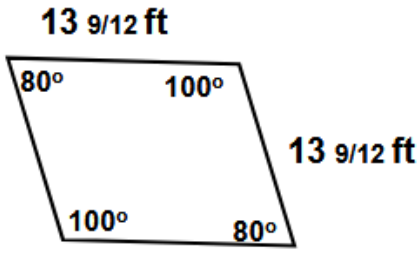
Rectangle $A = 181/3\ ft^2$

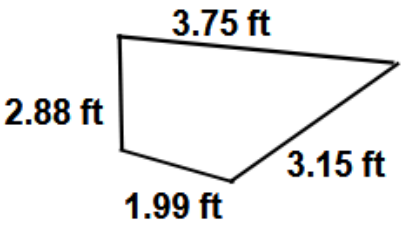


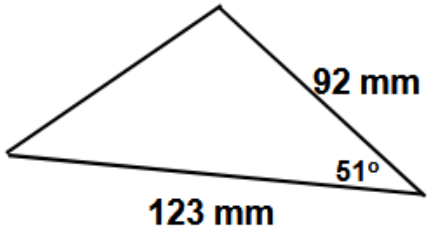
FORMULAS FOR POLYGONS

Identify the figures and calculate their areas.



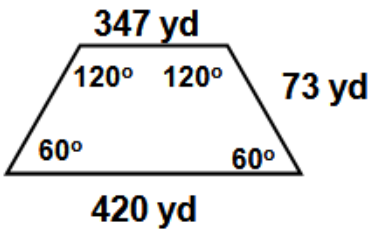




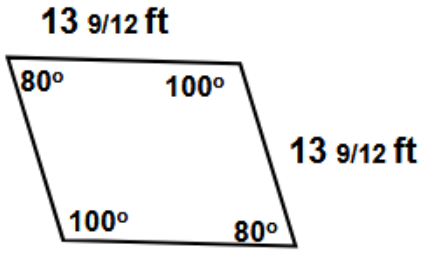


FORMULAS FOR POLYGONS

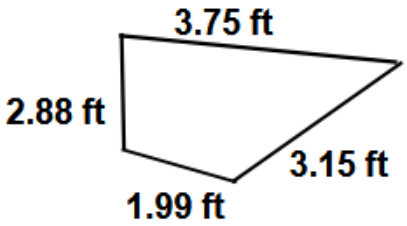
Identify the figures and calculate their areas.



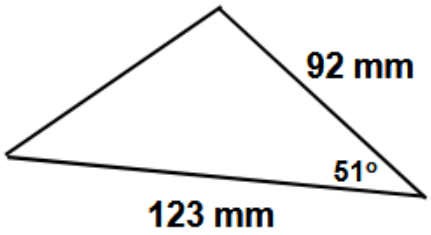
Trapezoid, A = 24,244.87 yd²



Rhombus, A = 189.1 ft²



Polygon, A = Insufficient Information



Triangle, A = 4,397.1 mm²

G10 LESSON: CIRCLES π CIRCUMFERENCE

A **Circle** is a set of points equidistant from a point called the Center. This distance is called the **Radius** of the circle.

The distance across the **Circle** from one side to the other through the center is called the **Diameter** = 2x**Radius**

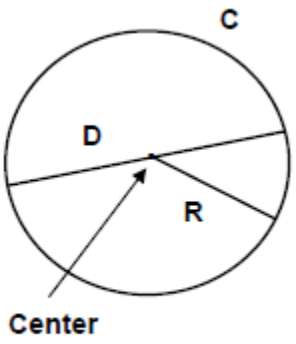
The **Circumference**, (**C**) of the **Circle** is the distance around the **Circle**, sort of its **perimeter**.

The ratio of the **Circumference** to the **Diameter** is always the same number for any circle. It is called **Pi** or π

Thus $C = \pi D = 2\pi R$

$\pi = 3.141592654 \ldots$ 22/7 is an approximation.

I usually use 3.14 unless I need a lot of accuracy, then I use 3.1416. π is called a "**transcendental number**."



R = Radius = Distance from center to any point on the circle.

D = Diameter = Distance across circle

C = Circumference

$C = \pi D = 2\pi R$

G10 Circles π Circumference Problems

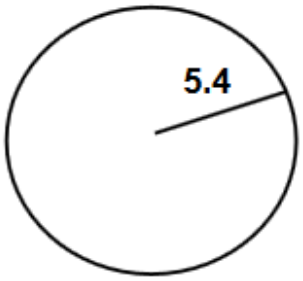
The TI 30XA has a "π Key" we will use for π.

The three formulas we must remember are:

$D = 2R$ **and** $C = 2\pi R$ **and** $A = \pi R^2$ (next lesson)

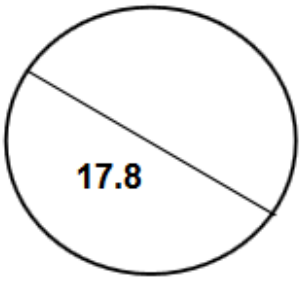
Find the unknown in the following problems.

Answers: #, R, D, C



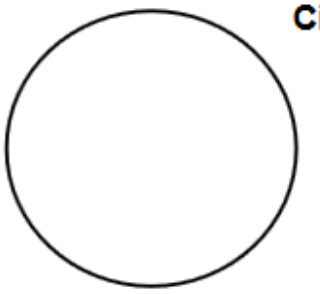
C =
D =

1



C =
R =

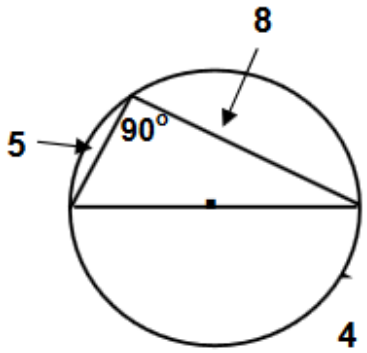
2



Circumference = 32

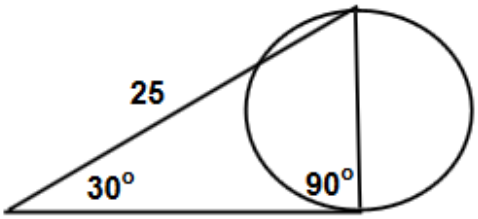
R =
D =

3



R =
D =
C =

4



R =
D =
C =

5

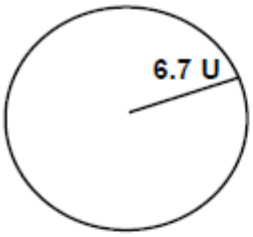
Answers 1. 5.4, 10.8, 33.9 2. 8.9, 17.8, 55.9 3. 5.1, 10.2, 32 4. 4.7, 9.4, 29.6
5. 6.25, 12.5, 39.3

G10E

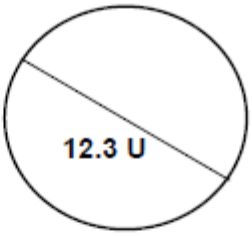
CIRCLES π CIRCUMFERENCE

R = Radius D = Diameter C = Circumference

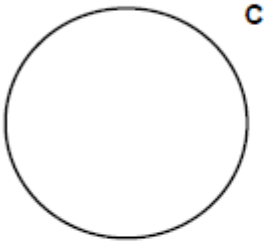
Find Unknowns



C = ? U
D = ? U

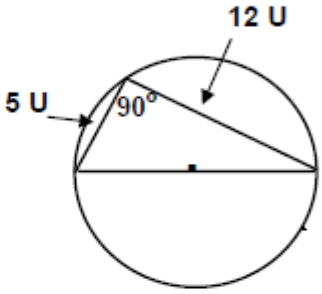


C = ? U
R = ? U

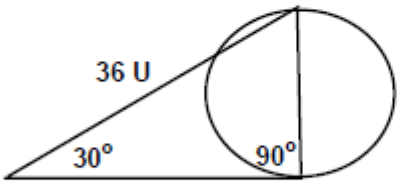


C = 53 U

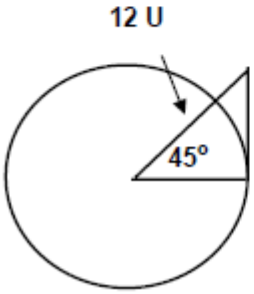
R = ? U
D = ? U



R = ? U
D = ? U
C = ? U

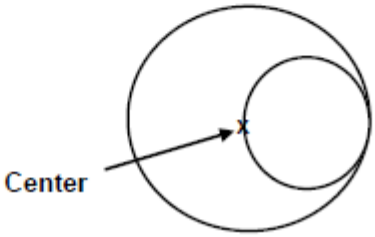


R = ? U
D = ? U
C = ? U



R = ? U
D = ? U
C = ? U

Inner Circle C = 15



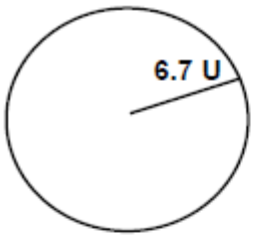
R = ? U
D = ? U
C = ? U

G10EA

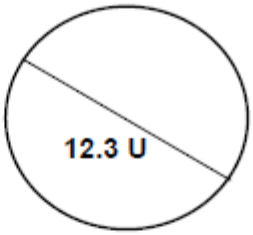
CIRCLES π CIRCUMFERENCE

R = Radius **D** = Diameter **C** = Circumference

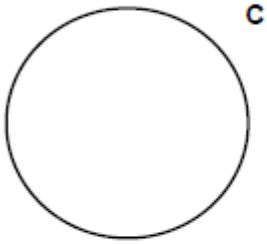
Find Unknowns



C = 42.1 U
D = 13.4 U

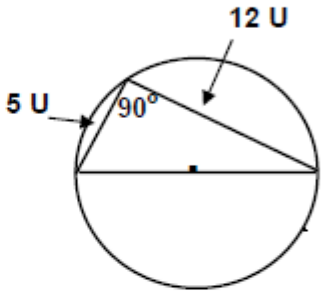


C = 38.6 U
R = 6.15 U

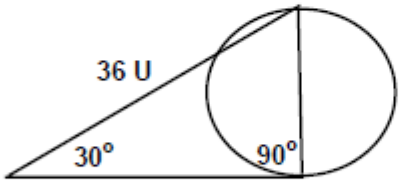


C = 53 U

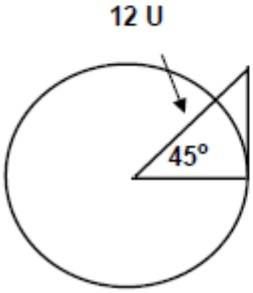
R = 8.4 U
D = 16.9 U



R = 6.5 U
D = 13 U
C = 40.8 U

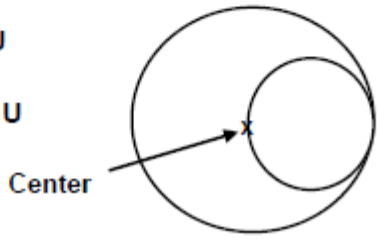


R = 9 U
D = 18 U
C = 56.6 U



R = 8.5 U
D = 17 U
C = 53.3 U

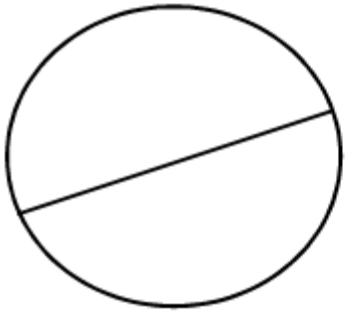
Inner Circle C = 15



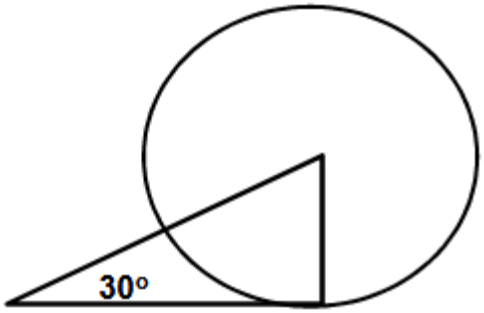
R = 4.8 U
D = 9.6 U
C = 30 U

CIRCLES π CIRCUMFERENCE

Identify the figures and calculate their perimeters. Be sure to check units and convert all numbers to the same unit where necessary.



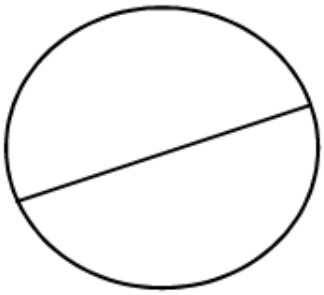
d = 460,689 light years



700 ft

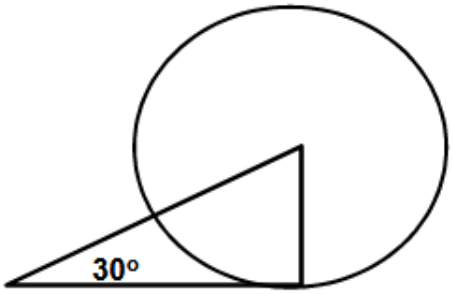
CIRCLES π CIRCUMFERENCE

Identify the figures and calculate their perimeters. Be sure to check units and convert all numbers to the same unit where necessary.



d = 460,689 light years

Circle, C = 460,689π ly = 1,447,297.2 ly



700 ft

Circle, C = 2539.32 ft

G11 LESSON: CIRCLES AREA $A = \pi R2$

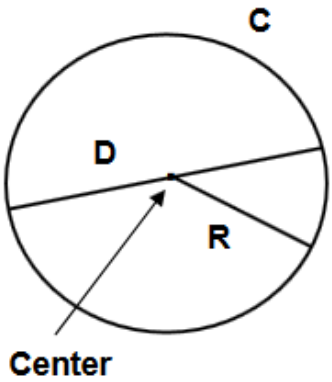
A **Circle** is a set of points equidistant from a point called the **Center**. This distance is called the **Radius** of the **circle**.

π is defined to be **C/D = Circumference/Diameter**

The **Area** (**A**) of the **Circle** turns out to be $A = \pi R^2$

This is a remarkable fact first discovered by the Greek genius mathematician **Archimedes**. It now is very easy to calculate the **Area** of any **Circle** using a calculator.

Remember: π is about 3.14



R = Radius = Distance from center to any point on the circle.

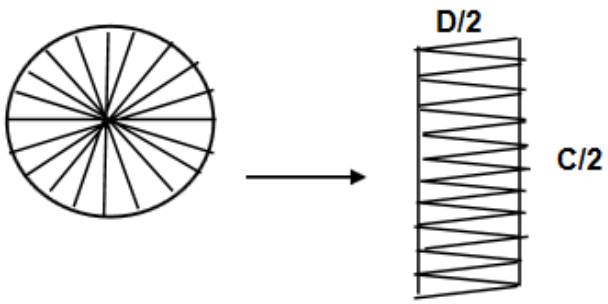
D = Diameter = Distance across circle

C = Circumference

C = πD = 2πR

A = πR^2

Archimedes "Proof" of Area. A = (C/2)x(D/2) = (2πR/2)x(2R/2) = πR^2



A = (D/2)X(C/2)

G11 Circles π Area Problems

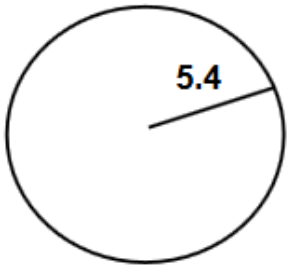
The TI 30XA has a "π Key" we will use for π.

The three formulas we must remember are:

D = 2R **and** **C** = 2πR **and** **A** = πR2 (**next lesson**)

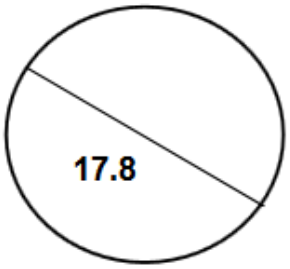
Find the Area in the following problems.

Answers: #, R, A



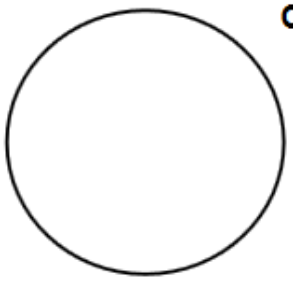
R =
A =

1



R =
A =

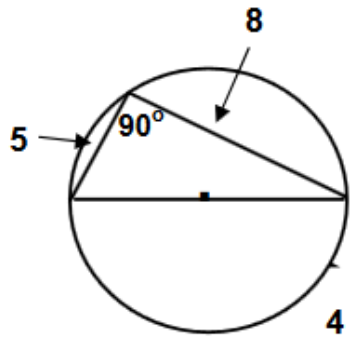
2



Circumference = 32

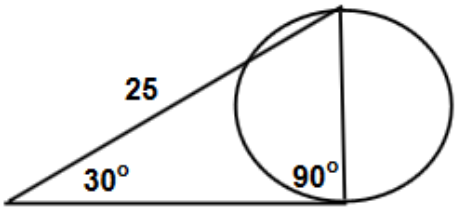
R =
A =

3



R =
A =

4



R =
A =

5

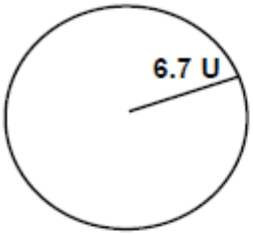
Answers **1. 5.4, 91.6** **2. 8.9, 249** **3. 5.1, 81.5** **4. 4.7, 70**
5. 6.25, 123

G11E

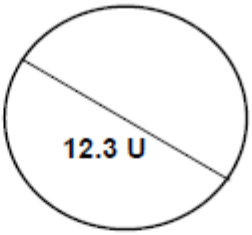
CIRCLES π AREA

R = Radius, **D** = Diameter, **C** = Circumference

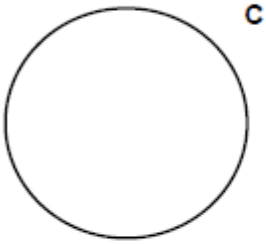
Find Area



A = ? U²

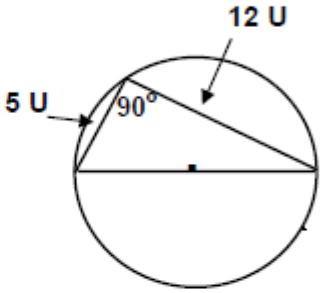


A = ? U²

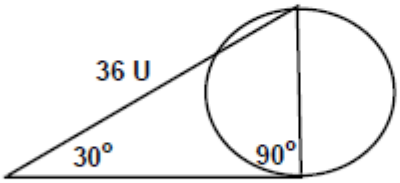


C = 53 U

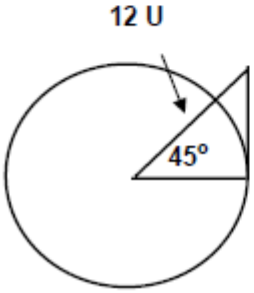
A = ? U²



A = ? U²

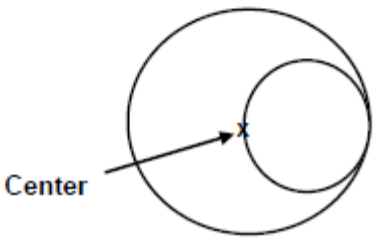


A = ? U²



A = ? U²

Inner Circle C = 15



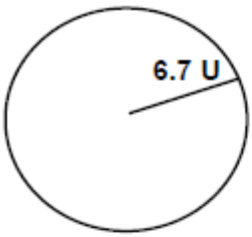
A = ? U²

G11EA

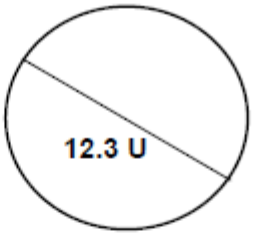
CIRCLES π AREA

R = Radius, **D** = Diameter, **C** = Circumference

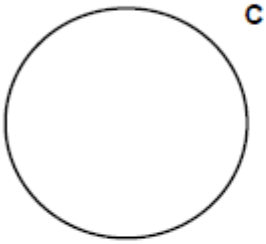
Find Area



A = 141 U^2

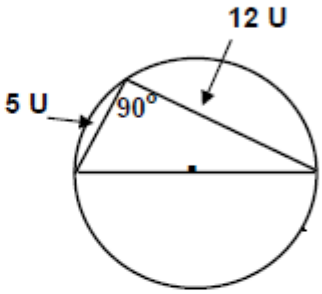


A = 118.9 U^2

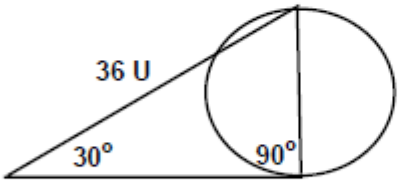


C = 53 U

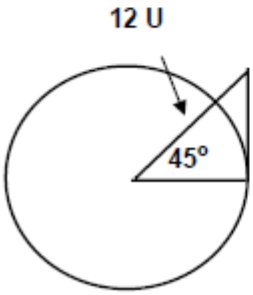
A = 223.5 U^2



A = 132.7 U^2

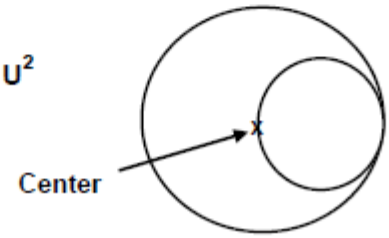


A = 254.5 U^2



A = 226 U^2

Inner Circle C = 15

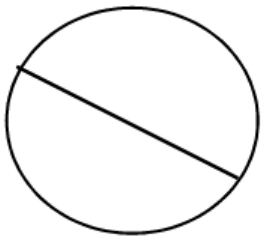


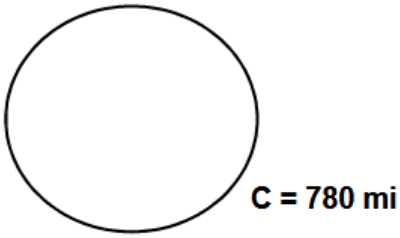
A = 71.6 U^2

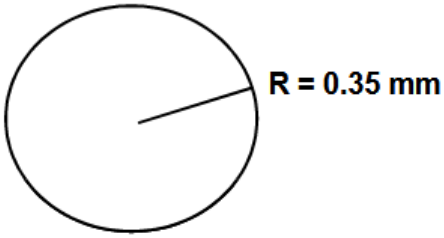
CIRCLES π AREA

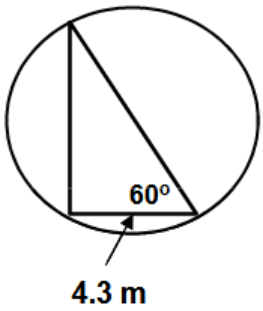
Calculate the areas of the figures below. Be sure to treat units appropriately!

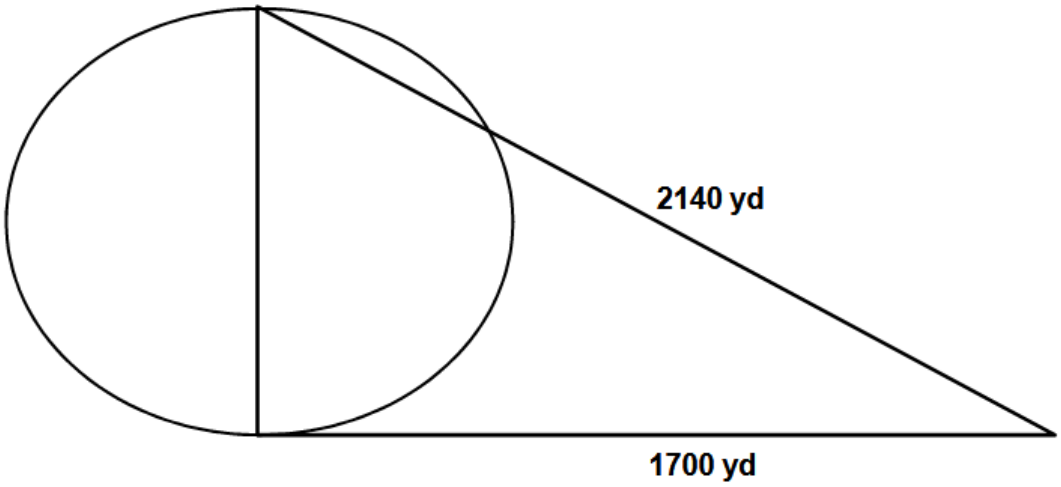
R = Radius, **D** = Diameter, **C** = Circumference







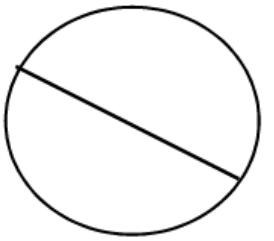




CIRCLES π AREA

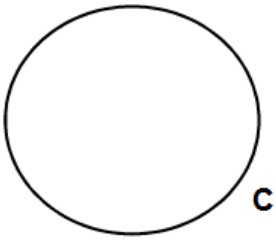
Calculate the areas of the figures below. Be sure to treat units appropriately!

R = Radius, **D** = Diameter, **C** = Circumference



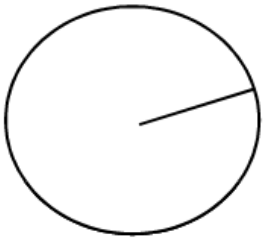
D = 5 ft

A = 19.6 ft²



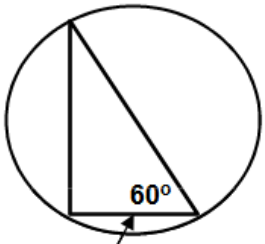
C = 780 mi

A = 48,415 mi²



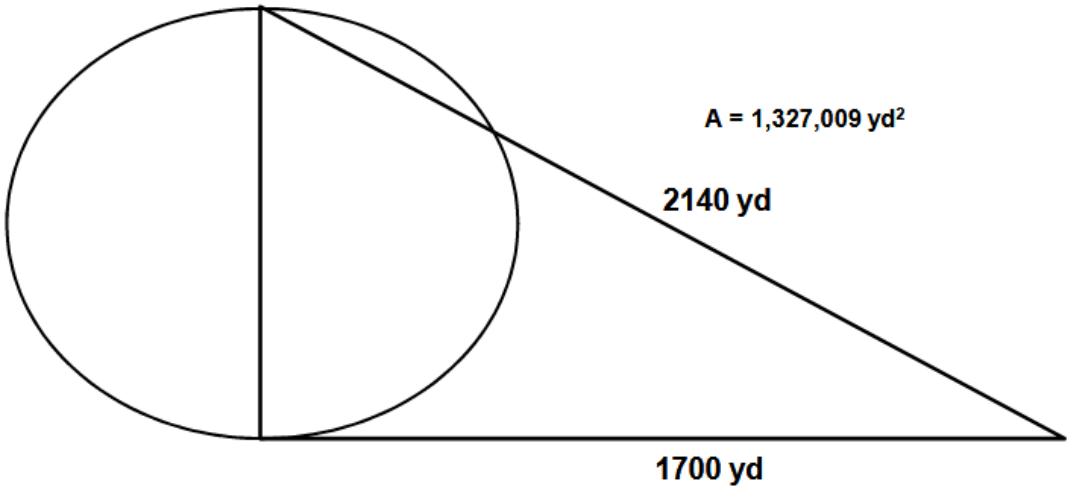
R = 0.35 mm

A = 0.385 mm²



4.3 m

A = 43.57 m²



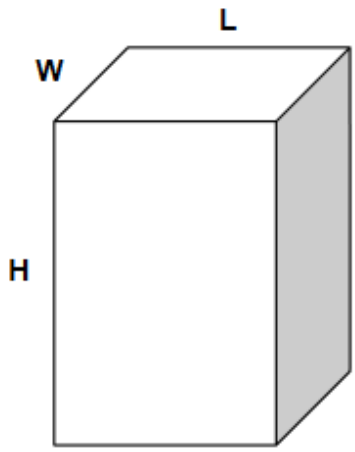
A = 1,327,009 yd²

G13 LESSON: SURFACE AREAS BLOCKS AND CYLINDERS

Calculate the Area of each "**face**" or "**side**" for a block.

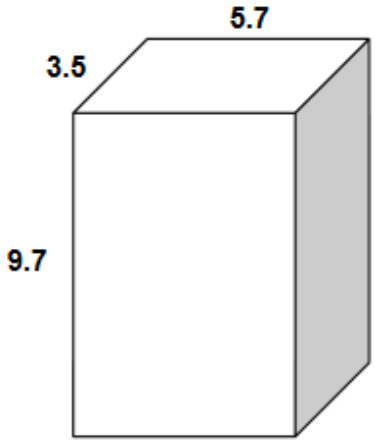
The **Ends** and then the **Lateral Area** for the **Cylinder**

Area is measured in **Square Units, U^2**

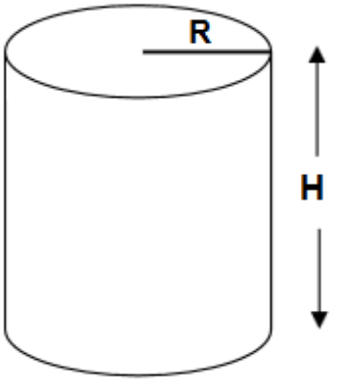


$$A = 2HL + 2HW + 2LW$$

$$= 2(HL + HW + LW)$$

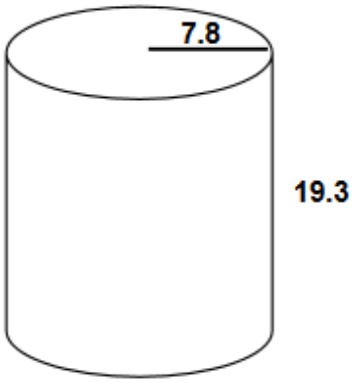


$$A = 2(3.5x5.7 + 3.5x9.7 + 5.7x9.7) = 218\ U^2$$



$$A = 2\pi R^2 + 2\pi RH$$

$$= 2\pi R(R + H)$$

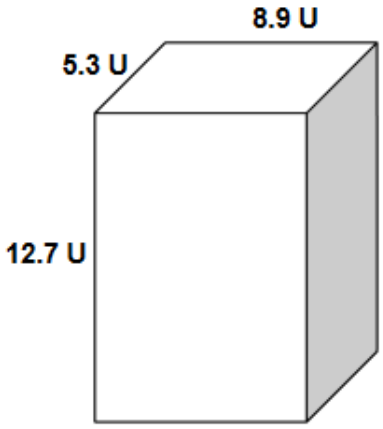


$$A = 2x\pi x7.8^2 + 2\pi x7.8x19.3 = 1328\ U^2$$

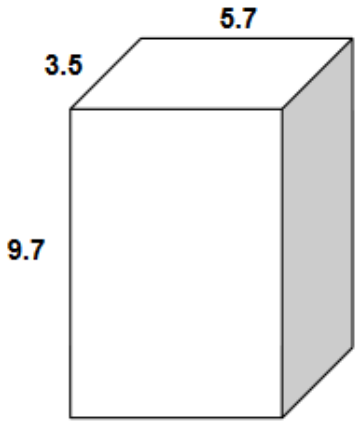
G13E

SURFACE AREAS BLOCKS AND CYLINDERS

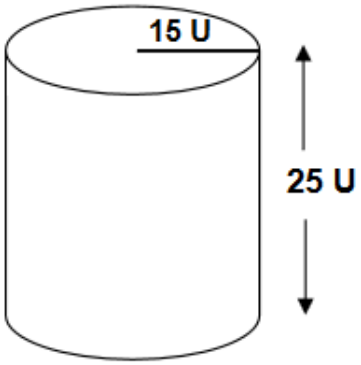
Calculate the Total Surface Area, U^2, in each case.



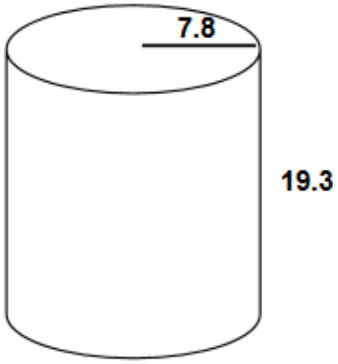
Area = ? U^2



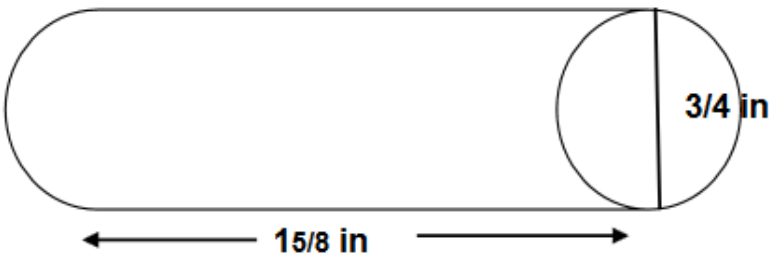
A = ? U^2



Area = ? U^2



A = ? U^2

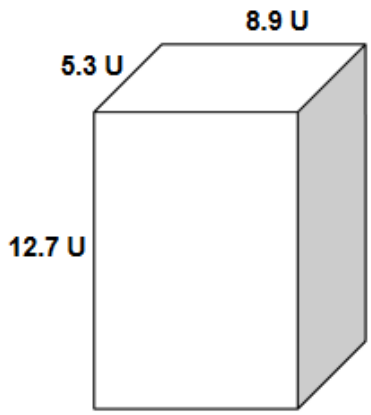


Total Surface Area = ? in^2

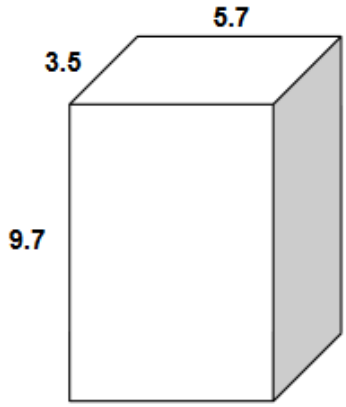
G13EA

SURFACE AREAS BLOCKS AND CYLINDERS

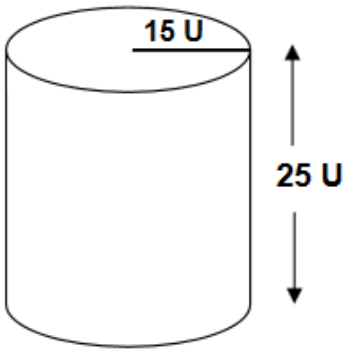
Calculate the Total Surface Area, U^2, in each case.



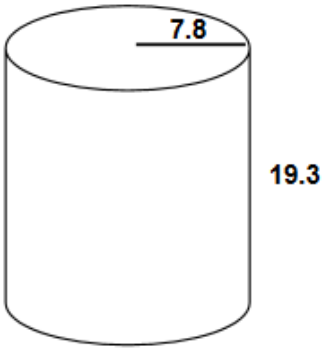
Area = 455 U^2



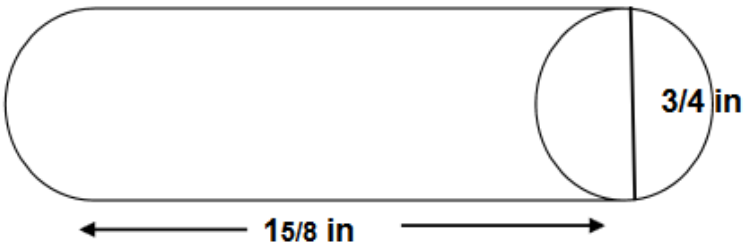
A = 2(3.5x5.7 + 3.5x9.7 + 5.7x9.7) = 218 U^2



Area = 3770 U^2



A = $2\pi x7.8^2$ + $2\pi x7.8x19.3$ = 1328 U^2

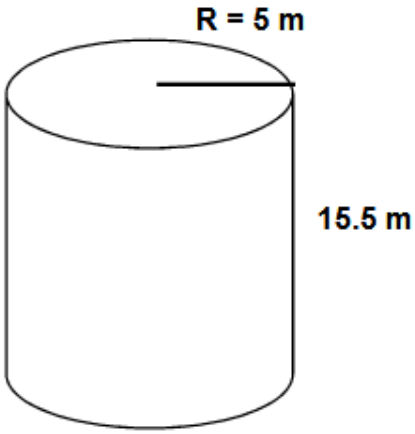


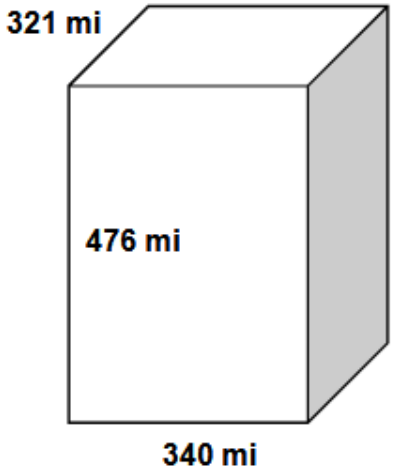
Total Surface Area = 4.71 in^2

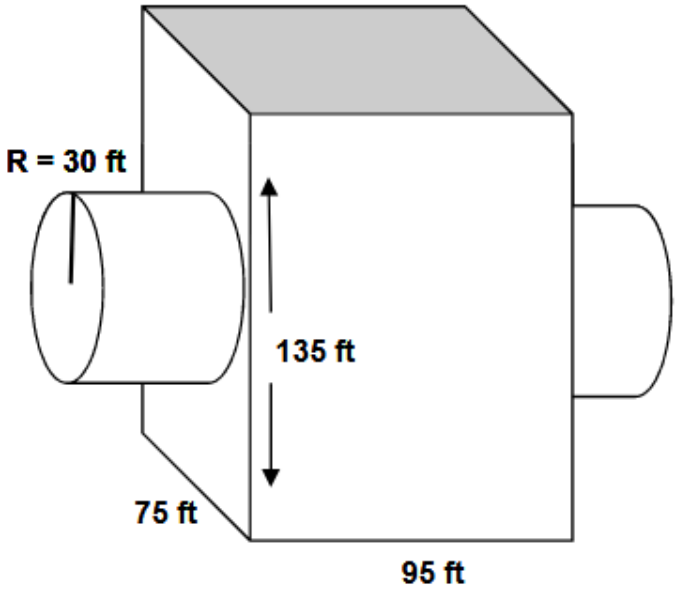
G13ES

SURFACE AREAS BLOCKS AND CYLINDERS

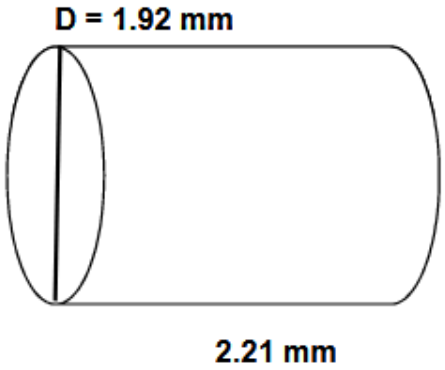
Calculate the surface area of the figures below. Be sure to treat units appropriately!







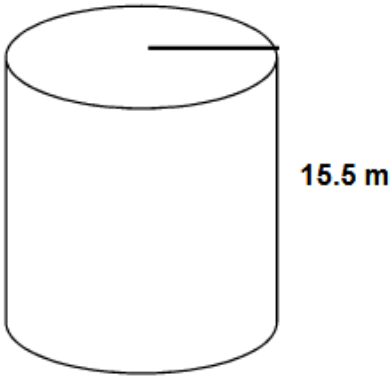
Note: the cylinder of length 140 ft is centered inside the block.



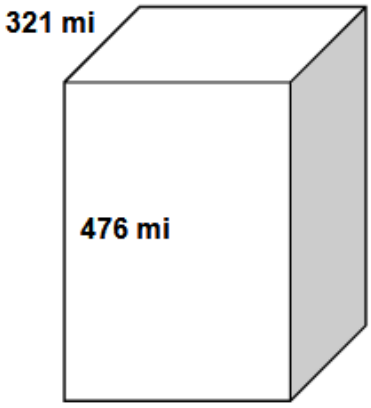
G13ESA

SURFACE AREAS BLOCKS AND CYLINDERS

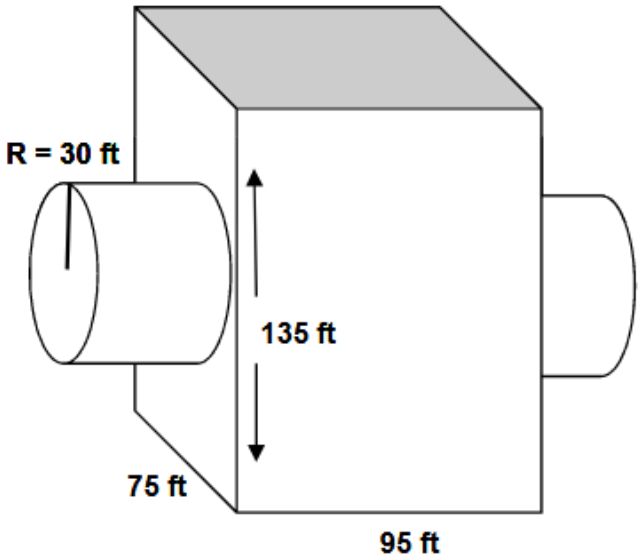
Calculate the surface area of the figures below. Be sure to treat units appropriately!



SA = 644 m²

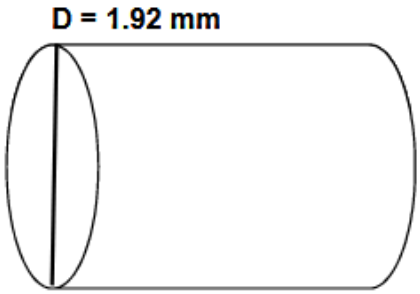


SA = 847,552 mi²



Note: the cylinder of length 140 ft is centered inside the block.

SA = 68,632.3 ft²

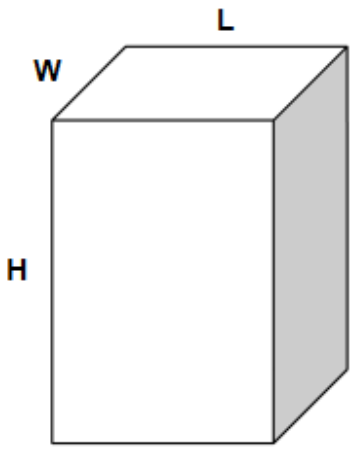


SA = 19.12 mm²

G15 LESSON: VOLUMES BLOCKS AND CYLINDERS

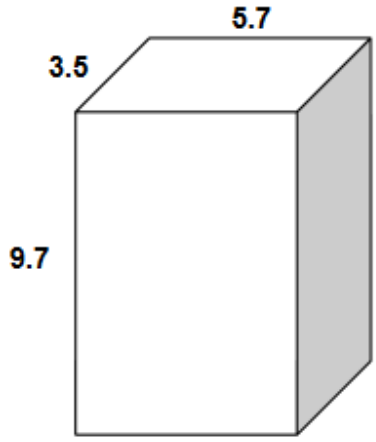
Volume = (**Area of Base**) x **Height**

Volume is measured in **Cubic Units, U^3**



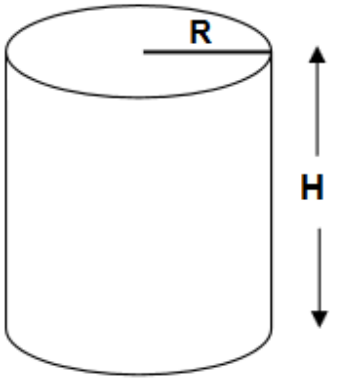
$$A = 2HL + 2HW + 2LW$$

$$V = LWH$$



$A = 2(3.5x5.7 + 3.5x9.7 + 5.7x9.7) = 218\ U^2$

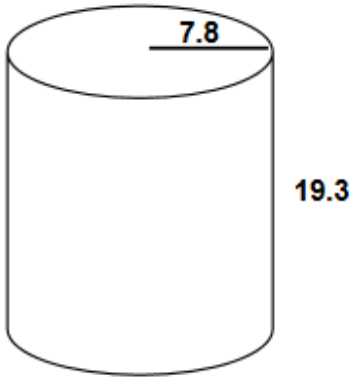
$V = 3.5x5.7x9.7 = 194\ U^3$



$$A = 2\pi R^2 + 2\pi RH$$

$$= 2\pi R(R + H)$$

$$V = \pi R^2 H$$



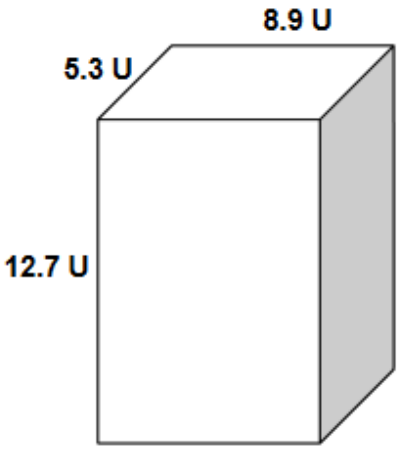
$A = 2x\pi x7.8^2 + 2\pi x7.8x19.3 = 1328\ U^2$

$V = \pi x7.8^2 x19.3 = 1174\ U^3$

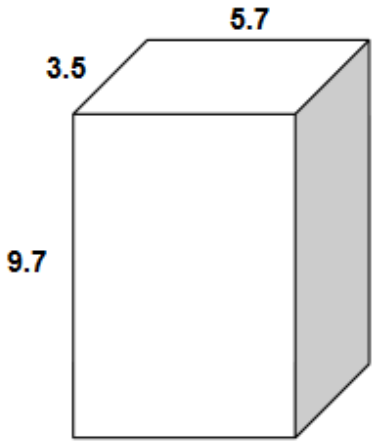
G15E

VOLUMES BLOCKS AND CYLINDERS

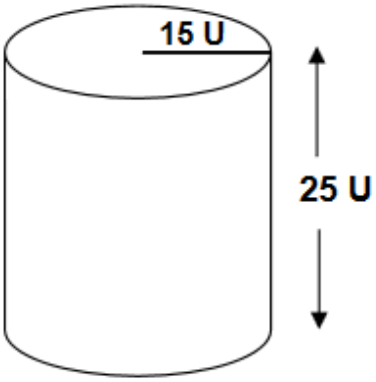
Calculate the **Volume, U^3**, in each case.



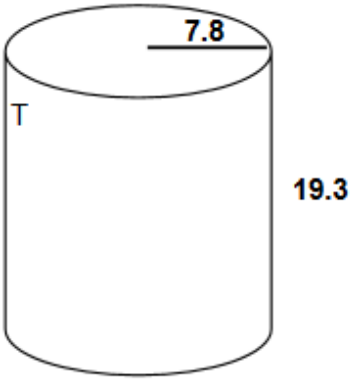
Volume = ? U^3



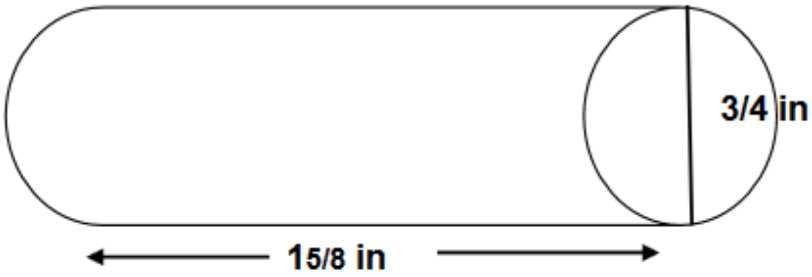
Volume = ? U^3



Volume = ? U^3



Volume = ? U^3

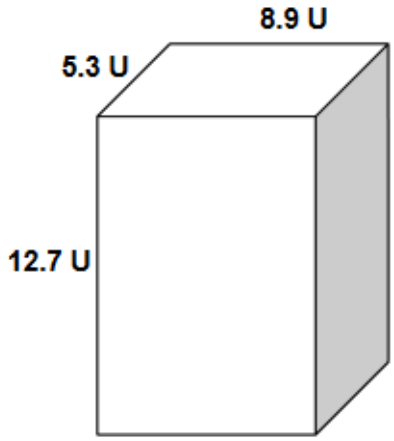


Volume = ? U^3

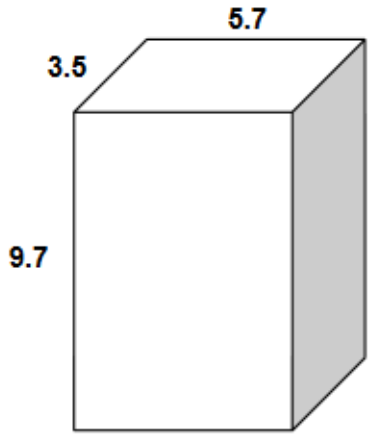
G15EA

VOLUMES BLOCKS AND CYLINDERS

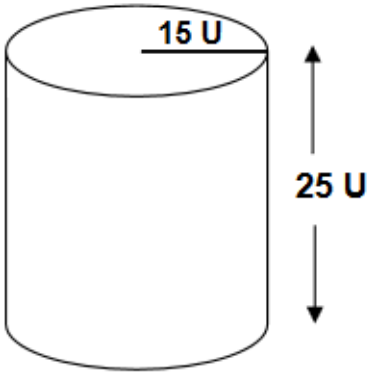
Calculate the **Volume, U^3**, in each case.



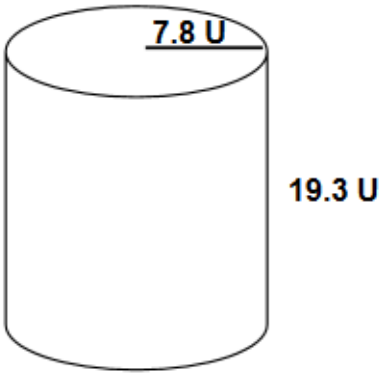
Volume = 599 U^3



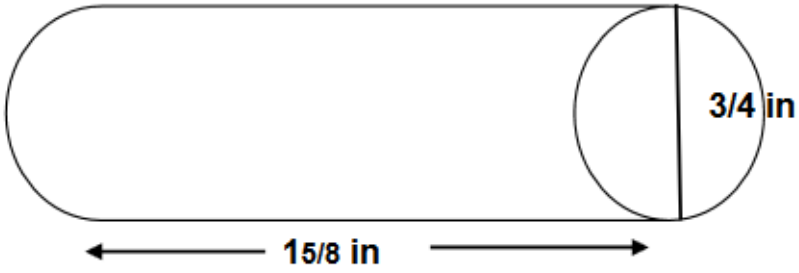
Volume = 193.5? U^3



Volume = 17,671 U^3



Volume = 3689 U^3

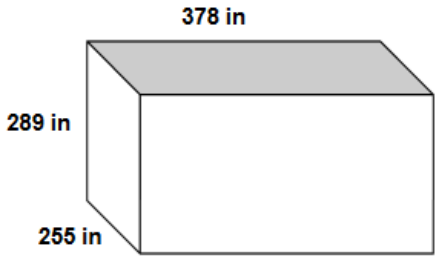


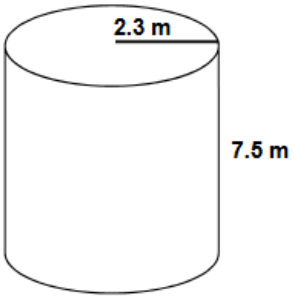
Volume = .718 in^3

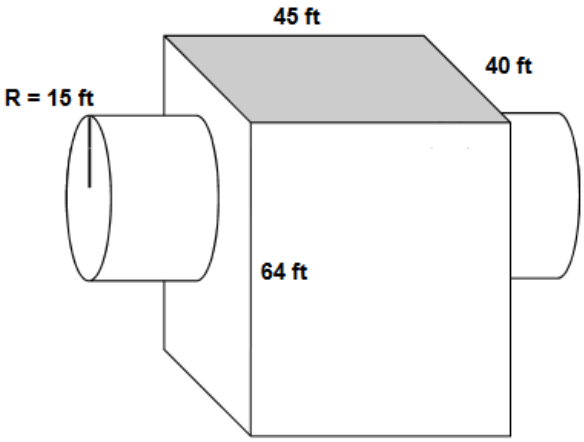
G15ES

VOLUMES BLOCKS AND CYLINDERS

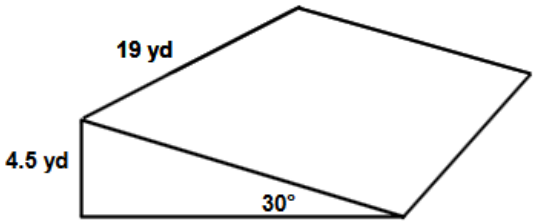
Find the volumes of the figures below. Be mindful of units!







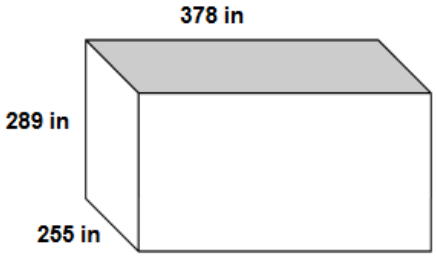
The cylinder of length 65 ft is centered inside the block.



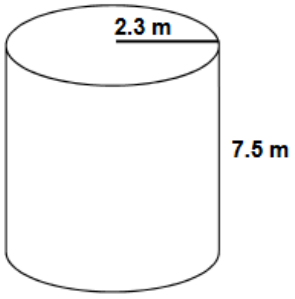
G15ESA

VOLUMES BLOCKS AND CYLINDERS

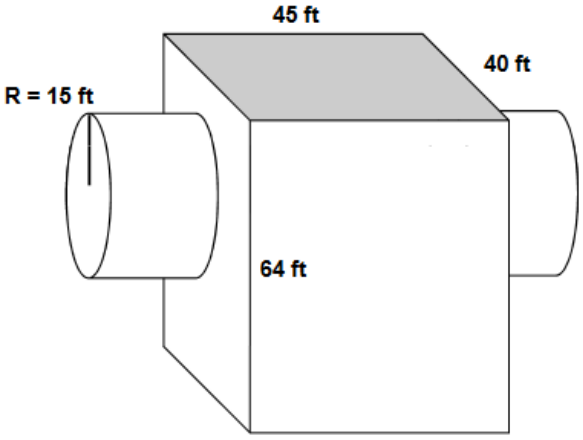
Find the volumes of the figures below. Be mindful of units!



$V = 27{,}856{,}710\ in^3$

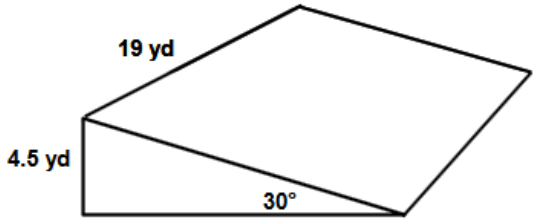


$V = 124.6\ m^3$



The cylinder of length 65 ft is centered inside the block.

$V = 129{,}337\ ft^3$



$V = 333.2\ yd^3$