ELSIE

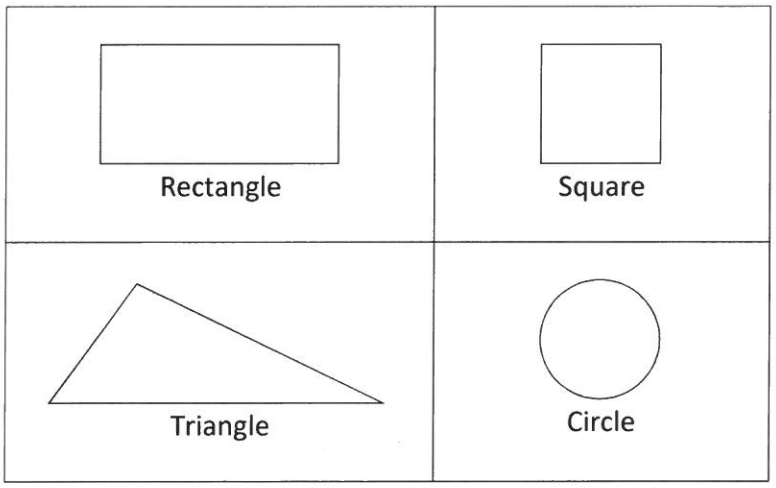
Lesson 2: Measuring 2D Shapes: Perimeter and Area

You have looked at linear measurements (and how to convert them from unit to unit). We are now going to look at 2-Dimensional (2D) shapes, and how those shapes are measured.

A 2D shape is a perfectly flat shape – it has two ***dimensions*** (commonly called *length* and *width*, or *base* and *height*). The top of your desk is not 2 dimensional – it has *depth* (or *thickness*), but the SURFACE on the top of your desk is 2-Dimensional (the part you can touch). 2D objects have NO depth – if you could look at them from the side you would see NOTHING.

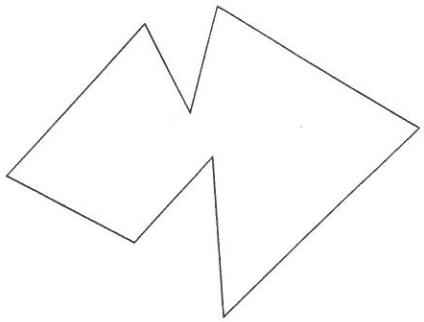
A piece of paper is close to being 2-dimensional, but it does have a *depth* (or *thickness*) – you can see a piece of paper from the side if you squint hard enough!

The following are common 2-dimensional shapes:



You see these shapes EVERYWHERE, but you can never hold one – it has no thickness – they only appear as being drawn on flat surfaces.

It is also important to note that a 2D shape does not have to be one of the common (named) shapes that you see above. The shape shown at right is also 2-dimensional, but it does not have a special name. *Any enclosed shape that you can draw on a piece of paper is 2-dimensional (2D).*



I have no name. :(

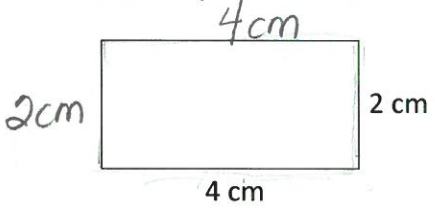
Any 2D shape is made up of a series of lines (or sides - a circle has one curved side). The lines themselves have *linear measurements* – they can be measured using standard units (cm, in, km, etc.). However, the shape *created* by those lines (the 2D shape) has two main types of measurements associated with it: Each 2D shape has a ***perimeter*** and an ***area***.

Perimeter

The ***perimeter*** of a 2D object is the *linear distance* around the outside of the object. There is no formula for perimeter (except for a circle); you simply **add the lengths of all of the sides of the object**.

Example 1

Determine the perimeter of the rectangle shown below.

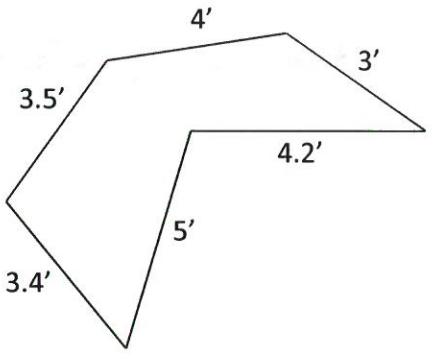


$P = 4 + 4 + 2 + 2$

$P = 12\ cm$

Example 2

Determine the perimeter of the shape shown below.

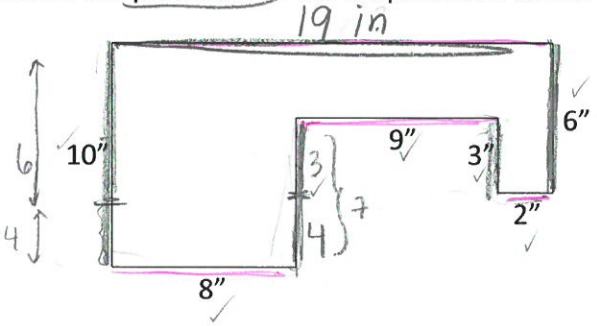


$P = 3.5 + 4 + 3 + 4.2 + 5 + 3.4$

$P = 23.1\ ft.$

Example 3

Determine the perimeter of the shape shown below



$P = 19 + 6 + 2 + 3 + 9 + 7 + 8 + 10$

$P = 64\ in.$

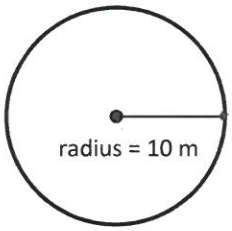
The Perimeter of a Circle: Circumference

The perimeter of a circle has a special name – it is called the ***circumference***. It gets a special name (and its own formula) because you cannot (easily) measure the 'side' of a circle with a ruler. This is where the special number π comes in.

The circumference of a circle is slightly more than 6 times the length of the radius. The formula for the circumference of a circle is $C = 2\pi r$. The symbol $\boldsymbol{\pi}$ is called **Pi** and represents the number 3.1415926..... Your calculator should have a Pi symbol on one of its buttons; this is the button you'll use when a formula has $\boldsymbol{\pi}$ in it.

Example 3

Determine the circumference of the circle shown below.



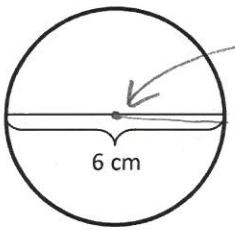
$C = 2\pi r$

$C = 2 \times \pi \times 10$

$C = 62.83 \text{ m}$

Example 4

Determine the circumference of the circle shown below. (Hint: You have been given the *diameter* of the circle: The diameter is twice as long as the radius – you need to divide the diameter by 2 before you use the circumference formula.)



diameter = the length from one end of circle to another passing through the centre

$d = 6$

$r = 3$

$C = 2 \times \pi \times r$

$C = 2 \times \pi \times 3$

$C = 18.85 \text{ cm}$

$C = 2 \times \pi \times r$ (2 and r equal to diameter)

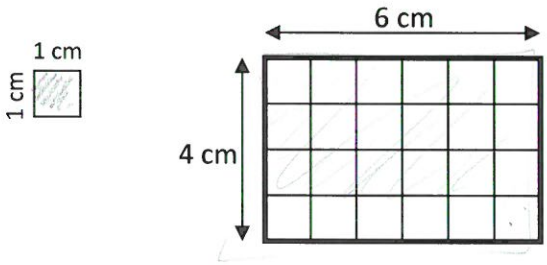
$C = \pi \times d$

$C = \pi \times 6$

$C = 18.85 \text{ cm}$

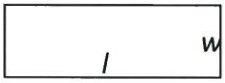
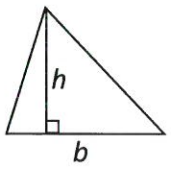
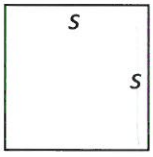
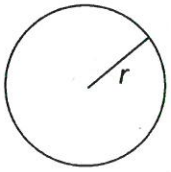
Area

Area is the measurement of the amount space covered by a 2-dimensional (2D) object. Area is measured in units squared (units^2). For example, the rectangle below has been filled with blocks that are one cm on each side. Each little block is referred to as a 'square centimeter'. (A square with centimeter-long sides).



Since there are 24 of these boxes contained in the rectangle, we say that the rectangle has an ***area* of 24 *square centimeters***.

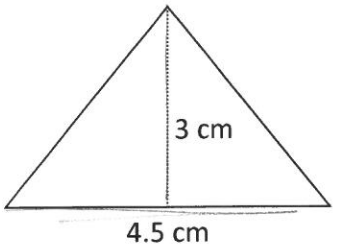
The short-cut to arrive at this number is to use the formula for the area of a rectangle, namely: $A = lw$. (Keep and mind that the actual labels used for the sides might be different – some formulas use *base (b)* and *height (h)* instead of length and width – the concept is the same.) By multiplying the length by the width, you can quickly and accurately calculate the area of a rectangle. Some important area formulas are:

Figure Name	Diagram	Formula	Figure Name	Diagram	Formula
rectangle		$A = lw$	triangle		$A = \frac{1}{2}bh$
square		$A = lw$ **OR** $A = s^2$	circle		$A = \pi r^2$

These formulas will be provided on your Unit Test and the Final Exam – there is no need to make room for them on your resource page.

Area is commonly used to calculate things like amount of paint needed to cover a wall, or how much carpet is needed to cover a floor.

Example 5
Determine the area of the triangle shown below.



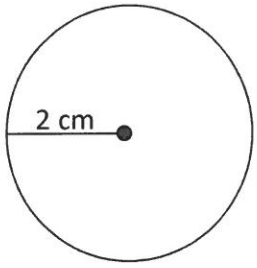
$A = \frac{1}{2} \times b \times h$

$A = \frac{1}{2} \times 4.5 \times 3$

$A = 6.75\ cm^2$

Note: unit is cm^2

Example 6
Determine the area of the circle shown.

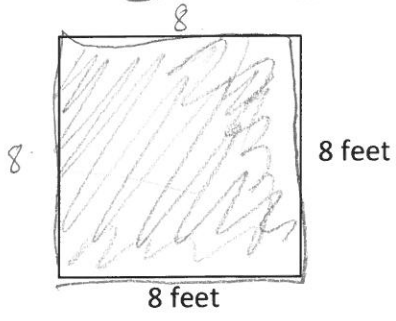


$A = \pi \times r^2$

$A = \pi \times 2^2$

$A = 12.57\ cm^2$

Example 7
Determine the area of the square shown below.



$A = s^2$

$A = 8^2$

$A = 64\ ft^2$

$P = 8 + 8 + 8 + 8$

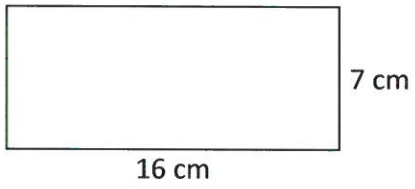
$P = 32\ ft$

Assignment 2: Measuring 2D Shapes: Perimeter and Area

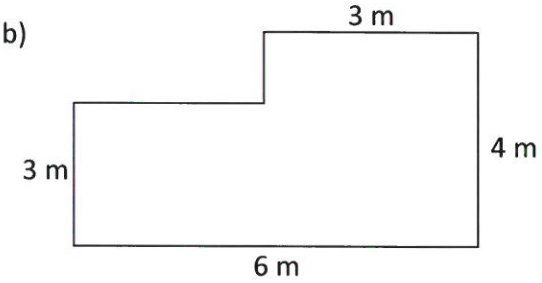
Find the requested values in each question. Remember to **include the appropriate unit** with your answer. Round to two decimal places where rounding is required.

1. Find the **perimeter** of the following objects:

a)

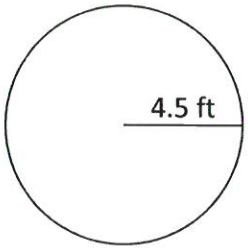


b)

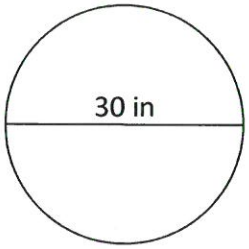


2. Find the **circumference** of the following circles:

a)

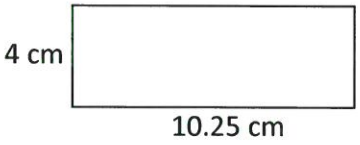


b)

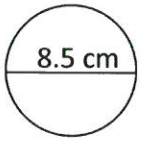


3. Find the **area** of the following shapes:

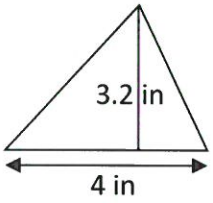
a)



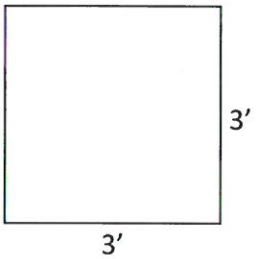
b)



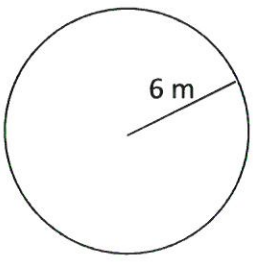
c)



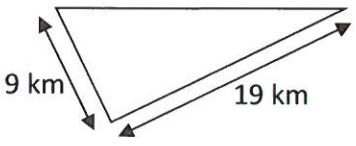
d)



e)



f)

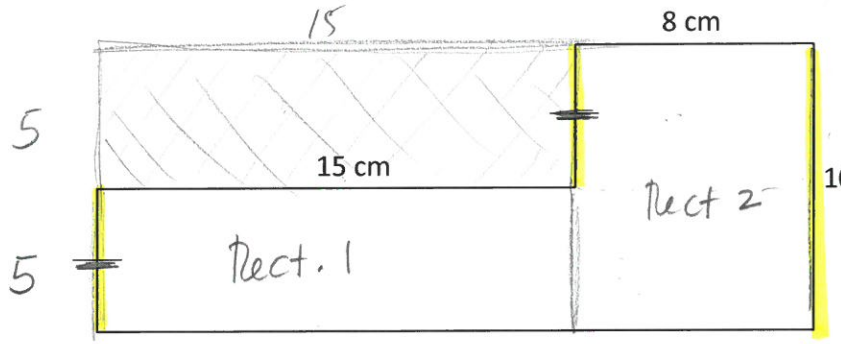


Lesson Three: Area of Irregular Shapes

There are times where you need to find the area of a shape which is not one of our 'standard' shapes (rectangle, square, triangle, circle). The following examples will show how we use formulas for the area of shapes that we already know, and apply them to new shapes.

Example 1: Area of a Composite Shape

Find the area of the figure shown below:



OTHER WAY

Whole rectangle

$A = 10 \times 23$

$A = 230\ cm^2$

Area to "cut out"

$A = 15 \times 5 = 75\ cm^2$

Remaining area $= 230 - 75$

$= 155\ cm^2$

$A = l \times w$

$A = 15 \times 5$

$A = 75\ cm^2$

$A = l \times w$

$A = 8 \times 10$

$A = 80\ cm^2$

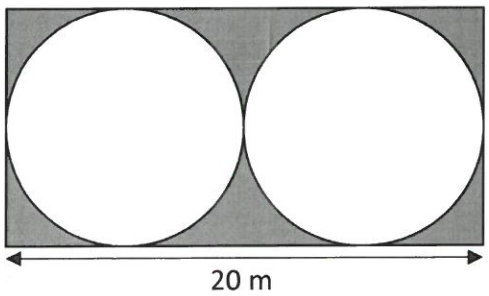
Total Area

$75 + 80$

$= 155\ cm^2$

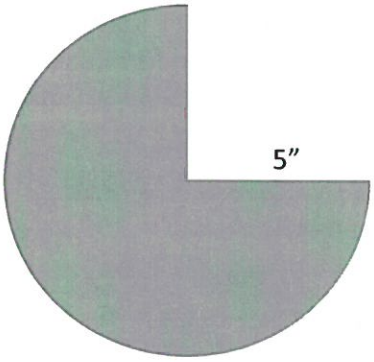
Example 2: Shaded Area

Find the shaded area of the following figure:



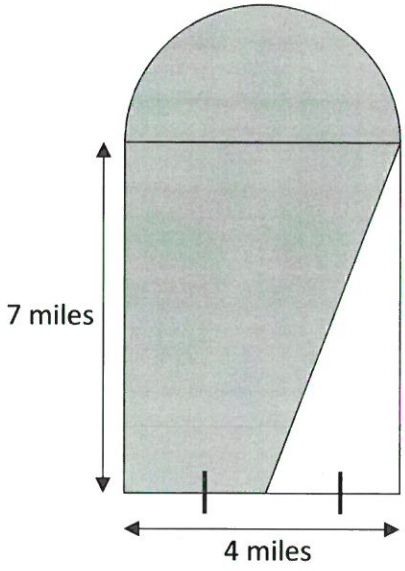
Example 3: Fraction of shape

Find the area of the following figure.



Example 4: Putting It All Together

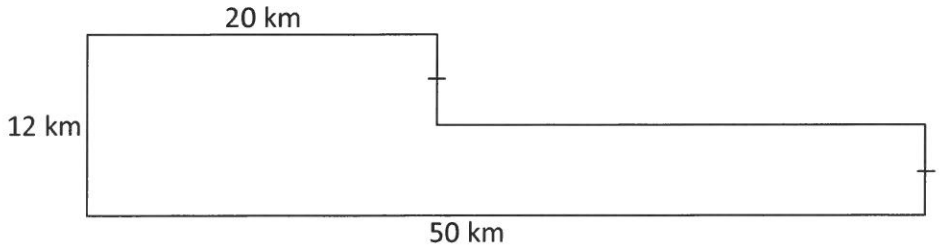
Find the shaded area of the following figure:



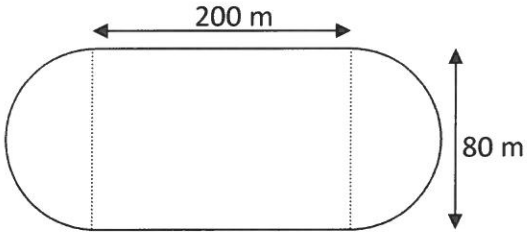
Assignment 3: Area of Irregular Shapes

1. Find the **area** of each of the figures shown below.

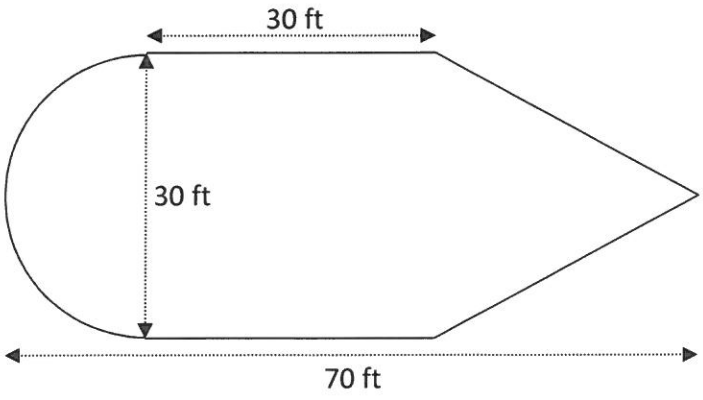
a)



b)

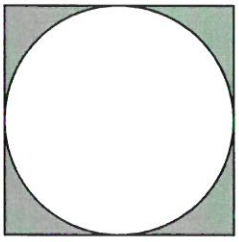


c)



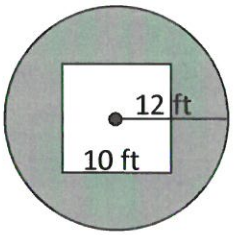
2. Find the shaded area in each of the figures shown below.

a)

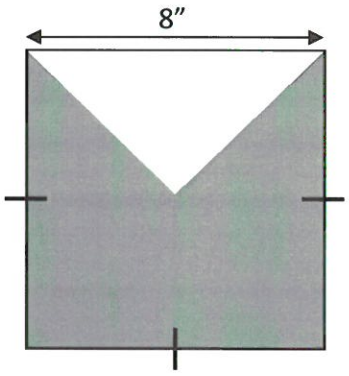


8 cm

b)



c)



d)