Plane Geometry and Solid Figures (Part 1)

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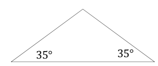
Objectives
- Angle Definitions
- Polygons
- Calculating Perimeter and Area for Quadrilaterals
- Pythagorean Theorem
- Area of a Triangle
  - Height Known
  - Isosceles Triangle
  - Equilateral Triangle
- Regular Hexagons
- Area of Irregular Polygons
- Circles – Circumference and Area
- Irregular Shapes with Circles
- Length of Stock

Angle Definitions

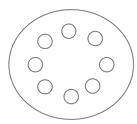
- Angle – how we measure the amount of the opening between the two lines
  - The basic unit we attach to an angle is degrees (°)
  - We also use minutes (′) and seconds (′′) to break down degrees more accurately in Trigonometry
  - Vertex – where two lines meet and form an angle
- Basic Angles
  - A full circle is _____ °.
  - A straight line is ____ °.
  - A perfect vertical line and horizontal line makes a ___ ° angle.
- Types of Angles
  - Acute – the angle is between 0° and 90°
  - Right – the angle is exactly 90°
  - Obtuse – the angle is between 90° and 180°
- Angles of a triangle – add up to ____°

Angle Definitions

- Example: Find the missing angle:

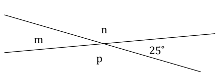


- Example: A bolt hole circle has eight circles. How far apart are the holes, in degrees?



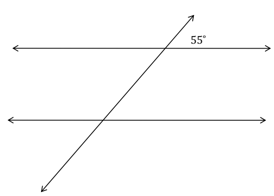
Angle Relationships

- Vertical angles – the opposite angles of two intersecting lines
  - The two vertical angles formed are always equal
- Example: Find angles m, n, and p



Angle Relationships

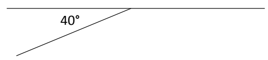
- Parallel Lines – two lines that never cross
- Transversal – a line that crosses two parallel lines
  - The corresponding angles formed are equal
- Example: Fill in all missing angles



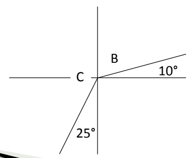
Try Yourself

- Find the missing angles

1)



2) The vertical and horizontal lines are perpendicular

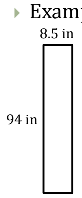


Polygons

- Polygon – a shape with at least three straight sides
- The different things that we calculate for two-dimensional polygons are
  - Perimeter
  - Area
  - What does it mean to calculate each of these? Give examples of when you would do each.
- See the formula sheet to look at the different shapes we will calculate Perimeter, Area, Surface Area, and Volume for.

Rectangles

- Example: Find the perimeter and area

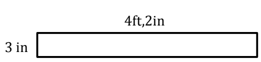


Rectangles

- The rectangle above is a 10 gauge, low carbon commercial steel sheet. Go to http://www.ryerson.com/en/Products/Stock-List to determine that the weight per square foot in lbs is 5.625 lbs/sq ft and then determine the weight of the sheet.

Try Yourself

- Example: Find the perimeter (in ft and in) and area (in square feet).

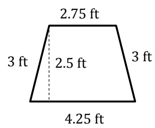


Try Yourself

- Example: You want to pave your driveway that is currently gravel. One company tells you that they charge $45/square yard. Your driveway is sixty feet long and fifteen feet wide. What would the cost be?

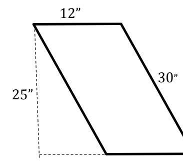
Trapezoid

- Example: Find the perimeter and area



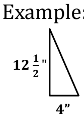
Try Yourself - Parallelogram

- See Formula Sheet
- Example: Find the perimeter and area



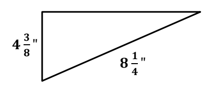
Pythagorean Theorem

- Used to find the third side of a right triangle if we know two of the sides.
- Notice that c <u>must</u> be the hypotenuse.
- Pythagorean Theorem: $a^2 + b^2 = c^2$
- Example: Find the missing side



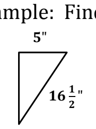
Pythagorean Theorem

- Example: Find the missing dimension to the nearest 16^{th} of an inch



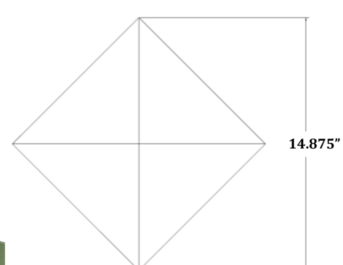
Try Yourself

- Example: Find the missing side



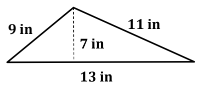
Try Yourself

- The following cross brace needs to be made. Find the total length of bar needed to make this piece.



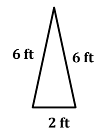
Area of a Triangle – Height Known

- Example: Find the perimeter and area



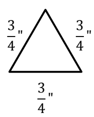
Area of a Triangle – Isosceles Triangle

- Isosceles Triangle – two sides are equal
- Example: Find the perimeter and area



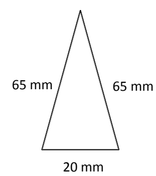
Area of a Triangle – Equilateral Triangle

- Equilateral Triangle – all three sides are equal
- Example: Find the perimeter and area



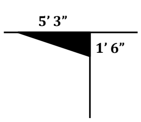
Try Yourself

- Find the total length of weld needed to go around the sheet of metal. Also calculate the area



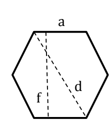
Try Yourself

- The supports under a bridge are shown below. If the sheets weigh 14.8 lb/sq ft, how much does each piece weigh?



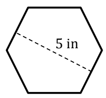
Regular Hexagons

- Regular Hexagon – a polygon with six equal sides
  - a is the length of a side
  - d is the distance from opposite corners
  - f is the shortest distance across opposite sides



Regular Hexagons

- Example: Find the side of the hexagon and find the area

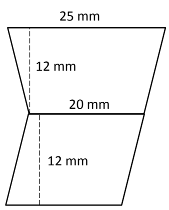


Try Yourself

- Example: You are asked to make a road sign in the shape of a regular hexagon. They should have a maximum width of 2 ft 3 in. Find the length of each side and find the area of the sign.

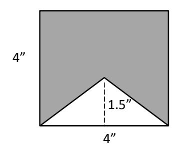
Irregular Polygons

- Find the area of the sheet of metal.



Irregular Polygons

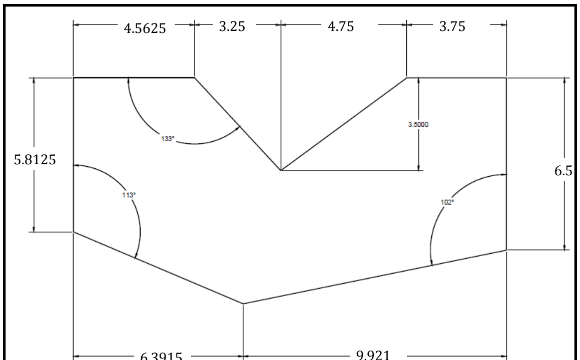
- Find the area of the shaded part:



- Compare the two different strategies used to calculate the area of these shapes.

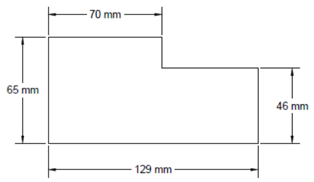
Application Problem

- The following figure needs to be cut from an originally rectangular sheet of metal that is $16\frac{5}{16}$ “ by $8\frac{9}{16}$ “. Determine the original area and the area once the triangular parts have been cut and removed.



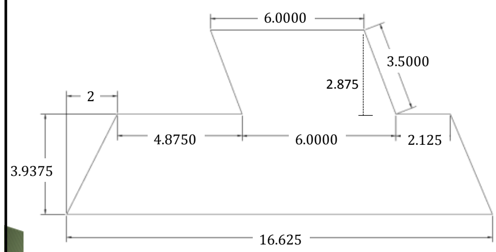
Try Yourself

- Determine the perimeter and area of the following sheet of metal in order to determine costs of materials related to the job.



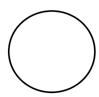
Try Yourself

- Find the perimeter and area of the figure below.



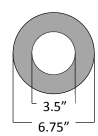
Circles

- Find the π button on your calculator. What is π?
- Examples: Convert to the decimal form to the nearest thousandth:
  - $\pi =$
  - $2\pi =$
  - $0.57\pi =$
- Circles: r is the radius, d is the diameter
  - Area: $A = \pi r^2$
  - Circumference (Perimeter): $C = \pi d = 2\pi r$



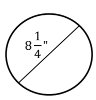
Circles

- Example: Find the area and circumference for a circle with a diameter of 5 in.
- Example: Find the area of the shaded part of the circle:



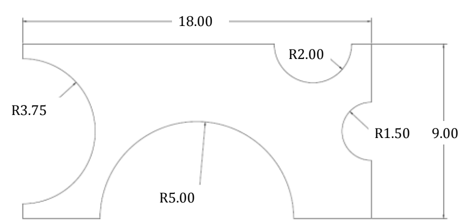
Try Yourself

- Find the area and circumference of the circle:



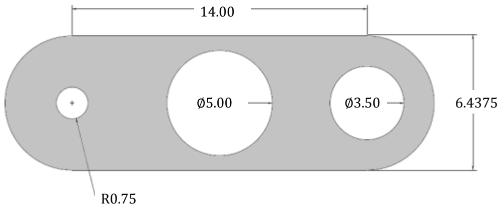
Irregular Shapes with Circles

- Find the area and perimeter of the figure with the semicircles removed from a rectangular sheet of metal.



Try Yourself

- Find the area of the shaded figure: (Ø is diameter)



Length of Stock

- Measure from the middle of the piece. This gives the mean(average) diameter or mean radius.
- Example: Find the original length of stock needed to have bend a ½" diameter round stock to have an inner diameter of 6" and bent 180°.

Try Yourself

- Find the length of stock in the figure below, including the vertical and horizontal parts at the ends: