Welcome to Geometry!

Geometry is one of the oldest areas of mathematics that deals with properties of space. We'll be learning about shape, distance, size, and position of objects.

We will discover many important relationships using the same tools that ancient mathematicians used many years ago: the *straight edge* and the *compass.*

The Point

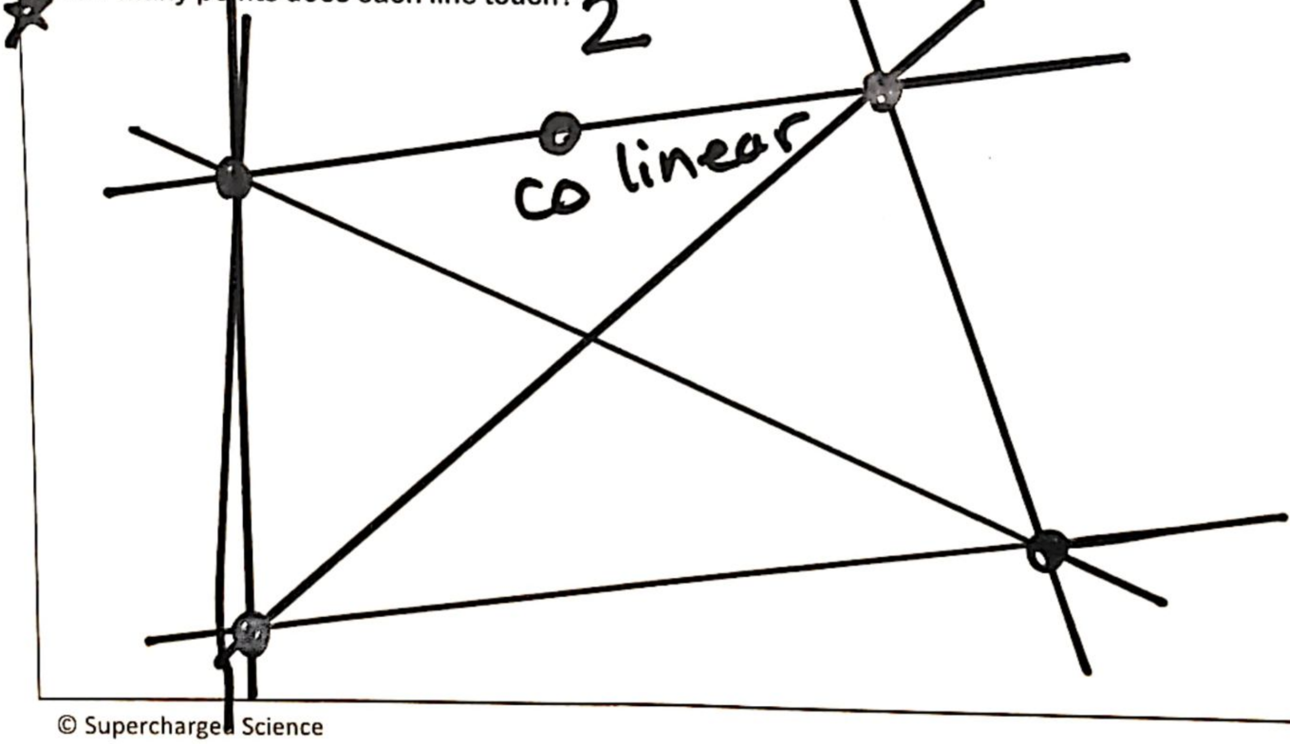
A point is a location represented by a dot. It does not have any length, thickness, shape or size, it only has a position.

The Line

A line is straight, goes on forever, and has no thickness or depth.

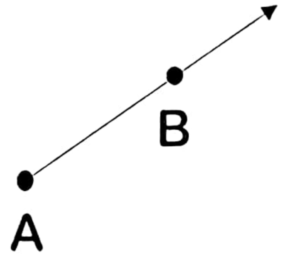
The Straight Edge is also called a *ruler* or a *straight tool.*
We use these to draw straight lines or to check a line for straightness.

How many lines can you draw that touch the points below?
How many points does each line touch? 2



The Ray

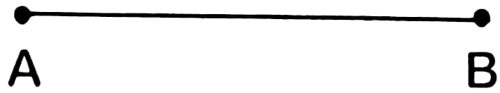
The ray is like a laser – it starts at one end and goes on infinitely.



This is ray $\overrightarrow{AB}$

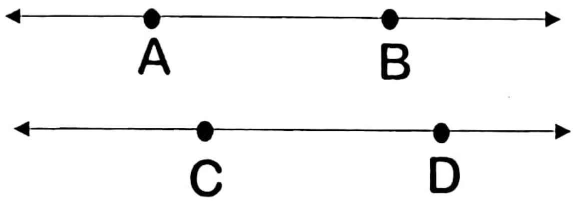
The Line Segment

The line segment starts at one end and ends at the other.



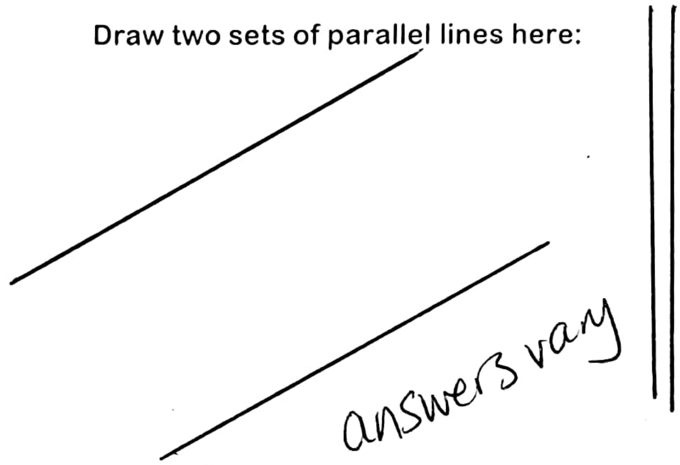
Draw a line that connects points A and B to make a line segment $\overline{AB}$

Parallel lines never meet.



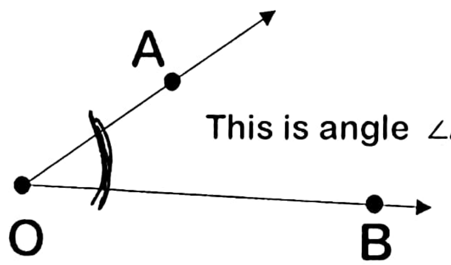
Line AB is parallel to Line CD: $\overleftrightarrow{AB} \parallel \overleftrightarrow{CD}$

Draw two sets of parallel lines here:



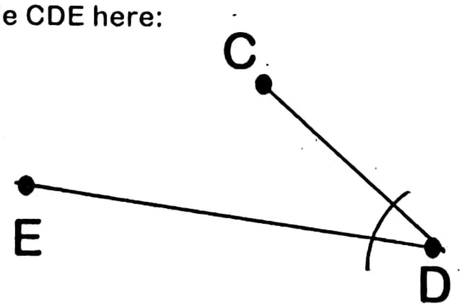
The Angle

An angle is when two rays meet at a point, measured in “degrees”.

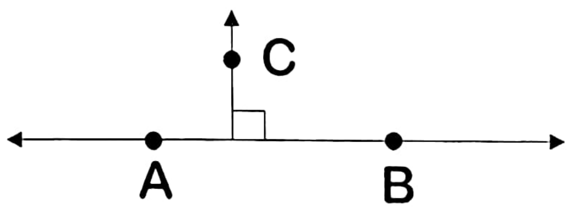


This is angle $\angle AOB$

Draw angle CDE here:

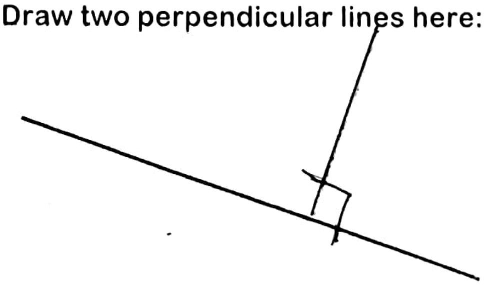


Perpendicular lines meet at a 90 degree angle.



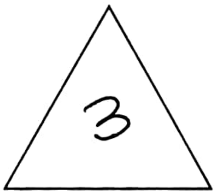
Line AB is perpendicular to Line CD: $\overleftrightarrow{AB} \perp \overleftrightarrow{CD}$

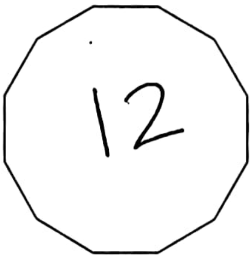
Draw two perpendicular lines here:

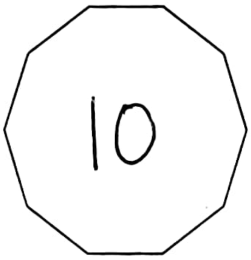


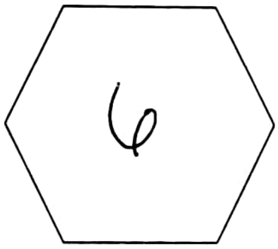
Basic Geometry Shapes

Three sides, four sides, five, six, seven, eight... how many do you know?



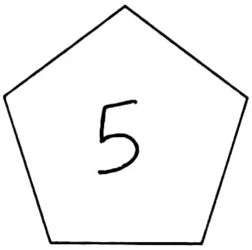


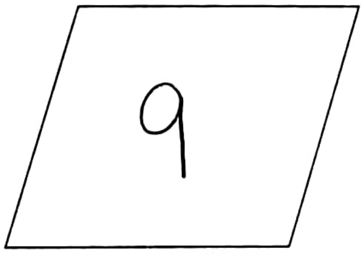


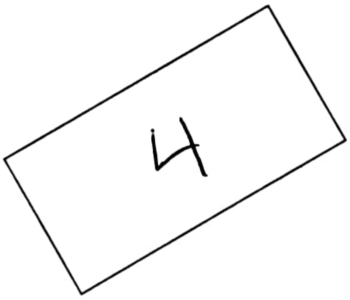


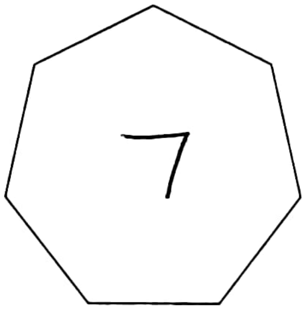
Write the number inside the corresponding shape:

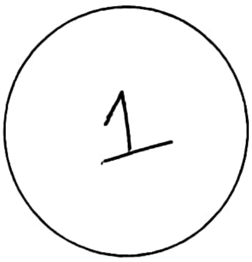
1. Circle
2. Square
3. Triangle
4. Rectangle
5. Pentagon (5 sides)
6. Hexagon (6 sides)
7. Heptagon (7 sides)
8. Octagon (8 sides)
9. Parallelogram
10. Decagon (10 sides)
11. Ellipse
12. Dodecagon (12 sides)
13. Trapezoid

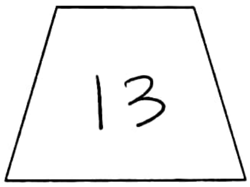


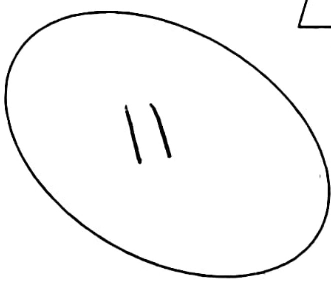


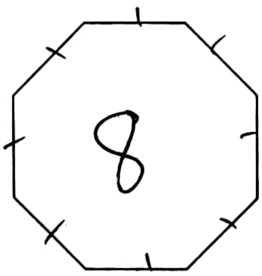


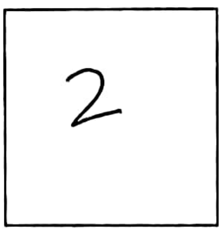








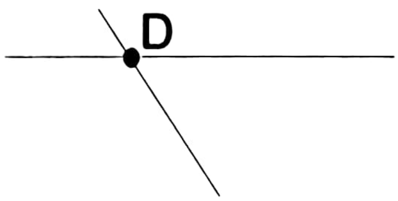




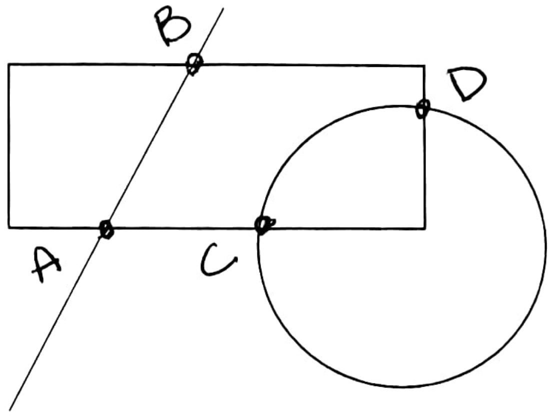
A polygon is a figure with at least three straight sides.

Point of Intersection

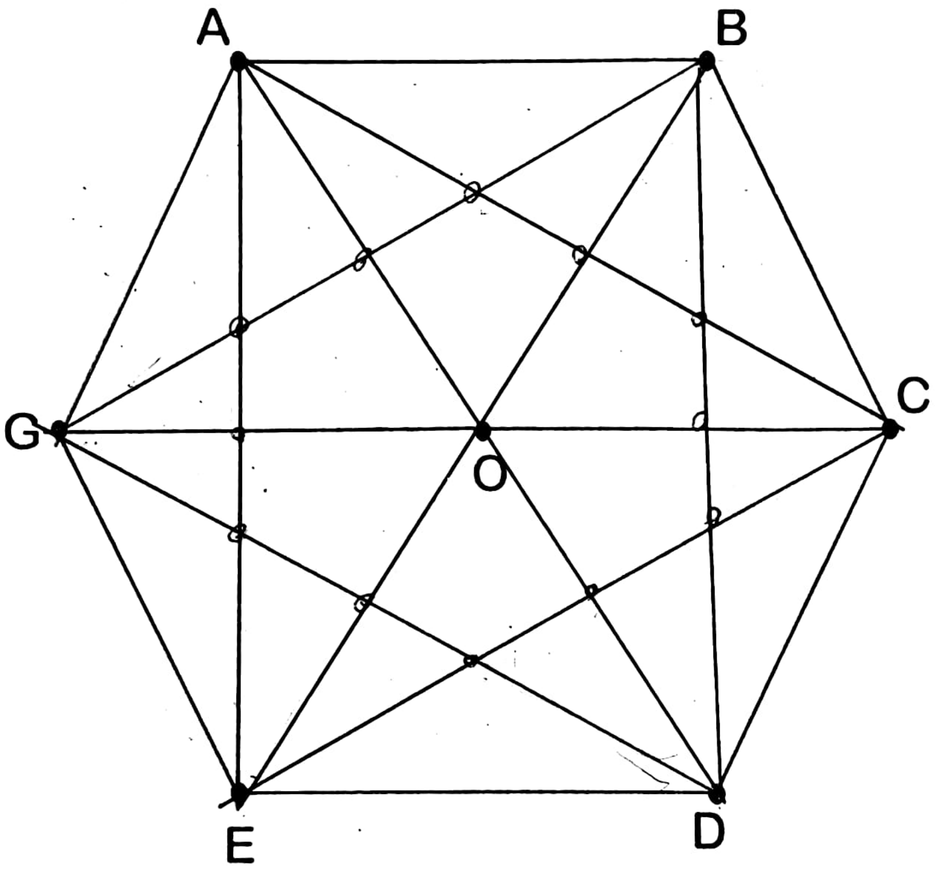
This is a point where two line segments meet or two lines meet.



Label all the points of intersection with different letters:



Draw all the line segments you can that connect A, B, C, D, E, F, G and O.



How many line segments did you draw? 30

How many intersections? 19

How many triangles? 18 18 + ? you count!

How many quadrilaterals? 6

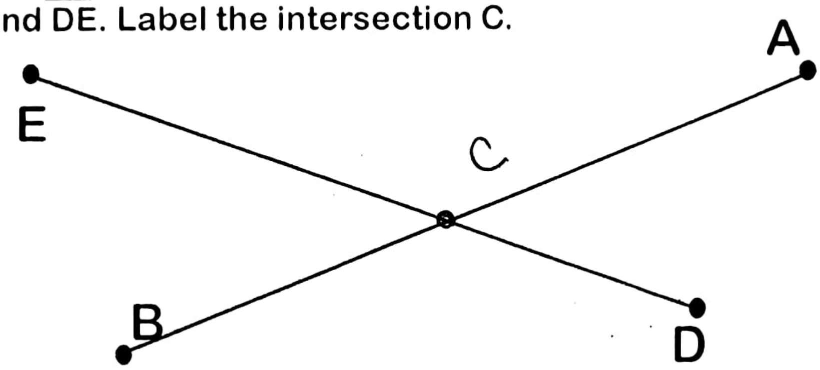
Are there any other shapes? hexagon, pentagon

A figure with six sides is a *hexagon.*

Intersections

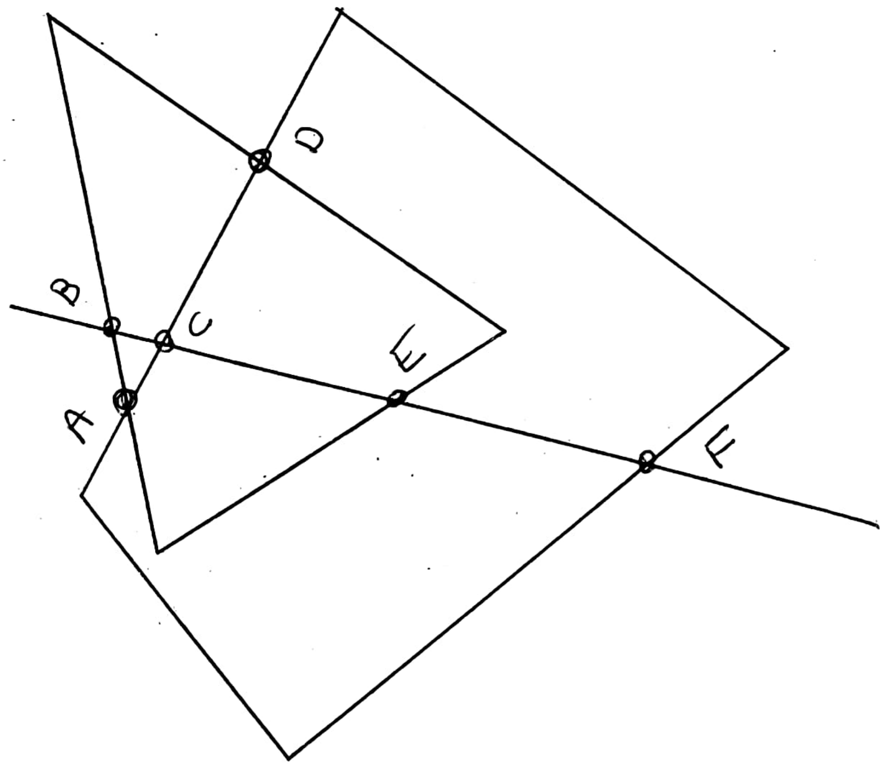
This is a point where two lines or curves meet.

Draw $\overline{AB}$ and $\overline{DE}$. Label the intersection C.



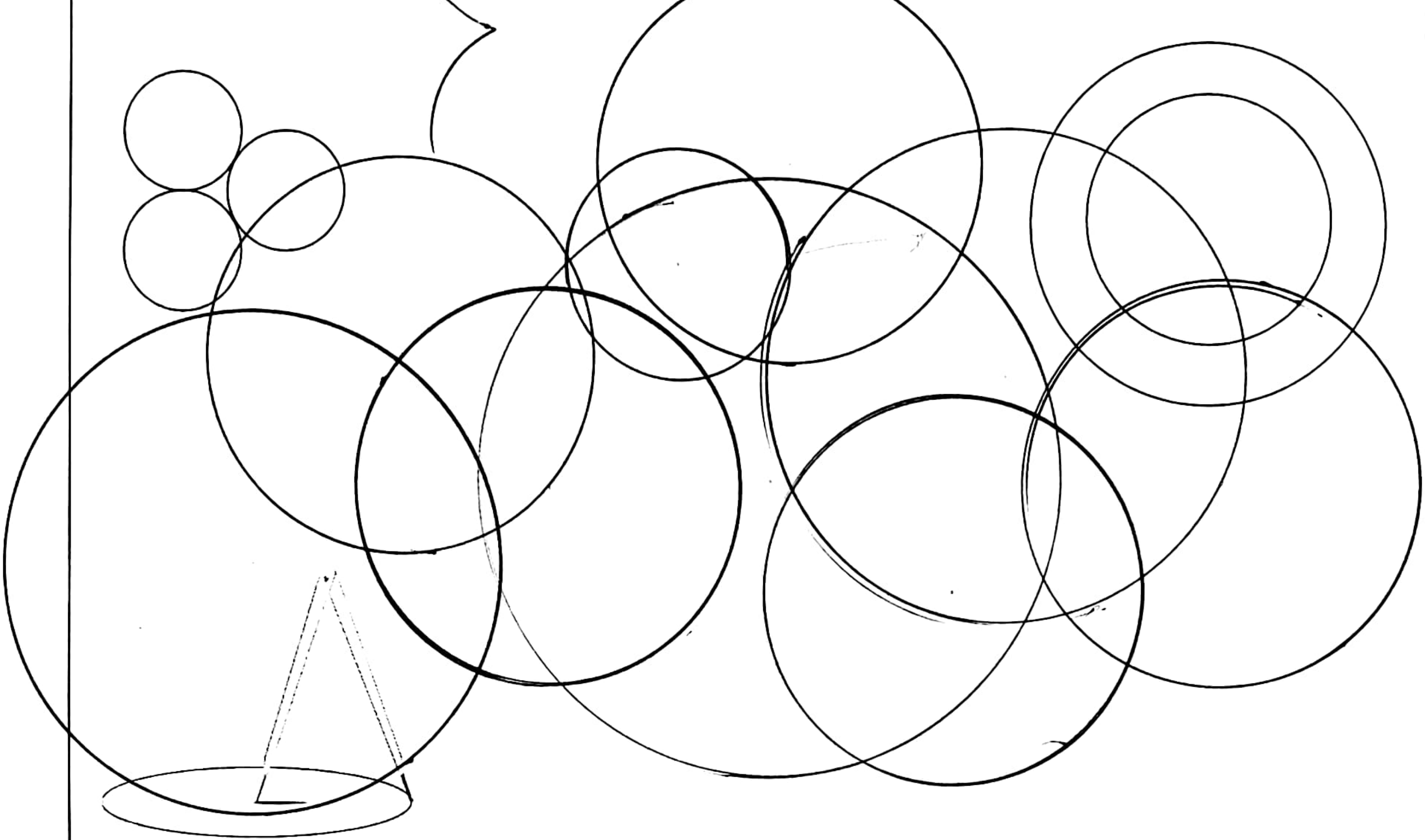
Draw a triangle, a quadrilateral, and a line so that they create six intersections. Label each intersection with different letters.

answers vary

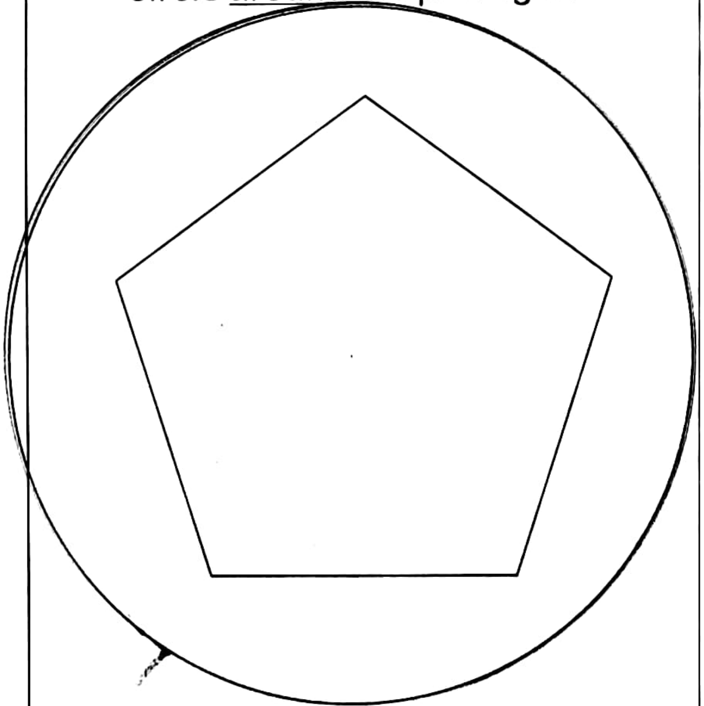


The Circle

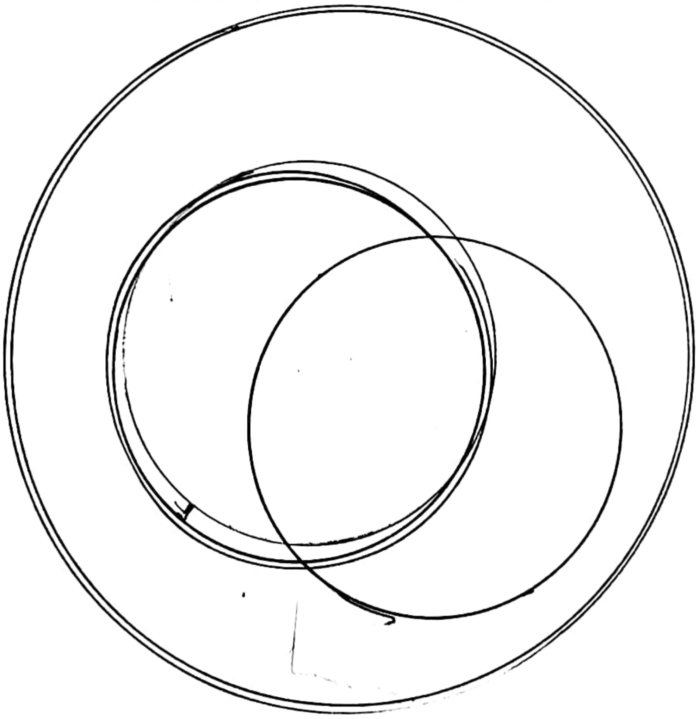
The circle is a round figure with no corners, no edges, and no flat lines.
Use your compass to make different circles and shapes!



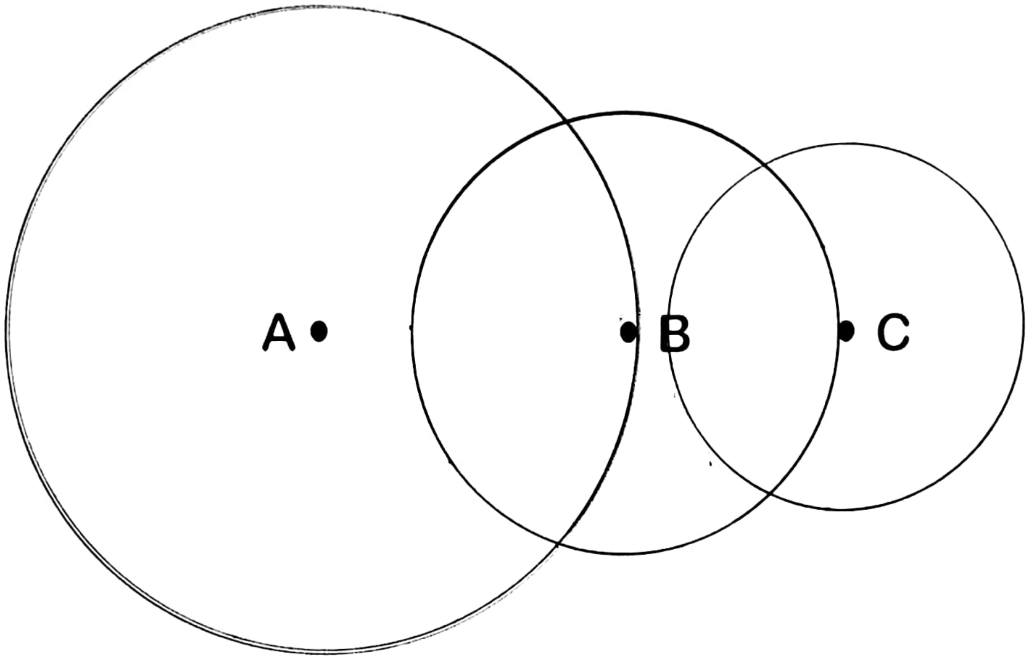
Use your compass to draw a circle <u>around the</u> pentagon:



Use your compass to draw a two circles inside another circle:



Draw a circle with the center at A, includes point B *on* the circle, with point C *outside* the circle.



Now draw a circle with the center on C which has the point B outside of it.

Draw a circle with center B that does ~~not~~ intersect ~~either of~~ both of the first two circles.

The Radius

This is measured *from* the center of a circle to any point *on* the circle.

Draw a circle with the center on Z.

Draw a line segment from Z to the circle. This line segment is your *radius.*

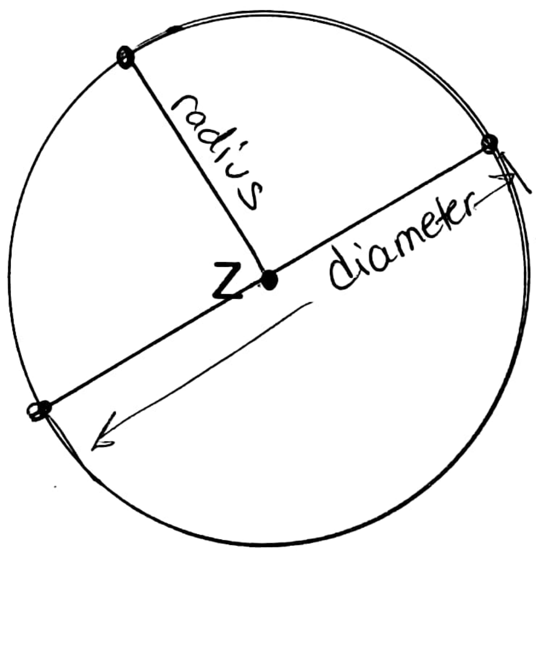
Measure the radius with your ruler:

3.5 cm

Now extend your line segment so it also touches the circle on the other side. This is your *diameter.*

Measure the diameter with your ruler:

7 cm



The Diameter

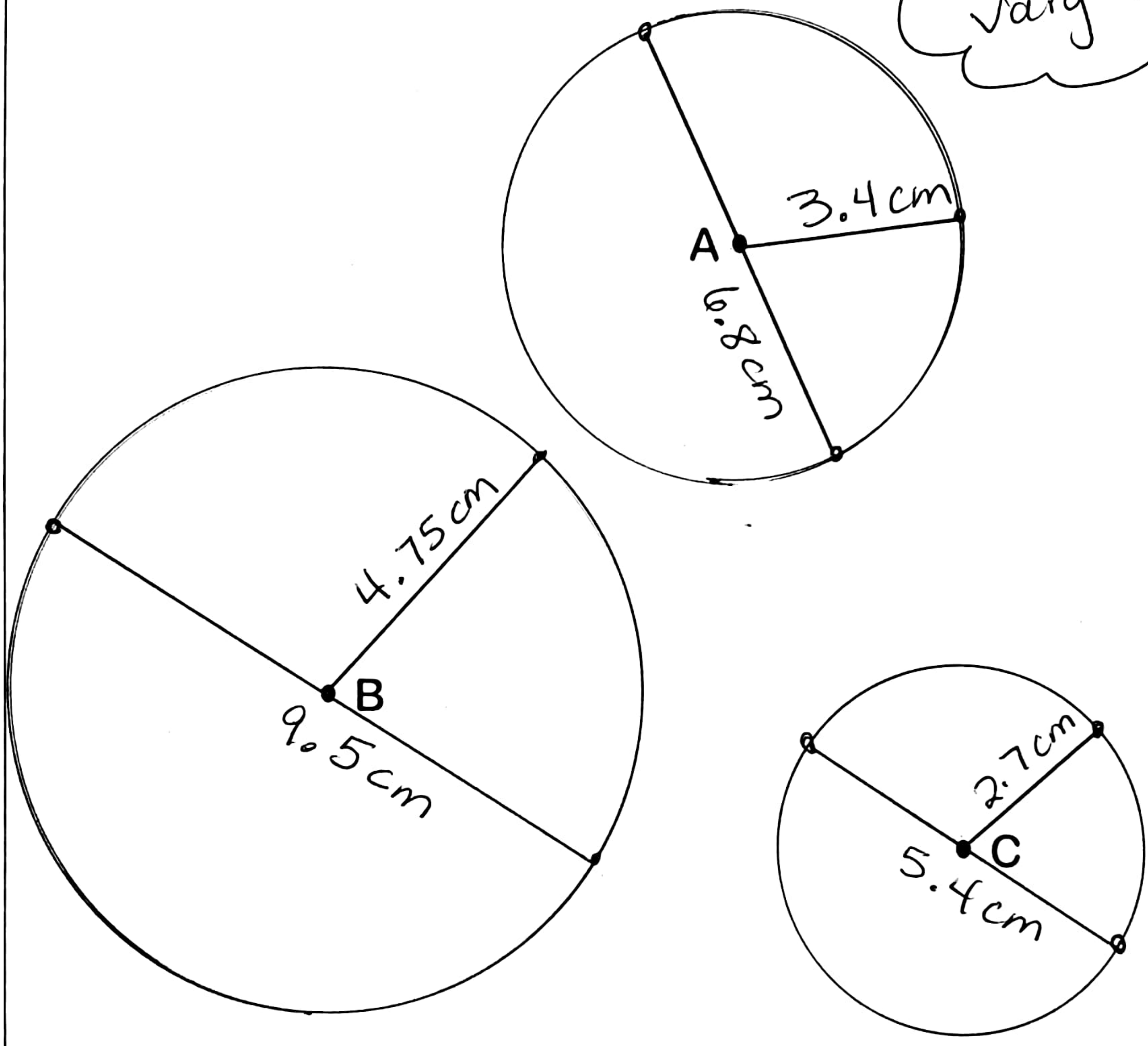
Any straight line passing through the *center* of the circle with endpoints *on* the circle.

Measuring Radius and Diameter

Use your ruler and measure the radius and diameter of each circle!

Draw three circles of different sizes at the points below.

Answers vary!



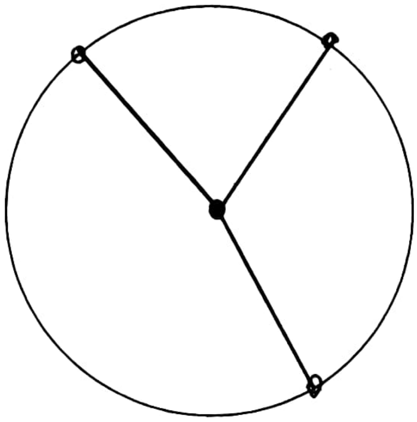
Draw a line through the center of each circle
with your ruler, intersecting the circle twice.

Measure both the *diameter* and the *radius*
of each circle (using inches or cm)
and write these next to each circle.

Congruent

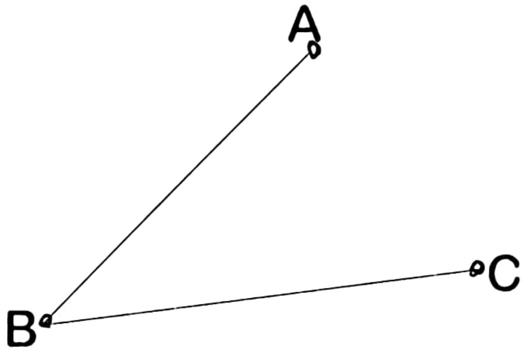
Congruent means to match *exactly* in both size and shape.

Draw three radii in the circle below.



Are these radii congruent? Yes

Use your compass to answer:



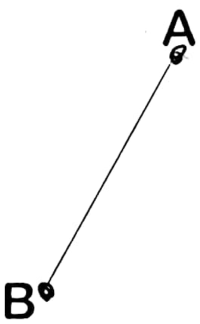
Are $\overline{AB}$ and $\overline{BC}$ congruent? NO

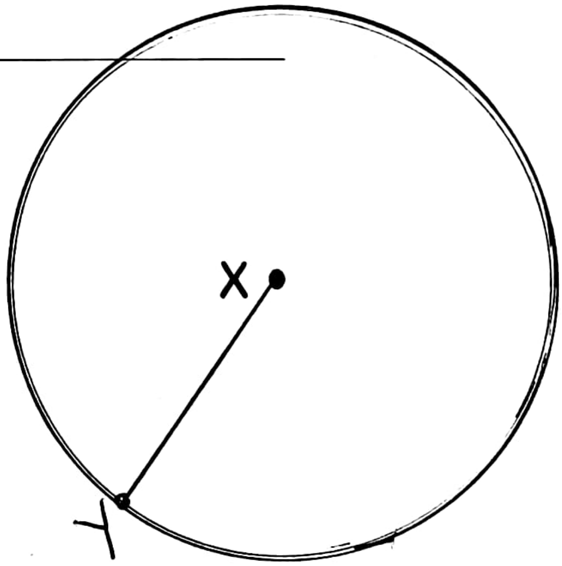
Draw a circle with center A and radius $\overline{AB}$.

Now draw a circle with center X with a radius congruent to $\overline{AB}$.

Choose a point on the circle X and label this point as "Y". Draw $\overline{XY}$.

Are the two ~~circle~~s congruent? Yes
lines

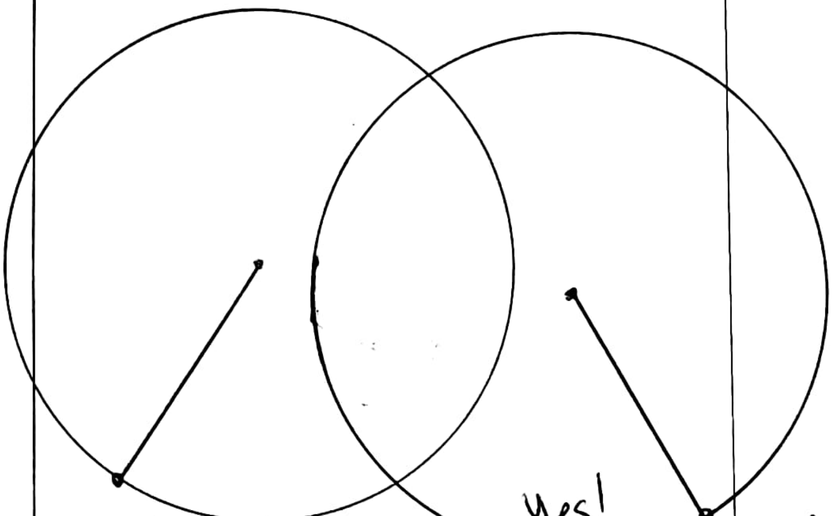




Congruent

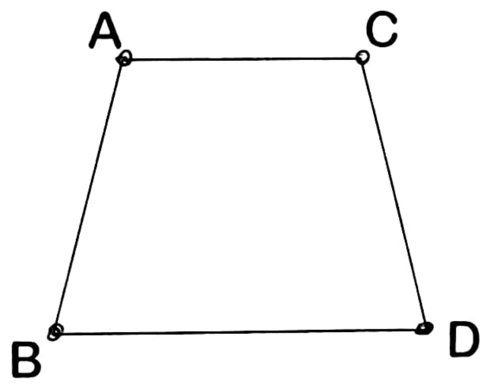
Congruent means to match *exactly* in both size and shape.

Draw two congruent circles.



Are the radii congruent? Yes!

Use your compass to answer:



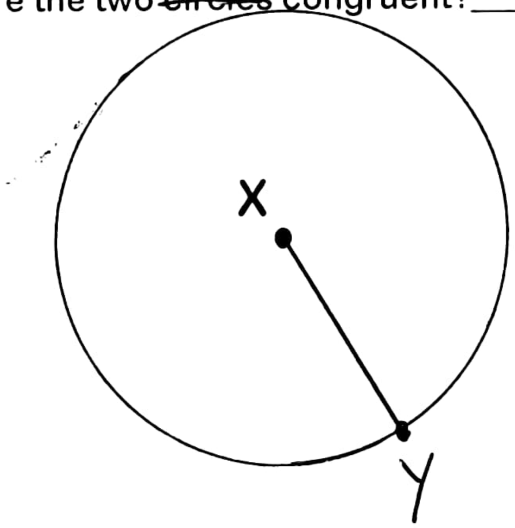
Are $\overline{AB}$ and $\overline{CD}$ congruent? Yes

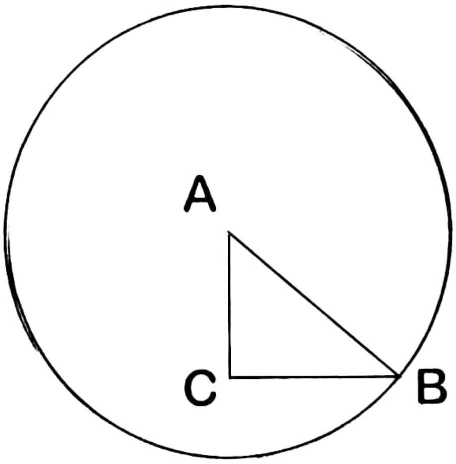
Draw a circle with center A and radius $\overline{AB}$.

Now draw a circle with center X with a radius congruent to $\overline{AB}$.

Choose a point on the circle X and label this point as "Y". Draw $\overline{XY}$.

Are the two ~~circles~~ lines congruent? Yes!

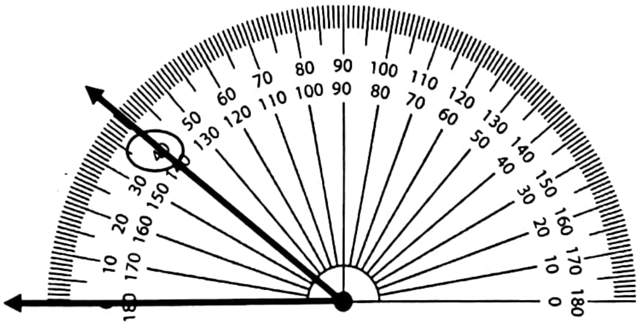




Measuring Angles with a Protractor

Angles are measured with a protractor. Angles are measured in *degrees.*

We measure line segments with a ruler.

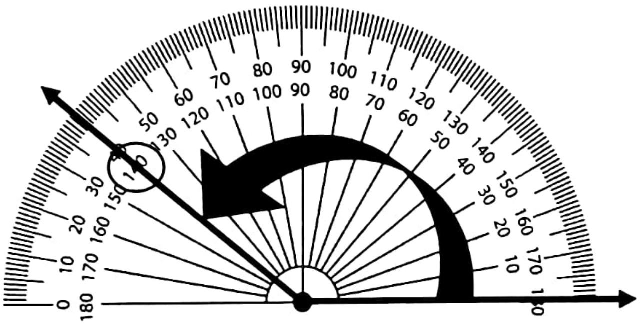


When we have an angle, we measure how "open" the angle is.

This line is "40 degrees", which we write as 40°.

Notice that we are reading the top scale.

Always start at the zero and use the scale that matches with where you started.

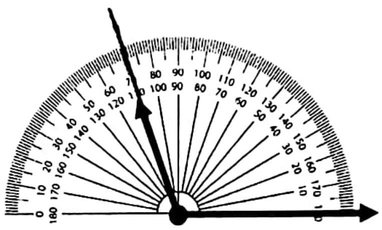


This time, we read the bottom scale because the zero is on the right.

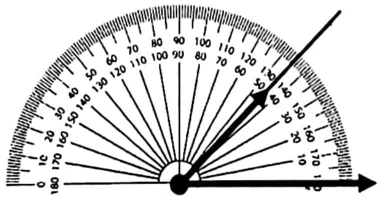
We read numbers increasing from zero on the lower scale.

This angle is now "140 degrees", which we write as 140°.

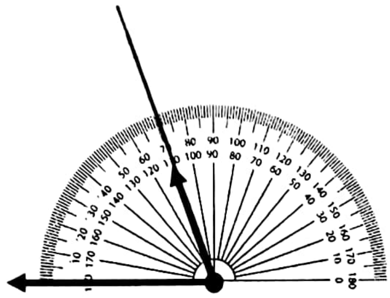
Measure the angle by extending the line through the scale:



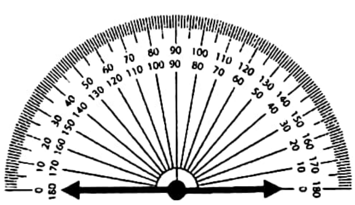
Angle: 110°



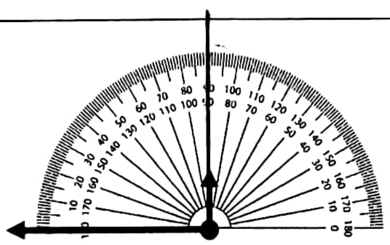
Angle: 45°



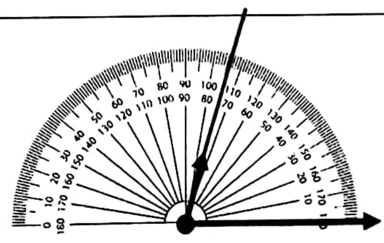
Angle: 70°



Angle: 180°



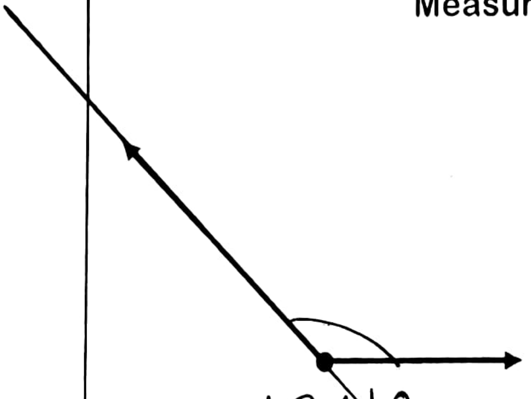
Angle: 90°



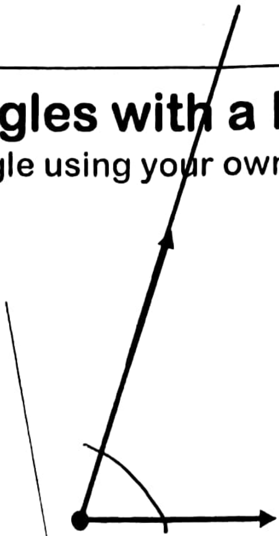
Angle: 75°

Measuring Angles with a Protractor

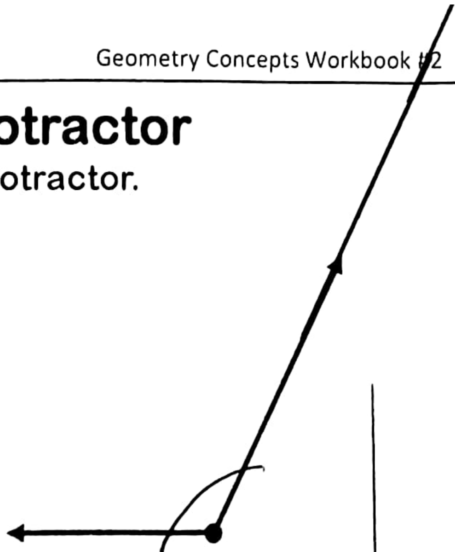
Measure each angle using your own protractor.



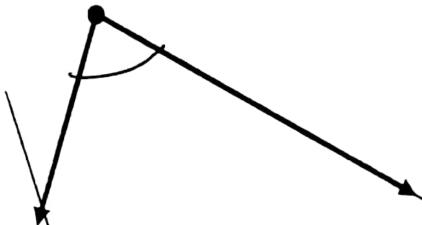
Angle: 134°



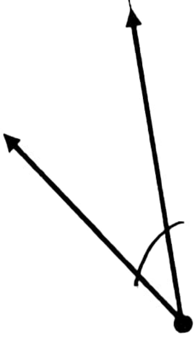
Angle: 72°



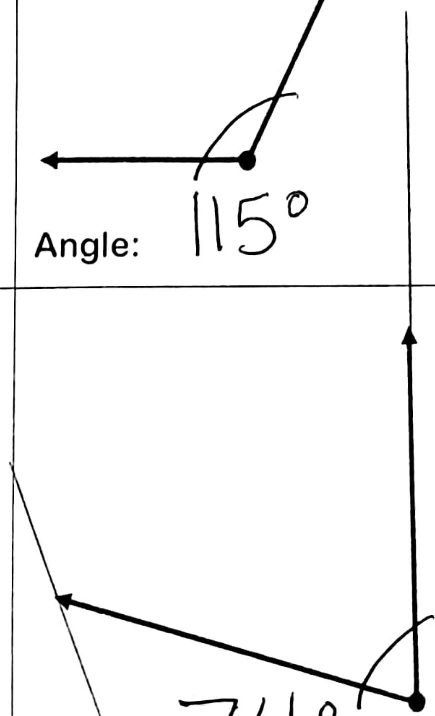
Angle: 115°



Angle: 83°

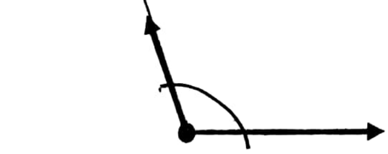


Angle: 35°

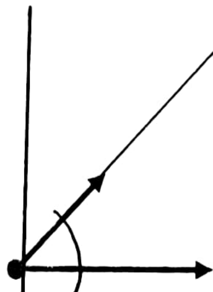


Angle: 74°

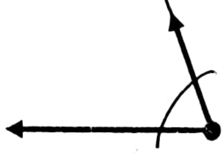
You can extend the lines first if they are too short to read on your protractor.



Angle: 108°



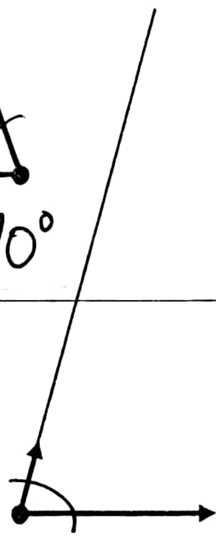
Angle: 45°



Angle: 70°

Angle: 180°

Angle: 90°

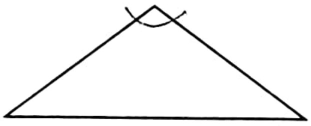


Angle: 74°

Special Properties of Triangles

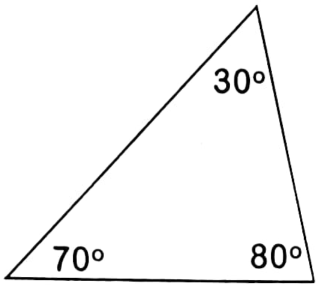
Triangles have properties we can use to find out everything about them!

A triangle has three sides and three angles.



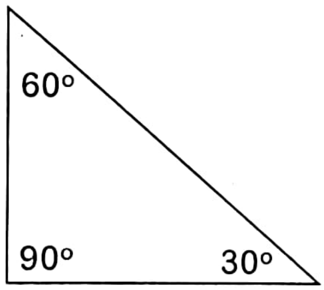
Obtuse triangles have one angle greater than 90°.

The sum of the angles always add up to 180 degrees.



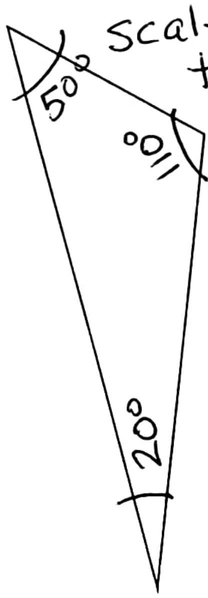
Acute triangles have all angles less than 90°.

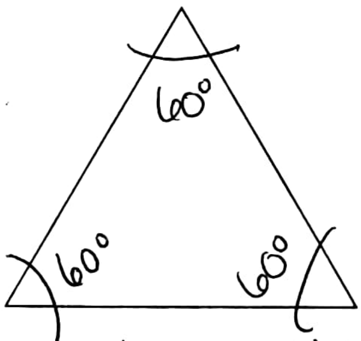
A right triangle has one angle equal to 90 degrees.



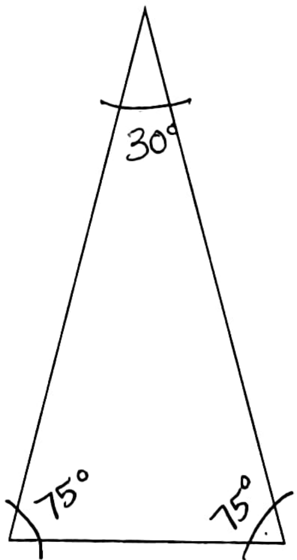
Use your protractor to measure the angles of each triangle.
Label the type of triangle as acute, right or obtuse.

obtuse scalene triangle

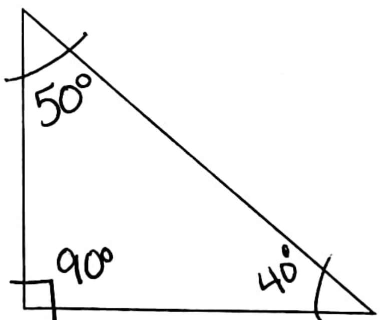




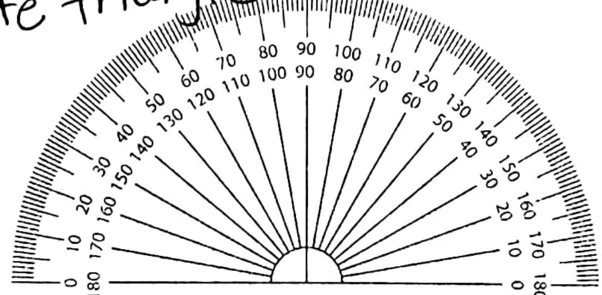
equilateral triangle



isosceles acute triangle



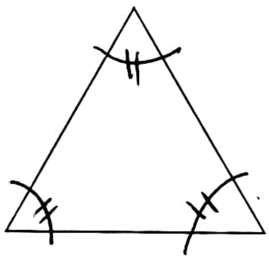
Right triangle



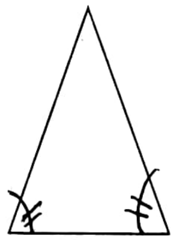
Special Triangles

These triangles show up often enough that they have their own special properties!

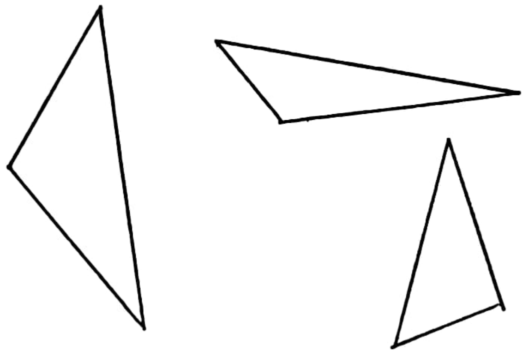
An equilateral triangle has three equal sides and three equal angles.



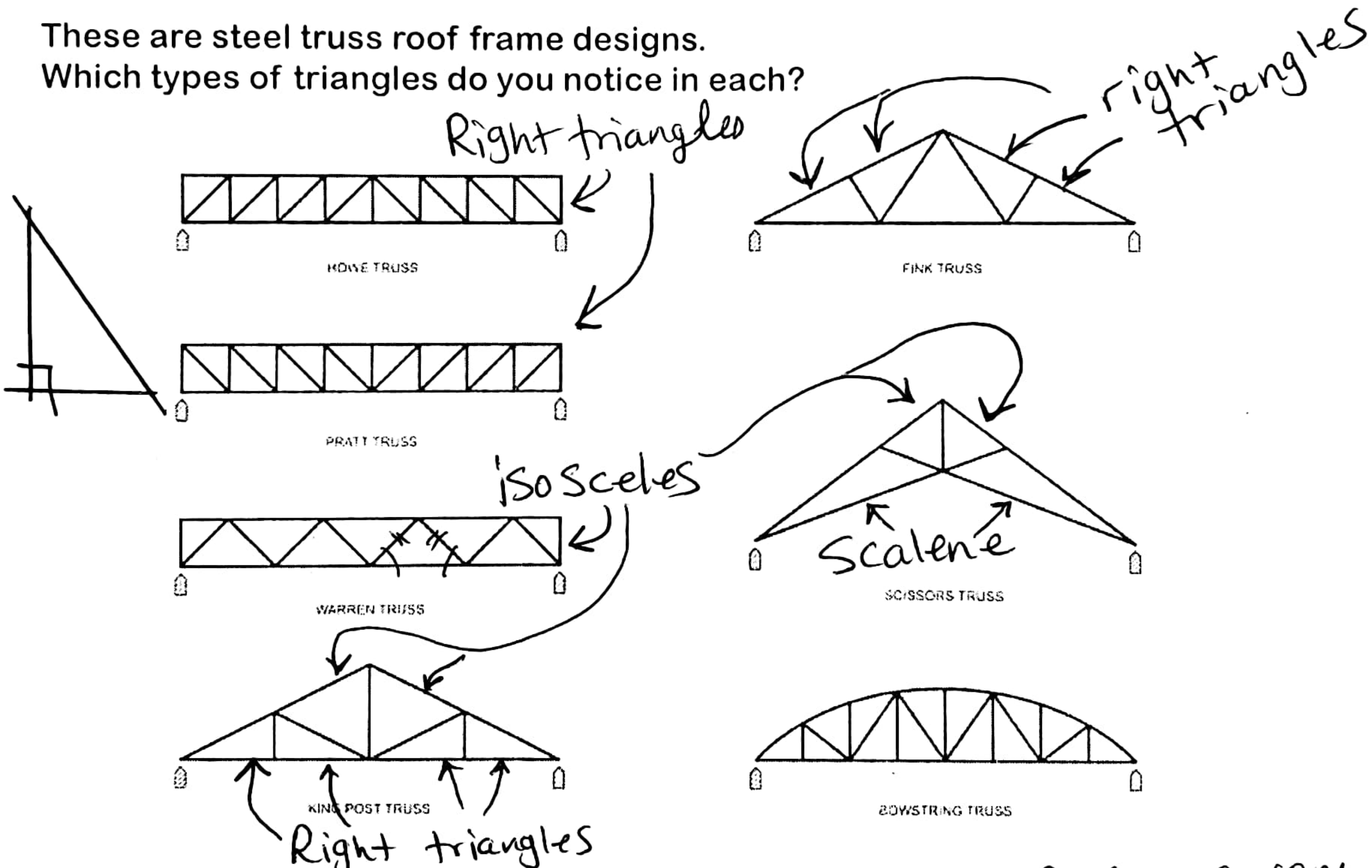
An isosceles triangle has two equal sides and two equal angles.



A scalene triangle has no equal sides and no equal angles. Draw three examples here:



These are steel truss roof frame designs.
Which types of triangles do you notice in each?



Pick your favorite design. How many triangles do you notice? answers vary

How many of the following are in your favorite truss?

Equilateral:

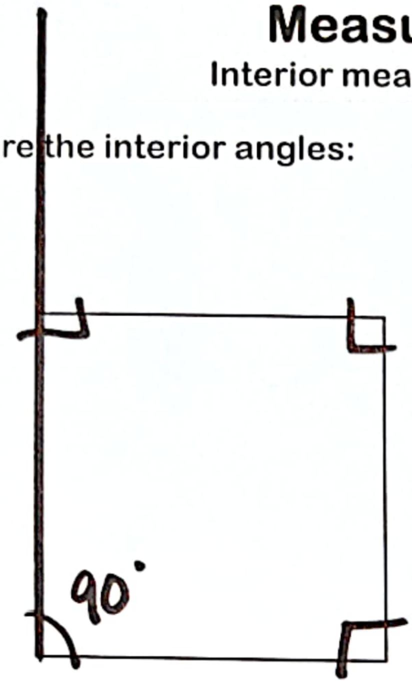
Isosceles:

Scalene:

Measuring Interior Angles

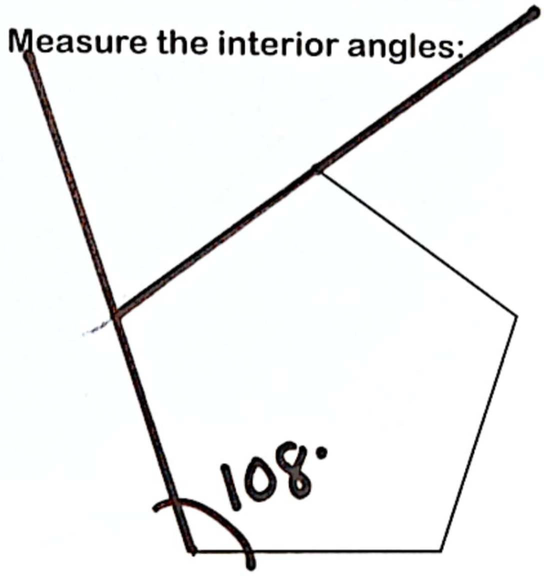
Interior means inside, exterior means outside.

Measure the interior angles:



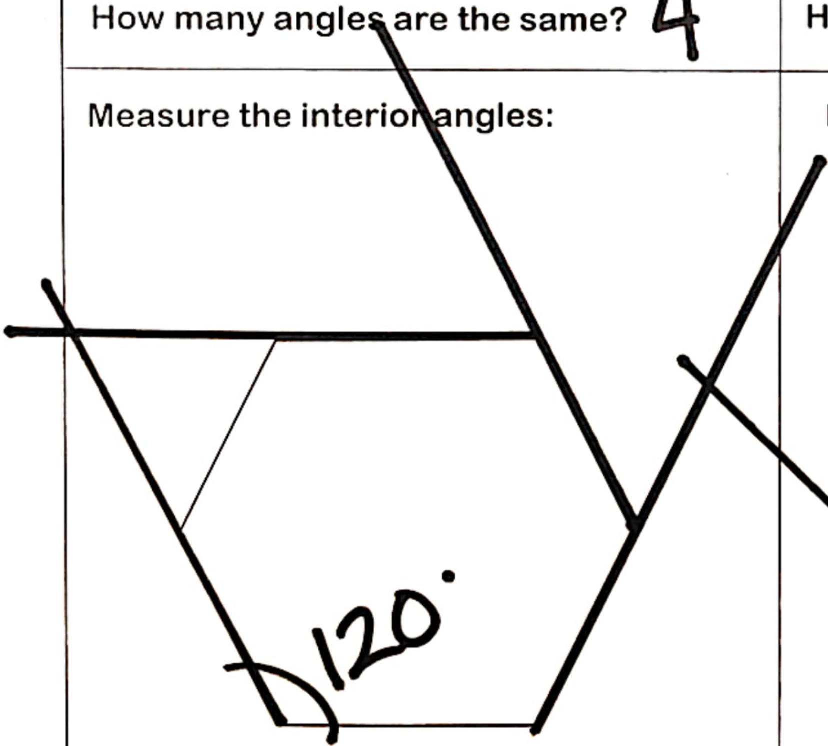
How many angles are the same? 4

Measure the interior angles:



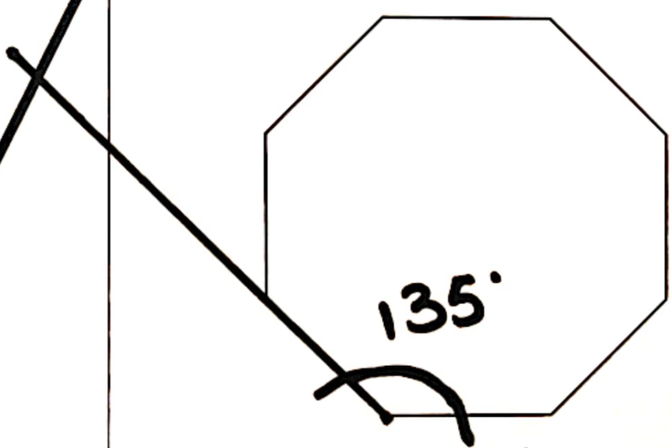
How many angles are the same? 5

Measure the interior angles:



How many angles are the same? 6

Measure the interior angles:



How many angles are the same? 8

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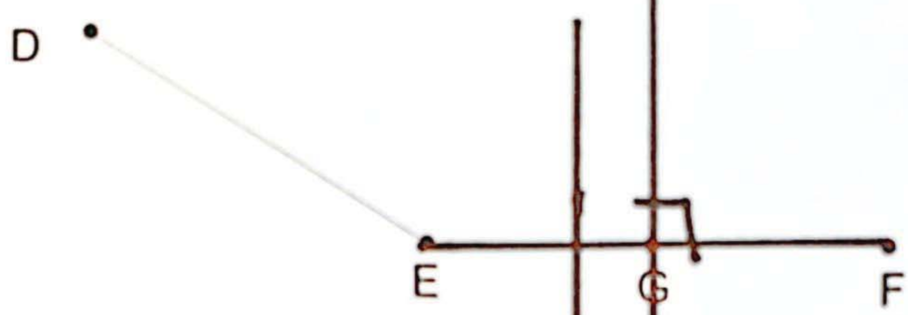
Right Angles

Right angles are made from a line that is perpendicular to a straight line.

Draw a line perpendicular to EF at point G:



Draw a line perpendicular to ABC at point B:

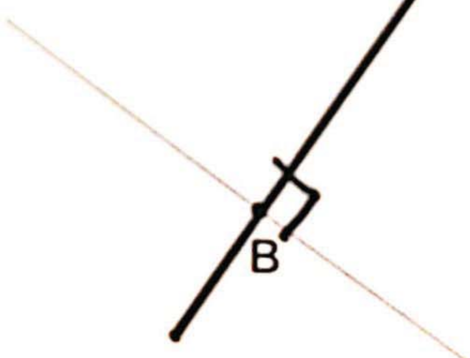
D

Pick a point on the perpendicular line you drew above and add point D. ∠ABD is a *right angle*. A right angle is always half of a straight angle.

Measure ∠ABD: 90°

Draw a perpendicular to the line below through point B and label with a perpendicular symbol:

Perpendicular Symbol



All About Squares

A square is a quadrilateral with four equal sides and four right angles.

A B

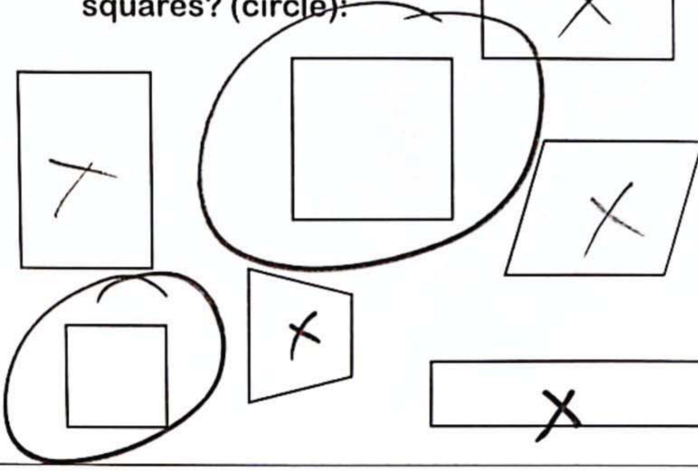
ABCD is a square.

Compare the sides of the square. Are they all congruent?

Compare all of the angles. What do you notice?

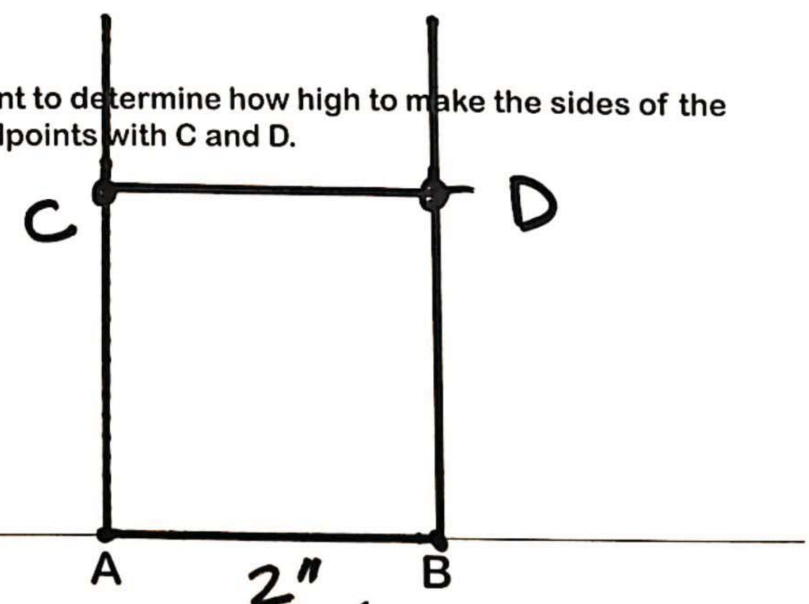
D C

Which of the following quadrilaterals are squares? (circle):



Let's construct a square!

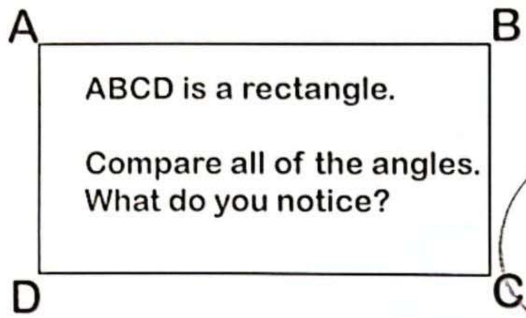
1. Use your protractor to mark two points, one above A and the other above point B. Line up the protractor's hole at A and make a mark at 90º. Do the same to mark a point above point B.
2. Draw a line perpendicular to A through the point above it. Do the same for B.
3. Measure line AB.
4. Use this measurement to determine how high to make the sides of the square. Mark the endpoints with C and D.
5. Draw CD.



Check:
- are all four sides congruent? (use a ruler!) ✓
- are all four angles right angles? (use a protractor!) ✓

All About Rectangles

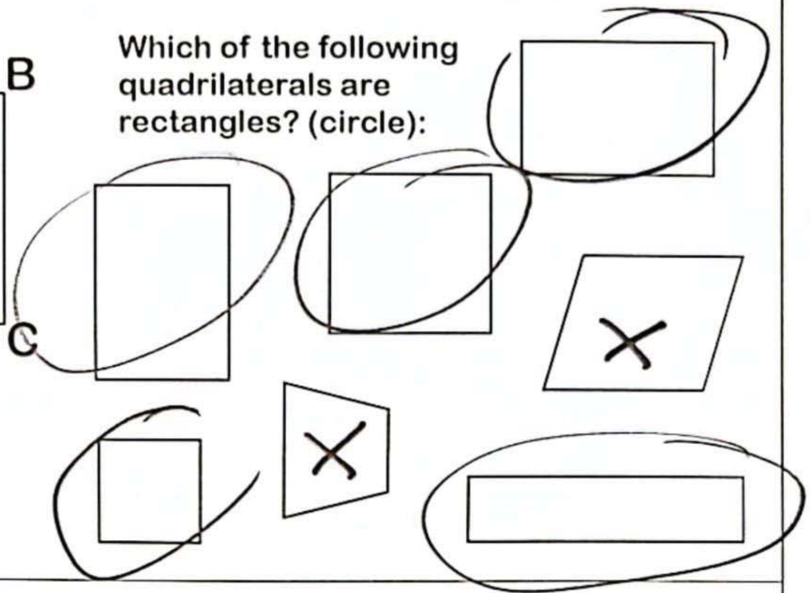
A rectangle is a quadrilateral with all right angles.



ABCD is a rectangle.

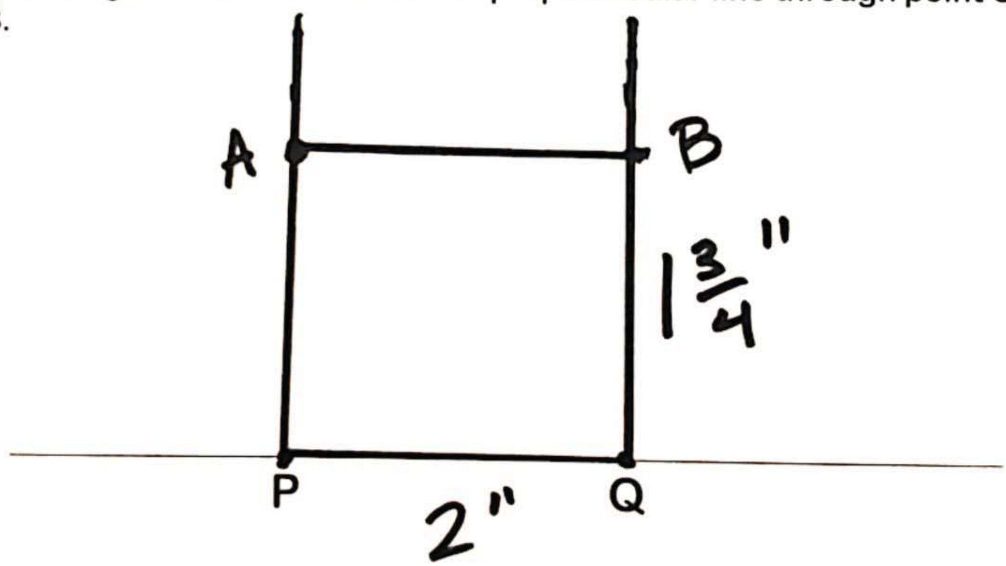
Compare all of the angles.
What do you notice?

Which of the following quadrilaterals are rectangles? (circle):



Let's construct a rectangle!

1. Draw perpendiculars to segment $\overline{PQ}$ through points P and Q.
2. Choose a point on the perpendicular through P and label it "A".
3. Measure $\overline{PA}$.
4. Use the line length $\overline{PA}$ to mark "B" on the perpendicular line through point Q.
5. Draw $\overline{AB}$.



Check:
- are all four angles right angles? (use your protractor!) ✓
- how do you know this object is a rectangle? all right ∠'s

Area of Rectangles and Squares

Area is the size of a surface of a two-dimensional figure.

Think of area as the *square units* that a shape covers.

In a square, *length* and *width* are the same!

width

length

Area is the *length* times the *width* of a rectangle and a square.

In a rectangle, *length* is the longer side.

width

length

Area is measured in *square units*:

- **square inches (in^2)**
- **square feet (ft^2)**
- **square cm (cm^2)**
- **square meters (m^2)**
- **square miles (mi^2)**
- **square kilometers (km^2)**

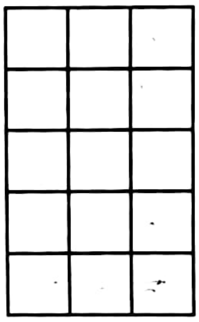
Area = 4 x 2 = 8 in^2

width = 2 inches

length = 4 inches

Area = L x W

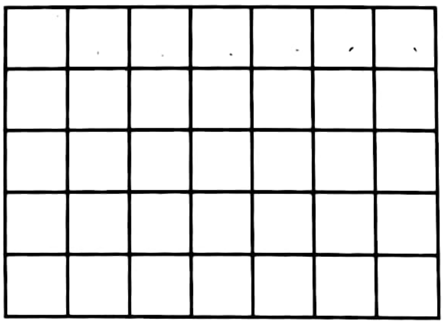
Count the number of squares to find the dimensions and area of each rectangle:



Length: 5

Width: 3

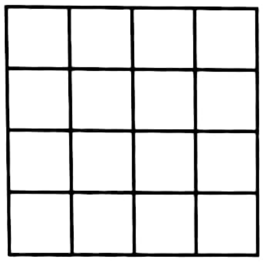
Area: 15 sq. units



Length: 7

Width: 5

Area: 35 sq. units



Length: 4

Width: 4

Area: 16 sq units

Area of Rectangles and Squares

Find the area of each shape using Area = Length x Width

Don't forget units in your numbers!

3 cm

3 cm

A = l · w

Length: 3 cm

Width: 3 cm

Area: 9 cm^2

6 cm

1.2 cm

6 x 12 = 72.

Length: 6 cm

Width: 1.2 cm

Area: 7.2 cm^2

4 inches

9 inches

Length: 9 in

Width: 4 in

Area: 36 in^2

75 feet

32 feet

Length: 75 ft

Width: 32 ft

Area: 2400 ft^2

2.1 miles

0.75 miles

miles = mi

Length: 2.1 mi

Width: 0.75 mi

Area: 1.575 mi^2

300 km

300 km

Length: 300 Km

Width: 300 Km

Area: 90,000 Km^2

Area of Rectangles and Squares

Use your ruler to measure each shape and find the area using Area = Length x Width

Measure shapes in inches or cm to the nearest tenth

$1\frac{1}{4}$"

$1\frac{1}{4}$"

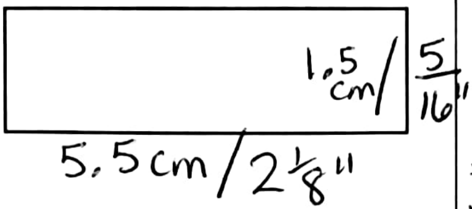
(or 3cm)

Length: 3 cm / 1.25"

Width: 3 cm / 1.25"

Area: 9 cm^2 / 1.56 in^2

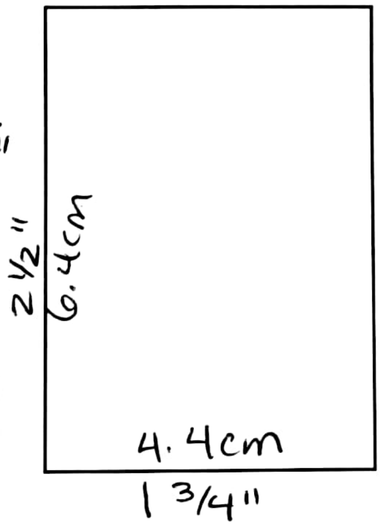
Don't forget units in your numbers!



Length: 5.5cm / $2\frac{1}{8}$"

Width: 1.5 cm / 5/16"

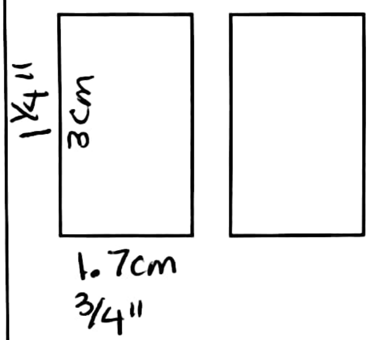
Area: 8.25 cm^2 / 0.66 in^2



Length: 6.4cm / $2\frac{1}{2}$"

Width: 4.4 cm / $1\frac{3}{4}$"

Area: 28.2 cm^2 / 4.4 in^2

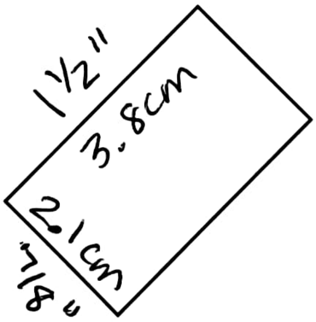


$A = 2 \cdot l \cdot w$

Length: 1¼" / 3 cm

Width: 3/4" / 1.7 cm

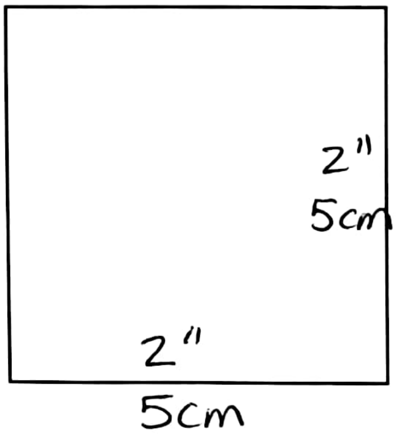
Total Area: 1.9 in^2 / 10.2 cm^2



Length: 3.8 cm / $1\frac{1}{2}$"

Width: 2.1 cm / $\frac{7}{8}$"

Area: 8 cm^2 / 1.3 in^2



Length: 2" / 5 cm

Width: 2" / 5 cm

Area: 4 in^2 / 25 cm^2

$A = l \cdot w \Rightarrow \frac{A}{l} = w$ + $\frac{A}{w} = l$

Area of Rectangles and Squares

Using Area = Length x Width find the missing dimension(s) for each shape.

Don't forget units in your numbers!

Area of this square is 25 cm²

$A = 25\ cm^2$

$A = l \cdot w$

$l = w = 5\ cm$

Area is 25 cm²

10 ¼ cm

$A = l \cdot w$

$\frac{25}{10.25} = \frac{(10.25)\,w}{10.25}$

$w = \frac{25}{10.25} = 2.38cm$

$\boxed{w = 2.38cm}$

6 ½ inches

Area = 64 in²

$\frac{64}{6.5} = \frac{(6.5)(w)}{6.5}$

$\boxed{w = 9.9\ in}$

Area = 89 ft²

36 feet

$A = \frac{89}{36} = \frac{36 \cdot w}{36}$

$\boxed{w = 2.5\ ft}$

Area = 3.5 ft²

18 inches

$18\ in \left(\frac{1\ ft}{12\ in}\right) = 1.5ft$

$\frac{3.5}{1.5} = \frac{l\,(1.5)}{1.5}$

$\boxed{l = 2.3\ ft}$

1 foot = 12 inches

Area of square is 6.4 mi²

l

w

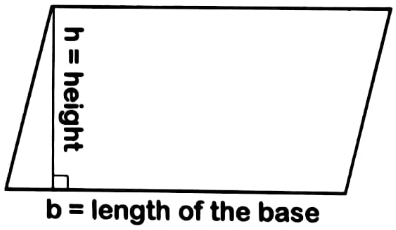
$6.4 = l \cdot w$ l

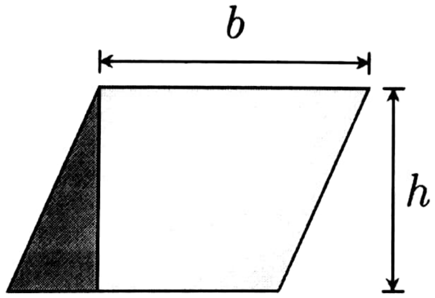
$\sqrt{6.4} = \sqrt{l^2}$

$\boxed{2.5mi = l}$

Area of a Parallelogram

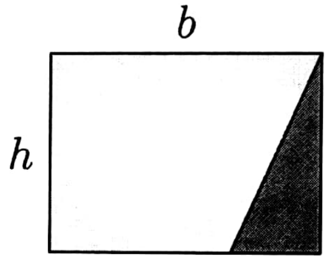
A parallelogram is a simple quadrilateral with two sets of parallel sides.



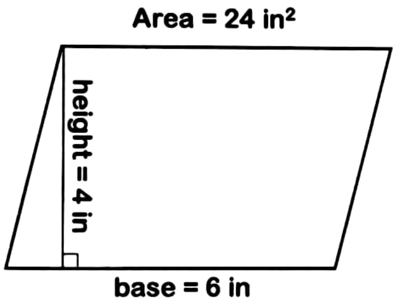


Area for a parallelogram is the height times the length of the base.

Make sure the height makes a 90° angle with the base.

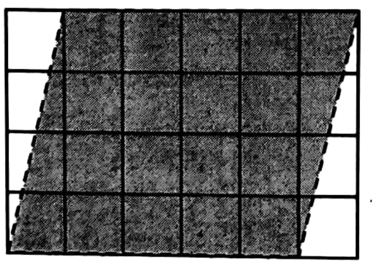


Area = b x h



A parallelogram can be rearranged into a rectangle with the same area.

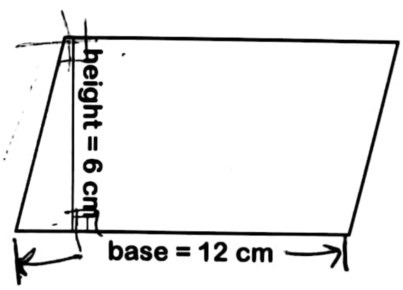
Find the dimensions and area of each parallelogram:



Base: 5 units

Height: 4 units

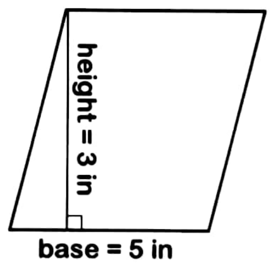
Area: 20 sq. units



Base: 12 cm

Height: 6 cm

Area: 72 cm^2



Base: 5 in

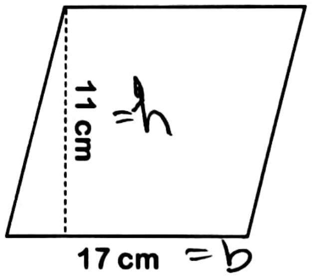
Height: 3 in

Area: 15 in^2

Area of Parallelograms

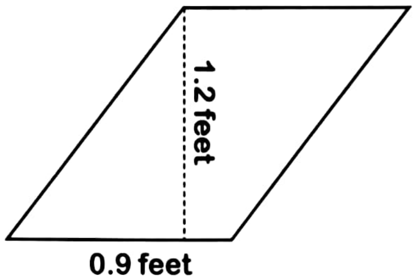
Find the area of each shape using Area = base x height

Don't forget units in your numbers!

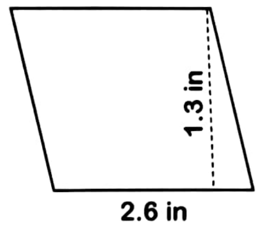


A = b · h

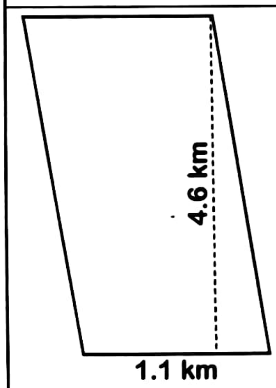
Base: 17 cm
Height: 11 cm
Area: 187 cm²



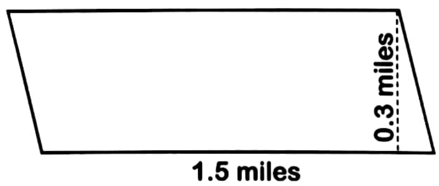
Base: 0.9'
Height: 1.2'
Area: 1.08 sq. ft



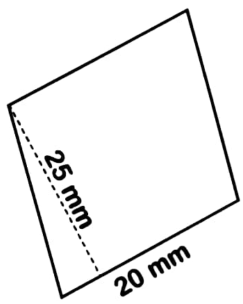
Base: 2.6"
Height: 1.3"
Area: 3.38 in²



Base: 1.1 km
Height: 4.6 km
Area: 5.06 km²



Base: 1.5 mi
Height: 0.3 mi
Area: 0.45 mi²

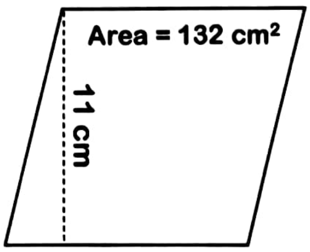


Base: 20 mm
Height: 25 mm
Area: 500 mm²

Area of Parallelograms

Find the area of each shape using Area = base x height

Don't forget units in your numbers!

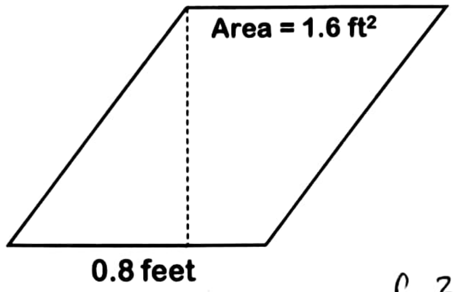


$b = \frac{A}{h} = \frac{132\,cm^2}{11\,cm}$

Base: 12 cm

Height: 11 cm

Area: 132 cm^2

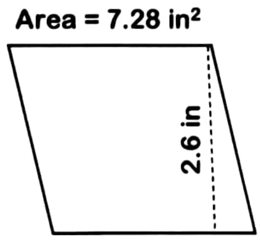


$h = \frac{A}{b} = \frac{1.6\,ft^2}{0.8\,ft}$

Base: 0.8 ft

Height: 2 ft

Area: 1.6 ft^2

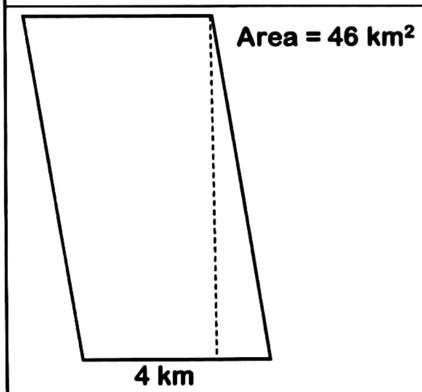


$b = \frac{A}{h} = \frac{7.28\,in^2}{2.6\,in}$

Base: 2.8 in

Height: 2.6 in

Area: 7.28 in^2

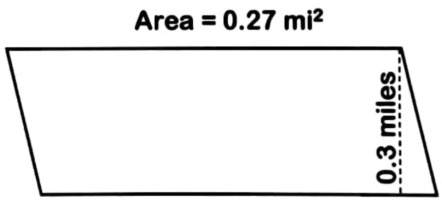


$h = \frac{46}{4}$

Base: 4 km

Height: 11.5 km

Area: 46 km^2

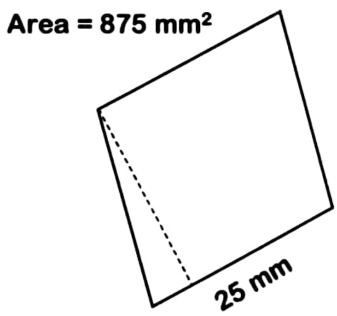


$b = \frac{0.27}{0.3}$

Base: 0.9 mi

Height: 0.3 mi

Area: 0.27 mi^2



$h = \frac{875}{25}$

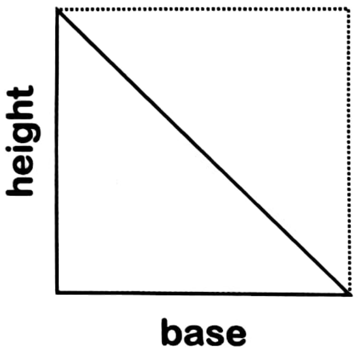
Base: 25 mm

Height: 35 mm

Area: 875 mm^2

Area of Triangles

Think of the area of a triangle as *half* the area of a square or rectangle.

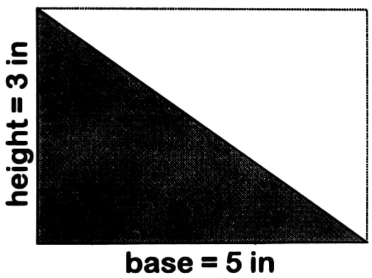


Area for a triangle is one-half of the two sides multiplied together.

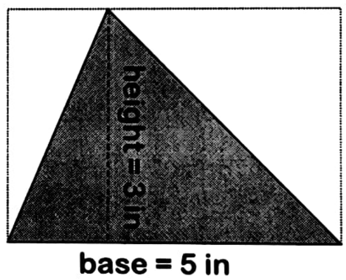
The area is ½ times the *base* times the *height* of a triangle.

Area = ½ b x h

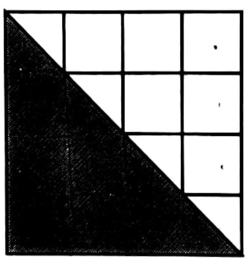
Area = ½ (5 x 3) = 4 in²



Area = ½ (5 x 3) = 4 in²



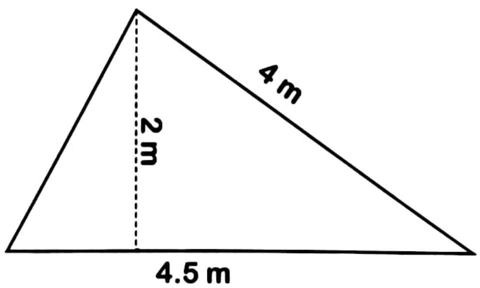
Find the dimensions and area of each triangle:



Base: 4 units

Height: 4 units

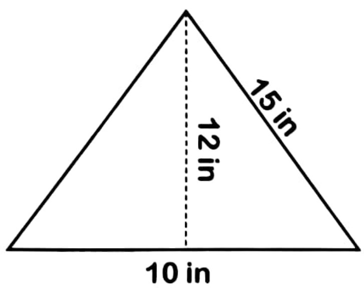
Area: $\frac{1}{2}(4)(4)$ → 8 sq. units



Base: 4.5 m

Height: 2 m

Area: $\frac{1}{2}(4.5)(2) = 4.5\ m^2$



Base: 10"

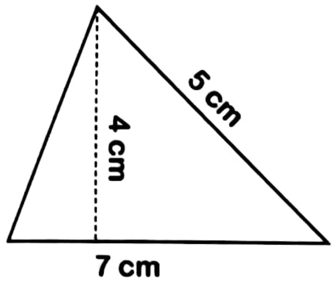
Height: 12"

Area: $\frac{1}{2}(10)(12) = 60$ sq. in

Area of Triangles

Find the area of each shape using Area = ½ base x height

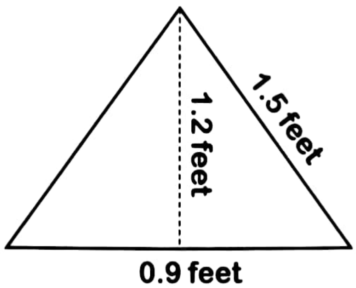
Don't forget units in your numbers!



Base: 7 cm

Height: 4 cm

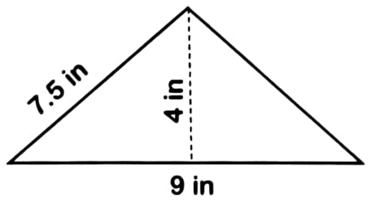
Area: $\frac{1}{2}(7)(4)=14 cm^2$



Base: 0.9'

Height: 1.2'

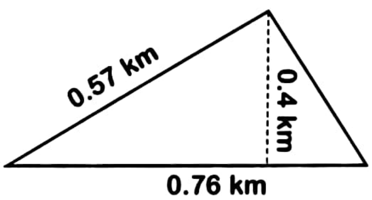
Area: $\frac{1}{2}(0.9)(1.2)=0.54 in^2$



Base: 9 in

Height: 4 in

Area: $\frac{1}{2}(4)(9) = 18 in^2$

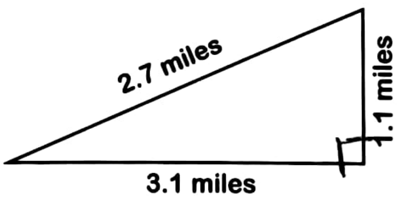


$\boxed{A = 0.152 Km^2}$

Base: 0.76 Km

Height: 0.4 Km

Area: $\frac{1}{2}(0.76)(0.4)$

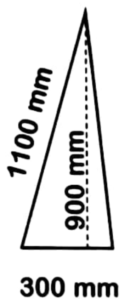


$\boxed{A = 1.705 mi^2}$

Base: 3.1 miles

Height: 1.1 miles

Area: $(\frac{1}{2})(3.1)(1.1)$



$\boxed{A = 135,000 mm^2}$

Base: (300mm)

Height: 900mm

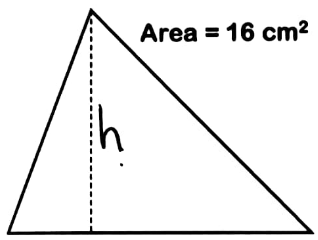
Area: $\frac{1}{2}(300)(100)$

Area of Triangles

Using Area = ½ Base x Height, find the missing dimension(s) for each shape.

Don't forget units in your numbers!

Area = 16 cm²



8 cm

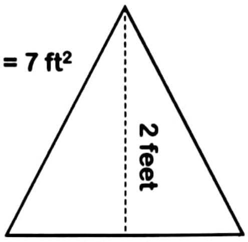
$$h = \frac{2A}{b} = \frac{2(16)}{8}$$

Base: 8 cm

Height: $\boxed{4\text{ cm}}$

Area: 16 cm²

Area = 7 ft²



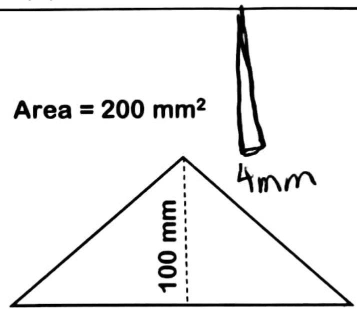
$$b = \frac{2A}{h} = \frac{2(7)}{2} =$$

Base: $\boxed{7\text{ ft}}$

Height: 2 ft

Area: 7 ft²

Area = 200 mm²



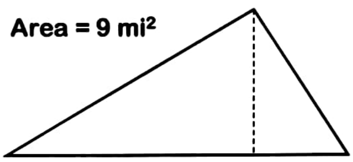
$$b = \frac{2A}{h} = \frac{2(200)}{100}$$

Base: $\boxed{4\text{ mm}}$

Height: 100mm

Area: 200mm²

Area = 9 mi²



6 miles

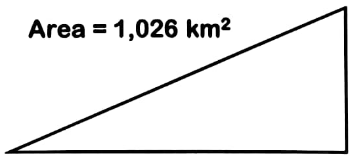
$$h = \frac{2A}{b} = \frac{2(9)}{6} = 3\text{mi}$$

Base: 6mi

Height: $\boxed{3\text{mi}}$

Area: 9 mi²

Area = 1,026 km²



76 km

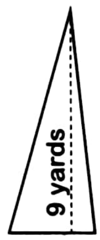
$$h = \frac{2A}{b} = \frac{2(1026)}{76}$$

Base: 76Km

Height: $\boxed{27\text{ Km}}$

Area: 1026 Km²

Area = 13.5 yd²



$$b = \frac{2A}{h} = \frac{2(13.5)}{9}$$

$$b = 3\text{ yd}$$

Base: $\boxed{3\text{ yd}}$

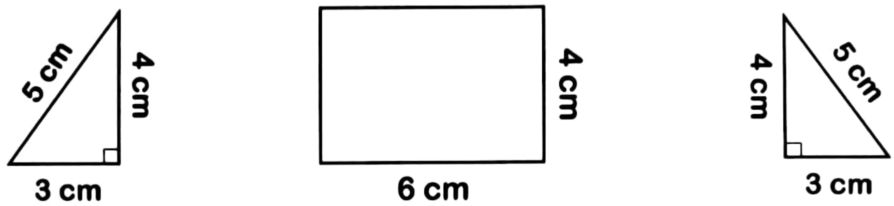
Height: 9 yd

Area: 13.5 yd²

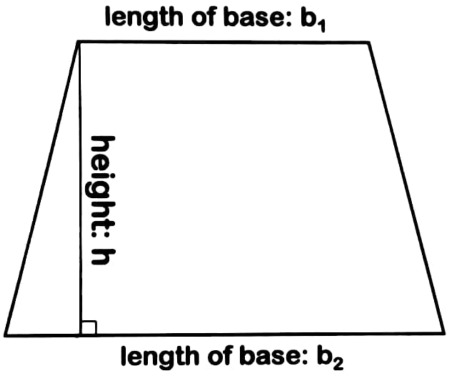
Area of Trapezoids

A trapezoid is one or two triangles and a rectangle (or square) combined.

Three figures are shown below. Find the area of each.



Area:



Rectangle Area = b x h

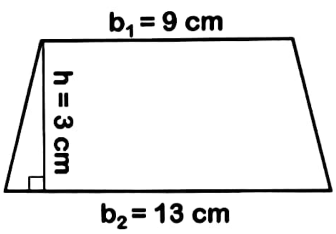
Triangle Area = ½ b x h

To find the area of a trapezoid, we combine the two areas above into this:

Trapezoid Area = ½ $(b_1 + b_2)$ h

Remember! Units for area are *squared* like this: cm^2 or in^2

Find the dimensions and area of each trapezoid:

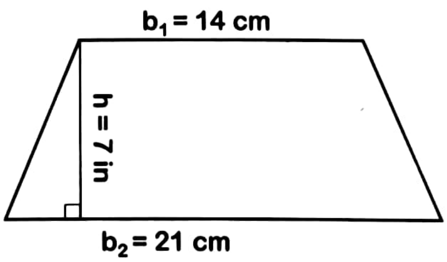


Area: $\frac{1}{2}(b_1+b_2)h$

$=\frac{1}{2}(9+13)(3)$

$=\frac{1}{2}(22)(3)$

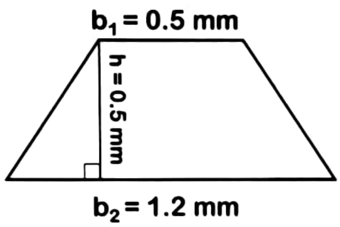
$= \boxed{33 \text{ cm}^2}$



Area: $\frac{1}{2}(14+21)(7)$

$A=\frac{1}{2}(35)(7)$

$\boxed{A = 122.5 \text{ cm}^2}$

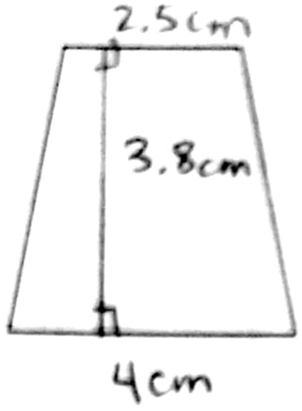


Area: $\frac{1}{2}(0.5+1.2)(0.5)$

$\boxed{A=0.425 \text{ mm}^2}$

Area of Trapezoids: $A = \frac{1}{2}(b_1 + b_2)h$

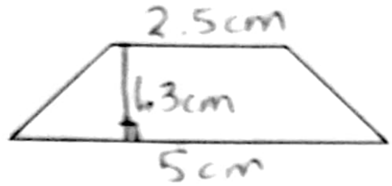
Use your ruler to measure each shape and find the area. (in cm^2)



$A = \frac{1}{2}(2.5 + 4)(3.8)$

$A = \frac{1}{2}(6.5)(3.8)$

Area: $\boxed{12.35\ cm^2}$

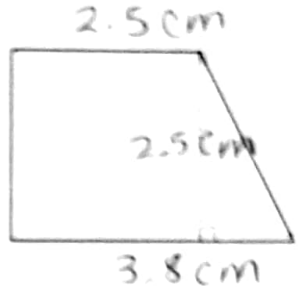


$A = \frac{1}{2}(2.5+5)(1.3)$

$A = \frac{1}{2}(7.5)(1.3)$

$\boxed{A = 4.875\ cm^2}$

Area:



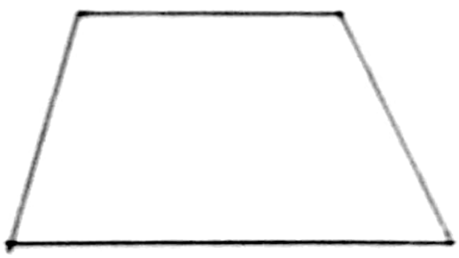
$A = \frac{1}{2}(2.5 + 3.8)(2.5)$

$\boxed{A = 7.875\ cm^2}$

Area:

Draw one trapezoid in each space below. Measure the sides you need and calculate the area.

Area:



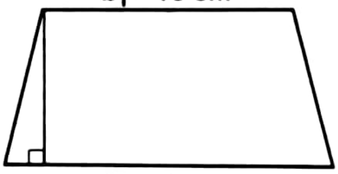
Area:

Area:

Area of Trapezoids: $A = \frac{1}{2}(b_1 + b_2)h$

These trapezoids are missing a dimension! Can you figure out each one?
Hint: You may have to re-arrange the trapezoid area equation to use it to find the missing side.

$b_1 = 16$ cm



$b_2 = 26$ cm

Area = 252 cm²

Base 1: 16 cm

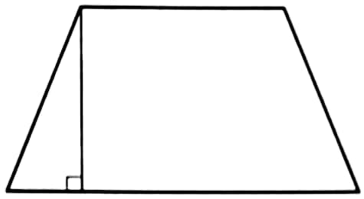
Base 2: 26 cm

Height: $\boxed{h = 12 \text{ cm}}$

Formula: $h = \dfrac{A}{\frac{1}{2}(b_1+b_2)}$

Area: 252 cm²

$b_1 = 100$ miles



$b_2 = 160$ miles

Area = 5,200 mi²

$h = \dfrac{2A}{(b_1+b_2)} = \dfrac{2(5200)}{(160+100)}$

$\boxed{h = 40 \text{ miles}}$

$b_1 = ?$

$b_2 = 22$ mm

Area = 204 mm²

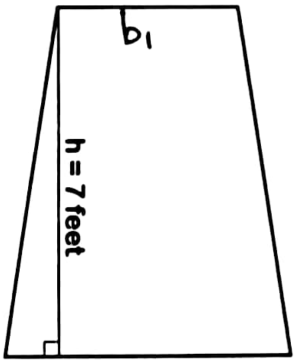
$b_1 = \dfrac{2A}{h} - b_2$

$b_1 = \dfrac{2(204)}{(12)} - 22$

$b_1 = 34 - 22$

$\boxed{b_1 = 12 \text{ mm}}$

Area = 56 ft²



$b_2 = 8$ feet

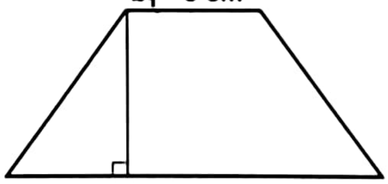
$b_1 = \dfrac{2A}{h} - b_2$

$b_1 = \dfrac{2(56)}{7} - 8$

$b_1 = 16 - 8$

$\boxed{b_1 = 8}$

$b_1 = 5$ cm



$b_2 = 15$ cm

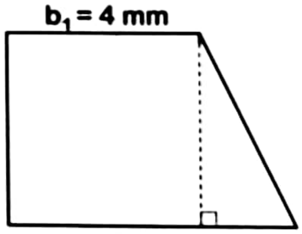
Area = 20 cm²

$h = \dfrac{2A}{(b_1+b_2)}$

$h = \dfrac{2(20\text{cm}^2)}{(\cancel{5+15}_{20})\text{cm}}$

$\boxed{h = 2 \text{ cm}}$

$b_1 = 4$ mm



$b_2 = 7$ mm

Area = 22 mm²

$h = \dfrac{2A}{(b_1+b_2)}$

$h = \dfrac{2(22)}{(4+7)}$

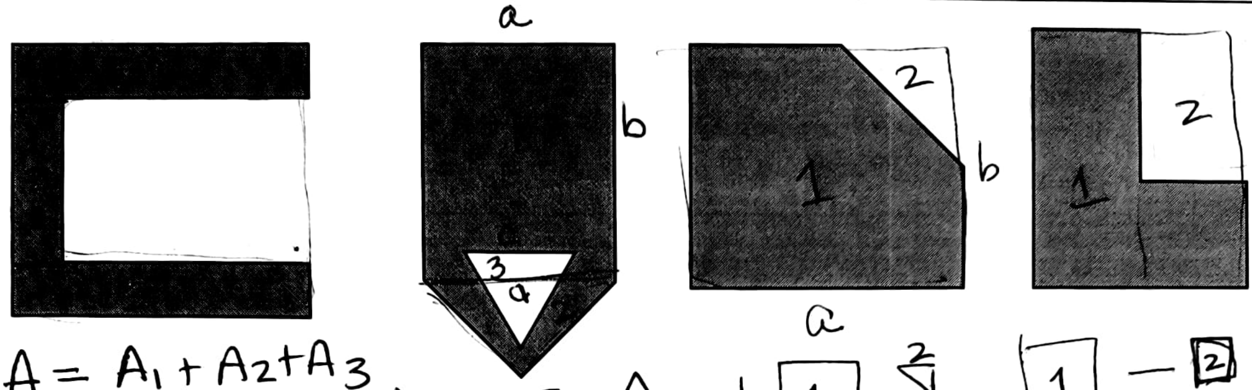
$h = \dfrac{2(22)}{11}$

$\boxed{h = 4 \text{ mm}}$

Area of Composite Figures

A *composite* figure is made up of two or more shapes.

How would you decompose the figures below?
Discuss and label the different ways could break each apart into familiar shapes.



$A = A_1 + A_2 + A_3$

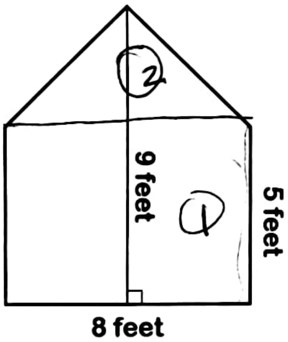
$A = bh)_1 + bh)_2 + bh)_3$

$\boxed{1} + \triangle 2 - \triangle 3$

$b \cdot a\ \boxed{1} - \triangle 2$

$\boxed{1} - \boxed{2}$

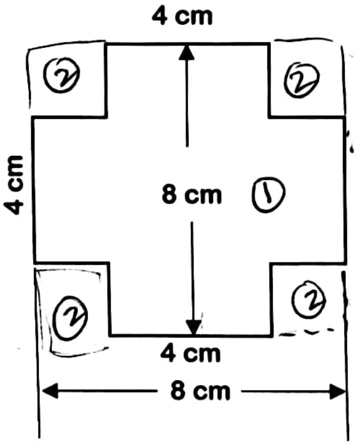
To find the area of a composite shape, first break the figure into familiar shapes, then add or subtract the area for each shape as appropriate.



$\boxed{1}$ 8', 5' $A_R = 8 \times 5 = 40\ ft^2$

(2) $\triangle$ 8', 4' $A_T = \frac{1}{2}(8)(4) = 16\ ft^2$

$A_{total} = A_R + A_T = 40 + 16 = \boxed{56 ft^2}$



$\boxed{1}$ 8, 8 $A_1 = 8 \cdot 8 = 64\ cm^2$

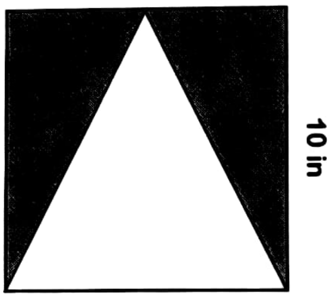
$-4\ \boxed{2}$ 2, 2 $\Rightarrow A_2 = (2)(2) = 4\ cm^2$

$4(4\ cm^2) = 16\ cm^2$

$64 - 16 \Rightarrow$ Total Area $= \boxed{48\ cm^2}$

Area of Composite Figures

Find the area of the shaded regions by decomposing it into familiar shapes.



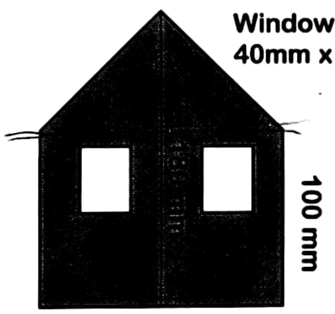
① 10, 10

$A_1 = b \cdot h = (10)(10) = 100 \text{ in}^2$

− ②

$A_2 = \frac{1}{2} bh = \frac{1}{2}(10)(10) = 50 \text{ in}^2$

$A_{Total} = A_1 - A_2 = 100 - 50 = \boxed{50 \text{ in}^2}$



+ ① 100, 160

$A_1 = b \cdot h = (100)(160) = 16{,}000 \text{ mm}^2$

+ ② 80, 160

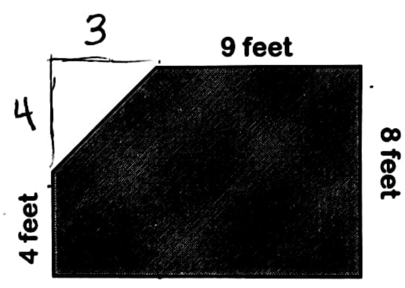
$A_2 = \frac{1}{2} bh = \frac{1}{2}(160)(80) = 6400 \text{ mm}^2$

− 2 ③ 40, 20

$A_3 = bh = (20)(40) = 800 \text{ mm}^2$

$\boxed{A_{Total} = 20{,}800 \text{ mm}^2}$

$A_{Total} = A_1 + A_2 - 2A_3 = 16{,}000 + 6{,}400 - 2(800) =$



8 ① 12

$A = b \cdot h = (12)(8) = 96 \text{ ft}^2$

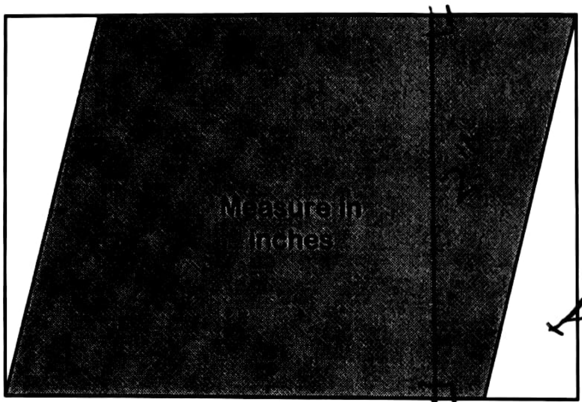
②

$A = \frac{1}{2} bh = \frac{1}{2}(4)(3) = 6 \text{ ft}^2$

$A_{Total} = 96 - 6 = \boxed{90 \text{ ft}^2}$

Area of Composite Figures

Calculate the area of the shaded regions below.
Use your ruler to measure any information you need.

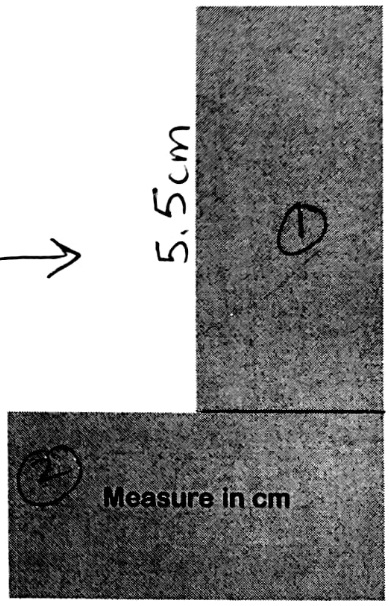


2.5"

$A = b \cdot h$

$A = (2.5)(2)$

$\boxed{A = 5 \text{ in}^2}$



2.5cm

5.5cm

2.5 cm

5 cm

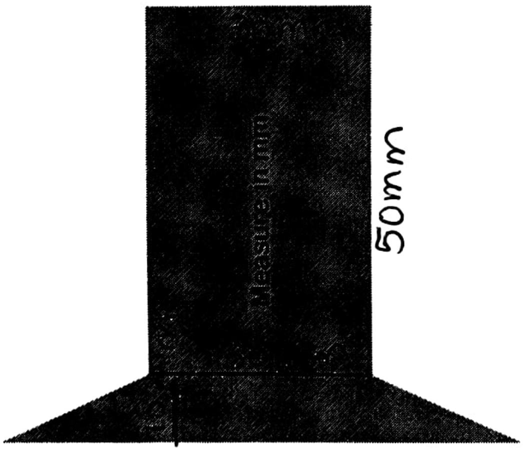
$A_1 = b \cdot h = (2.5)(5.5) = 13.75 \text{ cm}^2$

$A_2 = (5)(2.5) = 12.5 \text{ cm}^2$

$A_{TOTAL} = A_1 + A_2 = \boxed{26.25 \text{ cm}^2}$

$\boxed{1} = b \cdot h$

$(2) = \frac{1}{2}(b_1 + b_2)h$



50mm

70mm

$A_1 = (30)(50) = 1500 \text{ mm}^2$

$A_2 = \frac{1}{2}(30 + 70)(10)$

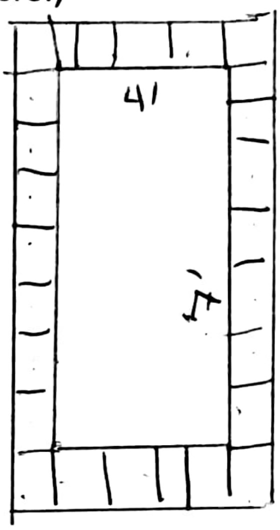
$= \frac{1}{2}(100)(10) = 500 \text{ mm}^2$

$A_{TOTAL} = 1500 + 500 = \boxed{2{,}000 \text{ mm}^2}$

Area of Composite Figures

Solve the word problems by first drawing the shapes.

Tony is placing new 12" square tiles around his 7 ft x 4' pool. Tiles cost $2.25 each. How much is this project going to cost? (Hint: Don't forget the corners!)

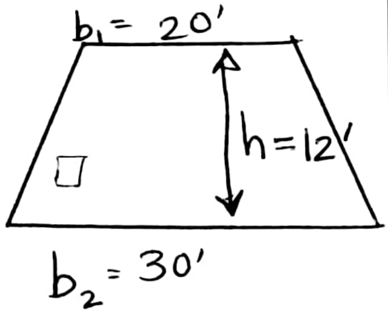


Total # tiles $= 7(2) + 4(2) + 4$ (corners)

$= 14 + 8 + 4 = 26$ tiles

$\frac{\$2.25}{\text{tile}}(26 \text{ tiles}) = \boxed{\$58^{05}}$

Sophia is building a new deck for her home. The deck is a trapezoid shape with parallel sides measuring 20 feet and 30 feet, and distance between the parallel sides is 12 feet. If wood is $3.40 per sq ft, how much will it cost to build the deck?



$A = \frac{1}{2}(b_1 + b_2)h$

$A = \frac{1}{2}(20 + 30)(12)$

$A = \frac{1}{2}(50)(12) = 300$ sq ft

$\frac{\$3.^{40}}{\text{sq. ft}}(300 \text{ sq ft}) = \boxed{\$1{,}020}$

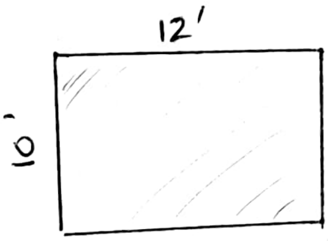
Area of Composite Figures

Solve the word problems by first drawing the shapes.

Arthur lives in a home with ten foot ceilings. He is going to paint two 12-foot long walls with two coats of paint. One wall has a 3 ft x 5 ft window. One gallon of paint covers 400 sq ft. How much paint should he buy?

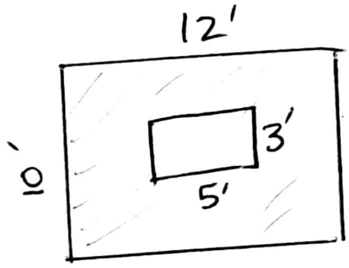
$A = b \cdot h \Rightarrow A = (10)(12) + (10)(12) - (5)(3)$

$A = \underbrace{120}_{\text{wall 1}} + \underbrace{120}_{\text{wall2}} - \underbrace{15}_{\text{window}} = \underbrace{225 \text{ sq ft}}_{\text{total}}$



$(225 \text{ sq.ft})(2 \text{ coats of paint})$

$= \underline{450 \text{ sq ft}} \rightarrow \boxed{2 \text{ gallons}}$



Trent is laying new tile in his kitchen. The kitchen measures 14 feet by 20 feet. The kitchen has cabinets that extend 2 feet into the room sitting along the 14 foot side. There's also a 6 x 8 foot center island that he is going to work around. The tiles are 12 inches square for $5.50. How much tile does he need and how much will it cost?

$A = bh : A = (18)(14) - (6)(8)$

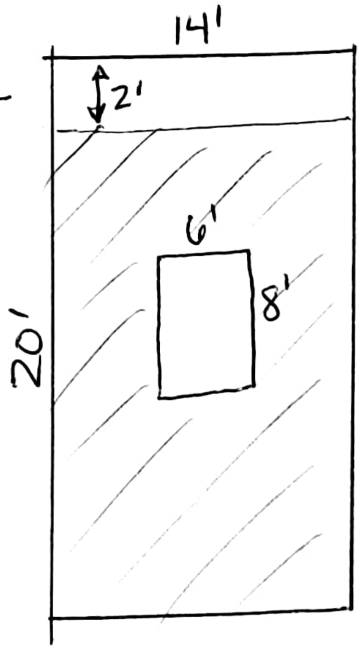
$A = 252 - 48 = \underline{204 \text{ sq ft}}$

1 ft

$\boxed{\$5^{50}}$ 1 ft

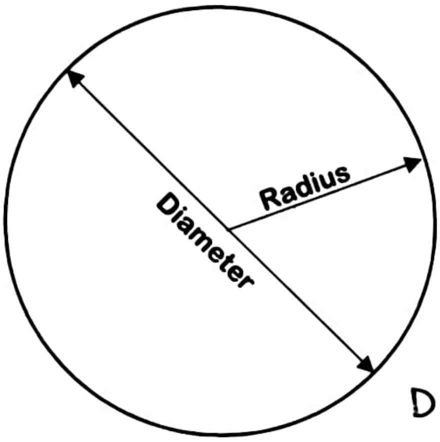
<u>204 tiles</u>

$204(\$5^{50}) = \boxed{\$1,122}$



Area of Circles

Circles are round shapes without any corners or line segments.



$D = 2r$

The Radius (r)

This is measured *from* the center of a circle to any point *on* the circle.

$$\text{Area} = \pi r^2$$

The Diameter (d)

Any straight line passing through the *center* of the circle with endpoints *on* the circle.

$$\text{Area} = \tfrac{1}{4} \pi d^2$$

$$\pi = 3.14159\ldots$$

π: (*pi*, pronounced *"pie"*) is a number a little larger than 3.

π is the number we get when we divide the circumference by the diameter.

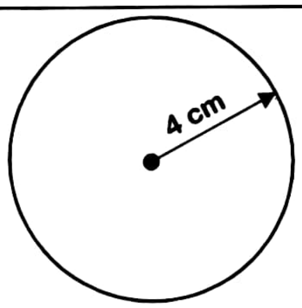
We will use $\pi = 3.14$ for our calculations.

The Circumference (C)

This is the distance measured *around* the entire circle.

$$C = 2 \pi r = \pi d$$

Find the dimensions and area of each circle:

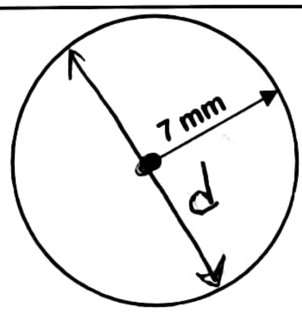


r = 4 cm

d = 2 x 4 cm = 8 cm

$C = 2 \pi r = 2 (3.14)(4 \text{ cm})$
$= 25.1 \text{ cm}$

$\text{Area} = \pi r^2 = (3.14)(4 \text{ cm})^2$
$= 50.3 \text{ cm}^2$

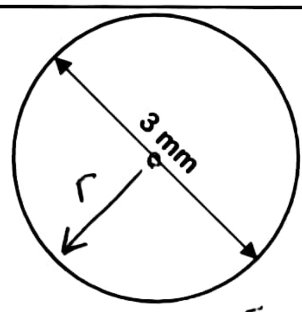


r: 7 mm

d: 14 mm

C: $2(\pi)(7 \text{mm}) = 43.96 \text{ mm}$

Area: $\pi r^2 = \pi (7 \text{mm})^2$
$= 153.86 \text{mm}^2$



r: $\frac{1}{2}(3 \text{mm}) = 1.5 \text{mm}$

d: 3mm

C: $\pi d = \pi (3 \text{mm}) = 9.42 \text{ mm}$

Area: $\pi r^2 = \pi (1.5 \text{mm})^2$
$\sim 7 \text{mm}^2$

Area of Circles

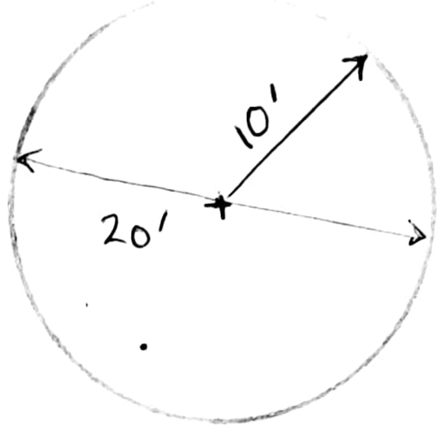
Circumference = 2 π r **Area = π r² = ¼ π d²** **Use: π = 3.14**

A wooden horse on a carousel travels in a circle. The carousel is 20 feet in diameter. How far does the horse travel each time it completes a circle?

$C = 2\pi r$

$C = 2(3.14)(10')$

$\boxed{C = 62.8 \text{ feet}}$



What is both the radius and diameter of the carousel?

$r = 10'$

$d = 20'$

The owner needs to install a new floor in the carousel. The carousel has a 4 foot hole in the center for the machinery that turns the carousel. How much wood does he need, in square feet?

$A_{TOTAL} = A_1 - A_2$

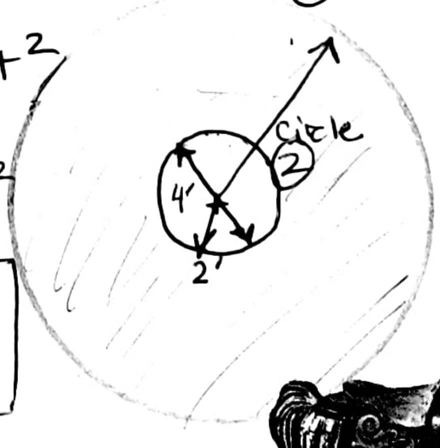
Circle 1

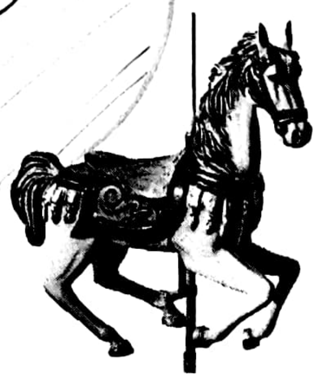
$A_1 = \pi(10')^2 = 314 \text{ ft}^2$

$A_2 = \pi(2')^2 = 12.56 \text{ ft}^2$

$A_{TOTAL} = 314 - 12.56 \text{ ft}^2$

$\boxed{A_{Total} = 301.44 \text{ ft}^2}$





Area of Circles

Circumference = 2 π r **Area = π r² = ¼ π d²** **Use: π = 3.14**

An electric model train travels in a circular loop of track made from 4-foot radius arcs. How far does the train travel after 10 laps around the track?

$r = 4'$ $d = 8'$

$C = 2\pi r = 2(3.14)(4') = 25.12'$

$10 \text{ Laps} = 10(25.12') = \boxed{251.2'}$

What is both the radius and diameter of the track?

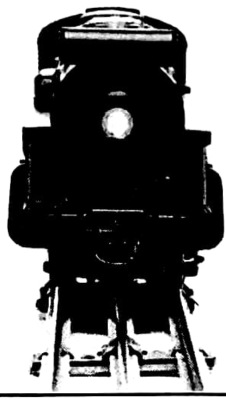
$d = 8'$ $r = 4'$

Approximately how many laps does the train need to do to travel 500 meters?

$3.28 \text{ ft} = 1 \text{ m}$

$25.12 \cancel{\text{ft}} \left(\frac{1 \text{ m}}{3.28 \cancel{\text{ft}}}\right) = 7.7 \text{ m for } 1 \text{ lap}$

$\frac{500 \cancel{\text{m}}}{7.7 \frac{\cancel{\text{m}}}{\text{lap}}} = \boxed{65.3 \text{ Laps}}$



Area of Circles

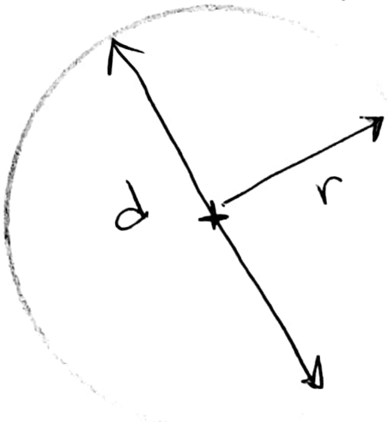
Circumference = $2 \pi r$ **Area = $\pi r^2 = \frac{1}{4} \pi d^2$** **Use: $\pi = 3.14$**

A farmer's rotating irrigation sprinkler setup covers an area of 2800 meters.^{2} About how big is the circle that it covers?

$A = 2800\ m^2$

$\frac{A}{\pi} = \frac{\cancel{\pi} r^2}{\cancel{\pi}} \Rightarrow r^2 = \frac{A}{\pi}$

so: $r = \sqrt{\frac{A}{\pi}}$



$r = \sqrt{\frac{2800 m^2}{3.14}} = \boxed{29.9\ m}$

$d = 2 \cdot r = 2(29.9)$

$\boxed{d = 59.7 m}$

A horse trainer wants to create a 50-foot diameter bullpen (a round fenced-in enclosure) for training and lunging horses. How many fences does she need if they come in 7 foot sections?

$C = \pi d = (3.14)(50')$

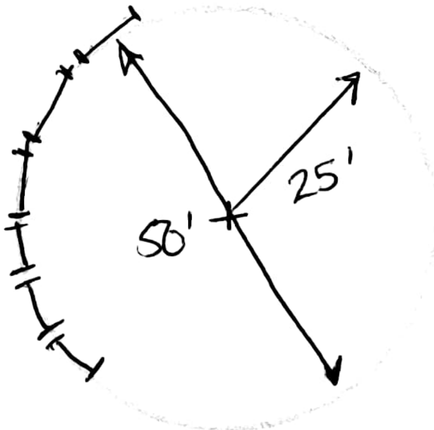
$C = 157\ ft$

$C = \pi d$

$C = 2 \pi r$

Total # of fences $= \frac{157\ ft}{7\ ft/fence}$

$= \boxed{23\ \text{fences}}$



Practice Test

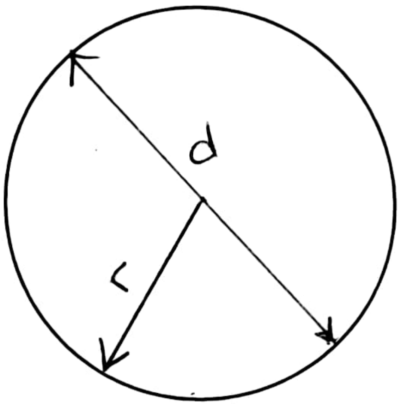
Use your ruler (use cm) to determine the dimensions, and then calculate the perimeter and area of each shape below. Round to the nearest tenth of a cm.

Diameter: $\boxed{5.2\text{ cm}}$

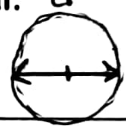
Radius: $\boxed{2.6\text{cm}}$

Circumference: $\pi d = \boxed{16.3\text{ cm}}$

Area: $\pi r^2 = \pi(2.6\text{cm})$
$= \boxed{21.2\text{cm}^2}$



Now draw a similar circle that is one quarter the size of the original. d = 1.3 cm

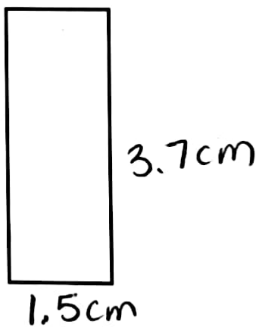


Length: $\boxed{3.7\text{cm}}$

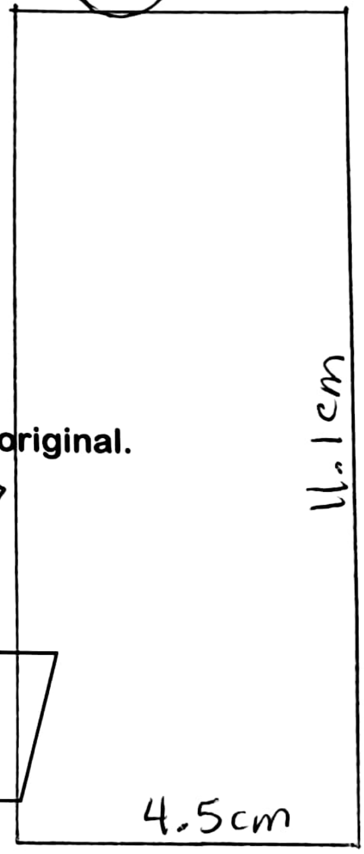
Width: $\boxed{1.5\text{ cm}}$

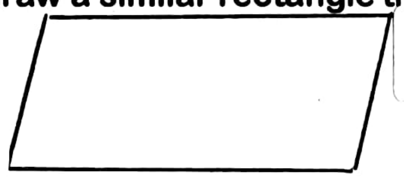
Perimeter: $2(3.7)+2(1.5) = \boxed{10.4\text{ cm}}$

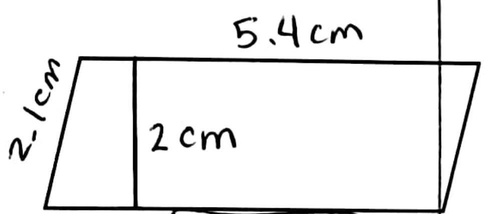
Area: $= b \cdot h = (3.7)(1.5)$
$= \boxed{5.5\text{ cm}^2}$



Now draw a similar rectangle that is three times the size of the original.







Length: $\boxed{5.4\text{cm}}$

height ~~**Width**~~**:** $\boxed{2\text{cm}}$

Perimeter: $2(2.1\text{cm})+2(5.4\text{ cm}) = \boxed{15\text{ cm}}$

Area: $bh = (5.4\text{ cm})(2\text{cm}) = \boxed{10.8\text{ cm}^2}$

Now draw a congruent parallelogram.

Practice Test

Use your ruler (use cm) to determine the dimensions, and then calculate the perimeter and area of each shape below. Round to the nearest tenth of a cm.

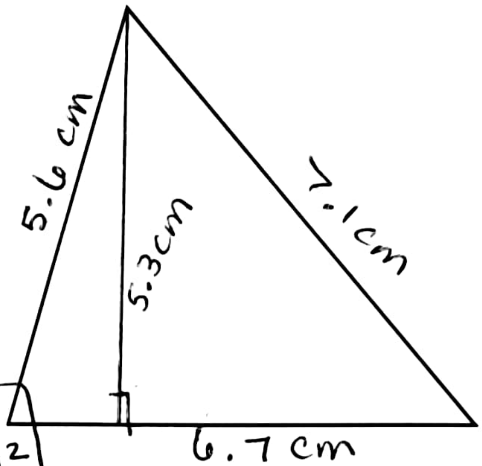
Base: 6.7 cm

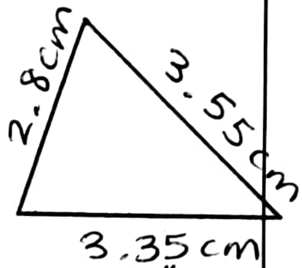
Height: 5.3 cm

Perimeter: 5.6 + 7.1 + 6.7 = $\boxed{19.4\text{ cm}}$

Area:

$\frac{1}{2}bh = \frac{1}{2}(6.7)(5.3) = \boxed{17.8\text{ cm}^2}$





Now draw a similar triangle that ~~is only~~ half the size of the original.

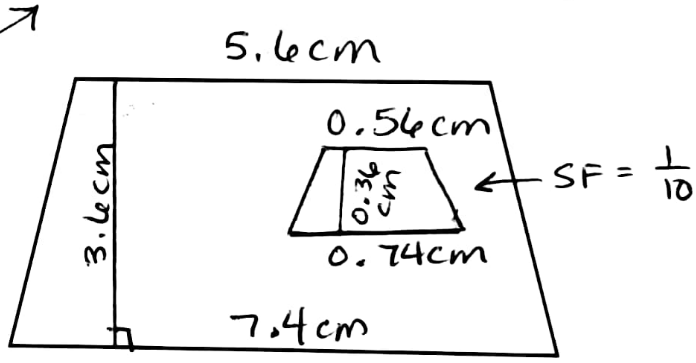
$A = \frac{1}{2}(5.6 + 7.4)(3.6) = \boxed{23.4\text{ cm}^2}$

Base 1: 5.6 cm

Height: 3.6 cm

Base 2: 7.4 cm

Area: $= \frac{1}{2}(b_1 + b_2)h$



Now draw a similar trapezoid *inside* the original of any scale factor.

$A_{TOTAL} = bh + \frac{1}{2}\pi r^2$

$= (5.4)(3) + \frac{1}{2}(3.14)(2.7)^2$

Area = 2.4 + 11.4 = $\boxed{13.8\text{ cm}^2}$

Length: 5.4 cm

Width: Rectangle: 3 cm
Radius = 2.7 cm

Perimeter: $5.4 + 2(3) + \pi(2.7)$
$= \boxed{19.9\text{ cm}}$

Area:

5.4 □ 3 + half circle