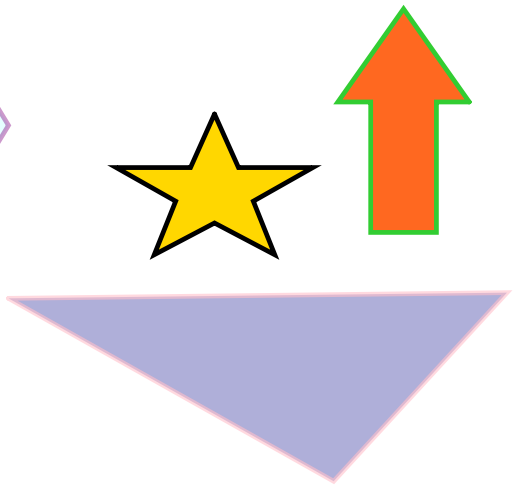
AGENDA - Unit 9 -

Polygons- Area and Perimeter of Simple and Composite Figures

- Go over HW 9.1
- Notes 9.2

HW - 9.2

- Worksheet
- CR #8 - Due 4/12



Worksheet 9-1

1. Name the convex polygon whose interior angle measure sum is 2520°.

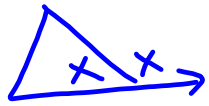
2. Each interior angle of a regular polygon measures 160°. How many sides does the polygon have?

3. Each exterior angle of a regular polygon measures 120°.
   a. How many sides does the polygon have?

   b. What is the measure of each interior angle?

4. Determine the number of sides of the regular polygon if:

   a. Each interior angle measure equals the measure of each exterior angle.



$x + x = 180$

$2x = 180$

$x = 90°$

$\frac{360°}{n} = 90°$

$n = 4$

   b. Each interior angle measure is four times the measure of each exterior angle.

$4x + x = 180$

$5x = 180$

$x = 36$

$\frac{360°}{n} = 36°$

$n = 10$

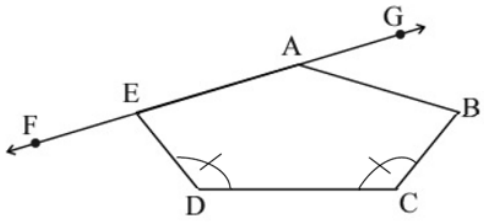
5. A pentagon has exterior angle measures of (5a)°, (10a)°, (4a)°, (3a)°, and (8a)°. Determine the value of a.

For questions 6-8, solve for the missing angles in the diagrams. Read carefully to see what information is given for each diagram. *(Problems from MathBits)*

6. $m\angle B = 76$; $m\angle GAB = 44$; $m\angle FED = 96$

   Find;

   $m\angle D =$ _____

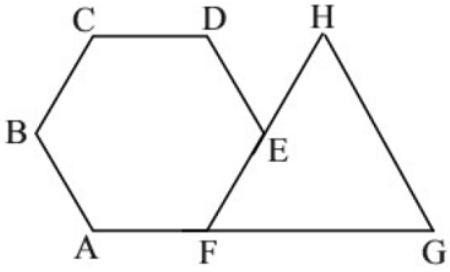


ABCDEF is a regular hexagon. $\overline{HF} \cong \overline{HG}$

Find:

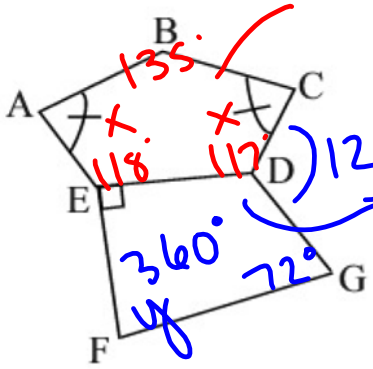
$m\angle A =$ _____ $m\angle HFG =$ _____

$m\angle DEH =$ _____ $m\angle H =$ _____



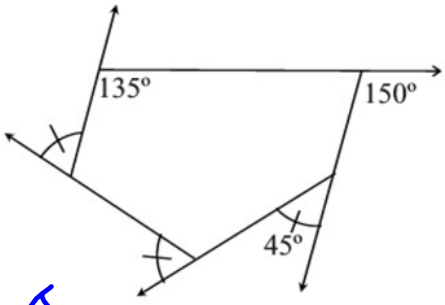
8. $m\angle B = 135$; $m\angle AED = 118$
$m\angle CDE = 117$; $m\angle G = 72$
$m\angle CDG = 129$
Find:
$m\angle A =$ _____

$m\angle F =$ _____



540° =
135°
x
118°
x
117°
129°
SUM ∠'S AT POINT
360°
72°

9. What is wrong with this picture?

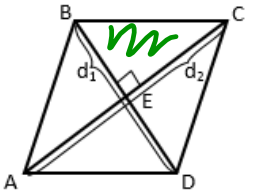


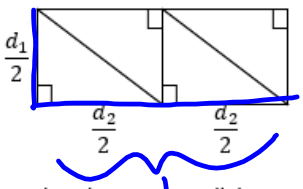
GEOMETRY Name: _____ Section: _____ Date: _____

9-2R Notes: Perimeter and Area Formulas of Simple Polygons/Circles and Composite Figures

USING DISSECTION TO GENERATE AREA FORMULAS – Rhombus, Parallelogram, Triangle, Trapezoid

In the bridge, we just discussed how to find the area of a rhombus by using it as a composite of two congruent isosceles triangles. Could we also generate the formula by rearranging the 4 smaller congruent right triangles to form a figure whose area formula we already know? This is called dissection and may be helpful for finding the area of polygons.





d_2

Area = $\frac{d_1 d_2}{2}$

Demonstrate how by using dissection you can show that the given parallelogram has an area equal to a rectangle with the same base and height.

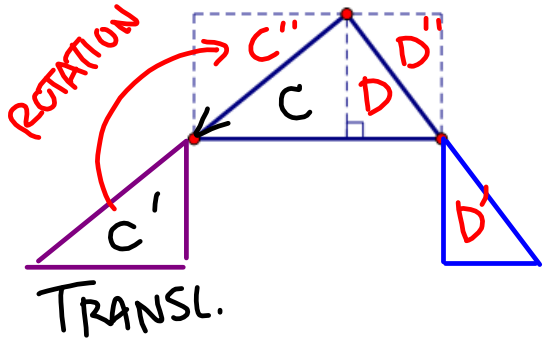
HEIGHT

BASE

$A_{\square} = bh$

Which transformation moved the dissected piece into its new location to form the rectangle? TRANSL Were all the transformations rigid motions for the rhombus dissection? YES So distance and therefore area were preserved.

Explain through rigid motions and dissection how the rectangle area is exactly double the area of the triangle and therefore the area of a triangle is A = ½ bh.

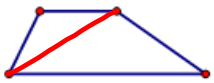


Let the area of the triangle equal the AreaC+AreaD. Since the smaller triangles C and D can be mapped onto triangles C" and D" by translations followed by rotations to create the rectangle, then the areas of the triangles are preserved AreaC=AreaC" and AreaD=AreaD". Therefore the total area of the rectangle is 2(AreaC)+2(AreaD)=bh. By the division property of equality, AreaC+AreaD=bh/2. By substitution, the area of the triangle is equal to bh/2.

≅ IF ISOS TRAP

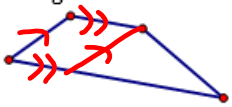
A trapezoid can be thought of as a composite shape (a shape made up of smaller more basic shapes). Dissect the trapezoid into the required shapes:

a) Two Triangles



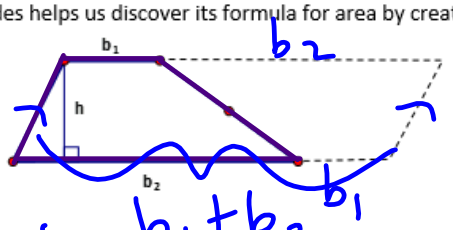
b) Rectangle & Triangle

c) Parallelogram and Triangle



d) Two Triangles and a Rectangle

One way to demonstrate that the area formula for a trapezoid is A = ½ $(b_1 + b_2)h$ is using a DOUBLING TECHNIQUE. Rotating a trapezoid on the midpoint of one of its non-base sides helps us discover its formula for area by creating a simple polygon whose are formula we know:



$A_{\square} = bh$

$= (b_1 + b_2)h$

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

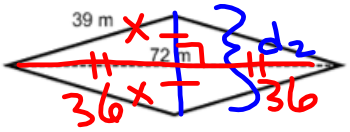
Remember: the base must always be PERPENDICULAR to the height (altitude).

Finding Missing Dimensions/Multi-Step Area & Perimeter– *Round to the nearest tenth*

Some figures will be missing the height or a side length. Dissect off triangles in order to use:

- RIGHT Δ's w/Pythag Thm, Geom Mean, Trig, or Special Rt Δ's
- PROPORTIONAL SIDES from similar triangles
- CPCTC from congruent triangles
- PROPERTIES of isosceles triangles

Example 1: Find the area of the rhombus



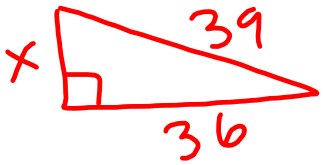
$A = \frac{d_1 d_2}{2}$

$d_2 = x + x$

$= 15 + 15 = 30$

$= \frac{(72)(30)}{2}$

$A = 1080.0\ m^2$



~~{3-4-5}~~

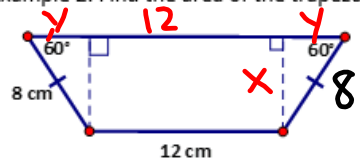
{x-36-39}

{5-12-13}

x=3(5) k=3 k=3

=15

Example 2: Find the area of the trapezoid



$b = 20$

$y \quad 4 \quad 4$

30	60	90
n	$n\sqrt{3}$	$2n$
y	x	8

$y = n \quad x = n\sqrt{3} \quad 2n = 8$

$y = 4 \quad x = 4\sqrt{3} \quad n = 4$

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

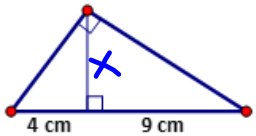
$$= \frac{(12 + 20)(4\sqrt{3})}{2}$$

$$= \frac{(32)(4\sqrt{3})}{2}$$

$$= 110.8512\ldots$$

$$A = 110.9 \text{ cm}^2$$

Example 3: Find the length of the altitude of the triangle



$b = 13$

$A = \frac{bh}{2}$

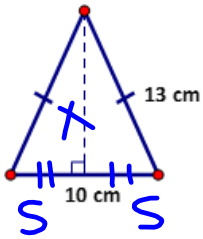
$\Delta I \sim \Delta II$ (SHL)

$$\frac{4}{x} = \frac{x}{9}$$

$$\pm\sqrt{x^2} = \sqrt{36}$$

$x = 6.0$ cm

Example 4: Find the altitude of the isosceles triangle

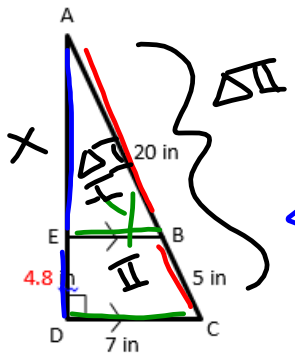


$\{5, 12, 13\}$

$x = 12$

ALT = 12.0 cm

Example 5: Find the area of triangle AEB



ΔI ΔII x

$A = \frac{bh}{2} = \frac{(EB)(EA)}{2} = \frac{(5.6)(19.2)}{2}$

$= 53.76$

$= 53.8 \text{ IN}^2$

SIDE SPLITTER $\frac{x}{4.8} = \frac{20}{5}$

$5x = (4.8)(20)$

$x = 19.2$

$\sim\Delta$'s ΔI ΔII $\frac{y}{7} = \frac{20}{25}$

$25y = (7)(20)$

$y = \frac{140}{25}$

$y = 5.6$

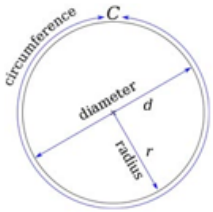
Circle Formulas - use CARD and box in the given information.

C (circumference) = $2\pi r$ OR πd LINEAR

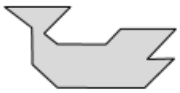
A (area) = πr^2 SQUARE UNITS

R (radius) = r

D (diameter) = $2r$



Composite Area & Perimeter of Planar Figures

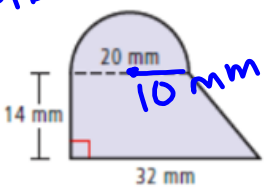


- Definition: a composite figure is a figure made up of simple shapes or parts of simple shapes (triangles, rectangles, parallelograms, trapezoids, circles, polygons).
- Technique:
  1. Break up the composite figure into simple planar figures
  2. Solve for any missing dimensions
  3. **Write an equation that represents the total area desired*** ** ✱
  4. Compute the simple planar figure areas
  5. Substitute the areas into the equation
  6. Round as needed

Example 1: Finding Area by Addition

Write an equation and list the necessary dimensions that would allow you to find the total area of the figure.

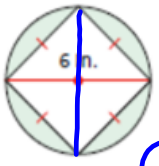
- Equation $Area_{figure}$ = $\frac{1}{2}$ AREA ⊙ + TRAPEZOID
- Radius r = 10 mm
- b_1 = 20 mm
- b_2 = 32 mm
- h = 14 mm



4 ≅ SIDES + ≅ DIAG.

Example 2: Finding a Composite Area by Subtraction

Find the area of the shaded region. Leave your answer in terms of π.



AREA SHADED = $A_{⊙} - A_{SQ}$

C

$A = \pi r^2 = \pi 3^2 = 9\pi$ IN^2

R = 3 IN

D = 6 IN

$A_{SQ} = bh = SIDE^2$

$= \frac{d_1 d_2}{2}$

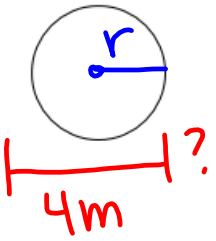
$= \frac{(6)(6)}{2} = 18$ IN^2

AREA SHADED = $9\pi - 18$ IN^2

Backsolving for Missing Dimensions in a Polygon or Circle

A) A circular area rug covers 9π square meters. Will it fit in a space that is 4 meters wide?

NO, RUG DIAM $= 6m > 4m.$



C

$A = 9\pi \; m^2 = \pi r^2$

$R = 3m$

$D = 6m$

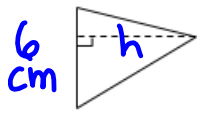
$\frac{9\pi}{\pi} = \frac{\pi r^2}{\pi}$

$\pm\sqrt{9} = \sqrt{r^2}$

$3 = r$

$3m$

B) A triangle has an area of 24 cm^2. If the base is 6 cm, determine the length of the altitude.



$A_\Delta = \frac{bh}{2}$

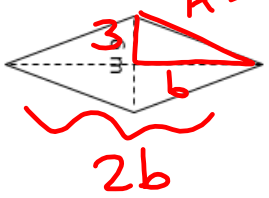
$24\ cm^2 = \frac{(6)(h)}{2}$

$24 = 3h$

$8 = h$

ALT = 8 cm

C) Find the length of the diagonal of a rhombus whose area is 90 m² and has a diagonal of 6 m.



$A = \frac{1}{4} A_{\text{Rhom}} = 22.5$

$A = \frac{d_1 d_2}{2}$

$90\ m^2 = \frac{(6)(d_2)}{2}$

$90 = 3d_2$

$30 = d_2$ m

$A_\Delta = 22.5$

$22.5 = \frac{bh}{2}$

$22.5 = \frac{b(3)}{2}$

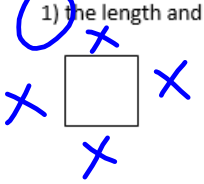
$45 = 3b$

$15 = b$

D) A rectangle has a perimeter of 48 feet. Which will have the greater area:

1) the length and width are equal or 2) the length is 2 feet longer than the width.

GREATER

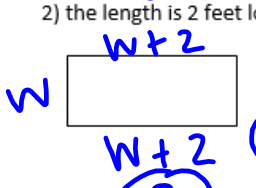


$P = 4x$

$48 = 4x$

$12 = x$

$A = bh = x^2 = 12^2 = 144$



$P = w + (w+2) + w + (w+2)$

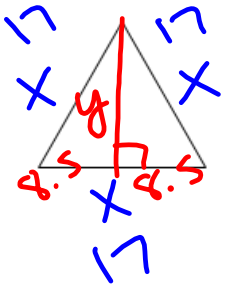
$48 = 4w + 4$

$44 = 4w$

$11 = w$

$A = bh = (13)(11) = 143$

E) An equilateral triangle has a perimeter of 51 m. Find the length of the altitude, to the nearest tenth.



$P = 3x$

$51 = 3x$

$17 = x$

$a^2 + b^2 = c^2$

$y^2 + 8.5^2 = 17^2$

$y^2 + 72.25 = 289$

$\sqrt{y^2} = \sqrt{216.75}$

$y = \pm 14.7224$

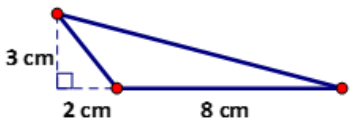
$y = 14.7\text{m}$

ALT

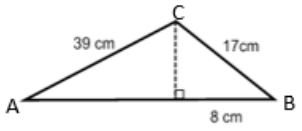
Geometry Worksheet 9-2R Name: _____ Due: _____ Section: _____

1. Find the area of the given figures to the nearest tenth:

A)

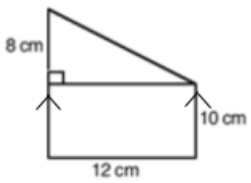


B)

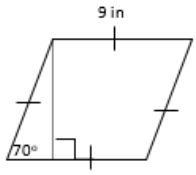


2. Find the area and perimeter of the given figures to the nearest tenth:

C)

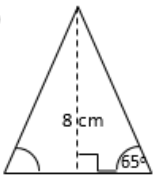


D)

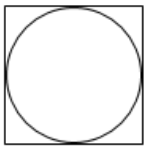


E) Rectangle

F)

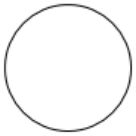


3. The circle is inscribed in the square. The area of the square is 100 ft^2. Determine the area of the circle in terms of π.

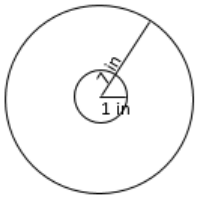


Round to the nearest tenth for problems 4-9.

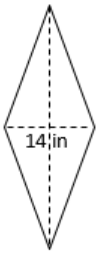
4. A circular table has an area of 20 ft^2. Determine the radius of the table.



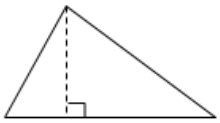
5. Given two circles with the same center and radii of 1 in and 7 in, determine the difference in the areas.



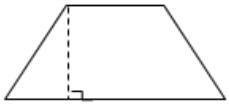
6. Given the area of rhombus is 336 in^2 and one diagonal is 14 inches. Determine the length of the other diagonal.



7. Given the area of a triangle is 50 cm^2 and the base is 4 times the height, determine the height of the triangle.



8. Given an isosceles trapezoid with a perimeter of 40 mm and bases with lengths of 11 mm and 19 mm, determine the area of the trapezoid.



9. Find the shaded area in terms of π and rounded to the nearest hundredth.