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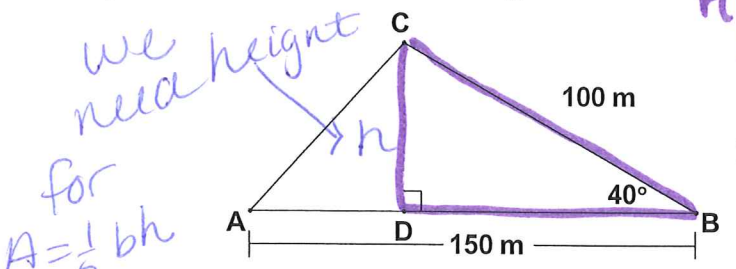
# Area of Regular Polygons- Given a Radius NOTES

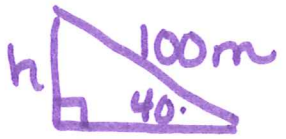
Using the area of a triangle from the law of sines.

Trigonometry can be used with all types of triangles, not just right triangles. The Law of Sines can be used to find the area of a triangle.

**Example A:** Find the area of triangle ABC.




we need height for $A=\frac{1}{2}bh$




$\sin 40 = \frac{h}{100}$

$100 \sin 40 = h$

Don't round.

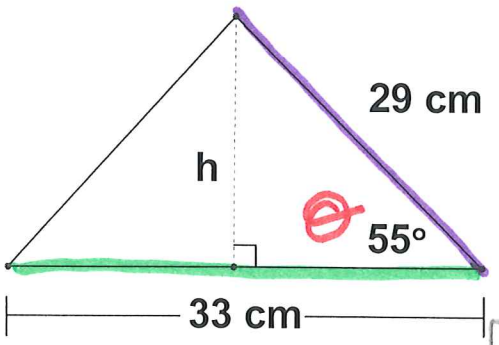
So $A = \frac{1}{2} b \cdot h$

$A = \frac{1}{2} 150 \cdot 100 \sin 40°$

$A \approx 4826.9$

Now you try!! Find the area of each triangle. Use example A as a guide.

B)





$\sin 55 = \frac{h}{29}$

$h = 29 \sin 55$

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

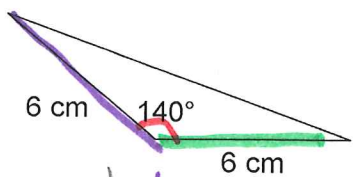
$A = \frac{1}{2} 33 \cdot 29 \sin 55$

$A \approx 391.96 \text{ cm}^2$

The area of a triangle is given by the formula $A = \frac{1}{2} ab \sin\theta$ where a and b are the lengths of two sides and C is the angles between them.

Now use it to find the area of

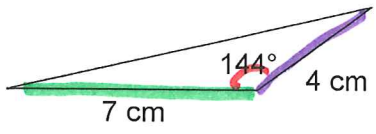
1.




$A = \frac{1}{2} 6 \cdot 6 \sin 140$

$A \approx 11.57 \text{ cm}^2$

2.

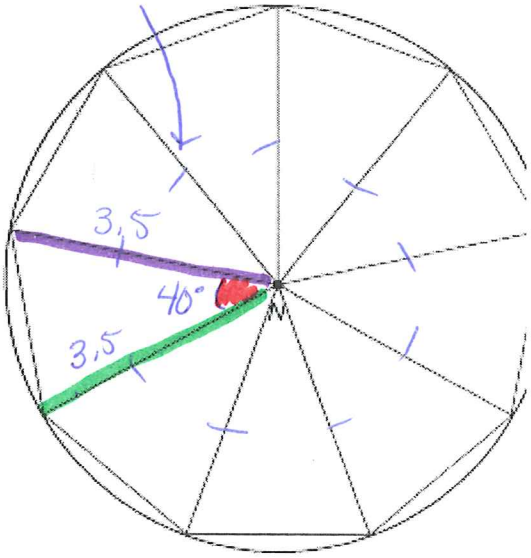



$A = \frac{1}{2} 4 \cdot 7 \sin 144$

$A \approx 9.05 \text{ cm}^2$

# Investigation and Notes

All radii are ≅.




**Warm Up- REGULAR Nonagon**

1. What does it mean to be a regular polygon?

All ≅ sides and all ≅ angles!

2. How many little triangles is the polygon broken into?

9 = nonagon

3. What is the degree measure of each central angle?

9 ≅ Δ parts → $\frac{360}{9} = 40°$

4. Measure in centimeters the length of the radii.

r = 3.5cm

5. Find the area of ONE of the triangles using . (Show all work)

$A = \frac{1}{2}(3.5)(3.5)\sin 40°$

Only one Δ $A \approx 3.94 cm^2$

Add now find Area of nonagon.

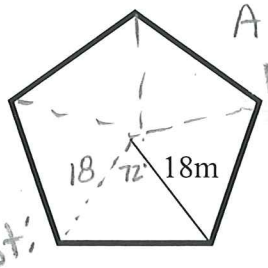
9 because of 9 Δs. n = # sides

$A = 9\left(\frac{1}{2}(3.5)(3.5)\sin 40\right)$

$A = 35.43 cm^2$

Examples: Find the area of each REGULAR polygon, rounding to the nearest tenth.

1.

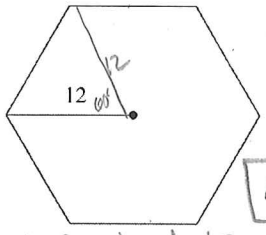



$A = 5\left(\frac{1}{2}(18)(18)\sin 72\right)$

$A \approx 770.4 cm^2$

Find Central angle 1st: $\frac{360}{5} = 72$

2.




$A = 6\left(\frac{1}{2}(12)(12)\sin 60\right)$

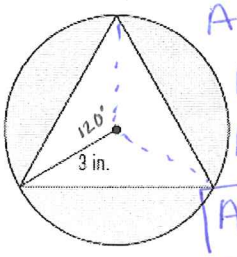
$A \approx 374.1 units^2$

Find central ∠s 1st: $\frac{360}{6} =$

Find the area of each shaded region , rounding to the nearest tenth.

120° = central angle

3.



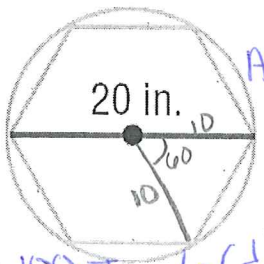

A = O − Δ

$A = \pi 3^2 - 3\left(\frac{1}{2}(3)(3)\sin 120\right)$

$A = 9\pi - 11.7$

$A \approx 16.6 in^2$

3.




A = O − hexagon

$A = \pi 10^2 - 6\left(\frac{1}{2}\right)(10)^2 \sin 60$

$A = 100\pi - 6\left(\frac{1}{2}\right)(10)(10)\sin 60$

$A = 100\pi - 259.8$

$A \approx 54.4 in^2$

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## Area of Regular Polygons- Given a Radius HW

Find the area of each regular polygon given the information. Add Round to nearest tenth

1. A regular heptagon with r = 10m

$360 \div 7 \approx 51.4$ $A = 7\left(\frac{1}{2}\right)(10)(10)\sin 51.4$

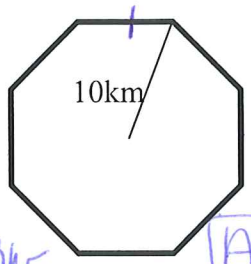
$A \approx 273.5 m^2$

2. A regular dodecagon with r = 3in

$\frac{360}{12} = 30$ $A = 12\left(\frac{1}{2}\right)(3)(3)\sin 30$

$A \approx 27 in^2$

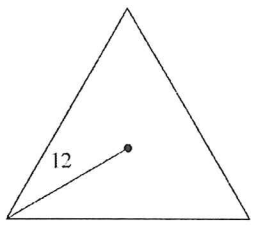
3.




$n = 8$ $\frac{360}{8} = 45$ $A = 8\left(\frac{1}{2}\right)10 \cdot 10 \sin 45$

$A \approx 282.4 km^2$

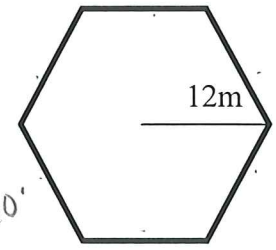
4.




$A = 3\frac{1}{2}(12)(12)\sin 120$

$A \approx 187.1 units^2$

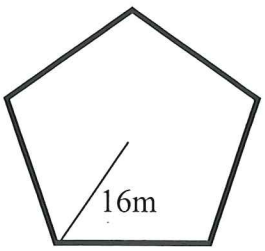
5.




$\frac{360}{6} = 60°$ $A = 6\left(\frac{1}{2}\right)(12)(12)\sin 60$

$A \approx 374.1 m^2$

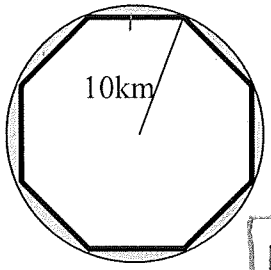
6.




$\frac{360}{5} = 72°$ $A = 5\left(\frac{1}{2}\right)(16)(16)\sin 72$

$A \approx 608.7 m^2$

Find the area of each shaded region, rounding to the nearest tenth.

7. 

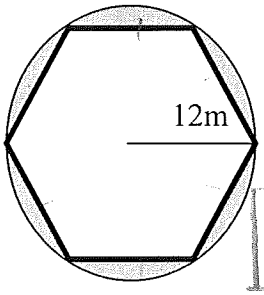

$\frac{360}{8} = 45$

8-gon

$A = \pi 10^2 - 8\left(\frac{1}{2}\right)(10)(10)\sin 45$

$A = 100\pi - 282.8$

$A \approx 31.4\ km^2$

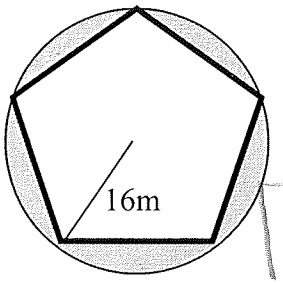
8. 


$\frac{360}{6} = 60$

$A = \pi 12^2 - 6\left(\frac{1}{2}\right)(12)(12)\sin 60$

$A = 144\pi - 374.1$

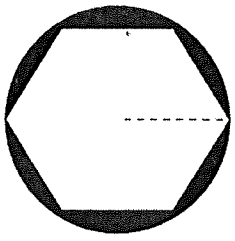
$A \approx 78.3\ m^2$

9. 


$A = \pi 16^2 - 5\left(\frac{1}{2}\right)(16)(16)\sin 72$

$A = 256\pi - 608.7$

$A \approx 195.5\ m^2$

10. 


$A = \pi 7^2 - 6\left(\frac{1}{2}\right)(7)(7)\sin 60$

$A = 49\pi - 127.3$

$A \approx 26.6\ m^2$

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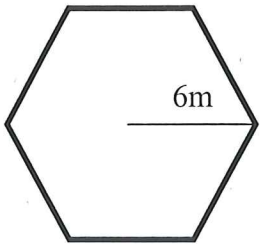
## Area of Regular Polygons- Given a Radius Checkpoint A

Find the area of each regular polygon given the information. Round to nearest tenth

1. A regular hexagon with r = 15m

$A = 6\left(\frac{1}{2}\right)15 \cdot 15 \sin 60$

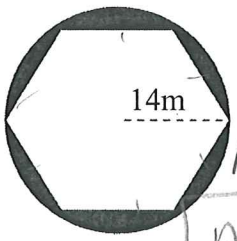
$A \approx 584.6 m^2$

2. 


$A = 6\frac{1}{2}36 \sin 60$

$A \approx 93.5 m^2$

Find the area of each shaded region, rounding to the nearest tenth.

3. 


$A = \pi 14^2 - 6\left(\frac{1}{2}\right)(14)(14)\sin 60$

$A = 196\pi - 509.2$

$A \approx 106.6 m^2$

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## Area of Regular Polygons- Given a Radius Checkpoint B

Find the area of each regular polygon given the information.

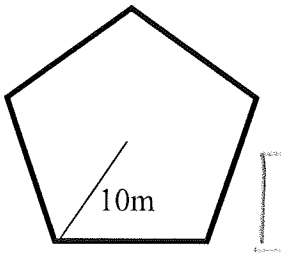
1. A regular pentagon with r = 22m

$\frac{360}{5} = 72$

$A = 5\left(\frac{1}{2}\right)(22)(22)\sin 72$

$A \approx 1150.8\ m^2$

2.

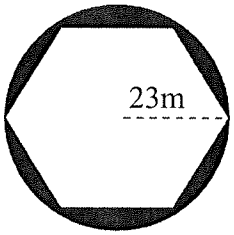



$A = 5\left(\frac{1}{2}\right)(10)(10)\sin 72$

$A \approx 237.8\ m^2$

Find the area of each shaded region, rounding to the nearest tenth.

3.




$A = \pi 23^2 - 6\left(\frac{1}{2}\right)23 \cdot 23 \sin 60$

$A = 529\pi - 1374.4$

$A \approx 287.5\ m^2$