



GK - Mathematics

Resources for Some Math Questions:

Kaplan et al (2015). Cliff Notes FTCE General Knowledge Test, 3rd Edition

Mander, E. (2015). FTE General Knowledge Test with Online Practice, 3rd Edition

GK- Math Review Overview

Session	Competency/Skill	%	#	Target
1	Pre-Test 15 Questions			
1 & 2	Number Sense	17	8	6
3 & 4	Algebraic Thinking	29	13	9
5 & 6	Geometry	21	9	6
7 & 8	Probability & Statistics	33	15	11
8	Post-Test 15 Questions			
8 Sessions	Total	100	45	32



Scavenger Hunt Worksheet

Requires GK Math Reference Sheet

15 minutes

Geometry and Measurement

- Identify and classify simple two- and three-dimensional figures according to their mathematical properties.
- Solve problems involving ratio and proportion (e.g., scaled drawings, models, real-world scenarios).
- Determine an appropriate measurement unit and form (e.g., scientific notation) for real-world problems involving length, area, volume, or mass.
- Solve real-world measurement problems including fundamental units (e.g., length, mass, time), derived units (e.g., miles per hour, dollars per gallon), and unit conversions.

21% or Approximately 9 questions

Cliff Notes Text: pages 107-149

Target: 6

GEOMETRY

- Three numbers are important:

$$90^{\circ} - 180^{\circ} - 360^{\circ}$$

- Congruent (\cong) having the same size and shape.
 - When comparing two or more triangles, congruent means that corresponding (in the same position) angles and sides are equal.

LINES

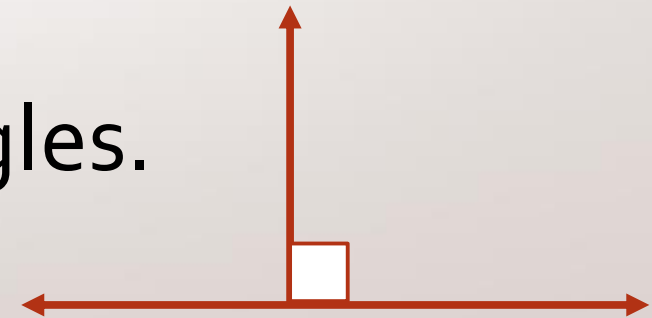
- Intersecting – touches in exactly one point.



- Parallel – never touches.

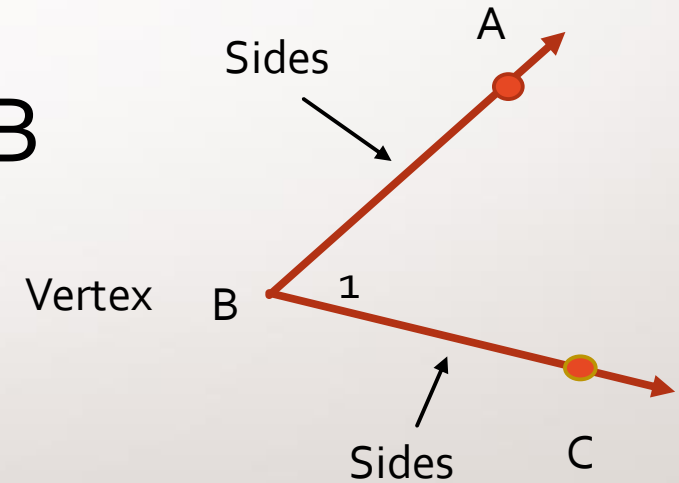


- Perpendicular – meet to form 90° angles.



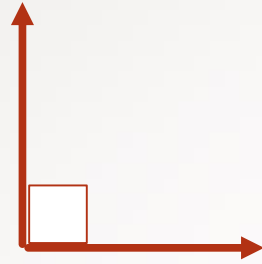
Angle

- An angle is formed by two rays that meet a common end point.
- Name: $\angle 1$, $\angle ABC$, or $\angle CBA$, $\angle B$
 - Vertex must be in the middle



Angles

- Right – exactly 90°



- Acute – less than 90°



- Straight – exactly 180°

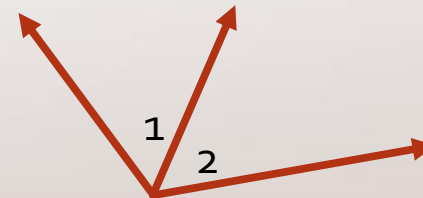


- Obtuse – between 90° and 180°



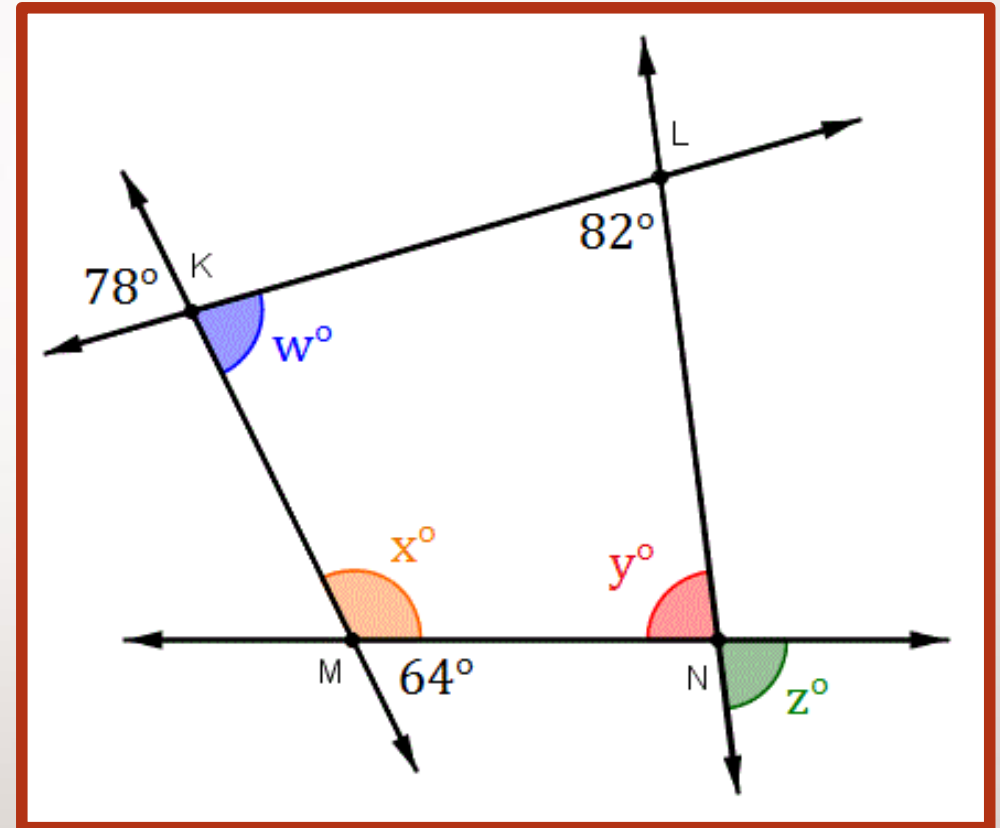
Angle Pairs

- Complementary – two angles with the sum 90°
Example: 40° and 50° ; 30° and 60° ; 20° and 70°
- Supplementary – two angles with the sum 180°
Example: 40° and 140° ; 30° and 150° ; 20° and 160°
- Adjacent – side by side (physical location) $\angle 1$ and $\angle 2$
 - Common vertex
 - Common side
 - No common interior points



More Angle Pairs

- **Linear Pair**: two angles that form a line (straight angle). Linear pairs are supplementary.
- **Vertical Angles**: two angles with the same vertex; that lie opposite one another; and are equal.
- **Find the measure of each angle.**



$$w = 78; k = 102; L = 82, M = 116;$$
$$x = 116; y = 84, z = 84, N = 96$$

Bisector

- A line or segment that cuts an object into two congruent objects:
 - A segment bisector takes a larger segment and creates 2 equal segments.
 - An angle bisector takes a larger angle and creates 2 equal angles.

Polygons

- Objects made of segments:

# of sides	Polygon
3	Triangle
4	Quadrilateral
5	Pentagon
6	Hexagon
7	Heptagon
8	Octagon
10	Decagon

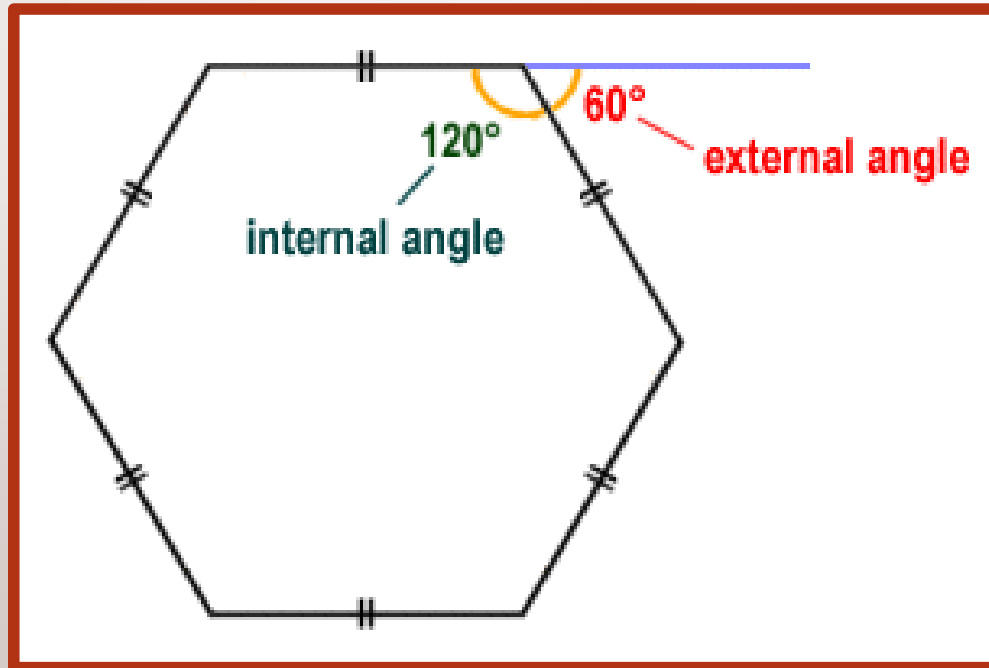
The exterior sum of all polygons, no matter the number of sides, is 360° . However, the interior sums will vary.

Polygons

- Interior Sum Formula: $(n - 2)180^\circ$.
- What is the interior and exterior sum or a 12-sided polygon?
 - Exterior Sum of all polygons is 360° .
 - Interior Sum of a 12-sided polygon: $(12 - 2)180^\circ = 10(180) = 1800$

Regular Polygon

- Regular polygons have equal angles and equal sides.
- In polygon, the sum of the measures of one interior angle and one exterior angle is 180° (this is important)!!



Regular hexagon
or 6 sided polygon

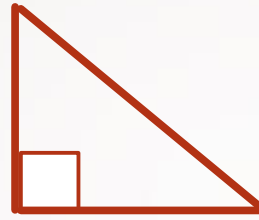
Regular Polygon Example

- Find the measure of one interior and one exterior angle of a regular octagon.
- Step 1: First determine the interior and exterior sums.
- Step 2: Take the interior and exterior sums and divide them individually by the number of sides.
- Answer: $(8 - 2)180^\circ = \frac{1080}{8} = 135^\circ$ and $\frac{360^\circ}{8} = 45^\circ$.
- Note the sum of one exterior and one interior angle is 180° .

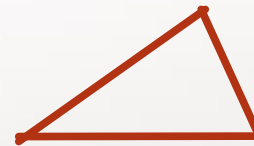
Triangles

Interior Sum = 180°
Exterior Sum = 360°

- Right – One 90° angle



- Acute – Three acute angles



- Obtuse – One obtuse angle



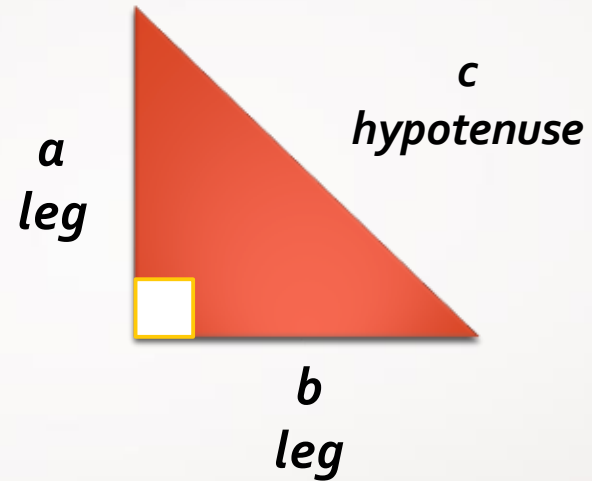
More Triangles

- Scalene – no congruent sides
- Equilateral – all congruent sides
- Equiangular – all congruent angles
 - If a triangle is equilateral, it is also equiangular.
- Isosceles – at least 2 congruent sides
 - If at least 2 sides are congruent, then at least two angles are equal.

Right Triangles

Using the Pythagorean Theorem to find the third side:

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



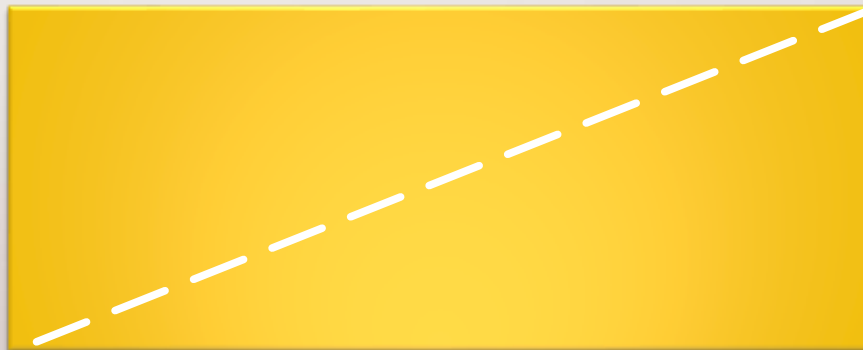
Tips

- Can be used in Right Triangle problems and any square or rectangle problem where a diagonal is referenced.
- If there is a diagram, line up the diagram with the right triangle on your formula sheet.
- Sometimes the word "hypotenuse" is in the problem.
- You MUST be able to identify the hypotenuse, "c".

Diagonal of a Rectangle

- Diagonal: Segment that touches non-consecutive vertices.
- Sometimes the figure is drawn, many times it is not. If not, you'll have to create it yourself.
- You must still be able to identify the hypotenuse.

The hypotenuse is the diagonal in this figure.



Quadrilaterals

Interior Sum = 360°
Exterior Sum = 360°

	Polygon	Characteristics
<u>Parallelograms</u> have two pairs of opposite sides parallel.	Squares	4 congruent sides; 4 right angles
	Rectangle	Opposite sides are congruent; 4 right angles
	Rhombus	4 congruent sides
Not a parallelogram.	Trapezoid	One pair of opposite sides parallel.
	Isosceles Trapezoid	One pair of opposite sides parallel; one pair of base angles are congruent.



Pause: Let's Try It!

Geometry Worksheet:

Questions 1-6, 8, 14-16, 18, 21

Perimeter

- **Perimeter**: The distance around a polygon. Add the lengths of all sides to find the perimeter.

Questions (You Try!):

1. Find the perimeter of a regular pentagon when the length of one side is 4 inches.
2. Find the perimeter of a square with a side length 20 cm.
3. Find the perimeter of a rectangle with length 6 ft. and width 3 ft.

Perimeter Answers

1. Regular Pentagon has 5 equal sides and each side measures 4 inches.

Answer: Perimeter = $5(4) = 20$ inches.

2. Squares have 4 equal sides and each side measures 20 cm.

Answer: Perimeter = $4(20) = 80$ cm.

3. Rectangles have opposite sides that are equal.

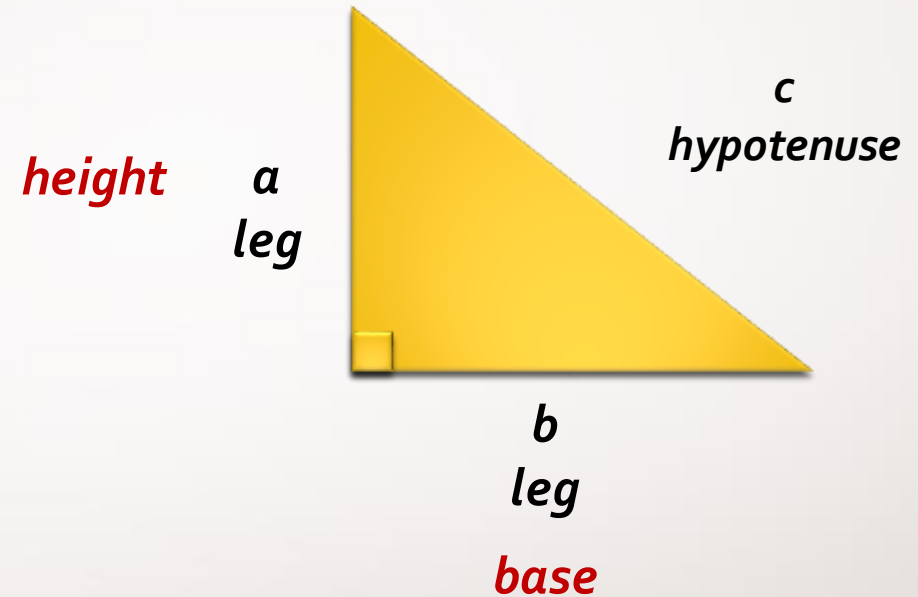
Answer: Perimeter = $6 + 6 + 3 + 3 = 18$ ft.

Perimeter of Right Triangles

- You must have the length of all sides, even if it means you've got to use the Pythagorean Theorem first.
- Try # 12 from your Geometry Worksheet and find the Perimeter ONLY.

Area of a Right Triangle

- Formula: $A = \frac{1}{2}bh$,
where b = base and h = height
- **WARNING**: You do not need the hypotenuse to find the area of a right triangle!!



Try # 7 and 12 and find the area.

Area of Polygons

Let's review the place on your reference sheet where the formulas for the areas of polygons are located.

- Rectangle: $A = lw$ or bh

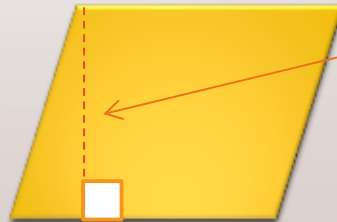


- Trapezoid: $A = \frac{1}{2}h(b_1 + b_2)$



height

- Parallelogram: $A = bh$



Multi-Step Area - You Try!

1. The perimeter of a rectangular rug is 42 yds. If the width of the rug is 8 yds, what is the length of the rug?
2. Patricia has a rectangular flower garden that is 100 ft long and 22 ft wide. One bag of soil can cover 10 ft^2 . How many bags will she need to cover the entire garden?
3. Find the height of an isosceles trapezoid with bases 12 cm and 28 cm and area 300 square cm.

Multi-Step Area Solutions

1. The perimeter of a rectangular rug is 42 yds. If the width of the rug is 8 yds, what is the length of the rug?

- **Perimeter is the sum of the sides. There are four sides and two of them equal 8. Draw a picture if it helps. $42 - 16 = 26$ yds. You've got 26 yds left that need to be shared with the other two sides of the rectangle. $26 \div 2 = 13$ yards.**

Multi-Step Area Solutions

2. Patricia has a rectangular flower garden that is 100 ft long and 22 ft wide. One bag of soil can cover 10 ft^2 . How many bags will she need to cover the entire garden?

- Solution: First find the area of the garden: $100(22) = 2200 \text{ ft}^2$.

Now make a ratio and follow with a proportion: $\frac{\text{bag}}{\text{ft}^2} = \frac{1}{10} = \frac{x}{2200}$

Cross multiply: $10x = 2200 \rightarrow x = 220$

Answer: 220 bags

Multi-Step Area Solutions

3. Find the height of an isosceles trapezoid with bases 12 cm and 28 cm and area 300 square cm.

- Solution: Start with the formula:

$A = \frac{1}{2}h(b_1 + b_2)$ Substitute the values you know into the formula.

$300 = \frac{1}{2}h(12 + 28)$ Now, add 12 and 28.

$300 = \frac{1}{2}h(40)$ Here, we have two choice multiply both sides by 2 or simply take half of 40.

$300 = 20h$ Divide both sides by 20 to find the height.

$15\text{cm} = h$ The eight of the isosceles trapezoid.

Conversions

- **Be aware of the units in each question.** Having even one unit that's different from others in your problem should influence your plan and/or approach to your problem.
- Attempt to complete any conversions prior to solving your problem.
- Use your reference sheet for each conversion.
- **Quick Steps**: Simply make a ratio, then make a proportion using the information in the problem, then work the problem.

Conversions Example

Convert 5 yards to feet.

Step 1: Look at Reference Sheet: 1 yard = 3 feet

Step 2: Make a ratio $\frac{\text{yard}}{\text{feet}}$.

Step 3: Make a proportion with information from reference sheet and problem.

$$\frac{\text{yard}}{\text{feet}} = \frac{1}{3} = \frac{5}{x} \rightarrow \text{Cross Multiply: } 1x = 15.$$

Answer: 15 feet.

Conversions (Try It!)

Convert 250 centimeters to meters.

Reference Sheet: 1 meter = 100 centimeters

Make a ratio: $\frac{\textit{meter}}{\textit{centimeter}}$

Make proportion: $\frac{\textit{meter}}{\textit{centimeter}} = \frac{1}{100} = \frac{x}{250}$

Solution: $100x = 250 \rightarrow x = \mathbf{2.5 \textit{ meters}}$

Now Try #10, 22, 24

Real-World Rate Problem 1

- You are on a road trip. The first day you drove 200 miles in 4 hours. The second day you travel at the same rate of speed for another 6 hours. If you get an average of 25 miles per gallon and gas costs \$3.79 a gallon, how much did you spend on gas during the trip?
- **Step 1: Find the total number of miles for the two days.**
 - Use $\text{Distance} = \text{Rate} \times \text{Time}$ to determine the rate of speed for both days.
- **Step 2: Find the number of gallons based on the number of miles found in Step 1.**
- **Step 3: Find the cost of the number of gallons. Answer = \$75.80.**

Take a few minutes to try to work through this problem.

Real-World Rate Problem 1

- You are on a road trip. The first day you drove 200 miles in 4 hours. The second day you travel at the same rate of speed for another 6 hours. If you get an average of 25 miles per gallon and gas costs \$3.79 a gallon, how much did you spend on gas during the trip?
- **Step 1: Day 1 = 200 miles; Day 2 is unknown.**
- **Use Distance = Rate x Time to determine the rate of speed for both days.**
- **$d = rt$: $200 = 4r$. Divide both sides by 4. $r = 50$ mph.**
- **Now, use the distance formula with 6 hours: $d = 50(6) = 300$**
- **Total number of miles: $200 + 300 = 500$.**
- **Step 2: Find the number of gallons: $500 \div 25 = 20$ gallons.**
- **Step 3: Next: find the cost of 20 gallons: $20(3.79) = \$75.80$.**

Real-World Rate Problem 2

- You are going to a meeting. If you drive 60 mph, you will get there two hours early. If you drive 30 mph you will get there two hours late. How far do you have to drive?

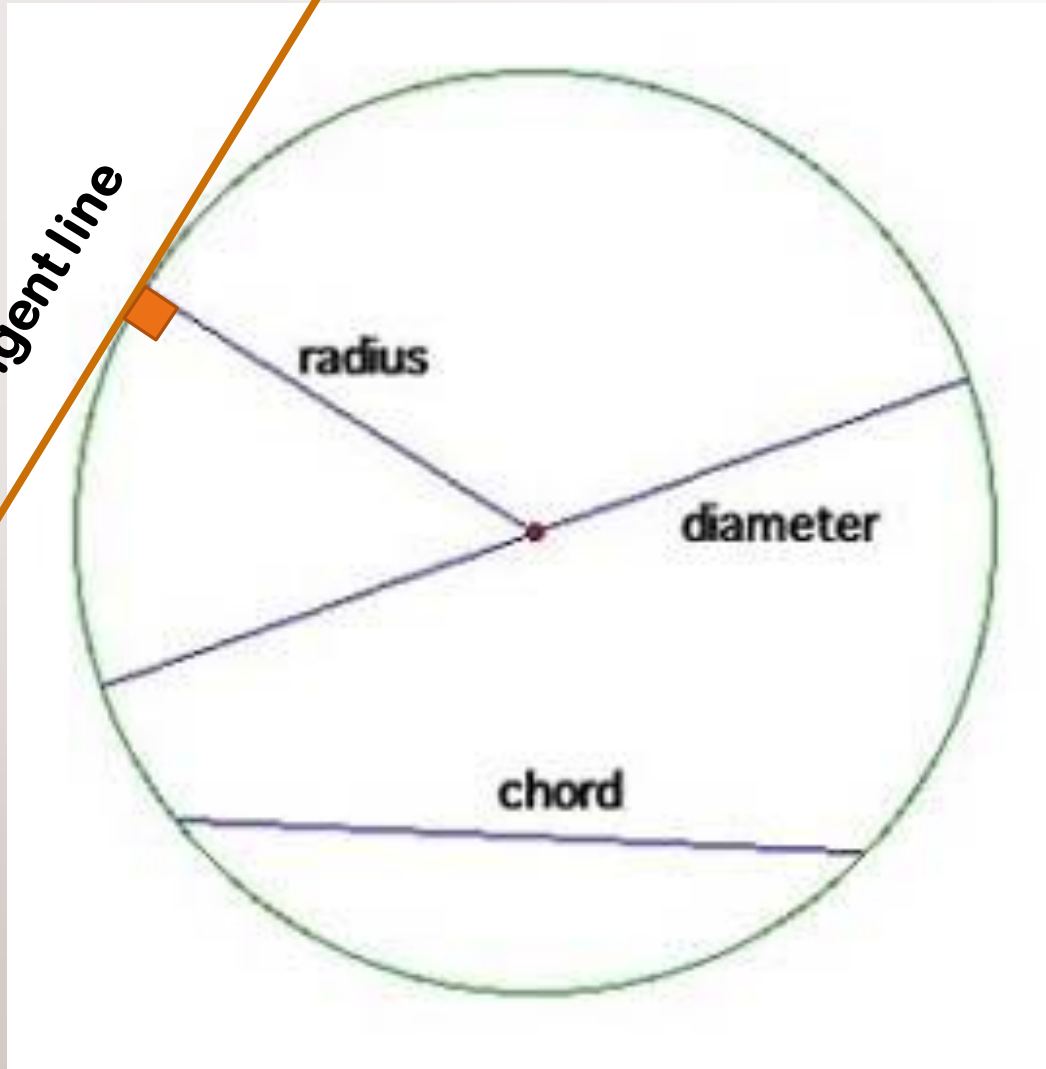
A) 240 miles B) 180 miles C) 120 miles D) 60 miles

- **What are you looking for?**
- **What do you know? What don't you know?**
- **What is the number of hours between the two arrivals?**
- **What formula will you use?**

Real-World Rate Problem 2

- You are looking for the distance!
- You do not know the number of hours, but you do know the difference between getting there 2 hours early and getting there 2 hours late.
 - Total of 4 hours.
- Use $d=rt$; Let the unknown number of hours (time) = x . Then, let the second unknown number be $x + 4$ (4 hours later). Now, write two equations.
- $d = 60x$ and $d = 30(x+4)$. Since both of these expressions equal d , set them equal to one another.
- $60x = 30x + 120$. Solve for x . $x = 4$. This means it takes 4 hours for the first person to get there, and 8 hours before the second person arrives.
- You are looking for the total number of miles. Take one of the equations you created earlier, and find the final answer. **$D = 60x = 60(4) = 240$ miles.**

Circles



2 Radii = diameter
or

$\frac{1}{2}$ diameter = radius

- **Chord** is simply a segment with both endpoints on the circle.
- **Diameter** is the longest chord in the circle and contains the center.

Circumference & Area of a Circle

- **Circumference** is the distance around a circle and is consistent with how we view perimeter.
- Formulas for circumference $C = 2\pi r$ or $C = \pi d$
- Formula for area $A = \pi r^2$
- You will either see π or be asked to substitute it for 3.14.

Try It!!

- Geometry Worksheet:

Try # 9, 13, 23, and 25.

Volume

- For the volume problems, be sure to check the units. If the units are different, change the units prior to working the problem.
- There are three volume formulas on the reference sheet. You must be sure to understand the meaning of each formula.

Prism or Cylinder	Pyramid or Cone	Sphere
$V = Bh$	$V = \frac{1}{3}Bh$	$V = \frac{4}{3}\pi r^3$
Area of the Base times the height of cylinder/ prism.	1/3 times the Area of the Base times the height of pyramid/cone.	4/3times 3.14 times the radius to the power 3.

Try It!!

- Geometry Worksheet:

Try #19, 20 and any remaining problems.

***Use the Cliff Notes text
for additional practice.***