## MATH 7: HOMEWORK 21

MARCH 10, 2019

## 1. Medians in a triangle

Medians in a triangle intersect in one point, the centroid. We have seen that their intersection point is $2 / 3$ of the median from the vertex and $1 / 3$ of the distance from the side of the triangle. Another way to say this is that it splits the median into a $2: 1$ ratio. Another property of the median is that it splits the area of the triangle in two equal areas. Can you explain why? The centroid is also called center of mass or center of gravity. The name comes from the fact that if an object is made of a uniform material, the centroid is the center of gravity for the object and the object can be balanced at that point.

## 2. Classifying Quadrilaterals

Chapter 9 in the Geometry book deals with definitions and properties of special quadrilaterals. In a quadrilateral, the sum of all angles add up to $360^{\circ}$.

## 3. Parallelograms

The definition of a parallelogram is that it has both pairs of opposing sides parallel. Parallelograms have many properties: opposing sides are congruent, diagonals bisect each other, opposing angles are congruent. The area of a prallelogram is $A=$ base $\times h e i g h t$, where height is the distance between the base and the opposing parallel side.

## 4. Trapezoid

The definition of a trapezoid is that it is a quadrilateral in which one pair of opposing sides are parallel. The midline in a trapezoid is the average sum of the two bases. The area is $A=\frac{\left(b_{1}+b_{2}\right) \times h}{2}$, where $b_{1}, b_{2}$ are the two parallel sides called bases.

## 5. Rhombus

The definition of a rhombus is that it is a quadrilateral which has all sides congruent. An important property is that the diagonals are perpendicular to each other. The diagonals also bisect each other and are congruent. The area of a rhombus is $A=\frac{d_{1} \times d_{2}}{2}$. where $d_{1}, d_{2}$ are the two diagonals.

## 6. Rectangle

The definition of a rectangle is that it has four right angles. A property is that its diagonals are congruent. The area is $A=$ width $\times$ length.

## 7. SQuare

A square has four right angles and all four sides congruent. The diagonals cut the right angles at $45^{\circ}$. The area of a square is $A=s^{2}$, where s is the length of its side. The length of the diagonal is $\sqrt{s}$.

## Homework

1. Read Chapter 9 in the E-Z Geometry book.
2. Solve problems 2-12 on page 193-194 in the Geometry book.
3. H is the orthocenter of triangle ABC , whose altitudes are $\mathrm{AD}, \mathrm{BE}, \mathrm{CF}$. Prove that $<B H D=<A C B$ and that $<C H D=<A B C$.
4. Show that if H is the orthocenter of the triangle ABC , then A is the orthocenter of the triangle HBC , $B$ is the orthocenter of the triangle HCA, and $C$ is the orthocenter of the triangle HAB.
5. $\mathrm{AD}, \mathrm{BE}$ are altitudes of triangle $\mathrm{ABC} . \mathrm{M}$ is the midpoint of AB . Prove that the triangle MED is isosceles.
6. AD is an altitude of an equilateral triangle ABC . DN is the perpendicular from D to AC . Prove that $\mathrm{AN}=3 \mathrm{NC}$
7. ABCD is a quadrilateral where $\mathrm{AB}=\mathrm{CD} . \mathrm{P}, \mathrm{Q}, \mathrm{R}, \mathrm{S}$ are the midpoints of $\mathrm{AD}, \mathrm{AC}, \mathrm{DB}, \mathrm{BC}$. Show that PS is perpendicular to QR .
8. ABCD is a quadrilateral. The bisector of $<A$ and the bisector of $<B$ intersect at X . Prove that X is the same distance from AD as it is from BC .
