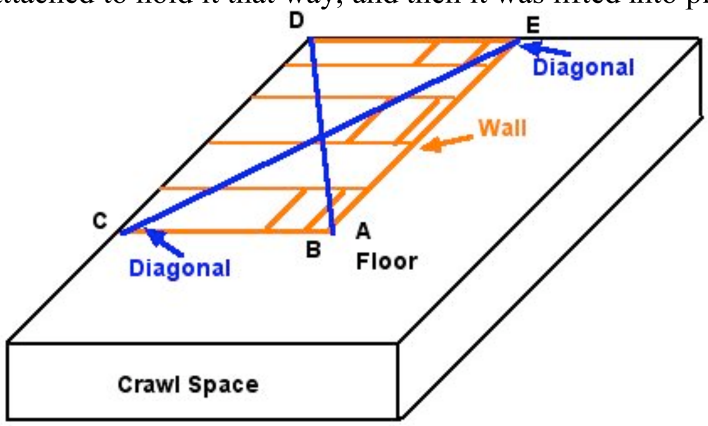
Applications of Quadrilaterals

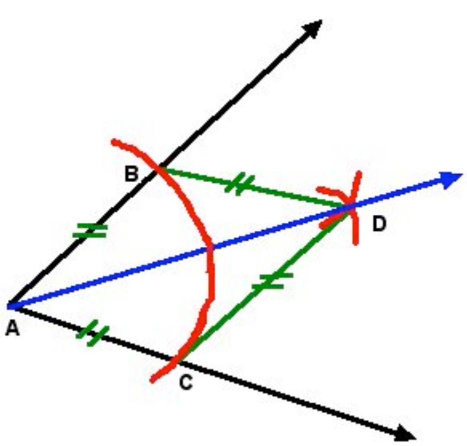
On Monday and Tuesday of the last two weeks, we have been looking at types of quadrilaterals, their definitions and their properties. Today, we take some of those properties and see how they are applied in the "real world".

(1) The diagonals of a rectangle are equal. The reverse is true as well, if you have a parallelogram with equal diagonals, then you have a rectangle. I first bumped into this application when I was working for a construction company in my summers to earn money for university. As you can see from the diagram below, a wall of a room has been laid out on the floor. Before it is raised up, it needed to be "squared away" and sheeted to hold it in shape. To make sure it was a rectangle, and had four 90 degree angles, they measured the lengths of the two diagonals. If they were not the same then it was gently tapped with a sledgehammer until the two diagonals were equal. Once that happened, sheets of plywood were attached to hold it that way, and then it was lifted into place.

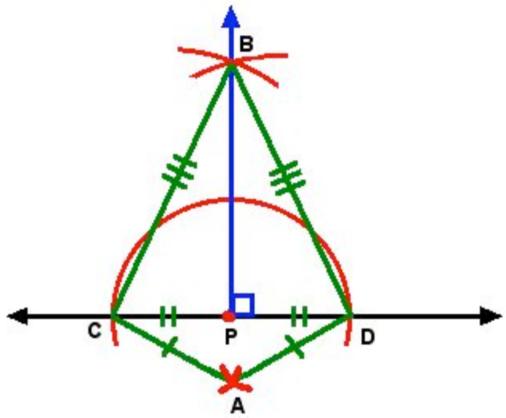


Construction workers A, C, D, and E work the measuring tapes while worker "B" wields the sledge hammer to "tap" the floor until the blue diagonals AD and CE are the same length.

(2) When we learned to bisect an angle, we drew an arc BC with centre at "A". This meant AB = AC. Now keeping our compass with the SAME radius, we drew arcs with centres at B and C, intersecting at "D". This makes BC = DC = AB = AC. In other words we have constructed a rhombus. By joining AD we have put in a diagonal of a rhombus. And one of the properties of a rhombus is that the diagonals bisect the angles at their ends. Hence ∠ BAC is bisected and ∠ BAD = ∠ CAD



(3) If we have a point on a line, we learned how to erect an perpendicular at that point by using the diagram on the next page.



We start by using the given point “P’” and drawing the arc that intersects the line at “C” and “D”. This makes PC = PD. Making “C” and “D” the centres, draw two arcs that intersect at point “B”. This makes CB = DB. In addition you could, but do not have to, use the same centres and draw two more arcs intersecting at point “A”. This makes CA = AD. Joining PB we have bisected a 180 degree angle, thus ∠ DPB = ∠ CPB = 90 degrees. Or, if you joined B to A you have AB being a diagonal of the kite ACBD (the other diagonal of the kite is CD. One of the properties of a kite, is that the diagonals are perpendicular. Hence BA would be perpendicular to CD (and would go through point “P”).

By the way, looking at the last two diagrams and thinking of them in reverse, we get two other neat “properties”. If I have an angle bisector such as ray AD in diagram 2, then any point “D” on that diagonal will be the centre of a circle that just touches the two rays of the original angle ∠ BAC.

The second neat property is to look at diagram 3, above. If I am any point “B” on the perpendicular bisector of CD is a centre of a circle that goes through points “C” and “D”. Try it, put you compass on any point along BA and start to draw a circle through point “C”, and you will find that it also goes through point “D”.

We will explore these ideas later next Friday, when we look at applications of the various “centres” of a triangle.