**Lesson 1.5 – Triangles**

Things you can assume:

You may assume that lines are straight, and if two lines intersect, they intersect at one point.

You may assume that all points on a line are collinear and that all points shown in a diagram are coplanar unless planes are drawn to show otherwise.

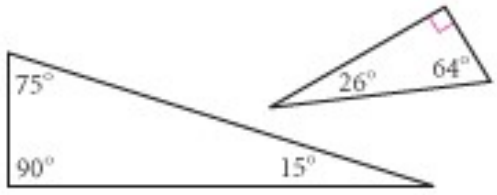
Things you cannot assume:

You may not assume that just because two lines or segments look parallel that they are parallel – they must be marked parallel.

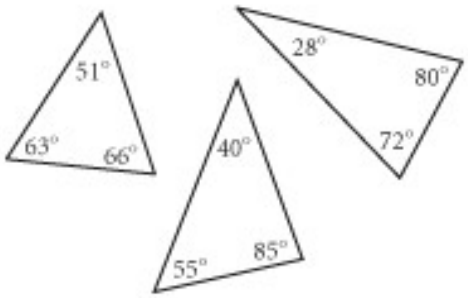
You may not assume that two lines are perpendicular just because they look perpendicular – they must be marked perpendicular.

Pairs of angles, segments, or polygons are not necessarily congruent unless they are marked with information that tells you they must be congruent.

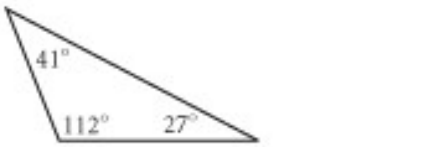
Right Triangle – A right triangle has one right angle.

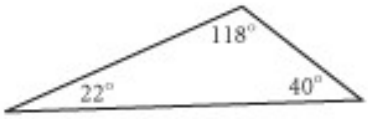



Acute Triangle – An acute triangle has three acute angles.

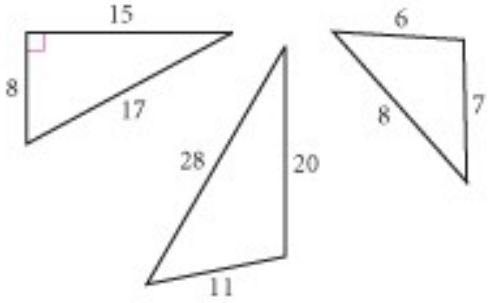


Obtuse Triangle – An obtuse triangle has one obtuse angle.

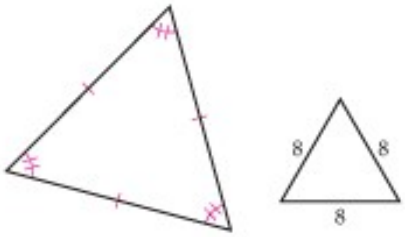


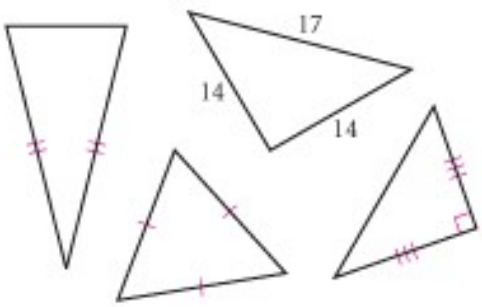

Scalene triangle – A scalene triangle is a triangle with no congruent sides.



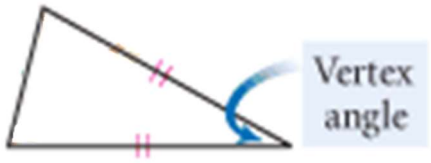

Equilateral triangle – An equilateral triangle has three congruent sides.



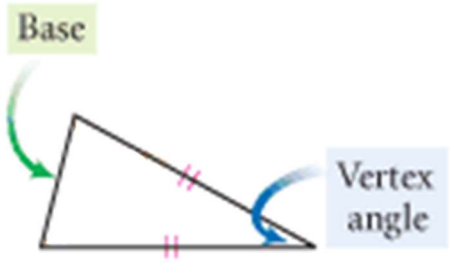

Isosceles Triangle – An isosceles triangle has at least two congruent sides.



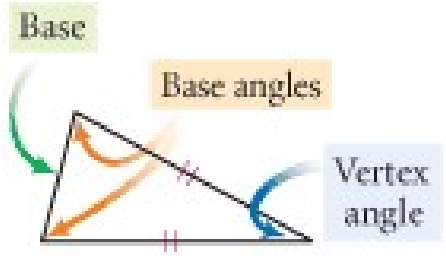
Vertex angle of an isosceles triangle - The angle between the two sides of equal length is called the vertex angle.




Base of an isosceles triangle - The side opposite the vertex angle is called the base of an isosceles triangle.




Base angles of an isosceles triangle - The two angles opposite the two sides of equal length are called the base angles of the isosceles triangle.

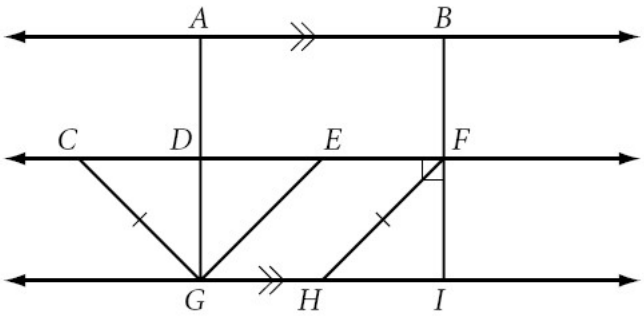



<u>Example 1: Name a pair of:</u>

Parallel segments

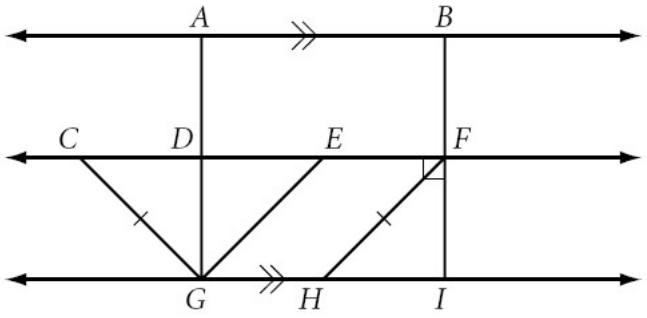
Parallel segments are marked with an equal number of arrows.

So, $\overline{AB}||\overline{GI}$.



Example 2: Name a pair of:

Perpendicular segments

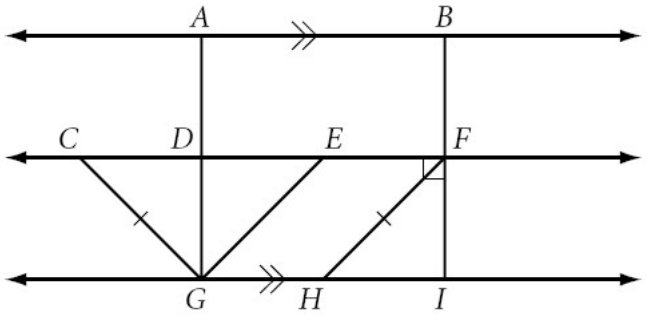



Perpendicular segments are marked with a right angle.

So, $\overline{EF} \perp \overline{BI}$.

Example 3: Name a pair of:

Congruent segments

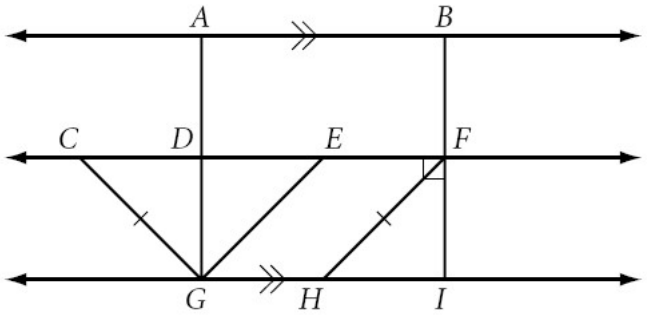



Congruent segments are marked with an equal number of tick marks.

So, $\overline{CG} \cong \overline{HF}$.

Example 4: Name a pair of:

Supplementary angles



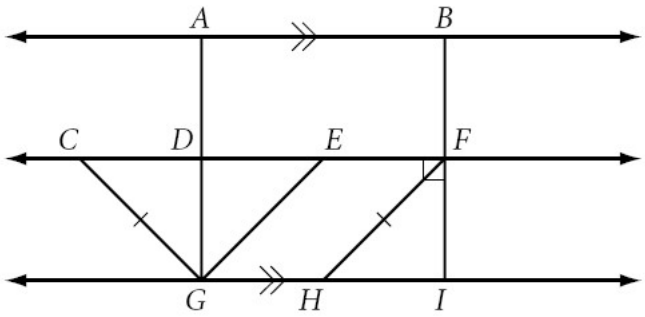

Supplementary angles add to 180 -degrees.

We can also say that supplementary angles make a line.

There are multiple examples, but one is $\angle GHF$ and $\angle FHI$.

Example 5: Name a pair of:

Linear angles




Linear angles are angles that make a line.

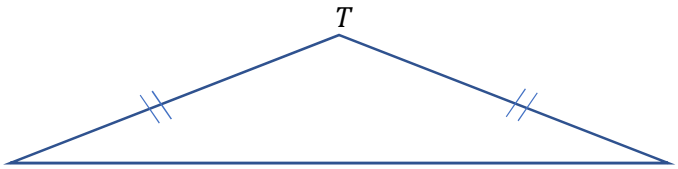
There are multiple examples (we could use the same as example 4), but one is $\angle EFI$ and $\angle EFB$.

Example 6: Sketch, label, and mark the figure

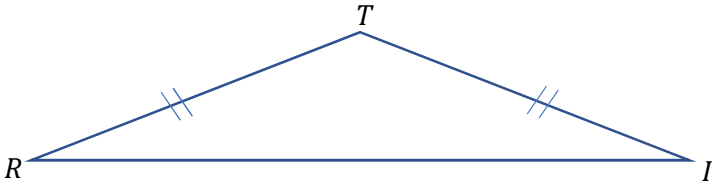
Isosceles obtuse triangle $TRI$ with vertex angle $T$.

An isosceles triangle has two congruent sides. An obtuse triangle has one obtuse angle. We need to mark the congruent sides as congruent using tick marks.

The vertex angle is between the two congruent sides.



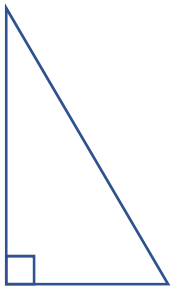

The other two vertices can be named R and I in either order.



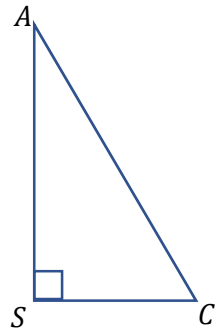

Example 7: Sketch, label, and mark the figure

Scalene right triangle $SCA$ with midpoints $L, M,$ and $N$ on $\overline{SC}, \overline{CA},$ and $\overline{SA}$, respectively.

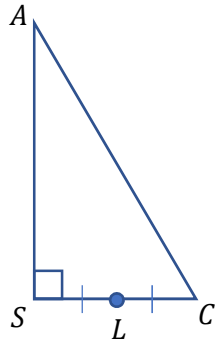
A scalene triangle has no sides congruent. A right triangle has one right angle. We need to mark the right angle.



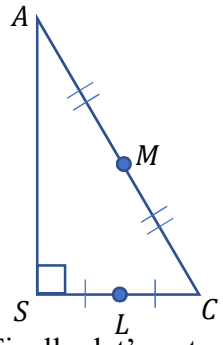
It doesn't matter which vertices we name S, C, or A.



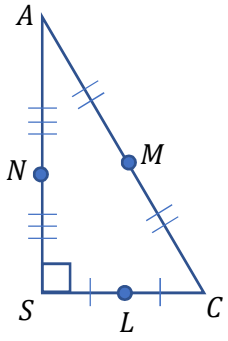

A midpoint is in the middle of the segment. The word "respectively" means that the first midpoint should be on the first segment named, the second midpoint on the second segment named, and so on. We need to remember to mark midpoints so that both sides of the point are congruent. So, let's put midpoint $L$ on side $\overline{SC}$.




Then let's put midpoint $M$ on side $\overline{CA}$. Use two tick marks because $\overline{SC} \ncong \overline{CA}$.



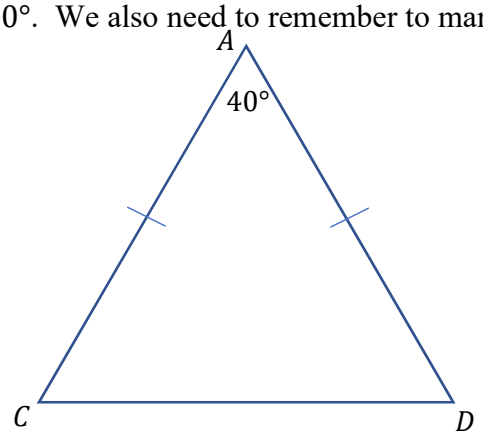

Finally, let's put midpoint $N$ on side $\overline{SA}$. Use three tick marks because $\overline{SC} \ncong \overline{CA} \ncong \overline{SA}$.



Example 8: Sketch, label, and mark the figure

Acute isosceles triangle $ACD$ with vertex angle $A$ measuring $40°$.

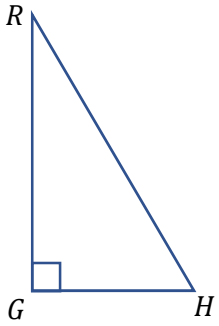
An isosceles triangle has two congruent sides. An acute triangle has three acute angles. We know that one of the angles (specifically the one between the two congruent sides) needs to measure $40°$. We also need to remember to mark the congruent sides as congruent using tick marks.




Example 9: Sketch, label, and mark the figure

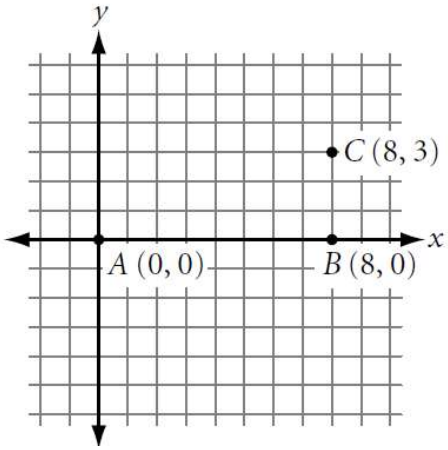
Scalene right triangle $RGH$.

A scalene triangle has no sides congruent. A right triangle has one right angle. We need to mark the right angle. It doesn't matter which vertices we name R, G, or H.



Example 10: Use the graph.

Locate $F$ so that $\Delta ABF$ is a right triangle.

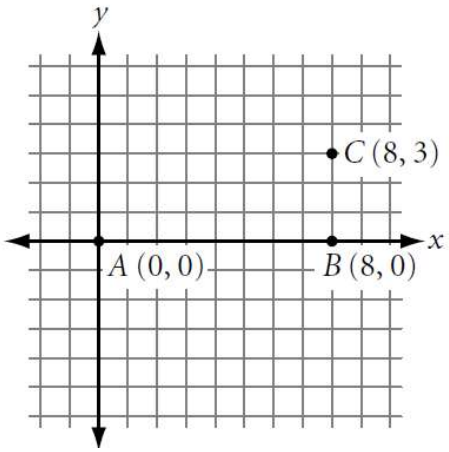



In order to make a right triangle the point needs to be located so that a right angle is formed. There are several options to do this. The easiest option is to place F directly above or below point A, or directly above or below point B.

Some possible answers: $(0, 3), (8, 4), (0, -5), (8, -2)$, etc.

Example 11: Use the graph.

Locate $D$ so that $\Delta ABD$ is an isosceles triangle.

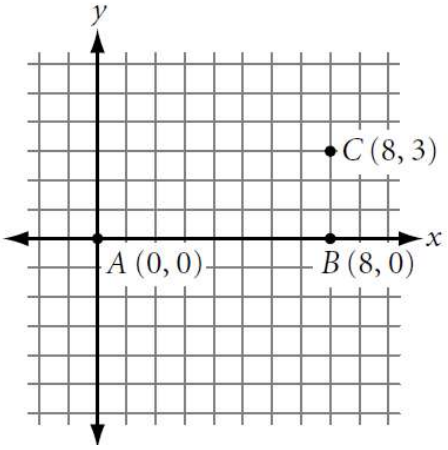



In order to make an isosceles triangle the point needs to be located so that two sides of equal length are formed. There are several options to do this. The easiest option is to place D directly above or below the midpoint of segment $\overline{AB}$.

Some possible answers: $(4, 3), (4, -1), (4, 15)$, etc.

Example 12: Use the graph.

Locate $G$ so that $\Delta ABG$ is scalene and not a right triangle.




We need to make a triangle that has no two sides congruent and no right angles. Avoid both conditions from #11 & #12 and some others.

Some possible answers: $(2, 2), (5, -1), (6, 6)$, etc.