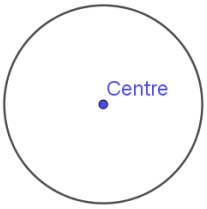
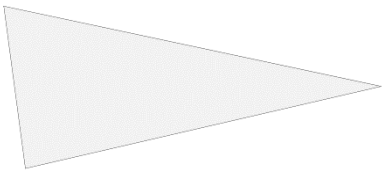
Where's the centre of the triangle?

There's only one centre of a circle. It's part of the definition of the circle.



What about a triangle?

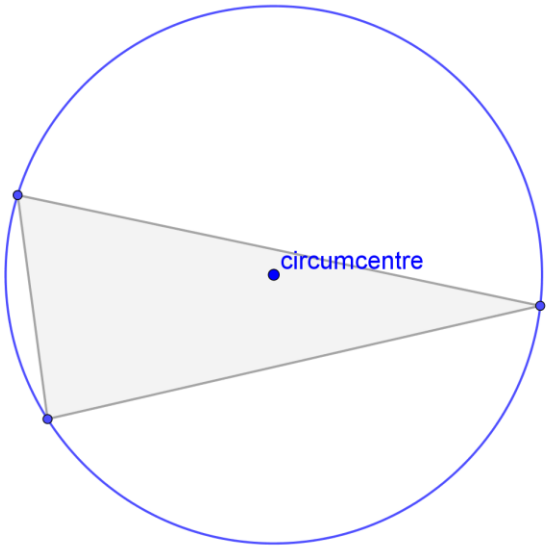


Consider this triangle: visualise where you'd consider the centre of the triangle to be.

This question is not clear like it is for the circle. This article will introduce you to 4 of the possible candidates to be named the centre of this triangle.

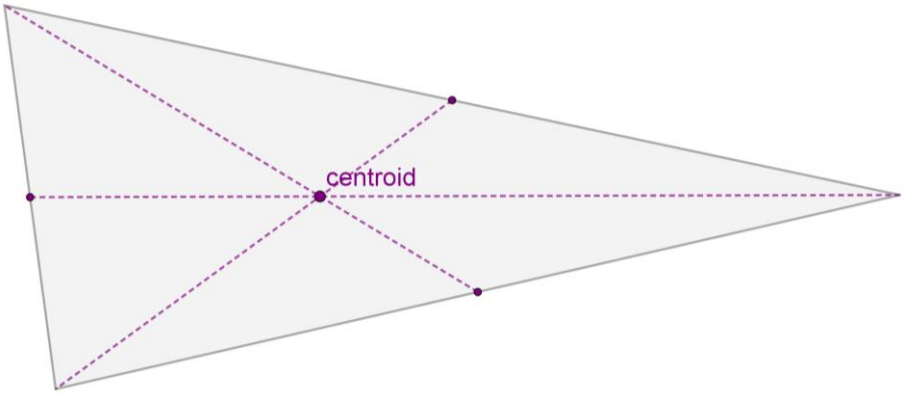
1. The Circumcentre

Definition: The 3 vertices (corners) of the triangle form a circle. The *circumcentre* is the centre of this circle.



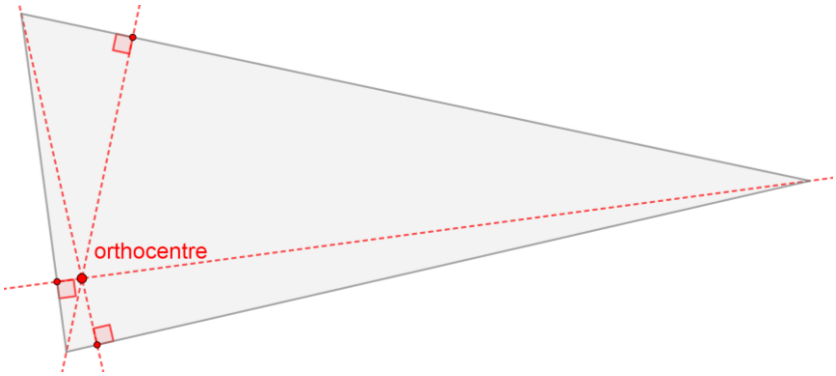
2. The Centroid

Definition: Draw a dot at the midpoints of the sides of the triangle. Draw a line from each dot to its opposite vertex. These 3 lines meet. The point where they meet is called the *centroid*.



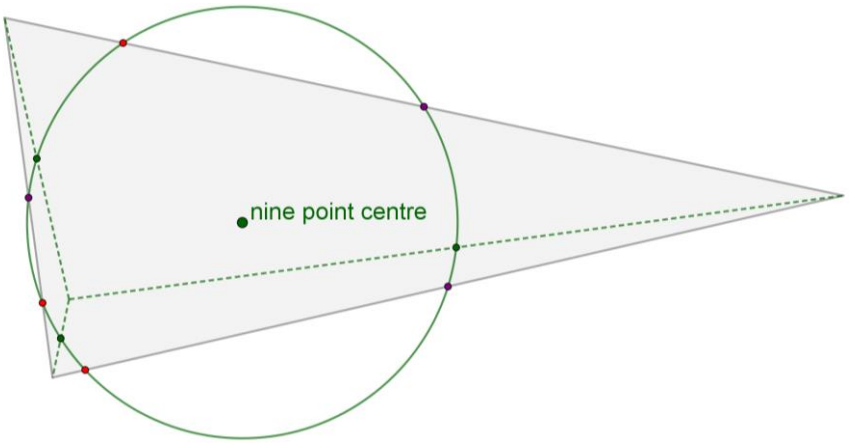
3. The Orthocentre

Definition: From each vertex, draw the line that meets the opposite side at right angles. These 3 lines meet. The point where they meet is called the *orthocentre*.

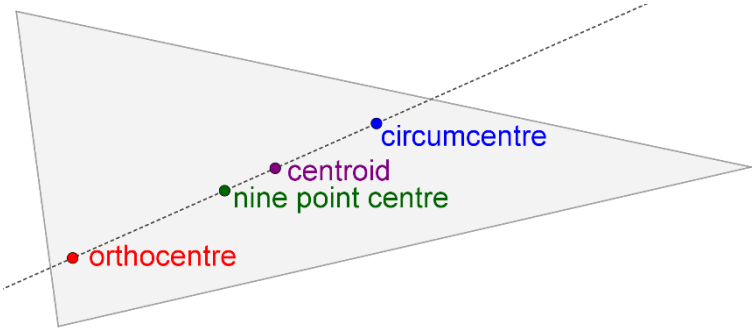


4. The Nine Point Centre

Definition: During the construction of **2. The centroid**, we marked the 3 midpoints (purple dots) and during the construction of **3. The orthocentre,** we marked the 3 points that formed the right angles. If we also mark the 3 points at the midpoints between the orthocentre and each vertex, amazingly, these 9 marked points lie in a circle. The centre of this circle is called the *nine point centre*.



Even though the way these centres are constructed are very different from each other, there's a wonderful connection between them, which is apparent when we see all four of the centres drawn together.



They lie on the same straight line!

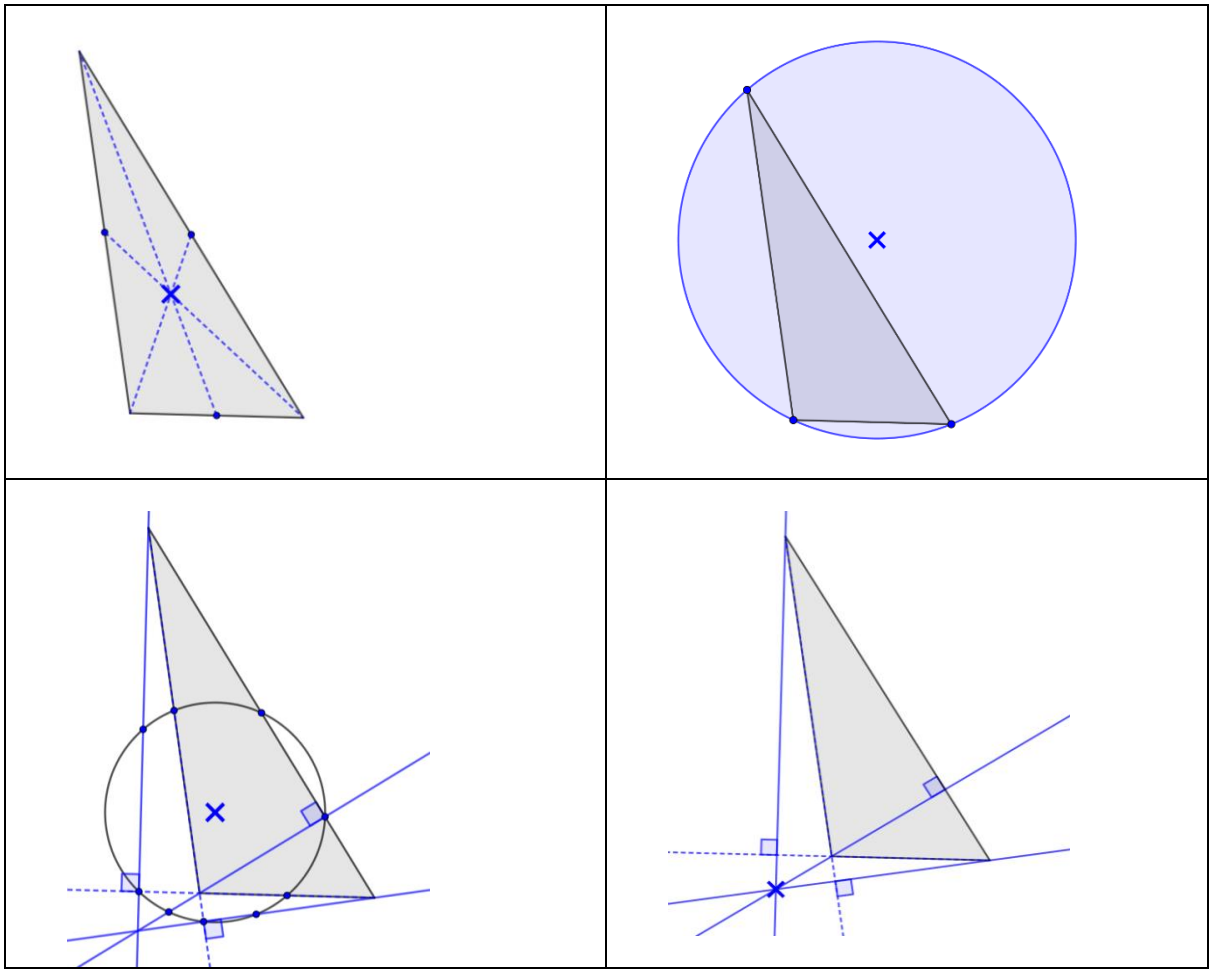
And this isn't just because the triangle I drew at the start was in any way special.

Whatever the shape and size of the original triangle, the *circumcentre*, *centroid*, *orthocentre* and *nine point centre* **always** form a straight line.

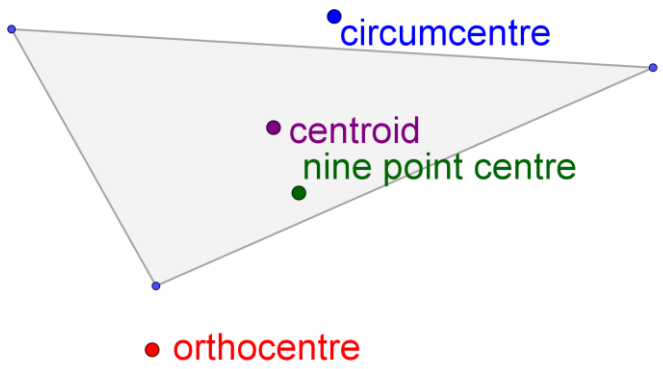
Where's the centre of the triangle? Comprehension Questions:

1. Here are four images of the same triangle, with different centres constructed (marked with a cross) Match up the correct picture with the correct centre, out of the following:

   1. circumcentre **2. centroid** **3. orthocentre** **4. nine point centre**



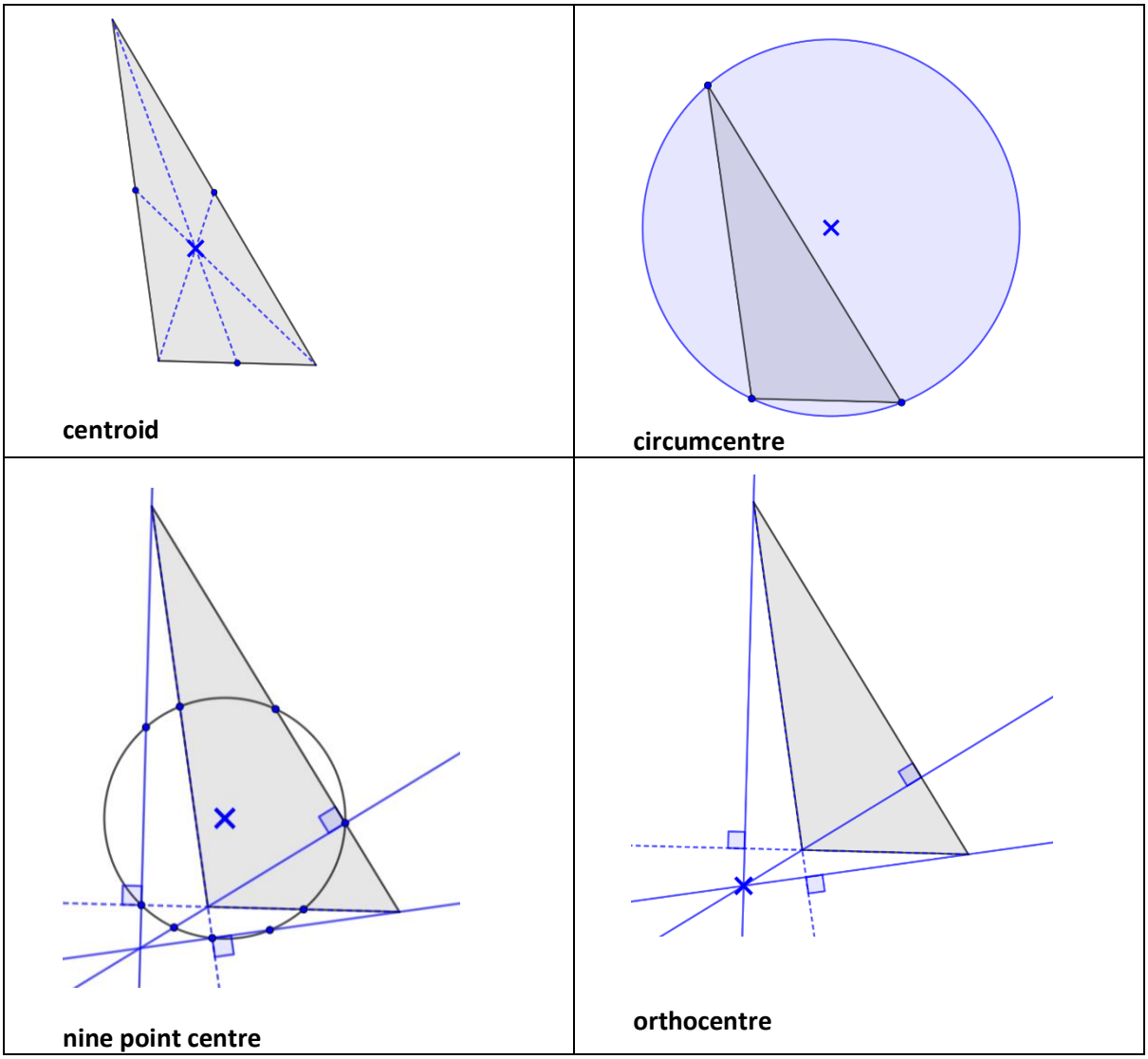
2. Lennie draws a triangle, and then attempts to construct, with his pencil and compass, the circumcentre, centroid, orthocentre and nine point centre. Here is a picture of the triangle and the four centre points that he has constructed.



How can we tell, just by looking, that Lennie must have made a mistake in the construction?

Where's the centre of the triangle? Comprehension Answers:

1.



2. Because of the result that Euler proved, we know that these four different centres should all lie in a straight line. Lennie's points don't lie in a straight line, so at least one of the centres must have been constructed incorrectly.