MathsBites by Clifford the Dog

A fraction of the number line

Starting a number line

We can start to make a number line from a geometric line by selecting a point to be the origin and taking this point to correspond to 0. If we also select another point to the right of the origin and take this to correspond to 1, the line segment between these points specifies a unit interval. We can then copy this unit line segment using a compass and straight edge or geometry software to locate points corresponding to elements of the set of integers $Z = \{\ldots -2, -1, 0, 1, 2, 3 \ldots\}$.

Activity: construct a number line like the one above and locate points corresponding to 4, 5, 10, –1, –2 –3 and –10

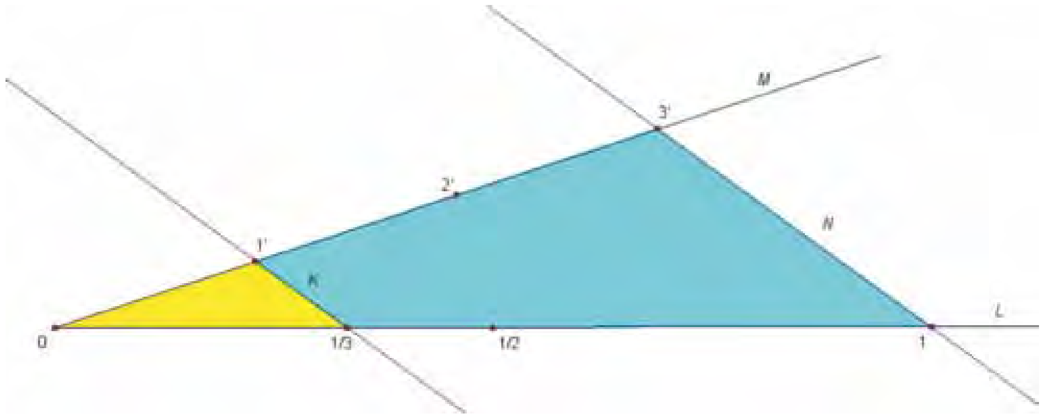
Halves and related fractions

Finding the midpoint of the unit interval between 0 and 1 locates the point corresponding to $\frac{1}{2}$ on the number line. This process of bisection, by compass and straight edge or using geometry software, can be extended to locate a point corresponding to any fraction of the form $\frac{k}{2^n}$ where k is an integer and n is a natural number – such as quarters and eighths as well as mixed numbers involving these fractions.

Activity: construct a number line like the one above and locate points corresponding to $-\frac{5}{8}$ and $1\frac{3}{16}$

Other fractions

To fit other fractions, for example $\frac{1}{3}$, on the same number line as $\frac{1}{2}$, similarity is used. The line K is constructed parallel to the line N passing through the point locating 1' on M. The small and large triangles are similar so the ratios of lengths on corresponding sides and segments are equal, hence the point where K intersects L is one third of the way along its unit length.



Activity: extend the construction of the diagram to locate $\frac{1}{5}$ on L, and explain in general how $\frac{1}{n}$ can be located on L. Show that for $\frac{1}{4}$ this coincides with the point found by bisection of the line segment from 0 to $\frac{1}{2}$. Develop a construction that locates $\frac{\sqrt{5}}{3}$, that is, $\frac{1}{3}$ of $\sqrt{5}$, on L.