

## PROBLEM

A bug that always crawls in a straight line, is within a circle. Whenever it reaches the edge of the circle, it turns through 135 degrees (anti-clockwise). Will the bug ever leave the circle? If so, when? If not, why not? Investigate and generalize.

John Olive (now retired) from the University of Georgia in Athens, USA, wrote: "I liked your challenge for the month and am attaching a *Sketchpad* exploration of the bug's possible paths that indicates the "escape zone" from the circle (approaching a point on the circle from the left at an angle of less than 45 degrees to the tangent at the point of impact). For the turning angle of 135 degrees 8 turning points completely determine the path of the bug [ $8 \cdot (180 - 135) = 360$  and the bug is back on the same path it started on unless it escaped!]. The generalization would work for any angle less than 180, where the escape zone would be that segment of the circle subtended by an angle less than the supplement of the given turning angle from the tangent at the first point of contact. The path would repeat itself after  $n$  points of contact with the circle where  $n$  is determined by the quotient of 360 and the GCF of the supplement angle and 360."