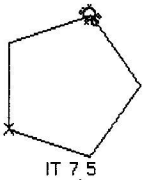
Exploring IT - A Microworld for Discovering Division

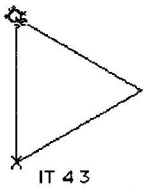
by Richard Binswanger

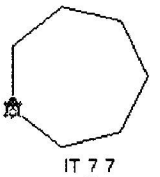
This microworld is described in more detail in Richard's article in the Arithmetic Teacher. (Dec., 1988)

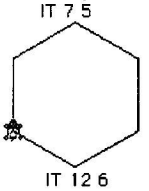
The IT procedures are:

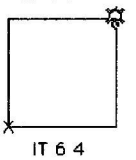
```
TO IT :M :N
X
REPEAT :M [FD 300/:N
WAIT 4 RT 360/:N]
END

TO X
RT 40 FD 5 BK 10 FD 5
LT 80 FD 5 BK 10 FD 5 RT 40
END
```

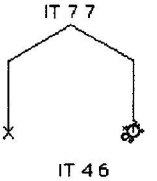












:M is the total number of segments the turtle draws
:N describes the number of sides in the regular shape that the turtle draws

Example:
IT 15 5 draws a pentagon where the turtle retraces the pentagon three times.

Some questions to explore:

Predict what the turtle will do when you give some inputs to IT. For example, what will IT 9 4 draw?
What figure does the turtle draw?
Where on the figure will the turtle wind up?
How many complete revolutions did the turtle make around the shape?

What values of :M and :N should be used to have the turtle make six revolutions around a hexagon? What values of :M and :N will cause the turtle to finish where it starts? For that matter, list all values of :M that will cause the turtle to land on a particular vertex for a given :N.

Explore repeating IT. For example, REPEAT 5 [IT 8 5] places an X at every vertex of the pentagon, whereas REPEAT 6 [IT 8 6] only places an X at vertices 0, 2, and 4, although it draws each one twice. When using REPEAT :M [IT :M :N] with arbitrary values, which vertices will have Xs and which won't? Furthermore, in what order will these Xs get drawn? Δ

Billiards

by Bob Jensen

For a good description of this problem see Chapter One of Harold Jacob's terrific textbook Mathematics: A Human Endeavor (Freeman & Co. San Francisco, 1971)

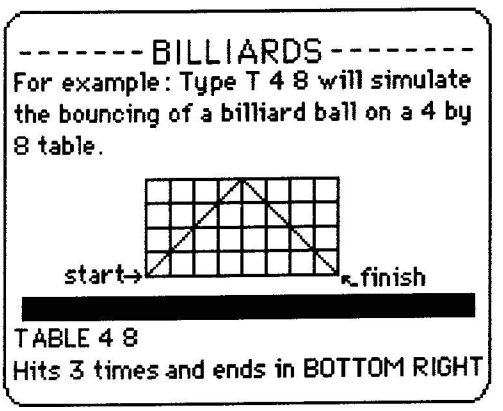
T is a command that takes two counting numbers as inputs. It then draws a billiard table of these dimensions and simulates the path of a billiard ball propelled at a 45 degree angle form the lower left hand corner. It records the number of bounces and the ending corner.

A problem to investigate:

Can you predict for a table of width W and length L how many times the ball will bounce before stopping? What would the rule look like?

Examples:

TABLE 5 7 hits the table 12 times. TABLE 4 6 hits the table 5 times. Δ



Length	Width	No. of hits
8	4	3
7	5	12
4	6	5