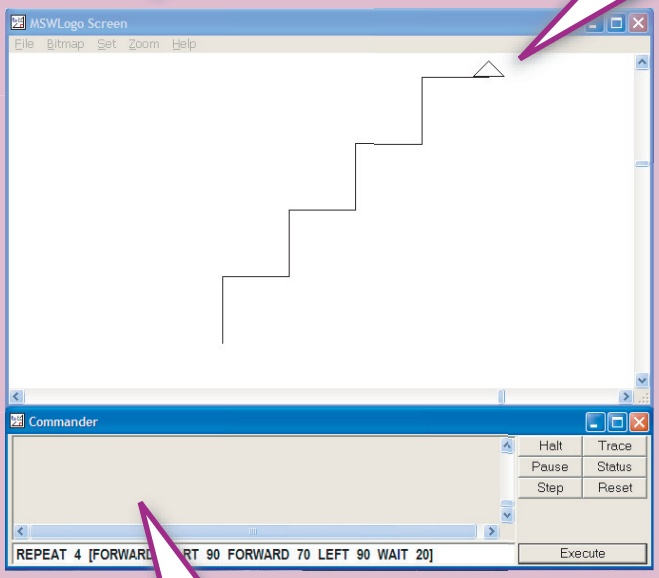
*This is the **MSWLogo** window where your drawing will appear.*

The little triangular pointer is called the 'turtle'.



Type your commands here.

An understanding of IT is helpful in understanding life in the 21st century. Every computer application, like Word or Excel, every consol game and every internet site requires teams of programmers to create them. So does every mp3 player and every other electronic device in your home!

Make the turtle move around the screen by entering commands like:

FORWARD 50 **RIGHT 90** **LEFT 60**

Note: Type **CS** whenever you want to clear the screen.

Type:

REPEAT 4 [FORWARD 70 RT 90 FORWARD 70 LEFT 90 WAIT 20]

What happens?

Try **changing some of the numbers** – predict what you think will happen – then test it out.

Can you draw these repeating patterns?

Special warning: Logo is really fussy about having spaces between each command or number.

challenge

Now design a **repeating pattern** of your own.

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Type the following commands into the Commander window

Over half a million people in the UK use programming skills in their work. These include such jobs as designing and writing computer systems used in industry or for government departments and creating computer games.

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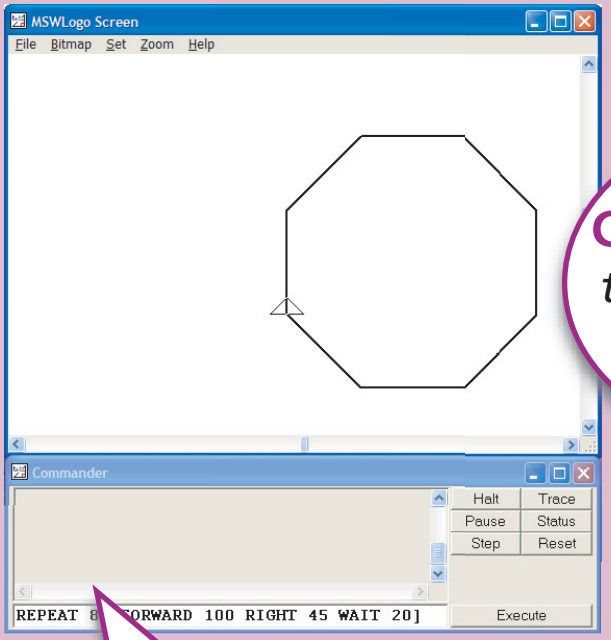

This is the Commander window.

```
CS  REPEAT 8 [FORWARD 100 RIGHT 45 WAIT 20]
```

*Only include **CS** first if you need to clear the screen from an earlier drawing.*

The number of times the commands in the bracket are repeated…

…whatever commands you put in the square brackets get repeated.

Try changing the numbers and predict what will happen.

challenges

Can you change the list of commands to draw a square?

What other polygons can you draw?

Special warning:
Logo is really fussy about having spaces between each command or number.

Type the following commands into the Commander window

```
CS REPEAT 5 [FORWARD 200 RIGHT 144 WAIT 20]
```

Almost all jobs now require you to use a computer. If you understand a little bit about how they work, it helps you to work with them effectively.

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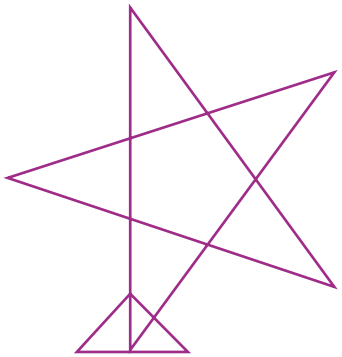
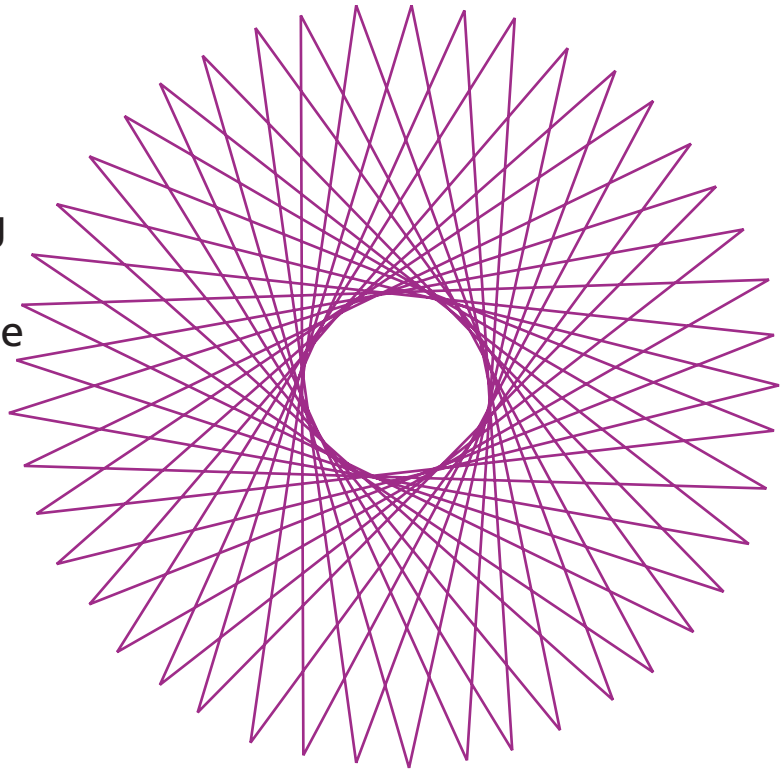
This will draw a 5 pointed star.



Sketch the star on paper and see if you can you work out why.

Try changing the repeat value and the angle to see what other stars you can draw.



Can you find any relationships between the **angle** and the **number of points**?

Why is it difficult to draw a **6-pointed star**?

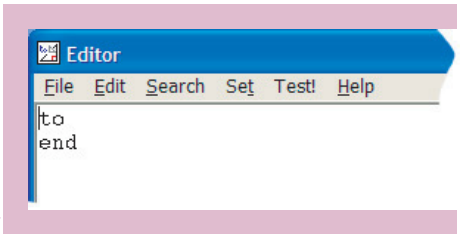
How many different **9-pointed stars** can you make?

Previously, you made **Logo** draw an octagon by typing the following commands into the Commander window:

You can create a new Logo command by making Logo remember a whole list of commands!

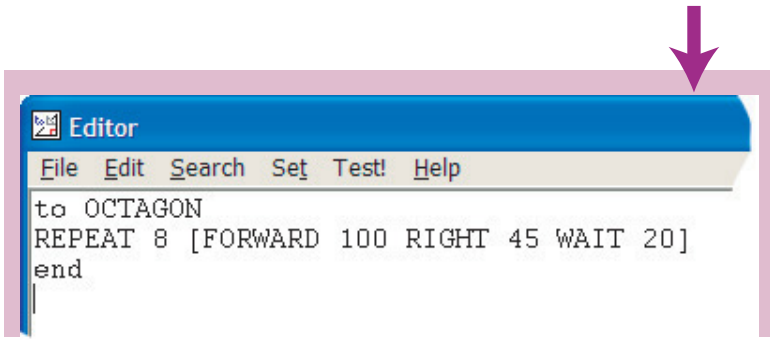
```
REPEAT 8 [FORWARD 100 RIGHT 45 WAIT 20]
```

Type **EDALL** in the Commander window to make Logo's Editor Window appear.



Make up a name for your new command and enter it after the word **'to'**. Here it is called **OCTAGON**, but you could use any name you like.

Now enter the commands which make up this new command on the next line. The new command looks like this in the Editor.



Now leave the editor by selecting File → Save and Exit

Logo now 'knows' the command OCTAGON.
Just type OCTAGON in the Commander window.

digital design

Teacher notes

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Digital design : Programming

Description

These activities are provided to introduce pupils to the fundamental processes involved in programming a computer. Almost all jobs now require the use of computers and understanding a little about how they work helps us to use them effectively. In addition, over half a million people in the UK use programming skills directly in their work. These include such jobs as designing and writing computer systems used in industry or for government departments and creating computer games.

Activity 1: Frieze patterns
Activity 2: Polygons
Activity 3: Stars
Enhancement material: Making a new command

Frieze patterns provides a simple introduction to the experience of programming a computer. The geometry is straightforward but the pupils will find lots of opportunities for discovering the need for precision and accuracy.

The activity introduces the pupils to some *primitive procedures*. **REPEAT** is one such primitive command. It is very powerful and all three activities make much use of it. The command **WAIT 20** just slows down the drawing so that it becomes easier to see what is going on. Without it, **Logo** draws so quickly that the completed pattern appears immediately.

When the screen is cleared (using the command **CS**), the turtle always returns to the centre of the screen and points upwards. Sometimes, it is useful to enter **RIGHT 90** so that the turtle points to the left before it starts to draw a repeating pattern.

The next two activities build on what has been learnt in the first. When attempting to draw **Polygons**, pupils will discover the need to visualise external angles rather than internal ones. Many pupils will learn most by experimentation using trial and improvement techniques.

Resources

Several versions of Logo are available, but the syntax may vary so it is a good idea to download the MSWLogo version from:
http://www.softronix.com/logo.html

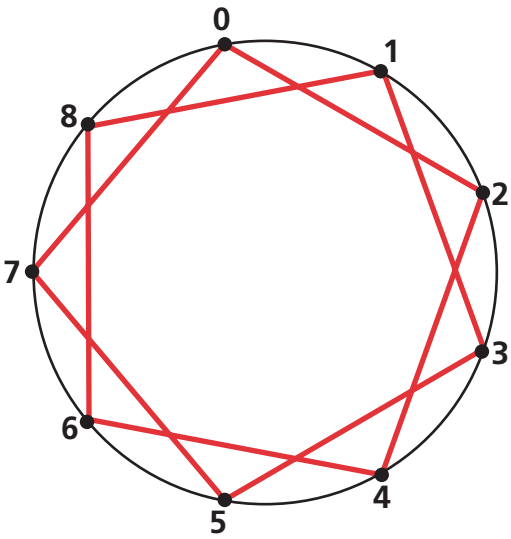
Simply download the file called 'Setup Kit'.
It downloads as a single executable zip file.
This means that you can just double click on the downloaded file and it will complete the installation for you with nothing further for you to do! *(As this is a program, you will need the relevant access rights to enable the installation to complete, so this may require the support of your technical manager).*
There is a series of free booklets to support work with **Logo** written by **Peter Smith** on the ***Association of Teachers of Mathematics*** website at:
http://www.atm.org.uk/free-resources/logo.html

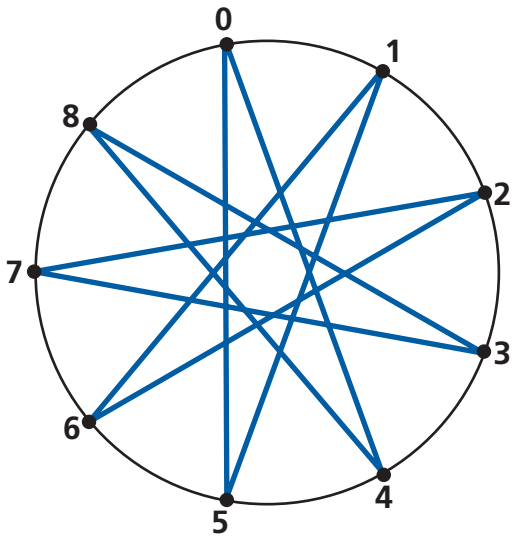
You could download these and print them out for your own use and for selected pupils to use.

But some may be ready to write programming procedures – **Making a new command** teaches them how to do this. Building your own commands is carried out in the **Editor**. Sometimes, pupils will find it helpful to experiment with a set of commands required to produce a particular result, and then use 'copy' and 'paste' to transfer several of these remembered commands to the **Editor**. It will be helpful to introduce the idea of an *input*. Some procedures do not need an input, for example, **CS** but others like **FORWARD** take one input – a number. **REPEAT** needs two inputs – first a number and then a list of commands. The booklet *Procedures* from the ATM site may be particularly helpful for pupils building their own commands.

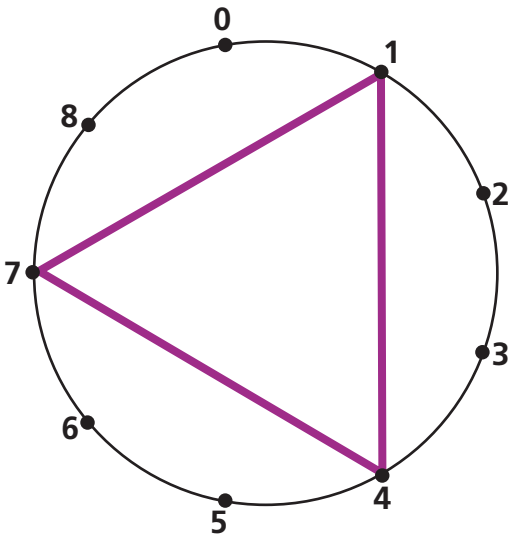
Digital design : Programming

Just these few simple commands can provide significant mathematical challenges. **Stars** is one such challenge. Experimentation will lead to some solutions but a full understanding of the problem requires deep mathematical thinking. For example, there are several ways to create a 9-pointed star:





In the first star, each line is made by connecting it to the point which is 2 steps on. In the second, each line is made by connecting it to the point which is 4 steps on.



Look what happens if each line is made by connecting it to the point which is 3 steps on. To make a 9-pointed star with steps of 3, you would have to start again at dot 2, and then add a third triangle starting at dot 3. Pupils will find the idea of co-prime numbers useful here.

The mathematics

Logical, algorithmic thinking is developed by all these activities. Geometric work focuses on exterior angles, particularly of polygons and star polygons.