

Personal Polynomials

Student Activity

7 8 9 10 11 12



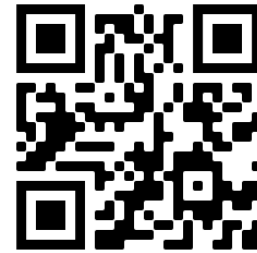
Introduction

Not everyone has a street named after them, but everyone can have a polynomial. What does your polynomial look like?

In this activity you will change your name into a set of points and determine the polynomial that passes through these points, your personal polynomial. How does your polynomial compare and interact with others? How much can you tell about someone's polynomial by just looking at their name?

You can turn your name or any text into numbers quickly and easily using TI-Nspire. Scan the QR code and watch the video to create a program that converts your name into numbers.

POLYNOMIAL WAY



Instructions – Converting your name into numbers – A programming approach

Start a new TI-Nspire document and insert a Calculator application.

Type the command:

```
ord("T")
```

Next, type the command:

```
ord("t")
```

Notice the difference in values. Try other letters such as A and a.



Technology Tip!

The 'ord()' command on the calculator returns the ASCII code for the corresponding text. ASCII code maps 128 characters, the more sophisticated UNICODE maps 2²¹ characters.

Question: 1.

What value needs to be subtracted from capital letters to compute the value of each letter such that A = 1, B = 2 and so on?

Question: 2.

What value needs to be subtracted from lower case letters to compute the value of each letter such that a = 1, b = 2 and so on?

There are other useful text commands on the calculator that will prove useful.

Type the command:

```
mid("Maths",1,1)
```

Then try:

```
mid("Maths",2,1) and mid("Maths",3,1)
```

```
ord("T")      84
mid("Maths",1,1)
```

Question: 3.

Explain what the 'mid' command does.

In mathematics one function can be embedded inside another, these are referred to as composite functions. The output of one function feeds directly into the input of another. This may be expressed as: $f(g(x))$.

In this case, two programming commands "ord" and "mid" will be combined to produce a single result.

The output from the 'mid' command is fed into the input of the 'ord' command.

Type in the following combination:

```
ord(mid("Maths",2,1))
```

```
ord("T")      84
mid("Maths",1,1)  "M"
ord(mid("Maths",2,1))  97
```



Technology Tip!

A short cut for entering the `ord(mid("Maths",2,1))` combination is to start with `ord(` then arrow up to select `mid("Maths",2,1)` and press **Enter** to paste it directly into the `ord()` command.

The last piece in this puzzle is the "dim" command.

Try the following:

```
dim("Maths")
```

```
ord("T")      84
mid("Maths",1,1)  "M"
ord(mid("Maths",2,1))  97
dim("Maths")     7
```

Question: 4.

What does the `dim()` command do?

Question: 5.

Write down your name as numbers from 1 to 26. [Note: On the calculator you can type: n]

Question: 6.

Write down the coordinates for the points that your polynomial must pass through: (1, #), (2, #) etc...

Question: 7.

What is smallest degree polynomial that will pass through all of your points? What assumptions do you need to make?

Question: 8.

Define your polynomial as: $f(x) = ax^n + bx^{n-1} + cx^{n-2} + \dots$ according to the degree of your polynomial. Using your points from Question 6, write down the simultaneous equations that need to be solved in order to determine the equation for your polynomial.

**Technology Tip!**

If you used a program to help with changing your name from letters to numbers, you will need to delete the value stored in 'd': **DelVar d**

Question: 9.

Determine the solution to the simultaneous equations (Question 8) and hence write down the equation to your polynomial.

Question: 10.

Generate a table of values to show that your polynomial passes through the appropriate points.

Question: 11.

Use the bisection method to determine the x-intercepts of your polynomial.
[Consult with your teacher if your personal polynomial does not have any x axis intercepts.]

You can write a program to perform the bisection method. Scan the QR code to watch an explanation of the bisection method and instructions for writing the program.

**Exploring more Personal Polynomials****Question: 12.**

Hannah noticed that her polynomial had a smaller degree than she first thought. Explain why this is so.

Question: 13.

Arora and Mayam both noticed that Elle and Hannah's polynomials had a smaller degree than expected, but their polynomials were 'as expected'. Explain why this is the case.

Question: 14.

Amy joins the conversation and states that her name is unique. It too has a lower than expected degree, but for a different reason. Explain. Can you find another name that also has this property?

Question: 15.

Which of the following names would provide polynomials $p(x)$ such that $p(x) = 0$ has at least one solution:

- i) Daisy ii) Peter iii) Brian iv) Emma v) John

Question: 16.

Bindi notices that her polynomial $p(x)$ has no solutions such that $p(x) = 0$. Find some other names that have no solutions to $p(x) = 0$. Explain how you searched and what criteria you used.

Question: 17.

According to their polynomials, where do Lilly and Lillian meet?

Question: 18.

Victor and his friend Victoria want to explore all the places where their polynomials meet. Without determining their equations:

- i) Identify six points where their polynomials will intersect.
- ii) Explain why their polynomials have seven points of intersection.

Question: 19.

Anna and Hannah claim to have very similar polynomials. Apply an appropriate transformation and compare the two polynomials.

Question: 20.

Are there any two names that share the same polynomial? Explain your reasoning.