Noteable™

RStudio: Secret Number

Creating Sequences Using R

Resource

Secondary

14-18 years

EDINA THE UNIVERSITY of EDINBURGH

Noteable™

Contents

Noteable Activities for Schools: Creating Sequences in R

These resources are a guide for teachers to use with the whole class or direct individual students as appropriate. The activities below can be directly distributed to pupils.

For instructions on how to install and use Noteable resources, please look at our guides for teachers in GLOW: GLOW guidance for teachers to start using Noteable.

Content and Curriculum links

Level	Context	Indicators
14-18	Generating Sequences	* sequence * term = the numbers in the sequence * *n*th term

Knowledge	Using bullet point lists to give instructions
Curriculum links (England) Computing KS4	• develop their capability, creativity and knowledge in computer science, digital media and information technology
Scottish Curriculum for Excellence	**Experiences and Outcomes:** • Having explored number sequences, I can establish the set of numbers generated by a given rule and determine a rule for a given sequence, expressing it using appropriate notation. **MTH 3-13a** **Benchmark:** ○ Generates number sequences from a given rule, for example, T = 4n + 6. ○ Extends a given pattern and describes the rule.
All: Cross-curricular opportunities	The activities have identified opportunities for Applications of Maths.

What is a sequence in R?

In R, a sequence is a way to generate a series of numbers or other objects in a specific order. The basic function for creating sequences in R is **`seq()`** or its shorthand **`:`** operator. Sequences are commonly used for generating numeric vectors, but they can also be used to create sequences of other data types, such as dates or characters. Here's how you can use **`seq()`** to define a sequence:

1. Using **`seq()`** function:
   - The **`seq()`** function takes several arguments, including **`from`**, **`to`**, **`by`**, and **`length.out`**, which allow you to control the start, end, step size, or the length of the sequence.

R Copy code

```
# Generate a sequence from 1 to 10 with a step size of 1

```{r chunk1}

sequence <- seq(from = 1, to = 10, by = 1)

```
```

This will create a sequence of numbers from 1 to 10 in increments of 1.

2. Using the **`:`** operator
   - The **`:`** operator is a shorthand way to create a simple sequence, and it's often used for sequences with a constant step size.

R Copy code

```
# Generate a sequence from 1 to 10 with a step size of 1

```{r chunk2}

sequence <- 1:10

```
```

The result is the same as the **`seq()`** function example above.

3. Using **`length.out`**:
    - You can also specify the length of the sequence while letting R compute the step size automatically.

R Copy code

```
# Generate a sequence of 5 numbers from 1 to 10

```{r chunk3}

sequence <- seq(from = 1, to = 10, length.out = 5)

```
```

This will create a sequence of 5 numbers evenly spaced between 1 and 10.

Sequences can be very flexible, and you can use them for various purposes, such as creating vectors, controlling loops, and defining ranges for plotting and analysis in R.

4. To find a specific number in a sequence in R, just add **`Term_5 <- sequenceX[5]`** to your query. See the example below:

R Copy code

```
# Generate a sequence of 5 numbers from 1 to 10

```{r chunk3}

sequence <- seq(from = 1, to = 10, length.out = 5)

# Writing down the 5th number in the sequence

Term_5 <- sequence_x[5]```
```

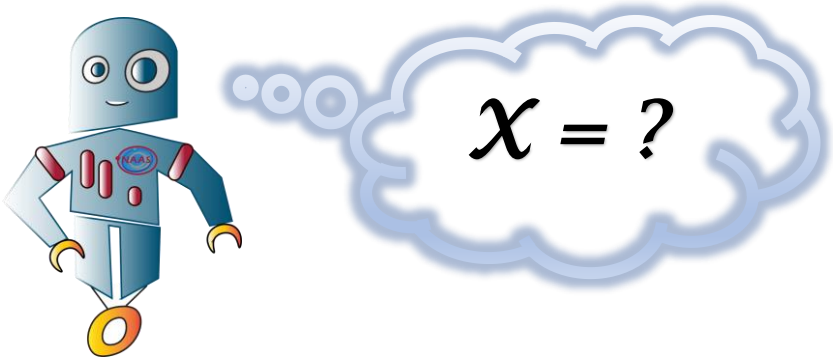
`term_5 <- sequence_x[5]`: This line of code does the following:

- **`sequence_x[5]`** selects the **5th term** from the sequence stored in the variable sequence_x.
- The value of this 5th term is then assigned to a new variable called term_5.
- So, term_5 now holds the value of the 5th term from the sequence.

In simpler terms, it's like picking the 5th item from a list (or sequence) of numbers and storing it in a special box called term_5.
```

Activity 1

Can you guess what numbers NAAS is thinking about?



Instructions:

A. Generate a sequence from 1 where the terms go up by 4 up to the 100th term.

```{r chunk1}
```

Write down the eighth number from your sequence: _____

B. Generate a sequence from 5 where the terms go up by 10 up to the 100th term.

```{r chunk2}
```

Write down the 86th term: _____

C. You can also sequence from 100 to 1 by -1.
Ex. ```{r chunk3}
seq(from=100, to=1, by=-1)
```

Based on the example above, generate a sequence that goes down from 50 to 0 where the terms go down by 5.

Write down the 3rd number in your sequence: _____

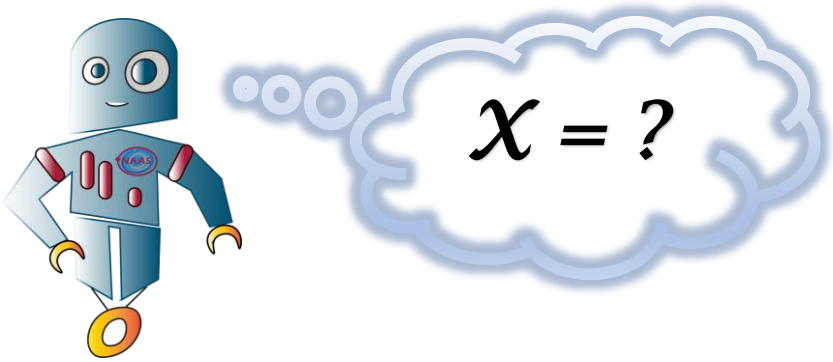
D. Calculate the numbers that you have written down from each activity using the model below to find NAAS' secret number (x).

X = (Q1 number + (Q2 number / Q3 number)

Answer: _____
```

Activity 2 – Challenge

NAAS is inviting you to a challenge!



A. In pairs, generate one sequence from any given number to any given number and ask your partner to find a specific number in the sequence.

B. Too easy? Create a set of three sequences and ask your partner to calculate the result and find the secret number. Use activity one as a model for your puzzle.

Adaptations

You can make this resource more challenging by asking your students to write the requests and calculations in R on Noteable.

A. Answer: 29

```
R                                                                    Copy code

# Generate a sequence from 1 where the terms go up by 4 up to the 100th term

```{r chunk1}

sequence1 <- seq(from = 1, to = 100, by = 4)

# Writing down the eighth number from the sequence

QA <- sequence1[8])```
```

B. Answer 855

```
R                                                                    Copy code

# Generate a sequence from 5 where the terms go up by 10 up to the 100th term

```sequence2 <- seq(from = 5, length.out = 100, by = 10)

# Writing down the 86th term

QB <- sequence2[86]```
```

C. Answer: 40

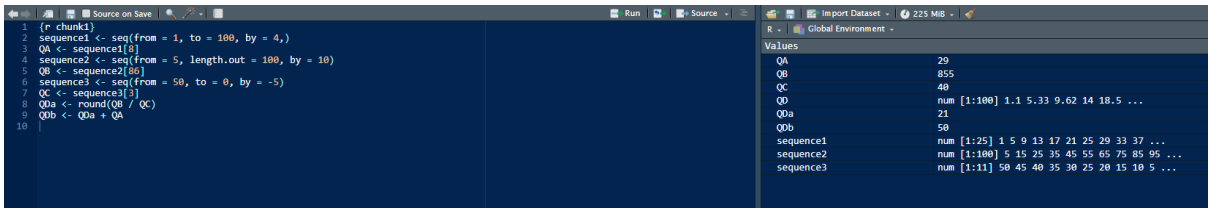
```
R                                                                    Copy code

# You can also sequence from 100 to 1 by -1

```sequence3 <- seq(from = 50, to = 0, by = -5)

# Writing down the 3th number in the sequence

QC <- sequence3[3]```
```
```

D. Secret Number: 50

R Copy code

```
# Calculate the numbers that you have written down from each activity using the model below to find NAAS' secret number (x)

```QDa <- QB / QC

QDb <- QDa + QA```
```


```

Cross-curricular opportunities

Applications of Maths: One area where you can enhance the utility of this resource is by incorporating code related to statistical analysis within RStudio.

RStudio can significantly enhance learning in Applications of Maths for SQA Highers by providing students with a practical and hands-on approach to mathematical concepts and their real-world applications. Here's how it can help:

- **Visualizing Concepts:** RStudio helps students understand math by creating visual representations of math ideas, like graphs and charts.
- **Statistics Made Easier:** It's great for teaching statistics, which is a big part of Applications of Maths. Students can use it to analyse data and learn statistical concepts.
- **Real-World Math:** With RStudio, students can work with real data to solve real problems, connecting math to the real world.
- **Programming Skills:** Students can learn programming basics in RStudio, which is a useful skill in today's job market.
- **Interactive Learning:** RStudio gives instant feedback, making learning more dynamic.
- **Project-Based Learning:** It supports projects where students use math to solve real problems. This builds critical thinking skills.
- **Data Interpretation:** RStudio helps students learn how to understand and analyze data.
- **Reproducibility:** It encourages good research practices by creating documents that show how math was used to solve a problem.
- **Career Readiness:** RStudio skills can prepare students for jobs in data science and other fields.

Using RStudio in your teaching can make math more practical and fun for students, helping them understand math concepts better and preparing them for future opportunities.

Preparation for Further Study and Careers: Proficiency in RStudio and R programming can open doors to careers in data science, statistics, finance, and research. It also prepares students for higher-level mathematical studies.

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