# Non-textbook textbook problems

1. Consider the following complex numbers:

Text, letter

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(a) Plot the above numbers on the complex plane.

Chart, scatter chart

Description automatically generated

(b) Connect the dots. The pattern should look familiar.

Chart, line chart

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2. Consider the function f(z) = iz.



(a) Determine first four iterates of z0 = 3.

Graphical user interface, application

Description automatically generated

,

which is to say:

(b) Determine first four iterates of z0 = 2i.

,

which is to say:

(c) Plot the iterates for each of the seeds in the complex plane.

A picture containing chart

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(d) How would you describe the behavior of the orbits?

I would likely describe the behaviour of these orbits as a rotation.

# Chapter 21

(21.1) Consider the set of all perfect squares: {1, 4, 9, 16, 25, …}. What is the cardinality of this set?

The cardinality of this set is , it is countably infinite.

(21.2) What is the cardinality of the following infinite set: {, , , …}?

The cardinality of this set is , it is countably infinite.

(21.3) What is the cardinality of the following infinite set: {613, 614, 615, 616, 617, …} ?

The cardinality of this set is , it is countably infinite.

(21.4) What is the cardinality of the following infinite set: {, , , , , …} ?

The cardinality of this set is , it is countably infinite.

(21.5) What is the cardinality of all numbers contained in the interval between 0 and ?

The cardinality of this set is , it is uncountably infinite.

# Chapter 21 - Optional problems

(21.8) Convert the following numbers from base-10 to binary:

(a) 8

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Decimal value | 8 | 4 | 2 | 1 |
| Presence/absence | 1 | 0 | 0 | 0 |

The binary form of base-10 8 is 1000.

(b) 9

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Decimal value | 8 | 4 | 2 | 1 |
| Presence/absence | 1 | 0 | 0 | 1 |

The binary form of base-10 9 is 1001.

(c) 48

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Decimal value | 32 | 16 | 8 | 4 | 2 | 1 |
| Presence/absence | 1 | 1 | 0 | 0 | 0 | 0 |

The binary form of base-10 48 is 110000.

(d) 100

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Decimal value | 64 | 32 | 16 | 8 | 4 | 2 | 1 |
| Presence/absence | 1 | 1 | 0 | 0 | 1 | 0 | 0 |

The binary form of base-10 100 is 1100100.

(21.9) Convert the following numbers from binary to base-10:

(a) 100

|  |  |  |  |
| --- | --- | --- | --- |
| Decimal value | 4 | 2 | 1 |
| Presence/absence | 1 | 0 | 0 |

4 + 0 + 0 = 4

The decimal form of base-2 100 is 4.

(b) 111

|  |  |  |  |
| --- | --- | --- | --- |
| Decimal value | 4 | 2 | 1 |
| Presence/absence | 1 | 1 | 1 |

4 + 2 + 1 = 7

The decimal form of base-2 111 is 7.

(c) 1001

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Decimal value | 8 | 4 | 2 | 1 |
| Presence/absence | 1 | 0 | 0 | 1 |

8 + 0 + 0 + 1 = 9

The decimal form of base-2 1001 is 9.

(d) 10101

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Decimal value | 16 | 8 | 4 | 2 | 1 |
| Presence/absence | 1 | 0 | 1 | 0 | 1 |

16 + 0 + 4 + 0 + 1 = 21

The decimal form of base-2 10101 is 21.

*Since there was no question (21.20), I assumed that the correct question might have been (21.10) and answered it instead.*

(21.10) Convert the following numbers from binary to base-10:

(a) 0.1

Graphical user interface

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One binary form of base-10 0.1 is approximately 0.0001100111, accurate to 3 decimal places.

(The R table looks fancy, but I only used it to get the decimal values column without having to think too much, I solved the binary bit by trial and error).

(b) 0.01

Graphical user interface

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One binary form of base-10 0.01 is approximately 0.0000001011, accurate to 3 decimal places.

(c) 0.001

Graphical user interface

Description automatically generated

One binary form of base-10 0.001 is approximately 0.00000000010001, accurate to 4 decimal places.