

FigurateNum

A Python library for generating infinite figurate number sequences across dimensions.

Installation

```
pip install figuratenum
```

Main Class

```
from figuratenum import FigurateNum as fgn
```

Classes

```
from figuratenum import PlaneFigurateNum as pfgn
from figuratenum import SpaceFigurateNum as sfgn
from figuratenum import MultidimensionalFigurateNum as mfgn
from figuratenum import ZooFigurateNum as zfgn
from figuratenum import NumCollector as nc
```

Generating FigurateNum Sequences Step by Step

```
>>> seq = fgn()
>>> hyperdodecahedral = seq.hyperdodecahedral()

>>> first = next(hyperdodecahedral)
>>> second = next(hyperdodecahedral)
>>> third = next(hyperdodecahedral)
>>> fourth = next(hyperdodecahedral)

>>> print(first, second, third, fourth)
1 600 4983 19468
```

Example Using a Specific Class with a Loop

```
>>> seq_loop = mfgn()
>>> k_dimensional_centered_hypertetrahedron =
    seq_loop.k_dimensional_centered_hypertetrahedron(21)
>>> figuratenum_arr = []
>>> for _ in range(1, 15):
>>>     next_num = next(k_dimensional_centered_hypertetrahedron)
>>>     figuratenum_arr.append(next_num)
>>> print(figuratenum_arr)
[1, 23, 276, 2300, 14950, 80730, 376740, 1560780, 5852925, 20160075,
64512240, 193536720, 548354040, 1476337800]
```

NumberCollector Class: Method Summary

- take(n)
- take_to_list(stop, start, step)
- take_to_array(stop, start, step)
- take_to_tuple(stop, start, step)
- pick(n)

Working with the NumberCollector Class

```
>>> seq = fgn()
>>> pentatope = seq.pentatope()

>>> print(nc.take_to_list(pentatope, 10))
[1, 5, 15, 35, 70, 126, 210, 330, 495, 715]
```

Plane Figurate Numbers

- polygonal
- triangular
- square
- pentagonal
- hexagonal
- heptagonal
- octagonal
- nonagonal
- decagonal
- hendecagonal
- dodecagonal
- tridecagonal
- tetradecagonal
- pentadecagonal
- hexadecagonal
- heptadecagonal
- octadecagonal
- nonadecagonal
- icosagonal
- icosihenagonal
- icosidigonal
- icositrigonal
- icositetragonal
- icosipentagonal
- icosihexagonal
- icosiheptagonal
- icosioctagonal
- icosinonagonal
- triacontagonal
- centered_triangular
- centered_square = diamond
- centered_pentagonal
- centered_hexagonal
- centered_heptagonal
- centered_octagonal
- centered_nonagonal
- centered_decagonal
- centered_hendecagonal
- centered_dodecagonal = star
- centered_tridecagonal

Plane Figurate Numbers

- centered_tetradecagonal
- centered_pentadecagonal
- centered_hexadecagonal
- centered_heptadecagonal
- centered_octadecagonal
- centered_nonadecagonal
- centered_icosagonal
- centered_icosihenagonal
- centered_icosidigonal
- centered_icositrigonal
- centered_icositetragonal
- centered_icosipentagonal
- centered_icosihexagonal
- centered_icosiheptagonal
- centered_icosioctagonal
- centered_icosinonagonal
- centered_triacontagonal
- centered_mgonal(m)
- pronic = heteromecic = oblong
- polite
- impolite
- cross
- aztec_diamond
- polygram(m) = centered_star_polygonal(m)
- pentagram
- gnomonic
- truncated_triangular
- truncated_square
- truncated_pronic
- truncated_centered_pol(m) = truncated_centered_mgonal(m)
- truncated_centered_triangular
- truncated_centered_square
- truncated_centered_pentagonal
- truncated_centered_hexagonal = truncated_hex
- generalized_mgonal(m, start_num)
- generalized_pentagonal(start_num)
- generalized_hexagonal(start_num)
- generalized_centered_pol(m, start_num)
- generalized_pronic(start_num)

Space Figurate Numbers

- `m_pyramidal(m)`
- `triangular_pyramidal`
- `square_pyramidal = pyramidal`
- `pentagonal_pyramidal`
- `hexagonal_pyramidal`
- `heptagonal_pyramidal`
- `octagonal_pyramidal`
- `nonagonal_pyramidal`
- `decagonal_pyramidal`
- `hendecagonal_pyramidal`
- `dodecagonal_pyramidal`
- `tridecagonal_pyramidal`
- `tetradecagonal_pyramidal`
- `pentadecagonal_pyramidal`
- `hexadecagonal_pyramidal`
- `heptadecagonal_pyramidal`
- `octadecagonal_pyramidal`
- `nonadecagonal_pyramidal`
- `icosagonal_pyramidal`
- `icosihenagonal_pyramidal`
- `icosidigonal_pyramidal`
- `icositrigonal_pyramidal`
- `icositetragonal_pyramidal`
- `icosipentagonal_pyramidal`
- `icosihexagonal_pyramidal`
- `icosiheptagonal_pyramidal`
- `icosioctagonal_pyramidal`
- `icosinonagonal_pyramidal`
- `triacontagonal_pyramidal`
- `triangular_tetrahedral[finite]`
- `triangular_square_pyramidal[finite]`
- `square_tetrahedral[finite]`
- `square_square_pyramidal[finite]`
- `tetrahedral_square_pyramidal[finite]`
- `cubic`
- `tetrahedral`
- `octahedral`
- `dodecahedral`
- `icosahedral`
- `truncated_tetrahedral`

Space Figurate Numbers

- `truncated_cubic`
- `truncated_octahedral`
- `stella_octangula`
- `centered_cube`
- `rhombic_dodecahedral`
- `hauy_rhombic_dodecahedral`
- `centered_tetrahedron = centered_tetrahedral`
- `centered_square_pyramid = centered_pyramid`
- `centered_mgonal_pyramid(m)`
- `centered_pentagonal_pyramid`
- `centered_hexagonal_pyramid`
- `centered_heptagonal_pyramid`
- `centered_octagonal_pyramid`
- `centered_octahedron`
- `centered_icosahedron = centered_cuboctahedron`
- `centered_dodecahedron`
- `centered_truncated_tetrahedron`
- `centered_truncated_cube`
- `centered_truncated_octahedron`
- `centered_mgonal_pyramidal(m)`
- `centered_triangular_pyramidal`
- `centered_square_pyramidal`
- `centered_pentagonal_pyramidal`
- `centered_heptagonal_pyramidal`
- `centered_octagonal_pyramidal`
- `centered_nonagonal_pyramidal`
- `centered_decagonal_pyramidal`
- `centered_hendecagonal_pyramidal`
- `centered_dodecagonal_pyramidal`
- `centered_hexagonal_pyramidal = hex_pyramidal`
- `hexagonal_prism`
- `mgonal_prism(m)`
- `generalized_mgonal_pyramidal(m, start_num)`
- `generalized_pentagonal_pyramidal(start_num)`
- `generalized_hexagonal_pyramidal(start_num)`
- `generalized_cubic(start_num)`
- `generalized_octahedral(start_num)`

Space Figurate Numbers

- `generalized_icosahedral(start_num)`
- `generalized_dodecahedral(start_num)`
- `generalized_centered_cube(start_num)`
- `generalized_centered_tetrahedron(start_num)`
- `generalized_centered_square_pyramid(start_num)`
- `generalized_rhombic_dodecahedral(start_num)`
- `generalized_centered_mgonal_pyramidal(m, start_num)`
- `generalized_mgonal_prism(m, start_num)`
- `generalized_hexagonal_prism(start_num)`

Multidimensional Figurate Numbers

- `k_dimensional_hypertetrahedron(k) = k_hypertetrahedron(k) = regular_k_polytopic(k) = figurate_of_order_k(k)`
- `five_dimensional_hypertetrahedron`
- `six_dimensional_hypertetrahedron`
- `k_dimensional_hypercube(k) = k_hypercube(k)`
- `five_dimensional_hypercube`
- `six_dimensional_hypercube`
- `hypertetrahedral = pentachoron = pentatope = triangulotriangular = cell_5`
- `hypercube = octachoron = tesseract = biquadratic = cell_8`
- `hyperoctahedral = hexadecachoron = four_cross_polytope = four_orthoplex = cell_16`
- `hypericosahedral = hexacosichoron = polytetrahedron = tetraplex = cell_600`
- `hyperdodecahedral = hecatonicosachoron = dodecaplex = polydodecahedron = cell_120`
- `polyoctahedral = icositetrachoron = octaplex = hyperdiamond = cell_24`
- `four_dimensional_hypercentahedron`
- `five_dimensional_hypercentahedron`
- `six_dimensional_hypercentahedron`
- `seven_dimensional_hypercentahedron`
- `eight_dimensional_hypercentahedron`
- `nine_dimensional_hypercentahedron`
- `ten_dimensional_hypercentahedron`
- `k_dimensional_hypercentahedron(k) = k_cross_polytope(k)`
- `four_dimensional_mgonal_pyramidal(m) = mgonal_pyramidal_of_the_second_order(m)`
- `four_dimensional_square_pyramidal`
- `four_dimensional_pentagonal_pyramidal`
- `four_dimensional_hexagonal_pyramidal`
- `four_dimensional_heptagonal_pyramidal`
- `four_dimensional_octagonal_pyramidal`
- `four_dimensional_nonagonal_pyramidal`
- `four_dimensional_decagonal_pyramidal`
- `four_dimensional_hendecagonal_pyramidal`
- `four_dimensional_dodecagonal_pyramidal`
- `k_dimensional_mgonal_pyramidal(k,m) = mgonal_pyramidal_of_the_k_2_th_order(k,m)`
- `five_dimensional_mgonal_pyramidal(m)`
- `five_dimensional_square_pyramidal`
- `five_dimensional_pentagonal_pyramidal`
- `five_dimensional_hexagonal_pyramidal`
- `five_dimensional_heptagonal_pyramidal`
- `five_dimensional_octagonal_pyramidal`

Multidimensional Figurate Numbers

- `six_dimensional_mgonal_pyramidal(m)`
- `six_dimensional_square_pyramidal`
- `six_dimensional_pentagonal_pyramidal`
- `six_dimensional_hexagonal_pyramidal`
- `six_dimensional_heptagonal_pyramidal`
- `six_dimensional_octagonal_pyramidal`
- `centered_biquadratic`
- `k_dimensional_centered_hypercube(k)`
- `five_dimensional_centered_hypercube`
- `six_dimensional_centered_hypercube`
- `centered_polytope`
- `k_dimensional_centered_hypertetrahedron(k)`
- `five_dimensional_centered_hypertetrahedron`
- `six_dimensional_centered_hypertetrahedron`
- `centered_hypercentahedron`
- `nexus(k)`
- `k_dimensional_centered_hypercentahedron(k)`
- `five_dimensional_centered_hypercentahedron`
- `six_dimensional_centered_hypercentahedron`
- `generalized_pentatope(start_num = 0)`
- `generalized_k_dimensional_hypertetrahedron(k = 5, start_num = 0)`
- `generalized_biquadratic(start_num = 0)`
- `generalized_k_dimensional_hypercube(k = 5, start_num = 0)`
- `generalized_hypercentahedron(start_num = 0)`
- `generalized_k_dimensional_hypercentahedron(k = 5, start_num = 0)`
- `generalized_hyperdodecahedral(start_num = 0)`
- `generalized_hypericosahedral(start_num = 0)`
- `generalized_polyoctahedral(start_num = 0)`
- `generalized_k_dimensional_mgonal_pyramidal(k, m, start_num = 0)`
- `generalized_k_dimensional_centered_hypercube(k, start_num = 0)`
- `generalized_nexus(start_num = 0)`

Zoo Figurate Numbers

- cuban_primes
- pell

