s8

March 8, 2022

1 28

[ ]:
```
import numpy as np
import numpy.linalg as la
from math import acos, sin, cos

R = 6370 # km

lr = np.deg2rad(-22) # lengdarbaugur Reykjavík
br = np.deg2rad(64) # breiddarbaugur Reykjavík
rvk = np.array([R*sin(lr)*cos(br), R*cos(lr)*cos(br), R*sin(br)])

ll = np.deg2rad(0) # lengdarbaugur London
bl = np.deg2rad(51.5) # breiddarbaugur London
lon = np.array([R*sin(ll)*cos(bl), R*cos(ll)*cos(bl), R*sin(bl)])

def hnattstada(x,y):
    theta = np.degrees(acos((x@y)/(la.norm(x)*la.norm(y))))
    return theta

print(hnattstada(rvk,lon))
```

```
16.97641406060247
```

[ ]:
```
def lengd(x,y,R):
    L = R * np.deg2rad(hnattstada(x,y))
    return L

print(lengd(rvk,lon,R))
```

```
1887.3948218358078
```

2 32

2.1 a)

[ ]:
```
u = np.array([100,200,300,200,200]) # upphafsár
d = np.array([                      # dánartíðni
    [0.1,0.3,0.5,0.4,0.1],
    [0.9,0  ,0  ,0  ,0  ],
    [0  ,0.9,0  ,0  ,0  ],
    [0  ,0  ,0.8,0  ,0  ],
    [0  ,0  ,0  ,0.6,0  ]
])

# x1 = d @ u
# print(x1)
# ar100 = la.matrix_power(d,100) @ u
# print(ar100)
```

2.2 b)

[ ]:
```
def stofnstaerd(ar):
    return sum(la.matrix_power(d,ar)@u)

ar = 1
while (stofnstaerd(ar) > 0):
    ar += 1

print(ar)
# ignore bara þessi error message
```

```
32769
```

```
/tmp/ipykernel_10105/614690868.py:2: RuntimeWarning: overflow encountered in
double_scalars
  return sum(la.matrix_power(d,ar)@u)
/tmp/ipykernel_10105/614690868.py:2: RuntimeWarning: overflow encountered in
matmul
  return sum(la.matrix_power(d,ar)@u)
/home/tumi/.local/lib/python3.10/site-packages/numpy/linalg/linalg.py:664:
RuntimeWarning: overflow encountered in matmul
  result = z if result is None else fmatmul(result, z)
/home/tumi/.local/lib/python3.10/site-packages/numpy/linalg/linalg.py:661:
RuntimeWarning: overflow encountered in matmul
  z = a if z is None else fmatmul(z, z)
/home/tumi/.local/lib/python3.10/site-packages/numpy/linalg/linalg.py:664:
RuntimeWarning: invalid value encountered in matmul
  result = z if result is None else fmatmul(result, z)
```

2.3 c)

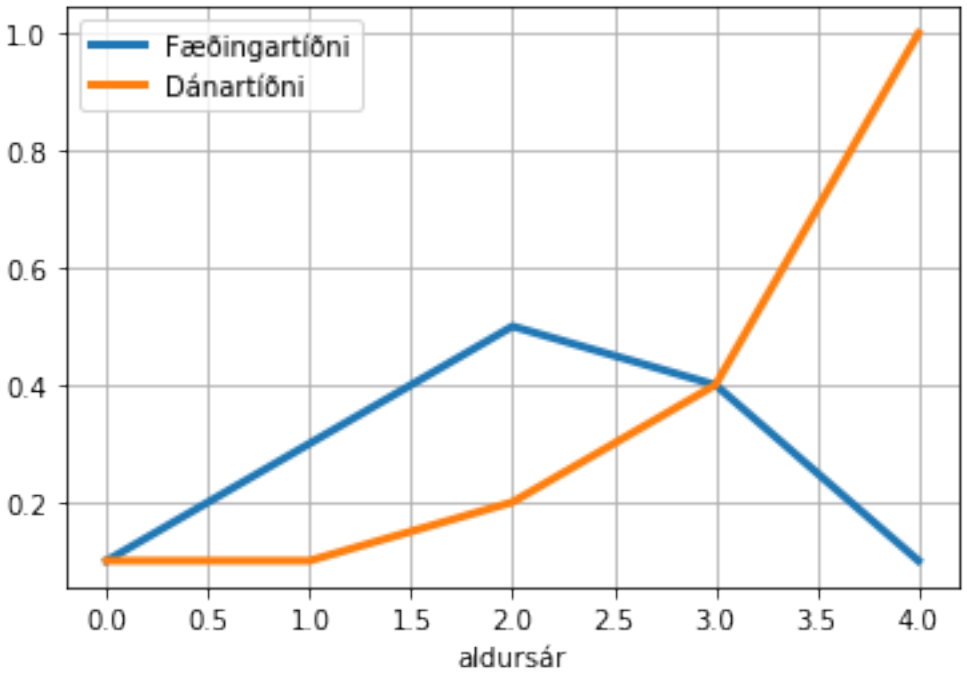
[ ]:
```
import matplotlib.pyplot as plt

f = np.array([0.1,0.3,0.5,0.4,0.1])
d = np.array([0.1,0.1,0.2,0.4,1])


plt.plot(f, lw=3, label = 'Fæðingartíðni')
plt.plot(d, lw=3, label = 'Dánartíðni')

plt.grid(True)
plt.legend(loc='best')
plt.xlabel('aldursár')
```

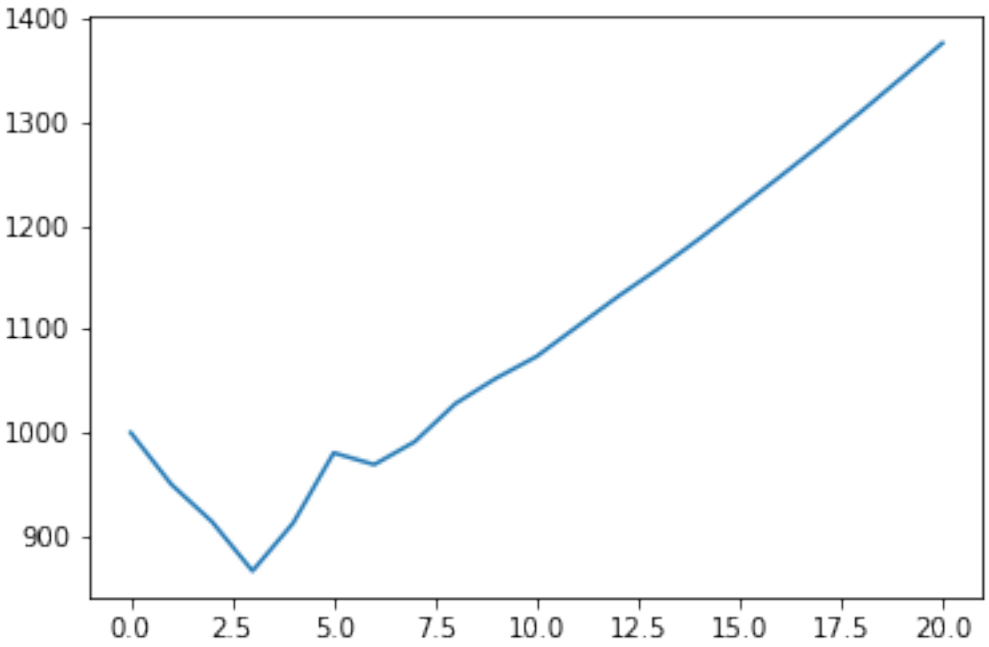
[ ]:
```
Text(0.5, 0, 'aldursár')
```



2.4 d)

[ ]:
```
plt.plot([stofnstaerd(i) for i in range(21)])
```

[ ]:
```
[<matplotlib.lines.Line2D at 0x7fc680c321a0>]
```



3 37

3.1 a)

[ ]:
```
from math import log
def logri(x, a = 10):
    return (log(x))/(log(a))

print(round(logri(100)))
print(round(logri(243,3)))
print(round(logri(128,2)))
```

```
2
5
7
```

3.2 b)

[ ]:
```
from math import exp

def nauk(listi,n=4):
    a = []
    for i in listi:
        a.append(f'{str((i+0.000000000000001))[0:n+2]}')
```

```
    return a

nauk([exp(x) for x in range(6)])
```

[ ]: ['1.0000', '2.7182', '7.3890', '20.085', '54.598', '148.41']