In[]:= **PROVA 2 COMPUTAÇÃO GRÁFICA**
QUESTÃO 1

In[]:=
```
P = {0, 1, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[]= {0, 1, 0, 0}

```
n= 1,q= {0, 1, 0, 0},\q\= 1.
n= 2,q= {-1, 1, 0, 0},\q\= 1.41421
n= 3,q= {0, -1, 0, 0},\q\= 1.
n= 4,q= {-1, 1, 0, 0},\q\= 1.41421
n= 5,q= {0, -1, 0, 0},\q\= 1.
n= 6,q= {-1, 1, 0, 0},\q\= 1.41421
n= 7,q= {0, -1, 0, 0},\q\= 1.
n= 8,q= {-1, 1, 0, 0},\q\= 1.41421
n= 9,q= {0, -1, 0, 0},\q\= 1.
n= 10,q= {-1, 1, 0, 0},\q\= 1.41421
n= 11,q= {0, -1, 0, 0},\q\= 1.
n= 12,q= {-1, 1, 0, 0},\q\= 1.41421
n= 13,q= {0, -1, 0, 0},\q\= 1.
n= 14,q= {-1, 1, 0, 0},\q\= 1.41421
n= 15,q= {0, -1, 0, 0},\q\= 1.
n= 16,q= {-1, 1, 0, 0},\q\= 1.41421
n= 17,q= {0, -1, 0, 0},\q\= 1.
n= 18,q= {-1, 1, 0, 0},\q\= 1.41421
n= 19,q= {0, -1, 0, 0},\q\= 1.
n= 20,q= {-1, 1, 0, 0},\q\= 1.41421
```

In[]:= **FAZENDO A ITEREÇÃO POR 20 PASSOS A SEQUENCIA 0 + 1 i NÃO AUMENTA EM MÓDULO, DESTE MODO O PONTO 0 + 1 i É UM PONTO PRISIONEIRO**

QUESTÃO 2

In[•]:=
```
P = {0.5, 0.1, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {0.5, 0.1, 0, 0}

n= 1,q= {0.5, 0.1, 0, 0},\q\= 0.509902

n= 2,q= {0.74, 0.2, 0., 0.},\q\= 0.766551

n= 3,q= {1.0076, 0.396, 0., 0.},\q\= 1.08262

n= 4,q= {1.35844, 0.898019, 0., 0.},\q\= 1.62844

n= 5,q= {1.53893, 2.53981, 0., 0.},\q\= 2.96967

n= 6,q= {-3.58236, 7.91717, 0., 0.},\q\= 8.68993

n= 7,q= {-49.3482, -56.6243, 0., 0.},\q\= 75.1103

n= 8,q= {-770.564, 5588.72, 0., 0.},\q\= 5641.59

n= 9,q= $\{-3.064\times10^{7}, -8.61293\times10^{6}, 0., 0.\}$,\q\= 3.18276×10^{7}

n= 10,q= $\{8.64628\times10^{14}, 5.27801\times10^{14}, 0., 0.\}$,\q\= 1.01299×10^{15}

n= 11,q= $\{4.69008\times10^{29}, 9.12703\times10^{29}, 0., 0.\}$,\q\= 1.02616×10^{30}

n= 12,q= $\{-6.13058\times10^{59}, 8.5613\times10^{59}, 0., 0.\}$,\q\= 1.05299×10^{60}

n= 13,q= $\{-3.57118\times10^{119}, -1.04971\times10^{120}, 0., 0.\}$,\q\= 1.1088×10^{120}

n= 14,q= $\{-9.74366\times10^{239}, 7.49744\times10^{239}, 0., 0.\}$,\q\= 1.22943×10^{240}

n= 15,q= $\{3.872729684870037\times10^{479}, -1.461049105567651\times10^{480}, 0., 0.\}$
,\q\= $1.511504165062329\times10^{480}$

n= 16,q= $\{-1.984684136759296\times10^{960}, -1.131649648436931\times10^{960}, 0., 0.\}$
,\q\= $2.284644841000767\times10^{960}$

n= 17,q= $\{2.658340195896561\times10^{1920}, 4.491934211244023\times10^{1920}, 0., 0.\}$
,\q\= $5.219602049511422\times10^{1920}$

n= 18,q= $\{-1.311070036102510\times10^{3841}, 2.388217854214581\times10^{3841}, 0., 0.\}$
,\q\= $2.724424555526384\times10^{3841}$

n= 19,q= $\{-3.984679879623459\times10^{7682}, -6.262241736691538\times10^{7682}, 0., 0.\}$
,\q\= $7.422489158755133\times10^{7682}$

n= 20,q= $\{-2.333799782568543\times10^{15\,365}, 4.990605729906608\times10^{15\,365}, 0., 0.\}$
,\q\= $5.509334531183748\times10^{15\,365}$

APÓS 20 PASSOS O MÓDULO CRESCE TENDENDO PARA INFINITO, LOGO 0.5 + 0.1 i NÃO É PRISIONEIRO

QUESTÃO 3

In[•]:=
```
P = {0.2, 0.2, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {0.2, 0.2, 0, 0}

n= 1,q= {0.2, 0.2, 0, 0},\q\= 0.282843

n= 2,q= {0.2, 0.28, 0., 0.},\q\= 0.344093

n= 3,q= {0.1616, 0.312, 0., 0.},\q\= 0.351367

n= 4,q= {0.128771, 0.300838, 0., 0.},\q\= 0.327239

n= 5,q= {0.126078, 0.277478, 0., 0.},\q\= 0.304778

n= 6,q= {0.138902, 0.269968, 0., 0.},\q\= 0.303605

n= 7,q= {0.146411, 0.274998, 0., 0.},\q\= 0.311545

n= 8,q= {0.145812, 0.280525, 0., 0.},\q\= 0.316158

n= 9,q= {0.142567, 0.281808, 0., 0.},\q\= 0.315818

n= 10,q= {0.140909, 0.280353, 0., 0.},\q\= 0.313773

n= 11,q= {0.141258, 0.279009, 0., 0.},\q\= 0.312729

n= 12,q= {0.142108, 0.278824, 0., 0.},\q\= 0.31295

n= 13,q= {0.142452, 0.279246, 0., 0.},\q\= 0.313482

n= 14,q= {0.142314, 0.279558, 0., 0.},\q\= 0.313697

n= 15,q= {0.142101, 0.27957, 0., 0.},\q\= 0.313611

n= 16,q= {0.142033, 0.279454, 0., 0.},\q\= 0.313477

n= 17,q= {0.142079, 0.279383, 0., 0.},\q\= 0.313435

n= 18,q= {0.142131, 0.279389, 0., 0.},\q\= 0.313464

n= 19,q= {0.142143, 0.27942, 0., 0.},\q\= 0.313497

n= 20,q= {0.142129, 0.279435, 0., 0.},\q\= 0.313504

PONTO 0.2 + 0.2 i É UM PONTO PRISIONEIRO

In[169]:=
```
P = {-0.3, 0.2, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[169]= {-0.3, 0.2, 0, 0}

```
n= 1,q= {-0.3, 0.2, 0, 0},\q\= 0.360555
n= 2,q= {-0.25, 0.08, 0., 0.},\q\= 0.262488
n= 3,q= {-0.2439, 0.16, 0., 0.},\q\= 0.291697
n= 4,q= {-0.266113, 0.121952, 0., 0.},\q\= 0.292726
n= 5,q= {-0.244056, 0.135094, 0., 0.},\q\= 0.278951
n= 6,q= {-0.258687, 0.134059, 0., 0.},\q\= 0.29136
n= 7,q= {-0.251053, 0.130641, 0., 0.},\q\= 0.28301
n= 8,q= {-0.25404, 0.134404, 0., 0.},\q\= 0.287403
n= 9,q= {-0.253528, 0.131712, 0., 0.},\q\= 0.2857
n= 10,q= {-0.253071, 0.133215, 0., 0.},\q\= 0.285992
n= 11,q= {-0.253701, 0.132574, 0., 0.},\q\= 0.286252
n= 12,q= {-0.253212, 0.132731, 0., 0.},\q\= 0.285891
n= 13,q= {-0.253501, 0.132782, 0., 0.},\q\= 0.286171
n= 14,q= {-0.253368, 0.132679, 0., 0.},\q\= 0.286005
n= 15,q= {-0.253408, 0.132767, 0., 0.},\q\= 0.286082
n= 16,q= {-0.253411, 0.132712, 0., 0.},\q\= 0.286059
n= 17,q= {-0.253395, 0.132739, 0., 0.},\q\= 0.286057
n= 18,q= {-0.25341, 0.132729, 0., 0.},\q\= 0.286066
n= 19,q= {-0.2534, 0.13273, 0., 0.},\q\= 0.286058
n= 20,q= {-0.253406, 0.132732, 0., 0.},\q\= 0.286063
```

O PONTO -0.3 + 0.3 i É PRISIONEIRO

In[•]:=

```
P = {-0.6, 0.4, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-0.6, 0.4, 0, 0}

```
n= 1,q= {-0.6, 0.4, 0, 0},\q\= 0.72111
n= 2,q= {-0.4, -0.08, 0., 0.},\q\= 0.407922
n= 3,q= {-0.4464, 0.464, 0., 0.},\q\= 0.64387
n= 4,q= {-0.616023, -0.0142592, 0., 0.},\q\= 0.616188
n= 5,q= {-0.220719, 0.417568, 0., 0.},\q\= 0.472313
n= 6,q= {-0.725646, 0.21567, 0., 0.},\q\= 0.757018
n= 7,q= {-0.119951, 0.0870003, 0., 0.},\q\= 0.14818
n= 8,q= {-0.593181, 0.379128, 0., 0.},\q\= 0.70399
n= 9,q= {-0.391875, -0.0497834, 0., 0.},\q\= 0.395024
n= 10,q= {-0.448912, 0.439018, 0., 0.},\q\= 0.6279
n= 11,q= {-0.591214, 0.00583894, 0., 0.},\q\= 0.591243
n= 12,q= {-0.2505, 0.393096, 0., 0.},\q\= 0.466127
n= 13,q= {-0.691774, 0.203059, 0., 0.},\q\= 0.720961
n= 14,q= {-0.162681, 0.119058, 0., 0.},\q\= 0.201594
n= 15,q= {-0.58771, 0.361263, 0., 0.},\q\= 0.689865
n= 16,q= {-0.385108, -0.0246354, 0., 0.},\q\= 0.385896
n= 17,q= {-0.452298, 0.418975, 0., 0.},\q\= 0.616533
n= 18,q= {-0.570966, 0.0209969, 0., 0.},\q\= 0.571352
n= 19,q= {-0.274439, 0.376023, 0., 0.},\q\= 0.465521
n= 20,q= {-0.666077, 0.193609, 0., 0.},\q\= 0.693644
```

APÓS 20 PASSOS, A SEQUENCIA DA ITERAÇÃO NÃO AUMENTA EM MÓDULO,
PORTANTO O PONTO P = -0.6 + 0.4 i É UM PONTO PRISIONEIRO (P)

In[•]:=
```
P = {-1.3, 0.1, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-1.3, 0.1, 0, 0}

```
n= 1,q= {-1.3, 0.1, 0, 0},\q\= 1.30384
n= 2,q= {0.38, -0.16, 0., 0.},\q\= 0.412311
n= 3,q= {-1.1812, -0.0216, 0., 0.},\q\= 1.1814
n= 4,q= {0.0947669, 0.151028, 0., 0.},\q\= 0.178298
n= 5,q= {-1.31383, 0.128625, 0., 0.},\q\= 1.32011
n= 6,q= {0.409601, -0.237982, 0., 0.},\q\= 0.473718
n= 7,q= {-1.18886, -0.0949556, 0., 0.},\q\= 1.19265
n= 8,q= {0.104377, 0.325778, 0., 0.},\q\= 0.342091
n= 9,q= {-1.39524, 0.168007, 0., 0.},\q\= 1.40532
n= 10,q= {0.61846, -0.36882, 0., 0.},\q\= 0.720084
n= 11,q= {-1.05354, -0.356201, 0., 0.},\q\= 1.11212
n= 12,q= {-0.316941, 0.850541, 0., 0.},\q\= 0.907673
n= 13,q= {-1.92297, -0.439142, 0., 0.},\q\= 1.97247
n= 14,q= {2.20496, 1.78891, 0., 0.},\q\= 2.83937
n= 15,q= {0.361643, 7.98895, 0., 0.},\q\= 7.99713
n= 16,q= {-64.9926, 5.87829, 0., 0.},\q\= 65.2579
n= 17,q= {4188.18, -763.991, 0., 0.},\q\= 4257.29
n= 18,q= {1.69572×10^7, -6.39947×10^6, 0., 0.},\q\= 1.81245×10^7
n= 19,q= {2.46593×10^14, -2.17034×10^14, 0., 0.},\q\= 3.28499×10^14
n= 20,q= {1.37043×10^28, -1.07038×10^29, 0., 0.},\q\= 1.07912×10^29
```

O PONTO -1.3 + 0.1 i APÓS 18 ITERAÇÕES TENDE AO INFINITO, LOGO NÃO É PONTO PRISIONEIRO P

In[ ]:=
```
P = {-1.7, 0.1, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[ ]= {-1.7, 0.1, 0, 0}

```
n= 1,q= {-1.7, 0.1, 0, 0},\q\= 1.70294
n= 2,q= {1.18, -0.24, 0., 0.},\q\= 1.20416
n= 3,q= {-0.3652, -0.4664, 0., 0.},\q\= 0.592368
n= 4,q= {-1.78416, 0.440659, 0., 0.},\q\= 1.83777
n= 5,q= {1.28904, -1.47241, 0., 0.},\q\= 1.95694
n= 6,q= {-2.20637, -3.69599, 0., 0.},\q\= 4.30446
n= 7,q= {-10.4923, 16.4094, 0., 0.},\q\= 19.4771
n= 8,q= {-160.88, -344.244, 0., 0.},\q\= 379.982
n= 9,q= {-92622.8, 110764., 0., 0.},\q\= 144387.
n= 10,q= {-3.68972×10^9, -2.05186×10^10, 0., 0.},\q\= 2.08477×10^10
n= 11,q= {-4.07398×10^20, 1.51416×10^20, 0., 0.},\q\= 4.34626×10^20
n= 12,q= {1.43046×10^41, -1.23373×10^41, 0., 0.},\q\= 1.889×10^41
n= 13,q= {5.24138×10^81, -3.52961×10^82, 0., 0.},\q\= 3.56831×10^82
n= 14,q= {-1.21834×10^165, -3.70001×10^164, 0., 0.},\q\= 1.27329×10^165
n= 15,q= {1.347457708064954×10^330, 9.01574774938275×10^329, 0., 0.}
 ,\q\= 1.621258569700916×10^330
n= 16,q= {1.002805200218656×10^660, 2.429667759775010×10^660, 0., 0.}
 ,\q\= 2.628479349828660×10^660
n= 17,q= {-4.897667153304539×10^1320, 4.872966928611985×10^1320, 0., 0.}
 ,\q\= 6.908903692475696×10^1320
n= 18,q= {2.413368572120610×10^2639, -4.773234013080444×10^2641, 0., 0.}
 ,\q\= 4.773295023190431×10^2641
n= 19,q= {-2.278318050884155×10^5283, -2.303914590909096×10^5281, 0., 0.}
 ,\q\= 2.278434537841453×10^5283
n= 20,q= {5.190202338740357×10^10566, 1.049810040032716×10^10565, 0., 0.}
 ,\q\= 5.191263943228798×10^10566
```

O PONTO -1.7 + 0.1 i APÓS 18 ITERAÇÕES TENDE AO INFINITO, LOGO NÃO É PONTO PRISIONEIRO P

In[•]:=
```
P = {0.2, -0.2, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {0.2, -0.2, 0, 0}

```
n= 1,q= {0.2, -0.2, 0, 0},\q\= 0.282843
n= 2,q= {0.2, -0.28, 0., 0.},\q\= 0.344093
n= 3,q= {0.1616, -0.312, 0., 0.},\q\= 0.351367
n= 4,q= {0.128771, -0.300838, 0., 0.},\q\= 0.327239
n= 5,q= {0.126078, -0.277478, 0., 0.},\q\= 0.304778
n= 6,q= {0.138902, -0.269968, 0., 0.},\q\= 0.303605
n= 7,q= {0.146411, -0.274998, 0., 0.},\q\= 0.311545
n= 8,q= {0.145812, -0.280525, 0., 0.},\q\= 0.316158
n= 9,q= {0.142567, -0.281808, 0., 0.},\q\= 0.315818
n= 10,q= {0.140909, -0.280353, 0., 0.},\q\= 0.313773
n= 11,q= {0.141258, -0.279009, 0., 0.},\q\= 0.312729
n= 12,q= {0.142108, -0.278824, 0., 0.},\q\= 0.31295
n= 13,q= {0.142452, -0.279246, 0., 0.},\q\= 0.313482
n= 14,q= {0.142314, -0.279558, 0., 0.},\q\= 0.313697
n= 15,q= {0.142101, -0.27957, 0., 0.},\q\= 0.313611
n= 16,q= {0.142033, -0.279454, 0., 0.},\q\= 0.313477
n= 17,q= {0.142079, -0.279383, 0., 0.},\q\= 0.313435
n= 18,q= {0.142131, -0.279389, 0., 0.},\q\= 0.313464
n= 19,q= {0.142143, -0.27942, 0., 0.},\q\= 0.313497
n= 20,q= {0.142129, -0.279435, 0., 0.},\q\= 0.313504
```

O PONTO 0.2 - 0.2 i É PRISIONEIRO DE P

In[ ]:=
```
P = {-0.3, -0.2, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[ ]= {-0.3, -0.2, 0, 0}

```
n= 1,q= {-0.3, -0.2, 0, 0},\q\= 0.360555
n= 2,q= {-0.25, -0.08, 0., 0.},\q\= 0.262488
n= 3,q= {-0.2439, -0.16, 0., 0.},\q\= 0.291697
n= 4,q= {-0.266113, -0.121952, 0., 0.},\q\= 0.292726
n= 5,q= {-0.244056, -0.135094, 0., 0.},\q\= 0.278951
n= 6,q= {-0.258687, -0.134059, 0., 0.},\q\= 0.29136
n= 7,q= {-0.251053, -0.130641, 0., 0.},\q\= 0.28301
n= 8,q= {-0.25404, -0.134404, 0., 0.},\q\= 0.287403
n= 9,q= {-0.253528, -0.131712, 0., 0.},\q\= 0.2857
n= 10,q= {-0.253071, -0.133215, 0., 0.},\q\= 0.285992
n= 11,q= {-0.253701, -0.132574, 0., 0.},\q\= 0.286252
n= 12,q= {-0.253212, -0.132731, 0., 0.},\q\= 0.285891
n= 13,q= {-0.253501, -0.132782, 0., 0.},\q\= 0.286171
n= 14,q= {-0.253368, -0.132679, 0., 0.},\q\= 0.286005
n= 15,q= {-0.253408, -0.132767, 0., 0.},\q\= 0.286082
n= 16,q= {-0.253411, -0.132712, 0., 0.},\q\= 0.286059
n= 17,q= {-0.253395, -0.132739, 0., 0.},\q\= 0.286057
n= 18,q= {-0.25341, -0.132729, 0., 0.},\q\= 0.286066
n= 19,q= {-0.2534, -0.13273, 0., 0.},\q\= 0.286058
n= 20,q= {-0.253406, -0.132732, 0., 0.},\q\= 0.286063
```

O PONTO -0.3 -0.2 i É PRISIONEIRO

In[ ]:=
```
P = {-0.6, -0.4, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[ ]= {-0.6, -0.4, 0, 0}

```
n= 1,q= {-0.6, -0.4, 0, 0},\q\= 0.72111
n= 2,q= {-0.4, 0.08, 0., 0.},\q\= 0.407922
n= 3,q= {-0.4464, -0.464, 0., 0.},\q\= 0.64387
n= 4,q= {-0.616023, 0.0142592, 0., 0.},\q\= 0.616188
n= 5,q= {-0.220719, -0.417568, 0., 0.},\q\= 0.472313
n= 6,q= {-0.725646, -0.21567, 0., 0.},\q\= 0.757018
n= 7,q= {-0.119951, -0.0870003, 0., 0.},\q\= 0.14818
n= 8,q= {-0.593181, -0.379128, 0., 0.},\q\= 0.70399
n= 9,q= {-0.391875, 0.0497834, 0., 0.},\q\= 0.395024
n= 10,q= {-0.448912, -0.439018, 0., 0.},\q\= 0.6279
n= 11,q= {-0.591214, -0.00583894, 0., 0.},\q\= 0.591243
n= 12,q= {-0.2505, -0.393096, 0., 0.},\q\= 0.466127
n= 13,q= {-0.691774, -0.203059, 0., 0.},\q\= 0.720961
n= 14,q= {-0.162681, -0.119058, 0., 0.},\q\= 0.201594
n= 15,q= {-0.58771, -0.361263, 0., 0.},\q\= 0.689865
n= 16,q= {-0.385108, 0.0246354, 0., 0.},\q\= 0.385896
n= 17,q= {-0.452298, -0.418975, 0., 0.},\q\= 0.616533
n= 18,q= {-0.570966, -0.0209969, 0., 0.},\q\= 0.571352
n= 19,q= {-0.274439, -0.376023, 0., 0.},\q\= 0.465521
n= 20,q= {-0.666077, -0.193609, 0., 0.},\q\= 0.693644
```

O PONTO -0.6 -0.4 i É PRISIOEIRO DE (P)

In[ ]:=
```
P = {-1.3, -0.1, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[ ]=
```
{-1.3, -0.1, 0, 0}
```

n= 1,q= {-1.3, -0.1, 0, 0},\q\= 1.30384

n= 2,q= {0.38, 0.16, 0., 0.},\q\= 0.412311

n= 3,q= {-1.1812, 0.0216, 0., 0.},\q\= 1.1814

n= 4,q= {0.0947669, -0.151028, 0., 0.},\q\= 0.178298

n= 5,q= {-1.31383, -0.128625, 0., 0.},\q\= 1.32011

n= 6,q= {0.409601, 0.237982, 0., 0.},\q\= 0.473718

n= 7,q= {-1.18886, 0.0949556, 0., 0.},\q\= 1.19265

n= 8,q= {0.104377, -0.325778, 0., 0.},\q\= 0.342091

n= 9,q= {-1.39524, -0.168007, 0., 0.},\q\= 1.40532

n= 10,q= {0.61846, 0.36882, 0., 0.},\q\= 0.720084

n= 11,q= {-1.05354, 0.356201, 0., 0.},\q\= 1.11212

n= 12,q= {-0.316941, -0.850541, 0., 0.},\q\= 0.907673

n= 13,q= {-1.92297, 0.439142, 0., 0.},\q\= 1.97247

n= 14,q= {2.20496, -1.78891, 0., 0.},\q\= 2.83937

n= 15,q= {0.361643, -7.98895, 0., 0.},\q\= 7.99713

n= 16,q= {-64.9926, -5.87829, 0., 0.},\q\= 65.2579

n= 17,q= {4188.18, 763.991, 0., 0.},\q\= 4257.29

n= 18,q= $\{1.69572\times10^{7}, 6.39947\times10^{6}, 0., 0.\}$,\q\= 1.81245×10^{7}

n= 19,q= $\{2.46593\times10^{14}, 2.17034\times10^{14}, 0., 0.\}$,\q\= 3.28499×10^{14}

n= 20,q= $\{1.37043\times10^{28}, 1.07038\times10^{29}, 0., 0.\}$,\q\= 1.07912×10^{29}

APÓS 17 ITERAÇÕES O PONTO -1.3 -0.1 i ESCAPA AO INFINITO

In[•]:=
```
P = {-1.7, -0.1, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-1.7, -0.1, 0, 0}

n= 1,q= {-1.7, -0.1, 0, 0},\q\= 1.70294

n= 2,q= {1.18, 0.24, 0., 0.},\q\= 1.20416

n= 3,q= {-0.3652, 0.4664, 0., 0.},\q\= 0.592368

n= 4,q= {-1.78416, -0.440659, 0., 0.},\q\= 1.83777

n= 5,q= {1.28904, 1.47241, 0., 0.},\q\= 1.95694

n= 6,q= {-2.20637, 3.69599, 0., 0.},\q\= 4.30446

n= 7,q= {-10.4923, -16.4094, 0., 0.},\q\= 19.4771

n= 8,q= {-160.88, 344.244, 0., 0.},\q\= 379.982

n= 9,q= {-92 622.8, -110 764., 0., 0.},\q\= 144 387.

n= 10,q= $\{-3.68972\times10^{9}, 2.05186\times10^{10}, 0., 0.\}$,\q\= 2.08477×10^{10}

n= 11,q= $\{-4.07398\times10^{20}, -1.51416\times10^{20}, 0., 0.\}$,\q\= 4.34626×10^{20}

n= 12,q= $\{1.43046\times10^{41}, 1.23373\times10^{41}, 0., 0.\}$,\q\= 1.889×10^{41}

n= 13,q= $\{5.24138\times10^{81}, 3.52961\times10^{82}, 0., 0.\}$,\q\= 3.56831×10^{82}

n= 14,q= $\{-1.21834\times10^{165}, 3.70001\times10^{164}, 0., 0.\}$,\q\= 1.27329×10^{165}

n= 15,q= $\{1.347457708064954\times10^{330}, -9.01574774938275\times10^{329}, 0., 0.\}$
,\q\= $1.621258569700916\times10^{330}$

n= 16,q= $\{1.002805200218656\times10^{660}, -2.429667759775010\times10^{660}, 0., 0.\}$
,\q\= $2.628479349828660\times10^{660}$

n= 17,q= $\{-4.897667153304539\times10^{1320}, -4.872966928611985\times10^{1320}, 0., 0.\}$
,\q\= $6.908903692475696\times10^{1320}$

n= 18,q= $\{2.413368572120610\times10^{2639}, 4.773234013080444\times10^{2641}, 0., 0.\}$
,\q\= $4.773295023190431\times10^{2641}$

n= 19,q= $\{-2.278318050884155\times10^{5283}, 2.303914590909096\times10^{5281}, 0., 0.\}$
,\q\= $2.278434537841453\times10^{5283}$

n= 20,q= $\{5.190202338740357\times10^{10\,566}, -1.049810040032716\times10^{10\,565}, 0., 0.\}$
,\q\= $5.191263943228798\times10^{10\,566}$

APÓS 9 ITERAÇÕES O PONTO -1.7 - 0.1 i ESCAPA AO INFINITO

QUESTÃO 5

In[•]:=
```
P = {-2.4, 1.4, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-2.4, 1.4, 0, 0}

```
n= 1,q= {-2.4, 1.4, 0, 0},\q\= 2.77849

n= 2,q= {1.4, -5.32, 0., 0.},\q\= 5.50113

n= 3,q= {-28.7424, -13.496, 0., 0.},\q\= 31.7532

n= 4,q= {641.584, 777.215, 0., 0.},\q\= 1007.82

n= 5,q= {-192436., 997298., 0., 0.},\q\= 1.01569×10^6

n= 6,q= {-9.57572×10^11, -3.83832×10^11, 0., 0.},\q\= 1.03163×10^12

n= 7,q= {7.69616×10^23, 7.35093×10^23, 0., 0.},\q\= 1.06427×10^24

n= 8,q= {5.19478×10^46, 1.13148×10^48, 0., 0.},\q\= 1.13267×10^48

n= 9,q= {-1.27755×10^96, 1.17556×10^95, 0., 0.},\q\= 1.28294×10^96

n= 10,q= {1.61831×10^192, -3.00366×10^191, 0., 0.},\q\= 1.64594×10^192

n= 11,q= {2.528694624649801×10^384, -9.72168510308598×10^383, 0., 0.}
 ,\q\= 2.709134200656815×10^384

n= 12,q= {5.449184892297159×10^768, -4.916634572542315×10^768, 0., 0.}
 ,\q\= 7.339408117168438×10^768

n= 13,q= {5.520320470521257×10^1536, -5.358330166728697×10^1537, 0., 0.}
 ,\q\= 5.386691151035795×10^1537

n= 14,q= {-2.840696279470222×10^3075, -5.915939941440801×10^3074, 0., 0.}
 ,\q\= 2.901644155664734×10^3075

n= 15,q= {7.719571898288617×10^6150, 3.361077716244033×10^6150, 0., 0.}
 ,\q\= 8.419538806103309×10^6150

n= 16,q= {4.829494687821511×10^12301, 5.189216217256304×10^12301, 0., 0.}
 ,\q\= 7.088863370747953×10^12301

n= 17,q= {-3.603946009739632×10^24602, 5.012258431039312×10^24603, 0., 0.}
 ,\q\= 5.025198388913203×10^24603

n= 18,q= {-2.499285031111348×10^49207, -3.612781754465592×10^49206, 0., 0.}
 ,\q\= 2.525261884793585×10^49207

n= 19,q= {6.115903746683258×10^98414, 1.805874271921610×10^98414, 0., 0.}
 ,\q\= 6.376947586791248×10^98414

n= 20,q= {3.414309675270592×10^196829, 2.208910645136855×10^196829, 0., 0.}
 ,\q\= 4.066546052468272×10^196829
```

In[•]:=
```
P = {-2.4, 1.2, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-2.4, 1.2, 0, 0}

```
n= 1,q= {-2.4, 1.2, 0, 0},\q\= 2.68328

n= 2,q= {1.92, -4.56, 0., 0.},\q\= 4.94773

n= 3,q= {-19.5072, -16.3104, 0., 0.},\q\= 25.4275

n= 4,q= {112.102, 637.54, 0., 0.},\q\= 647.321

n= 5,q= {-393893., 142940., 0., 0.},\q\= 419027.

n= 6,q= {1.3472×10^11, -1.12606×10^11, 0., 0.},\q\= 1.75584×10^11

n= 7,q= {5.46938×10^21, -3.03407×10^22, 0., 0.},\q\= 3.08297×10^22

n= 8,q= {-8.90642×10^44, -3.31889×10^44, 0., 0.},\q\= 9.5047×10^44

n= 9,q= {6.83093×10^89, 5.91189×10^89, 0., 0.},\q\= 9.03394×10^89

n= 10,q= {1.17111×10^179, 8.07675×10^179, 0., 0.},\q\= 8.16121×10^179

n= 11,q= {-6.386230150888532×10^359, 1.891758440540132×10^359, 0., 0.}
 ,\q\= 6.660531926015563×10^359

n= 12,q= {3.720518554276293×10^719, -2.416240958235052×10^719, 0., 0.}
 ,\q\= 4.436268553747259×10^719

n= 13,q= {8.004037944461517×10^1438, -1.797933863343168×10^1439, 0., 0.}
 ,\q\= 1.968047868096680×10^1439

n= 14,q= {-2.591919942792292×10^2878, -2.878146172766201×10^2878, 0., 0.}
 ,\q\= 3.873212411119887×10^2878

n= 15,q= {-1.565676401964332×10^5756, 1.491984892692805×10^5757, 0., 0.}
 ,\q\= 1.500177438165313×10^5757

n= 16,q= {-2.201505494066881×10^11514, -4.671931077152820×10^11513, 0., 0.}
 ,\q\= 2.250532345980240×10^11514

n= 17,q= {4.628357040509997×10^23028, 2.057056386850747×10^23028, 0., 0.}
 ,\q\= 5.064895840303323×10^23028

n= 18,q= {1.719020791575501×10^46057, 1.904158282161342×10^46057, 0., 0.}
 ,\q\= 2.565316987312191×10^46057

n= 19,q= {-6.707862816547707×10^92113, 6.546575354972072×10^92114, 0., 0.}
 ,\q\= 6.580851245392495×10^92114

n= 20,q= {-4.240769464267148×10^184229, -8.782705879868954×10^184228, 0., 0.}
 ,\q\= 4.330760311398395×10^184229
```

In[•]:=

```
P = {-2.4, 0.7, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-2.4, 0.7, 0, 0}

```
n= 1,q= {-2.4, 0.7, 0, 0},\q\= 2.5
n= 2,q= {2.87, -2.66, 0., 0.},\q\= 3.91312
n= 3,q= {-1.2387, -14.5684, 0., 0.},\q\= 14.621
n= 4,q= {-213.104, 36.7918, 0., 0.},\q\= 216.257
n= 5,q= {44 057.2, -15 680.2, 0., 0.},\q\= 46 764.4
n= 6,q= {1.69517×10^9, -1.38166×10^9, 0., 0.},\q\= 2.18691×10^9
n= 7,q= {9.64632×10^17, -4.68428×10^18, 0., 0.},\q\= 4.78258×10^18
n= 8,q= {-2.1012×10^37, -9.03722×10^36, 0., 0.},\q\= 2.2873×10^37
n= 9,q= {3.59833×10^74, 3.7978×10^74, 0., 0.},\q\= 5.23175×10^74
n= 10,q= {-1.47531×10^148, 2.73315×10^149, 0., 0.},\q\= 2.73713×10^149
n= 11,q= {-7.44832×10^298, -8.06447×10^297, 0., 0.},\q\= 7.49186×10^298
n= 12,q= {5.482717792520735×10^597, 1.201336439691409×10^597, 0., 0.}
 ,\q\= 5.612789291765180×10^597
n= 13,q= {2.861698515109301×10^1195, 1.317317734539920×10^1195, 0., 0.}
 ,\q\= 3.150340363375387×10^1195
n= 14,q= {6.453992377645391×10^2390, 7.539532409720072×10^2390, 0., 0.}
 ,\q\= 9.92464440511216×10^2390
n= 15,q= {-1.519053134651456×10^4781, 9.73201694066875×10^4781, 0., 0.}
 ,\q\= 9.84985665679242×10^4781
n= 16,q= {-9.24046313075691×10^9563, -2.956690168040786×10^9563, 0., 0.}
 ,\q\= 9.70196761593579×10^9563
n= 17,q= {7.664414212108867×10^19 127, 5.464237297370464×10^19 127, 0., 0.}
 ,\q\= 9.41281756206668×10^19 127
n= 18,q= {2.888535597280191×10^38 255, 8.376035600060306×10^38 255, 0., 0.}
 ,\q\= 8.860113445675085×10^38 255
n= 19,q= {-6.181433447672278×10^76 511, 4.838895398972067×10^76 511, 0., 0.}
 ,\q\= 7.850161027023243×10^76 511
n= 20,q= {1.479521078580855×10^153 023, -5.982261973798685×10^153 023, 0., 0.}
 ,\q\= 6.162502815019462×10^153 023
```

In[•]:=

```
P = {-2.4, 0.5, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-2.4, 0.5, 0, 0}

```
n= 1,q= {-2.4, 0.5, 0, 0},\q\= 2.45153
n= 2,q= {3.11, -1.9, 0., 0.},\q\= 3.64446
n= 3,q= {3.6621, -11.318, 0., 0.},\q\= 11.8957
n= 4,q= {-117.086, -82.3953, 0., 0.},\q\= 143.172
n= 5,q= {6917.78, 19295.2, 0., 0.},\q\= 20497.8
n= 6,q= {-3.24449×10^8, 2.6696×10^8, 0., 0.},\q\= 4.2016×10^8
n= 7,q= {3.39995×10^16, -1.7323×10^17, 0., 0.},\q\= 1.76535×10^17
n= 8,q= {-2.88526×10^34, -1.17794×10^34, 0., 0.},\q\= 3.11645×10^34
n= 9,q= {6.93715×10^68, 6.79734×10^68, 0., 0.},\q\= 9.71225×10^68
n= 10,q= {1.92016×10^136, 9.43083×10^137, 0., 0.},\q\= 9.43278×10^137
n= 11,q= {-8.89036×10^275, 3.62174×10^274, 0., 0.},\q\= 8.89773×10^275
n= 12,q= {7.890732392868608×10^551, -6.439721240970794×10^550, 0., 0.}
 ,\q\= 7.916966451392860×10^551
n= 13,q= {6.184895759925184×10^1103, -1.016282339943445×10^1103, 0., 0.}
 ,\q\= 6.267835779248005×10^1103
n= 14,q= {3.722010576665960×10^2207, -1.257120067040612×10^2207, 0., 0.}
 ,\q\= 3.928576535562145×10^2207
n= 15,q= {1.227301186985708×10^4415, -9.35802837132836×10^4414, 0., 0.}
 ,\q\= 1.543371359576946×10^4415
n= 16,q= {6.305412535906624×10^8829, -2.297023865595444×10^8830, 0., 0.}
 ,\q\= 2.381995153562392×10^8830
n= 17,q= {-4.878736366635353×10^17660, -2.896736615480441×10^17660, 0., 0.}
 ,\q\= 5.673900911594721×10^17660
n= 18,q= {1.541098551566525×10^35321, 2.826482854101728×10^35321, 0., 0.}
 ,\q\= 3.219315155459541×10^35321
n= 19,q= {-5.614020578890608×10^70642, 8.711777264967578×10^70642, 0., 0.}
 ,\q\= 1.036399007017149×10^70643
n= 20,q= {-4.437783605419874×10^141285, -9.78161936884786×10^141285, 0., 0.}
 ,\q\= 1.074122901746132×10^141286
```

In[•]:=

```
P = {-2.4, 0.4, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-2.4, 0.4, 0, 0}

```
n= 1,q= {-2.4, 0.4, 0, 0},\q\= 2.43311
n= 2,q= {3.2, -1.52, 0., 0.},\q\= 3.54265
n= 3,q= {5.5296, -9.328, 0., 0.},\q\= 10.8438
n= 4,q= {-58.8351, -102.76, 0., 0.},\q\= 118.411
n= 5,q= {-7100.49, 12092.2, 0., 0.},\q\= 14022.8
n= 6,q= {-9.58047×10^7, -1.71721×10^8, 0., 0.},\q\= 1.96639×10^8
n= 7,q= {-2.03097×10^16, 3.29034×10^16, 0., 0.},\q\= 3.86668×10^16
n= 8,q= {-6.70153×10^32, -1.33652×10^33, 0., 0.},\q\= 1.49512×10^33
n= 9,q= {-1.33717×10^66, 1.79134×10^66, 0., 0.},\q\= 2.23538×10^66
n= 10,q= {-1.42087×10^132, -4.79067×10^132, 0., 0.},\q\= 4.99694×10^132
n= 11,q= {-2.09317×10^265, 1.36139×10^265, 0., 0.},\q\= 2.49694×10^265
n= 12,q= {2.527971569102691×10^530, -5.699207888961210×10^530, 0., 0.}
 ,\q\= 6.234710162933736×10^530
n= 13,q= {-2.609033030740617×10^1061, -2.881487101939941×10^1061, 0., 0.}
 ,\q\= 3.887161081578921×10^1061
n= 14,q= {-1.495914563150672×10^2122, 1.503579005322872×10^2123, 0., 0.}
 ,\q\= 1.511002127414181×10^2123
n= 15,q= {-2.238372221445256×10^4246, -4.498451461820174×10^4245, 0., 0.}
 ,\q\= 2.283127429050181×10^4246
n= 16,q= {4.807949546194248×10^8492, 2.013841758331616×10^8492, 0., 0.}
 ,\q\= 5.212670857281289×10^8492
n= 17,q= {1.906082021114930×10^16985, 1.936489913615504×10^16985, 0., 0.}
 ,\q\= 2.717193746634965×10^16985
n= 18,q= {-1.168445143170074×10^33969, 7.382217216825830×10^33970, 0., 0.}
 ,\q\= 7.383141856752157×10^33970
n= 19,q= {-5.448347839587373×10^67941, -1.725143170565328×10^67940, 0., 0.}
 ,\q\= 5.451078367692569×10^67941
n= 20,q= {2.965473299154691×10^135883, 1.879836013265703×10^135882, 0., 0.}
 ,\q\= 2.971425537072588×10^135883
```

In[•]:=

```
P = {-2.4, 0.2, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-2.4, 0.2, 0, 0}

```
n= 1,q= {-2.4, 0.2, 0, 0},\q\= 2.40832

n= 2,q= {3.32, -0.76, 0., 0.},\q\= 3.40588

n= 3,q= {8.0448, -4.8464, 0., 0.},\q\= 9.39183

n= 4,q= {38.8312, -77.7766, 0., 0.},\q\= 86.9314

n= 5,q= {-4543.74, -6040.12, 0., 0.},\q\= 7558.35

n= 6,q= {-1.58375×10^7, 5.48895×10^7, 0., 0.},\q\= 5.71287×10^7

n= 7,q= {-2.76203×10^15, -1.73862×10^15, 0., 0.},\q\= 3.26369×10^15

n= 8,q= {4.60601×10^30, 9.60428×10^30, 0., 0.},\q\= 1.06516×10^31

n= 9,q= {-7.10268×10^61, 8.84748×10^61, 0., 0.},\q\= 1.13457×10^62

n= 10,q= {-2.78299×10^123, -1.25682×10^124, 0., 0.},\q\= 1.28726×10^124

n= 11,q= {-1.50214×10^248, 6.99542×10^247, 0., 0.},\q\= 1.65704×10^248

n= 12,q= {1.767055912188359×10^496, -2.101617338541634×10^496, 0., 0.}
 ,\q\= 2.745775306622640×10^496

n= 13,q= {-1.294308840858984×10^992, -7.427350686455117×10^992, 0., 0.}
 ,\q\= 7.539282034458655×10^992

n= 14,q= {-5.349030284405958×10^1985, 1.922657131527780×10^1985, 0., 0.}
 ,\q\= 5.684077359511103×10^1985

n= 15,q= {2.491551453807745×10^3971, -2.056870244614237×10^3971, 0., 0.}
 ,\q\= 3.230873542890671×10^3971

n= 16,q= {1.977113443792054×10^7942, -1.024959609652499×10^7943, 0., 0.}
 ,\q\= 1.043854385015092×10^7943

n= 17,q= {-1.011452425722770×10^15886, -4.052922847175623×10^15885, 0., 0.}
 ,\q\= 1.089631977115235×10^15886

n= 18,q= {8.587741734488940×10^31771, 8.198677290086038×10^31771, 0., 0.}
 ,\q\= 1.187297845552057×10^31772

n= 19,q= {6.530998791310567×10^63542, 1.408162462633571×10^63544, 0., 0.}
 ,\q\= 1.409676174052556×10^63544

n= 20,q= {-1.978656126649033×10^127088, 1.839341468285753×10^127087, 0., 0.}
 ,\q\= 1.987186915691453×10^127088
```

In[•]:=

```
P = {-2.4, -0.2, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-2.4, -0.2, 0, 0}

```
n= 1,q= {-2.4, -0.2, 0, 0},\q\= 2.40832
n= 2,q= {3.32, 0.76, 0., 0.},\q\= 3.40588
n= 3,q= {8.0448, 4.8464, 0., 0.},\q\= 9.39183
n= 4,q= {38.8312, 77.7766, 0., 0.},\q\= 86.9314
n= 5,q= {-4543.74, 6040.12, 0., 0.},\q\= 7558.35
n= 6,q= {-1.58375×10^7, -5.48895×10^7, 0., 0.},\q\= 5.71287×10^7
n= 7,q= {-2.76203×10^15, 1.73862×10^15, 0., 0.},\q\= 3.26369×10^15
n= 8,q= {4.60601×10^30, -9.60428×10^30, 0., 0.},\q\= 1.06516×10^31
n= 9,q= {-7.10268×10^61, -8.84748×10^61, 0., 0.},\q\= 1.13457×10^62
n= 10,q= {-2.78299×10^123, 1.25682×10^124, 0., 0.},\q\= 1.28726×10^124
n= 11,q= {-1.50214×10^248, -6.99542×10^247, 0., 0.},\q\= 1.65704×10^248
n= 12,q= {1.767055912188359×10^496, 2.101617338541634×10^496, 0., 0.}
 ,\q\= 2.745775306622640×10^496
n= 13,q= {-1.294308840858984×10^992, 7.427350686455117×10^992, 0., 0.}
 ,\q\= 7.539282034458655×10^992
n= 14,q= {-5.349030284405958×10^1985, -1.922657131527780×10^1985, 0., 0.}
 ,\q\= 5.684077359511103×10^1985
n= 15,q= {2.491551453807745×10^3971, 2.056870244614237×10^3971, 0., 0.}
 ,\q\= 3.230873542890671×10^3971
n= 16,q= {1.977113443792054×10^7942, 1.024959609652499×10^7943, 0., 0.}
 ,\q\= 1.043854385015092×10^7943
n= 17,q= {-1.011452425722770×10^15886, 4.052922847175623×10^15885, 0., 0.}
 ,\q\= 1.089631977115235×10^15886
n= 18,q= {8.587741734488940×10^31771, -8.198677290086038×10^31771, 0., 0.}
 ,\q\= 1.187297845552057×10^31772
n= 19,q= {6.530998791310567×10^63542, -1.408162462633571×10^63544, 0., 0.}
 ,\q\= 1.409676174052556×10^63544
n= 20,q= {-1.978656126649033×10^127088, -1.839341468285753×10^127087, 0., 0.}
 ,\q\= 1.987186915691453×10^127088
```

In[•]:=
```
P = {-2.4, -0.4, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]=
```
{-2.4, -0.4, 0, 0}
```

```
n= 1,q= {-2.4, -0.4, 0, 0},\q\= 2.43311
n= 2,q= {3.2, 1.52, 0., 0.},\q\= 3.54265
n= 3,q= {5.5296, 9.328, 0., 0.},\q\= 10.8438
n= 4,q= {-58.8351, 102.76, 0., 0.},\q\= 118.411
n= 5,q= {-7100.49, -12092.2, 0., 0.},\q\= 14022.8
n= 6,q= {-9.58047×10^7, 1.71721×10^8, 0., 0.},\q\= 1.96639×10^8
n= 7,q= {-2.03097×10^16, -3.29034×10^16, 0., 0.},\q\= 3.86668×10^16
n= 8,q= {-6.70153×10^32, 1.33652×10^33, 0., 0.},\q\= 1.49512×10^33
n= 9,q= {-1.33717×10^66, -1.79134×10^66, 0., 0.},\q\= 2.23538×10^66
n= 10,q= {-1.42087×10^132, 4.79067×10^132, 0., 0.},\q\= 4.99694×10^132
n= 11,q= {-2.09317×10^265, -1.36139×10^265, 0., 0.},\q\= 2.49694×10^265
n= 12,q= {2.527971569102691×10^530, 5.699207888961210×10^530, 0., 0.}
 ,\q\= 6.234710162933736×10^530
n= 13,q= {-2.609033030740617×10^1061, 2.881487101939941×10^1061, 0., 0.}
 ,\q\= 3.887161081578921×10^1061
n= 14,q= {-1.495914563150672×10^2122, -1.503579005322872×10^2123, 0., 0.}
 ,\q\= 1.511002127414181×10^2123
n= 15,q= {-2.238372221445256×10^4246, 4.498451461820174×10^4245, 0., 0.}
 ,\q\= 2.283127429050181×10^4246
n= 16,q= {4.807949546194248×10^8492, -2.013841758331616×10^8492, 0., 0.}
 ,\q\= 5.212670857281289×10^8492
n= 17,q= {1.906082021114930×10^16985, -1.936489913615504×10^16985, 0., 0.}
 ,\q\= 2.717193746634965×10^16985
n= 18,q= {-1.168445143170074×10^33969, -7.382217216825830×10^33970, 0., 0.}
 ,\q\= 7.383141856752157×10^33970
n= 19,q= {-5.448347839587373×10^67941, 1.725143170565328×10^67940, 0., 0.}
 ,\q\= 5.451078367692569×10^67941
n= 20,q= {2.965473299154691×10^135883, -1.879836013265703×10^135882, 0., 0.}
 ,\q\= 2.971425537072588×10^135883
```

In[•]:=

```
P = {-2.4, -0.5, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-2.4, -0.5, 0, 0}

```
n= 1,q= {-2.4, -0.5, 0, 0},\q\= 2.45153
n= 2,q= {3.11, 1.9, 0., 0.},\q\= 3.64446
n= 3,q= {3.6621, 11.318, 0., 0.},\q\= 11.8957
n= 4,q= {-117.086, 82.3953, 0., 0.},\q\= 143.172
n= 5,q= {6917.78, -19295.2, 0., 0.},\q\= 20497.8
n= 6,q= {-3.24449×10^8, -2.6696×10^8, 0., 0.},\q\= 4.2016×10^8
n= 7,q= {3.39995×10^16, 1.7323×10^17, 0., 0.},\q\= 1.76535×10^17
n= 8,q= {-2.88526×10^34, 1.17794×10^34, 0., 0.},\q\= 3.11645×10^34
n= 9,q= {6.93715×10^68, -6.79734×10^68, 0., 0.},\q\= 9.71225×10^68
n= 10,q= {1.92016×10^136, -9.43083×10^137, 0., 0.},\q\= 9.43278×10^137
n= 11,q= {-8.89036×10^275, -3.62174×10^274, 0., 0.},\q\= 8.89773×10^275
n= 12,q= {7.890732392868608×10^551, 6.439721240970794×10^550, 0., 0.}
 ,\q\= 7.916966451392860×10^551
n= 13,q= {6.184895759925184×10^1103, 1.016282339943445×10^1103, 0., 0.}
 ,\q\= 6.267835779248005×10^1103
n= 14,q= {3.722010576665960×10^2207, 1.257120067040612×10^2207, 0., 0.}
 ,\q\= 3.928576535562145×10^2207
n= 15,q= {1.227301186985708×10^4415, 9.35802837132836×10^4414, 0., 0.}
 ,\q\= 1.543371359576946×10^4415
n= 16,q= {6.305412535906624×10^8829, 2.297023865595444×10^8830, 0., 0.}
 ,\q\= 2.381995153562392×10^8830
n= 17,q= {-4.878736366635353×10^17660, 2.896736615480441×10^17660, 0., 0.}
 ,\q\= 5.673900911594721×10^17660
n= 18,q= {1.541098551566525×10^35321, -2.826482854101728×10^35321, 0., 0.}
 ,\q\= 3.219315155459541×10^35321
n= 19,q= {-5.614020578890608×10^70642, -8.711777264967578×10^70642, 0., 0.}
 ,\q\= 1.036399007017149×10^70643
n= 20,q= {-4.437783605419874×10^141285, 9.78161936884786×10^141285, 0., 0.}
 ,\q\= 1.074122901746132×10^141286
```

In[•]:=
```
P = {-2.4, -0.7, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-2.4, -0.7, 0, 0}

n= 1,q= {-2.4, -0.7, 0, 0},\q\= 2.5

n= 2,q= {2.87, 2.66, 0., 0.},\q\= 3.91312

n= 3,q= {-1.2387, 14.5684, 0., 0.},\q\= 14.621

n= 4,q= {-213.104, -36.7918, 0., 0.},\q\= 216.257

n= 5,q= {44 057.2, 15 680.2, 0., 0.},\q\= 46 764.4

n= 6,q= $\{1.69517\times10^{9}, 1.38166\times10^{9}, 0., 0.\}$,\q\= 2.18691×10^{9}

n= 7,q= $\{9.64632\times10^{17}, 4.68428\times10^{18}, 0., 0.\}$,\q\= 4.78258×10^{18}

n= 8,q= $\{-2.1012\times10^{37}, 9.03722\times10^{36}, 0., 0.\}$,\q\= 2.2873×10^{37}

n= 9,q= $\{3.59833\times10^{74}, -3.7978\times10^{74}, 0., 0.\}$,\q\= 5.23175×10^{74}

n= 10,q= $\{-1.47531\times10^{148}, -2.73315\times10^{149}, 0., 0.\}$,\q\= 2.73713×10^{149}

n= 11,q= $\{-7.44832\times10^{298}, 8.06447\times10^{297}, 0., 0.\}$,\q\= 7.49186×10^{298}

n= 12,q= $\{5.482717792520735\times10^{597}, -1.201336439691409\times10^{597}, 0., 0.\}$
,\q\= $5.612789291765180\times10^{597}$

n= 13,q= $\{2.861698515109301\times10^{1195}, -1.317317734539920\times10^{1195}, 0., 0.\}$
,\q\= $3.150340363375387\times10^{1195}$

n= 14,q= $\{6.453992377645391\times10^{2390}, -7.539532409720072\times10^{2390}, 0., 0.\}$
,\q\= $9.92464440511216\times10^{2390}$

n= 15,q= $\{-1.519053134651456\times10^{4781}, -9.73201694066875\times10^{4781}, 0., 0.\}$
,\q\= $9.84985665679242\times10^{4781}$

n= 16,q= $\{-9.24046313075691\times10^{9563}, 2.956690168040786\times10^{9563}, 0., 0.\}$
,\q\= $9.70196761593579\times10^{9563}$

n= 17,q= $\{7.664414212108867\times10^{19\,127}, -5.464237297370464\times10^{19\,127}, 0., 0.\}$
,\q\= $9.41281756206668\times10^{19\,127}$

n= 18,q= $\{2.888535597280191\times10^{38\,255}, -8.376035600060306\times10^{38\,255}, 0., 0.\}$
,\q\= $8.860113445675085\times10^{38\,255}$

n= 19,q= $\{-6.181433447672278\times10^{76\,511}, -4.838895398972067\times10^{76\,511}, 0., 0.\}$
,\q\= $7.850161027023243\times10^{76\,511}$

n= 20,q= $\{1.479521078580855\times10^{153\,023}, 5.982261973798685\times10^{153\,023}, 0., 0.\}$
,\q\= $6.162502815019462\times10^{153\,023}$

In[ ]:=
```
P = {-2.4, -1.2, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[ ]= {-2.4, -1.2, 0, 0}

```
n= 1,q= {-2.4, -1.2, 0, 0},\q\= 2.68328

n= 2,q= {1.92, 4.56, 0., 0.},\q\= 4.94773

n= 3,q= {-19.5072, 16.3104, 0., 0.},\q\= 25.4275

n= 4,q= {112.102, -637.54, 0., 0.},\q\= 647.321

n= 5,q= {-393893., -142940., 0., 0.},\q\= 419027.

n= 6,q= {1.3472×10^11, 1.12606×10^11, 0., 0.},\q\= 1.75584×10^11

n= 7,q= {5.46938×10^21, 3.03407×10^22, 0., 0.},\q\= 3.08297×10^22

n= 8,q= {-8.90642×10^44, 3.31889×10^44, 0., 0.},\q\= 9.5047×10^44

n= 9,q= {6.83093×10^89, -5.91189×10^89, 0., 0.},\q\= 9.03394×10^89

n= 10,q= {1.17111×10^179, -8.07675×10^179, 0., 0.},\q\= 8.16121×10^179

n= 11,q= {-6.386230150888532×10^359, -1.891758440540132×10^359, 0., 0.}
 ,\q\= 6.660531926015563×10^359

n= 12,q= {3.720518554276293×10^719, 2.416240958235052×10^719, 0., 0.}
 ,\q\= 4.436268553747259×10^719

n= 13,q= {8.004037944461517×10^1438, 1.797933863343168×10^1439, 0., 0.}
 ,\q\= 1.968047868096680×10^1439

n= 14,q= {-2.591919942792292×10^2878, 2.878146172766201×10^2878, 0., 0.}
 ,\q\= 3.873212411119887×10^2878

n= 15,q= {-1.565676401964332×10^5756, -1.491984892692805×10^5757, 0., 0.}
 ,\q\= 1.500177438165313×10^5757

n= 16,q= {-2.201505494066881×10^11514, 4.671931077152820×10^11513, 0., 0.}
 ,\q\= 2.250532345980240×10^11514

n= 17,q= {4.628357040509997×10^23028, -2.057056386850747×10^23028, 0., 0.}
 ,\q\= 5.064895840303323×10^23028

n= 18,q= {1.719020791575501×10^46057, -1.904158282161342×10^46057, 0., 0.}
 ,\q\= 2.565316987312191×10^46057

n= 19,q= {-6.707862816547707×10^92113, -6.546575354972072×10^92114, 0., 0.}
 ,\q\= 6.580851245392495×10^92114

n= 20,q= {-4.240769464267148×10^184229, 8.782705879868954×10^184228, 0., 0.}
 ,\q\= 4.330760311398395×10^184229
```

In[•]:=
```
P = {-2.4, -1.4, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]=
```
{-2.4, -1.4, 0, 0}
```

n= 1,q= {-2.4, -1.4, 0, 0},\q\= 2.77849

n= 2,q= {1.4, 5.32, 0., 0.},\q\= 5.50113

n= 3,q= {-28.7424, 13.496, 0., 0.},\q\= 31.7532

n= 4,q= {641.584, -777.215, 0., 0.},\q\= 1007.82

n= 5,q= {-192436., -997298., 0., 0.},\q\= 1.01569×10^{6}

n= 6,q= $\{-9.57572\times10^{11}, 3.83832\times10^{11}, 0., 0.\}$,\q\= 1.03163×10^{12}

n= 7,q= $\{7.69616\times10^{23}, -7.35093\times10^{23}, 0., 0.\}$,\q\= 1.06427×10^{24}

n= 8,q= $\{5.19478\times10^{46}, -1.13148\times10^{48}, 0., 0.\}$,\q\= 1.13267×10^{48}

n= 9,q= $\{-1.27755\times10^{96}, -1.17556\times10^{95}, 0., 0.\}$,\q\= 1.28294×10^{96}

n= 10,q= $\{1.61831\times10^{192}, 3.00366\times10^{191}, 0., 0.\}$,\q\= 1.64594×10^{192}

n= 11,q= $\{2.528694624649801\times10^{384}, 9.72168510308598\times10^{383}, 0., 0.\}$
,\q\= $2.709134200656815\times10^{384}$

n= 12,q= $\{5.449184892297159\times10^{768}, 4.916634572542315\times10^{768}, 0., 0.\}$
,\q\= $7.339408117168438\times10^{768}$

n= 13,q= $\{5.520320470521257\times10^{1536}, 5.358330166728697\times10^{1537}, 0., 0.\}$
,\q\= $5.386691151035795\times10^{1537}$

n= 14,q= $\{-2.840696279470222\times10^{3075}, 5.915939941440801\times10^{3074}, 0., 0.\}$
,\q\= $2.901644155664734\times10^{3075}$

n= 15,q= $\{7.719571898288617\times10^{6150}, -3.361077716244033\times10^{6150}, 0., 0.\}$
,\q\= $8.419538806103309\times10^{6150}$

n= 16,q= $\{4.829494687821511\times10^{12301}, -5.189216217256304\times10^{12301}, 0., 0.\}$
,\q\= $7.088863370747953\times10^{12301}$

n= 17,q= $\{-3.603946009739632\times10^{24602}, -5.012258431039312\times10^{24603}, 0., 0.\}$
,\q\= $5.025198388913203\times10^{24603}$

n= 18,q= $\{-2.499285031111348\times10^{49207}, 3.612781754465592\times10^{49206}, 0., 0.\}$
,\q\= $2.525261884793585\times10^{49207}$

n= 19,q= $\{6.115903746683258\times10^{98414}, -1.805874271921610\times10^{98414}, 0., 0.\}$
,\q\= $6.376947586791248\times10^{98414}$

n= 20,q= $\{3.414309675270592\times10^{196829}, -2.208910645136855\times10^{196829}, 0., 0.\}$
,\q\= $4.066546052468272\times10^{196829}$

In[•]:=
```
P = {-2.2, 1.4, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-2.2, 1.4, 0, 0}

```
n= 1,q= {-2.2, 1.4, 0, 0},\q\= 2.60768

n= 2,q= {0.68, -4.76, 0., 0.},\q\= 4.80833

n= 3,q= {-24.3952, -5.0736, 0., 0.},\q\= 24.9172

n= 4,q= {567.184, 248.943, 0., 0.},\q\= 619.412

n= 5,q= {259723., 282395., 0., 0.},\q\= 383670.

n= 6,q= {-1.22905×10^10, 1.46689×10^11, 0., 0.},\q\= 1.47203×10^11

n= 7,q= {-2.13666×10^22, -3.60575×10^21, 0., 0.},\q\= 2.16687×10^22

n= 8,q= {4.43529×10^44, 1.54085×10^44, 0., 0.},\q\= 4.69532×10^44

n= 9,q= {1.72976×10^89, 1.36682×10^89, 0., 0.},\q\= 2.2046×10^89

n= 10,q= {1.12385×10^178, 4.72855×10^178, 0., 0.},\q\= 4.86027×10^178

n= 11,q= {-2.109610344132128×10^357, 1.062835565311691×10^357, 0., 0.}
 ,\q\= 2.362218288592462×10^357

n= 12,q= {3.320836365177853×10^714, -4.484337805386124×10^714, 0., 0.}
 ,\q\= 5.580075242960698×10^714

n= 13,q= {-9.08133138852758×10^1428, -2.978350411573617×10^1429, 0., 0.}
 ,\q\= 3.113723971710289×10^1429

n= 14,q= {-8.045865376238171×10^2858, 5.409477415731507×10^2858, 0., 0.}
 ,\q\= 9.69527697200330×10^2858

n= 15,q= {3.547350374123897×10^5717, -8.704785408555294×10^5717, 0., 0.}
 ,\q\= 9.39983955638574×10^5717

n= 16,q= {-6.318959433220020×10^11435, -6.175784755141373×10^11435, 0., 0.}
 ,\q\= 8.835698368579411×10^11435

n= 17,q= {1.788930976843686×10^22870, 7.804906667207393×10^22871, 0., 0.}
 ,\q\= 7.806956566051686×10^22871

n= 18,q= {-6.088456534341931×10^45743, 2.792487861668224×10^45742, 0., 0.}
 ,\q\= 6.094857082421753×10^45743

n= 19,q= {3.699132308599532×10^91487, -3.400388193688885×10^91486, 0., 0.}
 ,\q\= 3.714728285514660×10^91487

n= 20,q= {1.356795343784711×10^182975, -2.515697165810991×10^182974, 0., 0.}
 ,\q\= 1.379920623520269×10^182975
```

In[•]:=
```
P = {-2.2, 1.2, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]=
```
{-2.2, 1.2, 0, 0}
```

```
n= 1,q= {-2.2, 1.2, 0, 0},\q\= 2.50599

n= 2,q= {1.2, -4.08, 0., 0.},\q\= 4.25281

n= 3,q= {-17.4064, -8.592, 0., 0.},\q\= 19.4115

n= 4,q= {226.96, 300.312, 0., 0.},\q\= 376.428

n= 5,q= {-38 678.3, 136 319., 0., 0.},\q\= 141 700.

n= 6,q= {-1.70868×10^10, -1.05452×10^10, 0., 0.},\q\= 2.00788×10^10

n= 7,q= {1.80759×10^20, 3.60366×10^20, 0., 0.},\q\= 4.03159×10^20

n= 8,q= {-9.71899×10^40, 1.30279×10^41, 0., 0.},\q\= 1.62537×10^41

n= 9,q= {-7.52666×10^81, -2.53235×10^82, 0., 0.},\q\= 2.64184×10^82

n= 10,q= {-5.84631×10^164, 3.81203×10^164, 0., 0.},\q\= 6.97932×10^164

n= 11,q= {1.964769367876027×10^329, -4.457265130109520×10^329, 0., 0.}
 ,\q\= 4.871091367346151×10^329

n= 12,q= {-1.600689377114627×10^659, -1.751499598428228×10^659, 0., 0.}
 ,\q\= 2.372753110903420×10^659

n= 13,q= {-5.055443612866299×10^1317, 5.607213602449199×10^1318, 0., 0.}
 ,\q\= 5.629957325301856×10^1318

n= 14,q= {-3.118526928226262×10^2637, -5.669390438495767×10^2636, 0., 0.}
 ,\q\= 3.169641948472003×10^2637

n= 15,q= {9.40379032263125×10^5274, 3.536029349815509×10^5274, 0., 0.}
 ,\q\= 1.004663008151340×10^5275

n= 16,q= {7.592776886925651×10^10 549, 6.650415716067033×10^10 549, 0., 0.}
 ,\q\= 1.009347759947699×10^10 550

n= 17,q= {1.342223165812101×10^21 099, 1.009902454748017×10^21 100, 0., 0.}
 ,\q\= 1.018782900511438×10^21 100

n= 18,q= {-1.001887337837645×10^42 200, 2.711028939946591×10^42 199, 0., 0.}
 ,\q\= 1.037918598374498×10^42 200

n= 19,q= {9.30281458587124×10^84 399, -5.432291134887805×10^84 399, 0., 0.}
 ,\q\= 1.077275016851682×10^84 400

n= 20,q= {5.703257224491797×10^168 799, -1.010711944086666×10^168 800, 0., 0.}
 ,\q\= 1.160521461932792×10^168 800
```

In[•]:=
```
P = {-2.2, 0.7, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-2.2, 0.7, 0, 0}

```
n= 1,q= {-2.2, 0.7, 0, 0},\q\= 2.30868

n= 2,q= {2.15, -2.38, 0., 0.},\q\= 3.20732

n= 3,q= {-3.2419, -9.534, 0., 0.},\q\= 10.0701

n= 4,q= {-82.5872, 62.5165, 0., 0.},\q\= 103.581

n= 5,q= {2910.13, -10325.4, 0., 0.},\q\= 10727.7

n= 6,q= {-9.81458×10^7, -6.00968×10^7, 0., 0.},\q\= 1.15084×10^8

n= 7,q= {6.02097×10^15, 1.17965×10^16, 0., 0.},\q\= 1.32442×10^16

n= 8,q= {-1.02905×10^32, 1.42053×10^32, 0., 0.},\q\= 1.7541×10^32

n= 9,q= {-9.58951×10^63, -2.9236×10^64, 0., 0.},\q\= 3.07685×10^64

n= 10,q= {-7.62783×10^128, 5.60717×10^128, 0., 0.},\q\= 9.467×10^128

n= 11,q= {2.67434×10^257, -8.55411×10^257, 0., 0.},\q\= 8.96242×10^257

n= 12,q= {-6.602067593304522×10^515, -4.575324516462220×10^515, 0., 0.}
 ,\q\= 8.032489709766331×10^515

n= 13,q= {2.265370207562151×10^1031, 6.041320343797380×10^1031, 0., 0.}
 ,\q\= 6.452089093750200×10^1031

n= 14,q= {-3.136564931906991×10^2063, 2.737165424235544×10^2063, 0., 0.}
 ,\q\= 4.162945367369028×10^2063

n= 15,q= {2.345965012438163×10^4126, -1.717059416497106×10^4127, 0., 0.}
 ,\q\= 1.733011413169925×10^4127

n= 16,q= {-2.893257521385542×10^8254, -8.056322630759397×10^8253, 0., 0.}
 ,\q\= 3.003328558177222×10^8254

n= 17,q= {7.721895741745150×10^16508, 4.661803209230636×10^16508, 0., 0.}
 ,\q\= 9.01998242836287×10^16508

n= 18,q= {3.789526468478882×10^33017, 7.199591670042385×10^33017, 0., 0.}
 ,\q\= 8.136008300797494×10^33017

n= 19,q= {-3.747360936004167×10^66035, 5.456608639173139×10^66035, 0., 0.}
 ,\q\= 6.619463107064573×10^66035

n= 20,q= {-1.573186385640891×10^132071, -4.089576411500056×10^132071, 0., 0.}
 ,\q\= 4.381729182578896×10^132071
```

In[•]:=

```
P = {-2.2, 0.5, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-2.2, 0.5, 0, 0}

```
n= 1,q= {-2.2, 0.5, 0, 0},\q\= 2.2561

n= 2,q= {2.39, -1.7, 0., 0.},\q\= 2.93293

n= 3,q= {0.6221, -7.626, 0., 0.},\q\= 7.65133

n= 4,q= {-59.9689, -8.98827, 0., 0.},\q\= 60.6387

n= 5,q= {3513.28, 1078.53, 0., 0.},\q\= 3675.1

n= 6,q= {1.11799×10^7, 7.57837×10^6, 0., 0.},\q\= 1.35063×10^7

n= 7,q= {6.75579×10^13, 1.6945×10^14, 0., 0.},\q\= 1.82421×10^14

n= 8,q= {-2.41494×10^28, 2.28954×10^28, 0., 0.},\q\= 3.32775×10^28

n= 9,q= {5.89901×10^55, -1.10582×10^57, 0., 0.},\q\= 1.10739×10^57

n= 10,q= {-1.21936×10^114, -1.30465×10^113, 0., 0.},\q\= 1.22632×10^114

n= 11,q= {1.46981×10^228, 3.18167×10^227, 0., 0.},\q\= 1.50385×10^228

n= 12,q= {2.059118015286201×10^456, 9.35290092289640×10^455, 0., 0.}
 ,\q\= 2.261577891121893×10^456

n= 13,q= {3.365199444141022×10^912, 3.851745357104583×10^912, 0., 0.}
 ,\q\= 5.114734557611349×10^912

n= 14,q= {-3.511374997129671×10^1824, 2.592378266940221×10^1825, 0., 0.}
 ,\q\= 2.616050959482376×10^1825

n= 15,q= {-6.597127535199311×10^3650, -1.820562445927248×10^3650, 0., 0.}
 ,\q\= 6.843722622608659×10^3650

n= 16,q= {4.020764409616434×10^7301, 2.402096528315291×10^7301, 0., 0.}
 ,\q\= 4.683653933520555×10^7301

n= 17,q= {1.039647870629381×10^14603, 1.931652845902663×10^14603, 0., 0.}
 ,\q\= 2.193661416898256×10^14603

n= 18,q= {-2.650415022179652×10^29206, 4.016477536075778×10^29206, 0., 0.}
 ,\q\= 4.812150411988066×10^29206

n= 19,q= {-9.10739200800579×10^58412, -2.129066479572471×10^58413, 0., 0.}
 ,\q\= 2.315679158759691×10^58413

n= 20,q= {-3.703478182564238×10^116826, 3.878048608114267×10^116826, 0., 0.}
 ,\q\= 5.362369966313992×10^116826
```

In[•]:=
```
P = {-2.2, 0.4, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]=
```
{-2.2, 0.4, 0, 0}
```

```
n= 1,q= {-2.2, 0.4, 0, 0},\q\= 2.23607
n= 2,q= {2.48, -1.36, 0., 0.},\q\= 2.82843
n= 3,q= {2.1008, -6.3456, 0., 0.},\q\= 6.68431
n= 4,q= {-38.0533, -26.2617, 0., 0.},\q\= 46.2356
n= 5,q= {756.177, 1999.09, 0., 0.},\q\= 2137.32
n= 6,q= {-3.42454×10^6, 3.02332×10^6, 0., 0.},\q\= 4.56815×10^6
n= 7,q= {2.587×10^12, -2.0707×10^13, 0., 0.},\q\= 2.0868×10^13
n= 8,q= {-4.22087×10^26, -1.07138×10^26, 0., 0.},\q\= 4.35472×10^26
n= 9,q= {1.66679×10^53, 9.04433×10^52, 0., 0.},\q\= 1.89636×10^53
n= 10,q= {1.96019×10^106, 3.015×10^106, 0., 0.},\q\= 3.59619×10^106
n= 11,q= {-5.24787×10^212, 1.18199×10^213, 0., 0.},\q\= 1.29326×10^213
n= 12,q= {-1.121709751939305×10^426, -1.240591418501088×10^426, 0., 0.}
 ,\q\= 1.672513029920628×10^426
n= 13,q= {-2.808343000628042×10^851, 2.783166984609771×10^852, 0., 0.}
 ,\q\= 2.797299835254278×10^852
n= 14,q= {-7.667150560130081×10^1704, -1.563217504161581×10^1704, 0., 0.}
 ,\q\= 7.824886368313612×10^1704
n= 15,q= {5.634154874638586×10^3409, 2.397084792527523×10^3409, 0., 0.}
 ,\q\= 6.122884667702018×10^3409
n= 16,q= {2.599768564884702×10^6819, 2.701109393748193×10^6819, 0., 0.}
 ,\q\= 3.748971665398045×10^6819
n= 17,q= {-5.371953660320695×10^13637, 1.404451858436265×10^13639, 0., 0.}
 ,\q\= 1.405478854795739×10^13639
n= 18,q= {-1.969599234052217×10^27278, -1.508930060334180×10^27277, 0., 0.}
 ,\q\= 1.975370811277943×10^27278
n= 19,q= {3.856552443509277×10^54556, 5.943974982145131×10^54555, 0., 0.}
 ,\q\= 3.902089842048879×10^54556
n= 20,q= {1.451968836365371×10^109113, 4.584650248309963×10^109112, 0., 0.}
 ,\q\= 1.522630513542105×10^109113
```

In[•]:=

```
P = {-2.2, 0.2, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-2.2, 0.2, 0, 0}

```
n= 1,q= {-2.2, 0.2, 0, 0},\q\= 2.20907

n= 2,q= {2.6, -0.68, 0., 0.},\q\= 2.68745

n= 3,q= {4.0976, -3.336, 0., 0.},\q\= 5.28386

n= 4,q= {3.46143, -27.1392, 0., 0.},\q\= 27.359

n= 5,q= {-726.754, -187.681, 0., 0.},\q\= 750.597

n= 6,q= {492 945., 272 796., 0., 0.},\q\= 563 394.

n= 7,q= {1.68577×10^11, 2.68947×10^11, 0., 0.},\q\= 3.17412×10^11

n= 8,q= {-4.3914×10^22, 9.06766×10^22, 0., 0.},\q\= 1.00751×10^23

n= 9,q= {-6.29381×10^45, -7.96394×10^45, 0., 0.},\q\= 1.01507×10^46

n= 10,q= {-2.38122×10^91, 1.00247×10^92, 0., 0.},\q\= 1.03036×10^92

n= 11,q= {-9.48245×10^183, -4.77421×10^183, 0., 0.},\q\= 1.06165×10^184

n= 12,q= {6.712382991058453×10^367, 9.05424202148467×10^367, 0., 0.}
 ,\q\= 1.127099747148714×10^368

n= 13,q= {-3.692321316496795×10^735, 1.215510802838808×10^736, 0., 0.}
 ,\q\= 1.270353840022696×10^736

n= 14,q= {-1.341134144775277×10^1472, -8.976112895507726×10^1471, 0., 0.}
 ,\q\= 1.613798878860409×10^1472

n= 15,q= {9.92934767153112×10^2943, 2.407634298304617×10^2944, 0., 0.}
 ,\q\= 2.604346821411114×10^2944

n= 16,q= {-4.810783462551363×10^5888, 4.781247602753883×10^5888, 0., 0.}
 ,\q\= 6.782622366194172×10^5888

n= 17,q= {2.833088847179252×10^11 775, -4.600309379538345×10^11 777, 0., 0.}
 ,\q\= 4.600396616239743×10^11 777

n= 18,q= {-2.116204374822688×10^23 555, -2.606617039348838×10^23 553, 0., 0.}
 ,\q\= 2.116364902671008×10^23 555

n= 19,q= {4.477641510779700×10^47 110, 1.103226876431475×10^47 109, 0., 0.}
 ,\q\= 4.479000401257664×10^47 110

n= 20,q= {2.003710240364870×10^94 221, 9.87970891543480×10^94 219, 0., 0.}
 ,\q\= 2.006144459446632×10^94 221
```

In[ ]:=
```
P = {-2.2, -0.2, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[ ]= {-2.2, -0.2, 0, 0}

```
n= 1,q= {-2.2, -0.2, 0, 0},\q\= 2.20907

n= 2,q= {2.6, 0.68, 0., 0.},\q\= 2.68745

n= 3,q= {4.0976, 3.336, 0., 0.},\q\= 5.28386

n= 4,q= {3.46143, 27.1392, 0., 0.},\q\= 27.359

n= 5,q= {-726.754, 187.681, 0., 0.},\q\= 750.597

n= 6,q= {492 945., -272 796., 0., 0.},\q\= 563 394.

n= 7,q= {1.68577×10^11, -2.68947×10^11, 0., 0.},\q\= 3.17412×10^11

n= 8,q= {-4.3914×10^22, -9.06766×10^22, 0., 0.},\q\= 1.00751×10^23

n= 9,q= {-6.29381×10^45, 7.96394×10^45, 0., 0.},\q\= 1.01507×10^46

n= 10,q= {-2.38122×10^91, -1.00247×10^92, 0., 0.},\q\= 1.03036×10^92

n= 11,q= {-9.48245×10^183, 4.77421×10^183, 0., 0.},\q\= 1.06165×10^184

n= 12,q= {6.712382991058453×10^367, -9.05424202148467×10^367, 0., 0.}
 ,\q\= 1.127099747148714×10^368

n= 13,q= {-3.692321316496795×10^735, -1.215510802838808×10^736, 0., 0.}
 ,\q\= 1.270353840022696×10^736

n= 14,q= {-1.341134144775277×10^1472, 8.976112895507726×10^1471, 0., 0.}
 ,\q\= 1.613798878860409×10^1472

n= 15,q= {9.92934767153112×10^2943, -2.407634298304617×10^2944, 0., 0.}
 ,\q\= 2.604346821411114×10^2944

n= 16,q= {-4.810783462551363×10^5888, -4.781247602753883×10^5888, 0., 0.}
 ,\q\= 6.782622366194172×10^5888

n= 17,q= {2.833088847179252×10^11 775, 4.600309379538345×10^11 777, 0., 0.}
 ,\q\= 4.600396616239743×10^11 777

n= 18,q= {-2.116204374822688×10^23 555, 2.606617039348838×10^23 553, 0., 0.}
 ,\q\= 2.116364902671008×10^23 555

n= 19,q= {4.477641510779700×10^47 110, -1.103226876431475×10^47 109, 0., 0.}
 ,\q\= 4.479000401257664×10^47 110

n= 20,q= {2.003710240364870×10^94 221, -9.87970891543480×10^94 219, 0., 0.}
 ,\q\= 2.006144459446632×10^94 221
```

In[•]:=

```
P = {-2.2, -0.4, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-2.2, -0.4, 0, 0}

```
n= 1,q= {-2.2, -0.4, 0, 0},\q\= 2.23607
n= 2,q= {2.48, 1.36, 0., 0.},\q\= 2.82843
n= 3,q= {2.1008, 6.3456, 0., 0.},\q\= 6.68431
n= 4,q= {-38.0533, 26.2617, 0., 0.},\q\= 46.2356
n= 5,q= {756.177, -1999.09, 0., 0.},\q\= 2137.32
n= 6,q= {-3.42454×10^6, -3.02332×10^6, 0., 0.},\q\= 4.56815×10^6
n= 7,q= {2.587×10^12, 2.0707×10^13, 0., 0.},\q\= 2.0868×10^13
n= 8,q= {-4.22087×10^26, 1.07138×10^26, 0., 0.},\q\= 4.35472×10^26
n= 9,q= {1.66679×10^53, -9.04433×10^52, 0., 0.},\q\= 1.89636×10^53
n= 10,q= {1.96019×10^106, -3.015×10^106, 0., 0.},\q\= 3.59619×10^106
n= 11,q= {-5.24787×10^212, -1.18199×10^213, 0., 0.},\q\= 1.29326×10^213
n= 12,q= {-1.121709751939305×10^426, 1.240591418501088×10^426, 0., 0.}
 ,\q\= 1.672513029920628×10^426
n= 13,q= {-2.808343000628042×10^851, -2.783166984609771×10^852, 0., 0.}
 ,\q\= 2.797299835254278×10^852
n= 14,q= {-7.667150560130081×10^1704, 1.563217504161581×10^1704, 0., 0.}
 ,\q\= 7.824886368313612×10^1704
n= 15,q= {5.634154874638586×10^3409, -2.397084792527523×10^3409, 0., 0.}
 ,\q\= 6.122884667702018×10^3409
n= 16,q= {2.599768564884702×10^6819, -2.701109393748193×10^6819, 0., 0.}
 ,\q\= 3.748971665398045×10^6819
n= 17,q= {-5.371953660320695×10^13637, -1.404451858436265×10^13639, 0., 0.}
 ,\q\= 1.405478854795739×10^13639
n= 18,q= {-1.969599234052217×10^27278, 1.508930060334180×10^27277, 0., 0.}
 ,\q\= 1.975370811277943×10^27278
n= 19,q= {3.856552443509277×10^54556, -5.943974982145131×10^54555, 0., 0.}
 ,\q\= 3.902089842048879×10^54556
n= 20,q= {1.451968836365371×10^109113, -4.584650248309963×10^109112, 0., 0.}
 ,\q\= 1.522630513542105×10^109113
```

In[•]:=

```
P = {-2.2, -0.5, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-2.2, -0.5, 0, 0}

```
n= 1,q= {-2.2, -0.5, 0, 0},\q\= 2.2561
n= 2,q= {2.39, 1.7, 0., 0.},\q\= 2.93293
n= 3,q= {0.6221, 7.626, 0., 0.},\q\= 7.65133
n= 4,q= {-59.9689, 8.98827, 0., 0.},\q\= 60.6387
n= 5,q= {3513.28, -1078.53, 0., 0.},\q\= 3675.1
n= 6,q= {1.11799×10^7, -7.57837×10^6, 0., 0.},\q\= 1.35063×10^7
n= 7,q= {6.75579×10^13, -1.6945×10^14, 0., 0.},\q\= 1.82421×10^14
n= 8,q= {-2.41494×10^28, -2.28954×10^28, 0., 0.},\q\= 3.32775×10^28
n= 9,q= {5.89901×10^55, 1.10582×10^57, 0., 0.},\q\= 1.10739×10^57
n= 10,q= {-1.21936×10^114, 1.30465×10^113, 0., 0.},\q\= 1.22632×10^114
n= 11,q= {1.46981×10^228, -3.18167×10^227, 0., 0.},\q\= 1.50385×10^228
n= 12,q= {2.059118015286201×10^456, -9.35290092289640×10^455, 0., 0.}
 ,\q\= 2.261577891121893×10^456
n= 13,q= {3.365199444141022×10^912, -3.851745357104583×10^912, 0., 0.}
 ,\q\= 5.114734557611349×10^912
n= 14,q= {-3.511374997129671×10^1824, -2.592378266940221×10^1825, 0., 0.}
 ,\q\= 2.616050959482376×10^1825
n= 15,q= {-6.597127535199311×10^3650, 1.820562445927248×10^3650, 0., 0.}
 ,\q\= 6.843722622608659×10^3650
n= 16,q= {4.020764409616434×10^7301, -2.402096528315291×10^7301, 0., 0.}
 ,\q\= 4.683653933520555×10^7301
n= 17,q= {1.039647870629381×10^14603, -1.931652845902663×10^14603, 0., 0.}
 ,\q\= 2.193661416898256×10^14603
n= 18,q= {-2.650415022179652×10^29206, -4.016477536075778×10^29206, 0., 0.}
 ,\q\= 4.812150411988066×10^29206
n= 19,q= {-9.10739200800579×10^58412, 2.129066479572471×10^58413, 0., 0.}
 ,\q\= 2.315679158759691×10^58413
n= 20,q= {-3.703478182564238×10^116826, -3.878048608114267×10^116826, 0., 0.}
 ,\q\= 5.362369966313992×10^116826
```

In[•]:=
```
P = {-2.2, -0.7, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-2.2, -0.7, 0, 0}

```
n= 1,q= {-2.2, -0.7, 0, 0},\q\= 2.30868

n= 2,q= {2.15, 2.38, 0., 0.},\q\= 3.20732

n= 3,q= {-3.2419, 9.534, 0., 0.},\q\= 10.0701

n= 4,q= {-82.5872, -62.5165, 0., 0.},\q\= 103.581

n= 5,q= {2910.13, 10325.4, 0., 0.},\q\= 10727.7

n= 6,q= {-9.81458×10^7, 6.00968×10^7, 0., 0.},\q\= 1.15084×10^8

n= 7,q= {6.02097×10^15, -1.17965×10^16, 0., 0.},\q\= 1.32442×10^16

n= 8,q= {-1.02905×10^32, -1.42053×10^32, 0., 0.},\q\= 1.7541×10^32

n= 9,q= {-9.58951×10^63, 2.9236×10^64, 0., 0.},\q\= 3.07685×10^64

n= 10,q= {-7.62783×10^128, -5.60717×10^128, 0., 0.},\q\= 9.467×10^128

n= 11,q= {2.67434×10^257, 8.55411×10^257, 0., 0.},\q\= 8.96242×10^257

n= 12,q= {-6.602067593304522×10^515, 4.575324516462220×10^515, 0., 0.}
 ,\q\= 8.032489709766331×10^515

n= 13,q= {2.265370207562151×10^1031, -6.041320343797380×10^1031, 0., 0.}
 ,\q\= 6.452089093750200×10^1031

n= 14,q= {-3.136564931906991×10^2063, -2.737165424235544×10^2063, 0., 0.}
 ,\q\= 4.162945367369028×10^2063

n= 15,q= {2.345965012438163×10^4126, 1.717059416497106×10^4127, 0., 0.}
 ,\q\= 1.733011413169925×10^4127

n= 16,q= {-2.893257521385542×10^8254, 8.056322630759397×10^8253, 0., 0.}
 ,\q\= 3.003328558177222×10^8254

n= 17,q= {7.721895741745150×10^16508, -4.661803209230636×10^16508, 0., 0.}
 ,\q\= 9.01998242836287×10^16508

n= 18,q= {3.789526468478882×10^33017, -7.199591670042385×10^33017, 0., 0.}
 ,\q\= 8.136008300797494×10^33017

n= 19,q= {-3.747360936004167×10^66035, -5.456608639173139×10^66035, 0., 0.}
 ,\q\= 6.619463107064573×10^66035

n= 20,q= {-1.573186385640891×10^132071, 4.089576411500056×10^132071, 0., 0.}
 ,\q\= 4.381729182578896×10^132071
```

In[•]:=

```
P = {-2.2, -1.2, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-2.2, -1.2, 0, 0}

```
n= 1,q= {-2.2, -1.2, 0, 0},\q\= 2.50599

n= 2,q= {1.2, 4.08, 0., 0.},\q\= 4.25281

n= 3,q= {-17.4064, 8.592, 0., 0.},\q\= 19.4115

n= 4,q= {226.96, -300.312, 0., 0.},\q\= 376.428

n= 5,q= {-38 678.3, -136 319., 0., 0.},\q\= 141 700.

n= 6,q= {-1.70868×10^10, 1.05452×10^10, 0., 0.},\q\= 2.00788×10^10

n= 7,q= {1.80759×10^20, -3.60366×10^20, 0., 0.},\q\= 4.03159×10^20

n= 8,q= {-9.71899×10^40, -1.30279×10^41, 0., 0.},\q\= 1.62537×10^41

n= 9,q= {-7.52666×10^81, 2.53235×10^82, 0., 0.},\q\= 2.64184×10^82

n= 10,q= {-5.84631×10^164, -3.81203×10^164, 0., 0.},\q\= 6.97932×10^164

n= 11,q= {1.964769367876027×10^329, 4.457265130109520×10^329, 0., 0.}
 ,\q\= 4.871091367346151×10^329

n= 12,q= {-1.600689377114627×10^659, 1.751499598428228×10^659, 0., 0.}
 ,\q\= 2.372753110903420×10^659

n= 13,q= {-5.055443612866299×10^1317, -5.607213602449199×10^1318, 0., 0.}
 ,\q\= 5.629957325301856×10^1318

n= 14,q= {-3.118526928226262×10^2637, 5.669390438495767×10^2636, 0., 0.}
 ,\q\= 3.169641948472003×10^2637

n= 15,q= {9.40379032263125×10^5274, -3.536029349815509×10^5274, 0., 0.}
 ,\q\= 1.004663008151340×10^5275

n= 16,q= {7.592776886925651×10^10 549, -6.650415716067033×10^10 549, 0., 0.}
 ,\q\= 1.009347759947699×10^10 550

n= 17,q= {1.342223165812101×10^21 099, -1.009902454748017×10^21 100, 0., 0.}
 ,\q\= 1.018782900511438×10^21 100

n= 18,q= {-1.001887337837645×10^42 200, -2.711028939946591×10^42 199, 0., 0.}
 ,\q\= 1.037918598374498×10^42 200

n= 19,q= {9.30281458587124×10^84 399, 5.432291134887805×10^84 399, 0., 0.}
 ,\q\= 1.077275016851682×10^84 400

n= 20,q= {5.703257224491797×10^168 799, 1.010711944086666×10^168 800, 0., 0.}
 ,\q\= 1.160521461932792×10^168 800
```

In[•]:=
```
P = {-2.2, -1.4, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-2.2, -1.4, 0, 0}

```
n= 1,q= {-2.2, -1.4, 0, 0},\q\= 2.60768

n= 2,q= {0.68, 4.76, 0., 0.},\q\= 4.80833

n= 3,q= {-24.3952, 5.0736, 0., 0.},\q\= 24.9172

n= 4,q= {567.184, -248.943, 0., 0.},\q\= 619.412

n= 5,q= {259723., -282395., 0., 0.},\q\= 383670.

n= 6,q= {-1.22905×10^10, -1.46689×10^11, 0., 0.},\q\= 1.47203×10^11

n= 7,q= {-2.13666×10^22, 3.60575×10^21, 0., 0.},\q\= 2.16687×10^22

n= 8,q= {4.43529×10^44, -1.54085×10^44, 0., 0.},\q\= 4.69532×10^44

n= 9,q= {1.72976×10^89, -1.36682×10^89, 0., 0.},\q\= 2.2046×10^89

n= 10,q= {1.12385×10^178, -4.72855×10^178, 0., 0.},\q\= 4.86027×10^178

n= 11,q= {-2.109610344132128×10^357, -1.062835565311691×10^357, 0., 0.}
 ,\q\= 2.362218288592462×10^357

n= 12,q= {3.320836365177853×10^714, 4.484337805386124×10^714, 0., 0.}
 ,\q\= 5.580075242960698×10^714

n= 13,q= {-9.08133138852758×10^1428, 2.978350411573617×10^1429, 0., 0.}
 ,\q\= 3.113723971710289×10^1429

n= 14,q= {-8.045865376238171×10^2858, -5.409477415731507×10^2858, 0., 0.}
 ,\q\= 9.69527697200330×10^2858

n= 15,q= {3.547350374123897×10^5717, 8.704785408555294×10^5717, 0., 0.}
 ,\q\= 9.39983955638574×10^5717

n= 16,q= {-6.318959433220020×10^11435, 6.175784755141373×10^11435, 0., 0.}
 ,\q\= 8.835698368579411×10^11435

n= 17,q= {1.788930976843686×10^22870, -7.804906667207393×10^22871, 0., 0.}
 ,\q\= 7.806956566051686×10^22871

n= 18,q= {-6.088456534341931×10^45743, -2.792487861668224×10^45742, 0., 0.}
 ,\q\= 6.094857082421753×10^45743

n= 19,q= {3.699132308599532×10^91487, 3.400388193688885×10^91486, 0., 0.}
 ,\q\= 3.714728285514660×10^91487

n= 20,q= {1.356795343784711×10^182975, 2.515697165810991×10^182974, 0., 0.}
 ,\q\= 1.379920623520269×10^182975
```

In[•]:=
```
P = {-1.7, 1.4, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-1.7, 1.4, 0, 0}

```
n= 1,q= {-1.7, 1.4, 0, 0},\q\= 2.20227
n= 2,q= {-0.77, -3.36, 0., 0.},\q\= 3.4471
n= 3,q= {-12.3967, 6.5744, 0., 0.},\q\= 14.0321
n= 4,q= {108.755, -161.602, 0., 0.},\q\= 194.789
n= 5,q= {-14289.1, -35148.7, 0., 0.},\q\= 37942.2
n= 6,q= {-1.03126×10^9, 1.00449×10^9, 0., 0.},\q\= 1.43961×10^9
n= 7,q= {5.4497×10^16, -2.07176×10^18, 0., 0.},\q\= 2.07248×10^18
n= 8,q= {-4.28923×10^36, -2.2581×10^35, 0., 0.},\q\= 4.29517×10^36
n= 9,q= {1.83465×10^73, 1.9371×10^72, 0., 0.},\q\= 1.84485×10^73
n= 10,q= {3.32843×10^146, 7.10782×10^145, 0., 0.},\q\= 3.40348×10^146
n= 11,q= {1.05732×10^293, 4.73157×10^292, 0., 0.},\q\= 1.15837×10^293
n= 12,q= {8.940544236564429×10^585, 1.000560736774964×10^586, 0., 0.}
 ,\q\= 1.341810381699036×10^586
n= 13,q= {-2.017884755160050×10^1171, 1.789111505701213×10^1172, 0., 0.}
 ,\q\= 1.800455100435313×10^1172
n= 14,q= {-3.160201390981388×10^2344, -7.220441665271841×10^2343, 0., 0.}
 ,\q\= 3.241638568683535×10^2344
n= 15,q= {9.46552505314476×10^4688, 4.563609958818408×10^4688, 0., 0.}
 ,\q\= 1.050822060997663×10^4689
n= 16,q= {6.876962867548461×10^9377, 8.639392879595317×10^9377, 0., 0.}
 ,\q\= 1.104227003879377×10^9378
n= 17,q= {-2.734649104636191×10^18755, 1.188255680622791×10^18756, 0., 0.}
 ,\q\= 1.219317276096426×10^18756
n= 18,q= {-1.337168505277458×10^37512, -6.498924666187968×10^37511, 0., 0.}
 ,\q\= 1.486734619787208×10^37512
n= 19,q= {1.365659393338087×10^75024, 1.738031476359474×10^75024, 0., 0.}
 ,\q\= 2.210379829673815×10^75024
n= 20,q= {-1.155727834203739×10^150048, 4.747118023215157×10^150048, 0., 0.}
 ,\q\= 4.885778991428844×10^150048
```

In[•]:=
```
P = {-1.7, 1.2, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-1.7, 1.2, 0, 0}

```
n= 1,q= {-1.7, 1.2, 0, 0},\q\= 2.08087

n= 2,q= {-0.25, -2.88, 0., 0.},\q\= 2.89083

n= 3,q= {-9.9319, 2.64, 0., 0.},\q\= 10.2768

n= 4,q= {89.973, -51.2404, 0., 0.},\q\= 103.541

n= 5,q= {5467.87, -9219.31, 0., 0.},\q\= 10718.8

n= 6,q= {-5.50982×10^7, -1.0082×10^8, 0., 0.},\q\= 1.14893×10^8

n= 7,q= {-7.12885×10^15, 1.111×10^16, 0., 0.},\q\= 1.32005×10^16

n= 8,q= {-7.26115×10^31, -1.58403×10^32, 0., 0.},\q\= 1.74253×10^32

n= 9,q= {-1.98191×10^64, 2.30038×10^64, 0., 0.},\q\= 3.03639×10^64

n= 10,q= {-1.36378×10^128, -9.11827×10^128, 0., 0.},\q\= 9.21969×10^128

n= 11,q= {-8.12829×10^257, 2.48706×10^257, 0., 0.},\q\= 8.50027×10^257

n= 12,q= {5.988355632813150×10^515, -4.043111978051559×10^515, 0., 0.}
 ,\q\= 7.225452072507918×10^515

n= 13,q= {1.951364871798100×10^1031, -4.842318477571874×10^1031, 0., 0.}
 ,\q\= 5.220715765210897×10^1031

n= 14,q= {-1.964022337534638×10^2063, -1.889826035038522×10^2063, 0., 0.}
 ,\q\= 2.725587310112161×10^2063

n= 15,q= {2.859412996256020×10^4125, 7.423321093740348×10^4126, 0., 0.}
 ,\q\= 7.428826185044443×10^4126

n= 16,q= {-5.502393363393881×10^8253, 4.245268162164521×10^8252, 0., 0.}
 ,\q\= 5.518745848760197×10^8253

n= 17,q= {3.009610970783415×10^16507, -4.671827072264280×10^16506, 0., 0.}
 ,\q\= 3.045655574320791×10^16507

n= 18,q= {8.839498513528476×10^33014, -2.812076402057908×10^33014, 0., 0.}
 ,\q\= 9.27601787739130×10^33014

n= 19,q= {7.022896027966118×10^66029, -4.971469035183876×10^66029, 0., 0.}
 ,\q\= 8.604450766168308×10^66029

n= 20,q= {2.460556425183018×10^132059, -6.982822028069879×10^132059, 0., 0.}
 ,\q\= 7.403657298741438×10^132059
```

In[•]:=
```
P = {-1.7, 0.7, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-1.7, 0.7, 0, 0}

```
n= 1,q= {-1.7, 0.7, 0, 0},\q\= 1.83848

n= 2,q= {0.7, -1.68, 0., 0.},\q\= 1.82

n= 3,q= {-4.0324, -1.652, 0., 0.},\q\= 4.35768

n= 4,q= {11.8311, 14.023, 0., 0.},\q\= 18.3473

n= 5,q= {-58.3699, 332.517, 0., 0.},\q\= 337.602

n= 6,q= {-107 163., -38 817.3, 0., 0.},\q\= 113 976.

n= 7,q= {9.97702×10^9, 8.31953×10^9, 0., 0.},\q\= 1.29906×10^10

n= 8,q= {3.03265×10^19, 1.66008×10^20, 0., 0.},\q\= 1.68756×10^20

n= 9,q= {-2.6639×10^40, 1.00689×10^40, 0., 0.},\q\= 2.84784×10^40

n= 10,q= {6.08256×10^80, -5.36451×10^80, 0., 0.},\q\= 8.11021×10^80

n= 11,q= {8.21959×10^160, -6.52599×10^161, 0., 0.},\q\= 6.57755×10^161

n= 12,q= {-4.191290585161919×10^323, -1.072818517595919×10^323, 0., 0.}
 ,\q\= 4.326413796779458×10^323

n= 13,q= {1.641597719757023×10^647, 8.992988304774280×10^646, 0., 0.}
 ,\q\= 1.871785634096364×10^647

n= 14,q= {1.886104687013389×10^1294, 2.952573818983807×10^1294, 0., 0.}
 ,\q\= 3.503581460009528×10^1294

n= 15,q= {-5.160301266174752×10^2588, 1.113772663747676×10^2589, 0., 0.}
 ,\q\= 1.227508304692250×10^2589

n= 16,q= {-9.74202454934747×10^5177, -1.149480497393592×10^5178, 0., 0.}
 ,\q\= 1.506776638088441×10^5178

n= 17,q= {-3.722349906873325×10^10 355, 2.239653444920901×10^10 356, 0., 0.}
 ,\q\= 2.270375837089106×10^10 356

n= 18,q= {-4.877488665054063×10^20 712, -1.667354758425968×10^20 712, 0., 0.}
 ,\q\= 5.154606441638060×10^20 712

n= 19,q= {2.100982378728515×10^41 425, 1.626500786969322×10^41 425, 0., 0.}
 ,\q\= 2.656996756817658×10^41 425

n= 20,q= {1.768622145715902×10^82 850, 6.834498984821216×10^82 850, 0., 0.}
 ,\q\= 7.059631765739552×10^82 850
```

In[ ]:=
```
P = {-1.7, 0.5, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[ ]= {-1.7, 0.5, 0, 0}

```
n= 1,q= {-1.7, 0.5, 0, 0},\q\= 1.772

n= 2,q= {0.94, -1.2, 0., 0.},\q\= 1.52434

n= 3,q= {-2.2564, -1.756, 0., 0.},\q\= 2.85917

n= 4,q= {0.307805, 8.42448, 0., 0.},\q\= 8.4301

n= 5,q= {-72.5771, 5.68619, 0., 0.},\q\= 72.7995

n= 6,q= {5233.4, -824.874, 0., 0.},\q\= 5298.01

n= 7,q= {2.6708×10^7, -8.63379×10^6, 0., 0.},\q\= 2.80689×10^7

n= 8,q= {6.38777×10^14, -4.61183×10^14, 0., 0.},\q\= 7.87861×10^14

n= 9,q= {1.95346×10^29, -5.89186×10^29, 0., 0.},\q\= 6.20725×10^29

n= 10,q= {-3.0898×10^59, -2.3019×10^59, 0., 0.},\q\= 3.853×10^59

n= 11,q= {4.24812×10^118, 1.42248×10^119, 0., 0.},\q\= 1.48456×10^119

n= 12,q= {-1.84299×10^238, 1.20857×10^238, 0., 0.},\q\= 2.20392×10^238

n= 13,q= {1.935962613380683×10^476, -4.454785477860046×10^476, 0., 0.}
 ,\q\= 4.857269283677870×10^476

n= 14,q= {-1.609716241334500×10^953, -1.724859627153650×10^953, 0., 0.}
 ,\q\= 2.359306489416053×10^953

n= 15,q= {-3.839543557685598×10^1905, 5.553069111702801×10^1906, 0., 0.}
 ,\q\= 5.566327111000699×10^1906

n= 16,q= {-3.068915561203409×10^3813, -4.264250146644275×10^3812, 0., 0.}
 ,\q\= 3.098399750666139×10^3813

n= 17,q= {9.23640442866488×10^7626, 2.617324726380107×10^7626, 0., 0.}
 ,\q\= 9.60008101492799×10^7626

n= 18,q= {7.846077804653943×10^15253, 4.834933938798261×10^15253, 0., 0.}
 ,\q\= 9.21615554931808×10^15253

n= 19,q= {3.818435072413998×10^30507, 7.587053572834620×10^30507, 0., 0.}
 ,\q\= 8.493752310922651×10^30507

n= 20,q= {-4.298293551482128×10^61015, 5.794134291759129×10^61015, 0., 0.}
 ,\q\= 7.214382831930387×10^61015
```

In[•]:=
```
P = {-1.7, 0.4, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-1.7, 0.4, 0, 0}

```
n= 1,q= {-1.7, 0.4, 0, 0},\q\= 1.74642

n= 2,q= {1.03, -0.96, 0., 0.},\q\= 1.40801

n= 3,q= {-1.5607, -1.5776, 0., 0.},\q\= 2.21915

n= 4,q= {-1.75304, 5.32432, 0., 0.},\q\= 5.60549

n= 5,q= {-26.9753, -18.2675, 0., 0.},\q\= 32.5786

n= 6,q= {392.264, 985.939, 0., 0.},\q\= 1061.11

n= 7,q= {-818 206., 773 497., 0., 0.},\q\= 1.12595×10^6

n= 8,q= {7.11642×10^10, -1.26576×10^12, 0., 0.},\q\= 1.26776×10^12

n= 9,q= {-1.59708×10^24, -1.80154×10^23, 0., 0.},\q\= 1.60721×10^24

n= 10,q= {2.51822×10^48, 5.75441×10^47, 0., 0.},\q\= 2.58313×10^48

n= 11,q= {6.01031×10^96, 2.89817×10^96, 0., 0.},\q\= 6.67257×10^96

n= 12,q= {2.77244×10^193, 3.48378×10^193, 0., 0.},\q\= 4.45232×10^193

n= 13,q= {-4.450324293558656×10^386, 1.931712070691921×10^387, 0., 0.}
 ,\q\= 1.982313140559597×10^387

n= 14,q= {-3.533457660878485×10^774, -1.719349031272150×10^774, 0., 0.}
 ,\q\= 3.929565387235252×10^774

n= 15,q= {9.52916194988437×10^1548, 1.215049401254516×10^1549, 0., 0.}
 ,\q\= 1.544148413255733×10^1549

n= 16,q= {-5.682957728177167×10^3097, 2.315680504332865×10^3098, 0., 0.}
 ,\q\= 2.384394322160199×10^3098

n= 17,q= {-5.039416112744825×10^6196, -2.631982883617531×10^6196, 0., 0.}
 ,\q\= 5.685336283549797×10^6196

n= 18,q= {1.846838085773651×10^12 393, 2.652731390434154×10^12 393, 0., 0.}
 ,\q\= 3.232304865704782×10^12 393

n= 19,q= {-3.626172914730638×10^24 786, 9.79833072636218×10^24 786, 0., 0.}
 ,\q\= 1.044779474485881×10^24 787

n= 20,q= {-8.285815501564710×10^49 573, -7.106088297901502×10^49 573, 0., 0.}
 ,\q\= 1.091564150306993×10^49 574
```

In[•]:=
```
P = {-1.7, 0.2, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-1.7, 0.2, 0, 0}

```
n= 1,q= {-1.7, 0.2, 0, 0},\q\= 1.71172

n= 2,q= {1.15, -0.48, 0., 0.},\q\= 1.24615

n= 3,q= {-0.6079, -0.904, 0., 0.},\q\= 1.08938

n= 4,q= {-2.14767, 1.29908, 0., 0.},\q\= 2.51

n= 5,q= {1.22488, -5.38001, 0., 0.},\q\= 5.51769

n= 6,q= {-29.1442, -12.9798, 0., 0.},\q\= 31.9039

n= 7,q= {679.209, 756.771, 0., 0.},\q\= 1016.87

n= 8,q= {-111 379., 1.02801×10^6, 0., 0.},\q\= 1.03403×10^6

n= 9,q= {-1.0444×10^12, -2.28998×10^11, 0., 0.},\q\= 1.06922×10^12

n= 10,q= {1.03834×10^24, 4.78334×10^23, 0., 0.},\q\= 1.14322×10^24

n= 11,q= {8.4935×10^47, 9.93347×10^47, 0., 0.},\q\= 1.30696×10^48

n= 12,q= {-2.65344×10^95, 1.6874×10^96, 0., 0.},\q\= 1.70813×10^96

n= 13,q= {-2.7769×10^192, -8.95481×10^191, 0., 0.},\q\= 2.91772×10^192

n= 14,q= {6.909315014496898×10^384, 4.973330293805434×10^384, 0., 0.}
 ,\q\= 8.513086877322180×10^384

n= 15,q= {2.300461975826942×10^769, 6.872461134208431×10^769, 0., 0.}
 ,\q\= 7.247264818083511×10^769

n= 16,q= {-4.193859673897983×10^1539, 3.161967103918998×10^1539, 0., 0.}
 ,\q\= 5.252284734343103×10^1539

n= 17,q= {7.590422998081801×10^3078, -2.652169265463576×10^3079, 0., 0.}
 ,\q\= 2.758649493061360×10^3079

n= 18,q= {-6.457856599771514×10^6158, -4.026217317476089×10^6158, 0., 0.}
 ,\q\= 7.610147025567696×10^6158

n= 19,q= {2.549348597566814×10^12 317, 5.200146815155465×10^12 317, 0., 0.}
 ,\q\= 5.791433775075686×10^12 317

n= 20,q= {-2.054234862725564×10^24 635, 2.651397398071624×10^24 635, 0., 0.}
 ,\q\= 3.354070517108741×10^24 635
```

In[ ]:=
```
P = {-1.7, -0.2, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[ ]= {-1.7, -0.2, 0, 0}

```
n= 1,q= {-1.7, -0.2, 0, 0},\q\= 1.71172

n= 2,q= {1.15, 0.48, 0., 0.},\q\= 1.24615

n= 3,q= {-0.6079, 0.904, 0., 0.},\q\= 1.08938

n= 4,q= {-2.14767, -1.29908, 0., 0.},\q\= 2.51

n= 5,q= {1.22488, 5.38001, 0., 0.},\q\= 5.51769

n= 6,q= {-29.1442, 12.9798, 0., 0.},\q\= 31.9039

n= 7,q= {679.209, -756.771, 0., 0.},\q\= 1016.87

n= 8,q= {-111 379., -1.02801×10^6, 0., 0.},\q\= 1.03403×10^6

n= 9,q= {-1.0444×10^12, 2.28998×10^11, 0., 0.},\q\= 1.06922×10^12

n= 10,q= {1.03834×10^24, -4.78334×10^23, 0., 0.},\q\= 1.14322×10^24

n= 11,q= {8.4935×10^47, -9.93347×10^47, 0., 0.},\q\= 1.30696×10^48

n= 12,q= {-2.65344×10^95, -1.6874×10^96, 0., 0.},\q\= 1.70813×10^96

n= 13,q= {-2.7769×10^192, 8.95481×10^191, 0., 0.},\q\= 2.91772×10^192

n= 14,q= {6.909315014496898×10^384, -4.973330293805434×10^384, 0., 0.}
 ,\q\= 8.513086877322180×10^384

n= 15,q= {2.300461975826942×10^769, -6.872461134208431×10^769, 0., 0.}
 ,\q\= 7.247264818083511×10^769

n= 16,q= {-4.193859673897983×10^1539, -3.161967103918998×10^1539, 0., 0.}
 ,\q\= 5.252284734343103×10^1539

n= 17,q= {7.590422998081801×10^3078, 2.652169265463576×10^3079, 0., 0.}
 ,\q\= 2.758649493061360×10^3079

n= 18,q= {-6.457856599771514×10^6158, 4.026217317476089×10^6158, 0., 0.}
 ,\q\= 7.610147025567696×10^6158

n= 19,q= {2.549348597566814×10^12 317, -5.200146815155465×10^12 317, 0., 0.}
 ,\q\= 5.791433775075686×10^12 317

n= 20,q= {-2.054234862725564×10^24 635, -2.651397398071624×10^24 635, 0., 0.}
 ,\q\= 3.354070517108741×10^24 635
```

In[ ]:=
```
P = {-1.7, -0.4, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[ ]= {-1.7, -0.4, 0, 0}

```
n= 1,q= {-1.7, -0.4, 0, 0},\q\= 1.74642

n= 2,q= {1.03, 0.96, 0., 0.},\q\= 1.40801

n= 3,q= {-1.5607, 1.5776, 0., 0.},\q\= 2.21915

n= 4,q= {-1.75304, -5.32432, 0., 0.},\q\= 5.60549

n= 5,q= {-26.9753, 18.2675, 0., 0.},\q\= 32.5786

n= 6,q= {392.264, -985.939, 0., 0.},\q\= 1061.11

n= 7,q= {-818 206., -773 497., 0., 0.},\q\= 1.12595×10^6

n= 8,q= {7.11642×10^10, 1.26576×10^12, 0., 0.},\q\= 1.26776×10^12

n= 9,q= {-1.59708×10^24, 1.80154×10^23, 0., 0.},\q\= 1.60721×10^24

n= 10,q= {2.51822×10^48, -5.75441×10^47, 0., 0.},\q\= 2.58313×10^48

n= 11,q= {6.01031×10^96, -2.89817×10^96, 0., 0.},\q\= 6.67257×10^96

n= 12,q= {2.77244×10^193, -3.48378×10^193, 0., 0.},\q\= 4.45232×10^193

n= 13,q= {-4.450324293558656×10^386, -1.931712070691921×10^387, 0., 0.}
 ,\q\= 1.982313140559597×10^387

n= 14,q= {-3.533457660878485×10^774, 1.719349031272150×10^774, 0., 0.}
 ,\q\= 3.929565387235252×10^774

n= 15,q= {9.52916194988437×10^1548, -1.215049401254516×10^1549, 0., 0.}
 ,\q\= 1.544148413255733×10^1549

n= 16,q= {-5.682957728177167×10^3097, -2.315680504332865×10^3098, 0., 0.}
 ,\q\= 2.384394322160199×10^3098

n= 17,q= {-5.039416112744825×10^6196, 2.631982883617531×10^6196, 0., 0.}
 ,\q\= 5.685336283549797×10^6196

n= 18,q= {1.846838085773651×10^12 393, -2.652731390434154×10^12 393, 0., 0.}
 ,\q\= 3.232304865704782×10^12 393

n= 19,q= {-3.626172914730638×10^24 786, -9.79833072636218×10^24 786, 0., 0.}
 ,\q\= 1.044779474485881×10^24 787

n= 20,q= {-8.285815501564710×10^49 573, 7.106088297901502×10^49 573, 0., 0.}
 ,\q\= 1.091564150306993×10^49 574
```

In[•]:=

```
P = {-1.7, -0.5, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-1.7, -0.5, 0, 0}

```
n= 1,q= {-1.7, -0.5, 0, 0},\q\= 1.772
n= 2,q= {0.94, 1.2, 0., 0.},\q\= 1.52434
n= 3,q= {-2.2564, 1.756, 0., 0.},\q\= 2.85917
n= 4,q= {0.307805, -8.42448, 0., 0.},\q\= 8.4301
n= 5,q= {-72.5771, -5.68619, 0., 0.},\q\= 72.7995
n= 6,q= {5233.4, 824.874, 0., 0.},\q\= 5298.01
n= 7,q= {2.6708×10^7, 8.63379×10^6, 0., 0.},\q\= 2.80689×10^7
n= 8,q= {6.38777×10^14, 4.61183×10^14, 0., 0.},\q\= 7.87861×10^14
n= 9,q= {1.95346×10^29, 5.89186×10^29, 0., 0.},\q\= 6.20725×10^29
n= 10,q= {-3.0898×10^59, 2.3019×10^59, 0., 0.},\q\= 3.853×10^59
n= 11,q= {4.24812×10^118, -1.42248×10^119, 0., 0.},\q\= 1.48456×10^119
n= 12,q= {-1.84299×10^238, -1.20857×10^238, 0., 0.},\q\= 2.20392×10^238
n= 13,q= {1.935962613380683×10^476, 4.454785477860046×10^476, 0., 0.}
 ,\q\= 4.857269283677870×10^476
n= 14,q= {-1.609716241334500×10^953, 1.724859627153650×10^953, 0., 0.}
 ,\q\= 2.359306489416053×10^953
n= 15,q= {-3.839543557685598×10^1905, -5.553069111702801×10^1906, 0., 0.}
 ,\q\= 5.566327111000699×10^1906
n= 16,q= {-3.068915561203409×10^3813, 4.264250146644275×10^3812, 0., 0.}
 ,\q\= 3.098399750666139×10^3813
n= 17,q= {9.23640442866488×10^7626, -2.617324726380107×10^7626, 0., 0.}
 ,\q\= 9.60008101492799×10^7626
n= 18,q= {7.846077804653943×10^15253, -4.834933938798261×10^15253, 0., 0.}
 ,\q\= 9.21615554931808×10^15253
n= 19,q= {3.818435072413998×10^30507, -7.587053572834620×10^30507, 0., 0.}
 ,\q\= 8.493752310922651×10^30507
n= 20,q= {-4.298293551482128×10^61015, -5.794134291759129×10^61015, 0., 0.}
 ,\q\= 7.214382831930387×10^61015
```

In[•]:=
```
P = {-1.7, -0.7, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-1.7, -0.7, 0, 0}

```
n= 1,q= {-1.7, -0.7, 0, 0},\q\= 1.83848

n= 2,q= {0.7, 1.68, 0., 0.},\q\= 1.82

n= 3,q= {-4.0324, 1.652, 0., 0.},\q\= 4.35768

n= 4,q= {11.8311, -14.023, 0., 0.},\q\= 18.3473

n= 5,q= {-58.3699, -332.517, 0., 0.},\q\= 337.602

n= 6,q= {-107 163., 38 817.3, 0., 0.},\q\= 113 976.

n= 7,q= {9.97702×10^9, -8.31953×10^9, 0., 0.},\q\= 1.29906×10^10

n= 8,q= {3.03265×10^19, -1.66008×10^20, 0., 0.},\q\= 1.68756×10^20

n= 9,q= {-2.6639×10^40, -1.00689×10^40, 0., 0.},\q\= 2.84784×10^40

n= 10,q= {6.08256×10^80, 5.36451×10^80, 0., 0.},\q\= 8.11021×10^80

n= 11,q= {8.21959×10^160, 6.52599×10^161, 0., 0.},\q\= 6.57755×10^161

n= 12,q= {-4.191290585161919×10^323, 1.072818517595919×10^323, 0., 0.}
 ,\q\= 4.326413796779458×10^323

n= 13,q= {1.641597719757023×10^647, -8.992988304774280×10^646, 0., 0.}
 ,\q\= 1.871785634096364×10^647

n= 14,q= {1.886104687013389×10^1294, -2.952573818983807×10^1294, 0., 0.}
 ,\q\= 3.503581460009528×10^1294

n= 15,q= {-5.160301266174752×10^2588, -1.113772663747676×10^2589, 0., 0.}
 ,\q\= 1.227508304692250×10^2589

n= 16,q= {-9.74202454934747×10^5177, 1.149480497393592×10^5178, 0., 0.}
 ,\q\= 1.506776638088441×10^5178

n= 17,q= {-3.722349906873325×10^10 355, -2.239653444920901×10^10 356, 0., 0.}
 ,\q\= 2.270375837089106×10^10 356

n= 18,q= {-4.877488665054063×10^20 712, 1.667354758425968×10^20 712, 0., 0.}
 ,\q\= 5.154606441638060×10^20 712

n= 19,q= {2.100982378728515×10^41 425, -1.626500786969322×10^41 425, 0., 0.}
 ,\q\= 2.656996756817658×10^41 425

n= 20,q= {1.768622145715902×10^82 850, -6.834498984821216×10^82 850, 0., 0.}
 ,\q\= 7.059631765739552×10^82 850
```

In[•]:=

```
P = {-1.7, -1.2, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-1.7, -1.2, 0, 0}

```
n= 1,q= {-1.7, -1.2, 0, 0},\q\= 2.08087

n= 2,q= {-0.25, 2.88, 0., 0.},\q\= 2.89083

n= 3,q= {-9.9319, -2.64, 0., 0.},\q\= 10.2768

n= 4,q= {89.973, 51.2404, 0., 0.},\q\= 103.541

n= 5,q= {5467.87, 9219.31, 0., 0.},\q\= 10718.8

n= 6,q= {-5.50982×10^7, 1.0082×10^8, 0., 0.},\q\= 1.14893×10^8

n= 7,q= {-7.12885×10^15, -1.111×10^16, 0., 0.},\q\= 1.32005×10^16

n= 8,q= {-7.26115×10^31, 1.58403×10^32, 0., 0.},\q\= 1.74253×10^32

n= 9,q= {-1.98191×10^64, -2.30038×10^64, 0., 0.},\q\= 3.03639×10^64

n= 10,q= {-1.36378×10^128, 9.11827×10^128, 0., 0.},\q\= 9.21969×10^128

n= 11,q= {-8.12829×10^257, -2.48706×10^257, 0., 0.},\q\= 8.50027×10^257

n= 12,q= {5.988355632813150×10^515, 4.043111978051559×10^515, 0., 0.}
 ,\q\= 7.225452072507918×10^515

n= 13,q= {1.951364871798100×10^1031, 4.842318477571874×10^1031, 0., 0.}
 ,\q\= 5.220715765210897×10^1031

n= 14,q= {-1.964022337534638×10^2063, 1.889826035038522×10^2063, 0., 0.}
 ,\q\= 2.725587310112161×10^2063

n= 15,q= {2.859412996256020×10^4125, -7.423321093740348×10^4126, 0., 0.}
 ,\q\= 7.428826185044443×10^4126

n= 16,q= {-5.502393363393881×10^8253, -4.245268162164521×10^8252, 0., 0.}
 ,\q\= 5.518745848760197×10^8253

n= 17,q= {3.009610970783415×10^16507, 4.671827072264280×10^16506, 0., 0.}
 ,\q\= 3.045655574320791×10^16507

n= 18,q= {8.839498513528476×10^33014, 2.812076402057908×10^33014, 0., 0.}
 ,\q\= 9.27601787739130×10^33014

n= 19,q= {7.022896027966118×10^66029, 4.971469035183876×10^66029, 0., 0.}
 ,\q\= 8.604450766168308×10^66029

n= 20,q= {2.460556425183018×10^132059, 6.982822028069879×10^132059, 0., 0.}
 ,\q\= 7.403657298741438×10^132059
```

In[•]:=
```
P = {-1.7, -1.4, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-1.7, -1.4, 0, 0}

```
n= 1,q= {-1.7, -1.4, 0, 0},\q\= 2.20227

n= 2,q= {-0.77, 3.36, 0., 0.},\q\= 3.4471

n= 3,q= {-12.3967, -6.5744, 0., 0.},\q\= 14.0321

n= 4,q= {108.755, 161.602, 0., 0.},\q\= 194.789

n= 5,q= {-14289.1, 35148.7, 0., 0.},\q\= 37942.2

n= 6,q= {-1.03126×10^9, -1.00449×10^9, 0., 0.},\q\= 1.43961×10^9

n= 7,q= {5.4497×10^16, 2.07176×10^18, 0., 0.},\q\= 2.07248×10^18

n= 8,q= {-4.28923×10^36, 2.2581×10^35, 0., 0.},\q\= 4.29517×10^36

n= 9,q= {1.83465×10^73, -1.9371×10^72, 0., 0.},\q\= 1.84485×10^73

n= 10,q= {3.32843×10^146, -7.10782×10^145, 0., 0.},\q\= 3.40348×10^146

n= 11,q= {1.05732×10^293, -4.73157×10^292, 0., 0.},\q\= 1.15837×10^293

n= 12,q= {8.940544236564429×10^585, -1.000560736774964×10^586, 0., 0.}
 ,\q\= 1.341810381699036×10^586

n= 13,q= {-2.017884755160050×10^1171, -1.789111505701213×10^1172, 0., 0.}
 ,\q\= 1.800455100435313×10^1172

n= 14,q= {-3.160201390981388×10^2344, 7.220441665271841×10^2343, 0., 0.}
 ,\q\= 3.241638568683535×10^2344

n= 15,q= {9.46552505314476×10^4688, -4.563609958818408×10^4688, 0., 0.}
 ,\q\= 1.050822060997663×10^4689

n= 16,q= {6.876962867548461×10^9377, -8.639392879595317×10^9377, 0., 0.}
 ,\q\= 1.104227003879377×10^9378

n= 17,q= {-2.734649104636191×10^18755, -1.188255680622791×10^18756, 0., 0.}
 ,\q\= 1.219317276096426×10^18756

n= 18,q= {-1.337168505277458×10^37512, 6.498924666187968×10^37511, 0., 0.}
 ,\q\= 1.486734619787208×10^37512

n= 19,q= {1.365659393338087×10^75024, -1.738031476359474×10^75024, 0., 0.}
 ,\q\= 2.210379829673815×10^75024

n= 20,q= {-1.155727834203739×10^150048, -4.747118023215157×10^150048, 0., 0.}
 ,\q\= 4.885778991428844×10^150048
```

In[•]:=

```
P = {-1.5, 1.4, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-1.5, 1.4, 0, 0}

```
n= 1,q= {-1.5, 1.4, 0, 0},\q\= 2.05183

n= 2,q= {-1.21, -2.8, 0., 0.},\q\= 3.05026

n= 3,q= {-7.8759, 8.176, 0., 0.},\q\= 11.3524

n= 4,q= {-6.31718, -127.387, 0., 0.},\q\= 127.543

n= 5,q= {-16189., 1610.85, 0., 0.},\q\= 16268.9

n= 6,q= {2.59488×10^8, -5.21559×10^7, 0., 0.},\q\= 2.64678×10^8

n= 7,q= {6.46137×10^16, -2.70677×10^16, 0., 0.},\q\= 7.00542×10^16

n= 8,q= {3.44227×10^33, -3.49789×10^33, 0., 0.},\q\= 4.90759×10^33

n= 9,q= {-3.85959×10^65, -2.40814×10^67, 0., 0.},\q\= 2.40845×10^67

n= 10,q= {-5.79763×10^134, 1.85888×10^133, 0., 0.},\q\= 5.80061×10^134

n= 11,q= {3.3578×10^269, -2.15542×10^268, 0., 0.},\q\= 3.36471×10^269

n= 12,q= {1.122833072883896×10^539, -1.447494313562347×10^538, 0., 0.}
 ,\q\= 1.132124775561354×10^539

n= 13,q= {1.239801711683940×10^1078, -3.250588976158354×10^1077, 0., 0.}
 ,\q\= 1.281706507439847×10^1078

n= 14,q= {1.431444997375206×10^2156, -8.060171553244148×10^2155, 0., 0.}
 ,\q\= 1.642771571213650×10^2156

n= 15,q= {1.399371125833242×10^4312, -2.307538449575456×10^4312, 0., 0.}
 ,\q\= 2.698698435187765×10^4312

n= 16,q= {-3.366494148453304×10^8624, -6.458205356171798×10^8624, 0., 0.}
 ,\q\= 7.282973244084894×10^8624

n= 17,q= {-3.037513357091577×10^17249, 4.348302108212429×10^17249, 0., 0.}
 ,\q\= 5.304169927405644×10^17249

n= 18,q= {-9.68124382977492×10^34498, -2.641605146872943×10^34499, 0., 0.}
 ,\q\= 2.813421861879440×10^34499

n= 19,q= {-6.040812931070075×10^68998, 5.114804705773068×10^68998, 0., 0.}
 ,\q\= 7.915342572901173×10^68998

n= 20,q= {1.033019368998511×10^137997, -6.179515681306405×10^137997, 0., 0.}
 ,\q\= 6.265264804638176×10^137997
```

In[•]:=
```
P = {-1.5, 1.2, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-1.5, 1.2, 0, 0}

```
n= 1,q= {-1.5, 1.2, 0, 0},\q\= 1.92094

n= 2,q= {-0.69, -2.4, 0., 0.},\q\= 2.49722

n= 3,q= {-6.7839, 4.512, 0., 0.},\q\= 8.14736

n= 4,q= {24.1632, -60.0179, 0., 0.},\q\= 64.6994

n= 5,q= {-3019.79, -2899.24, 0., 0.},\q\= 4186.26

n= 6,q= {713524., 1.75102×10^7, 0., 0.},\q\= 1.75248×10^7

n= 7,q= {-3.06099×10^14, 2.49879×10^13, 0., 0.},\q\= 3.07117×10^14

n= 8,q= {9.30722×10^28, -1.52976×10^28, 0., 0.},\q\= 9.4321×10^28

n= 9,q= {8.42842×10^57, -2.84756×10^57, 0., 0.},\q\= 8.89646×10^57

n= 10,q= {6.29298×10^115, -4.80008×10^115, 0., 0.},\q\= 7.91469×10^115

n= 11,q= {1.65607×10^231, -6.04136×10^231, 0., 0.},\q\= 6.26423×10^231

n= 12,q= {-3.375546788832662×10^463, -2.000987394327528×10^463, 0., 0.}
 ,\q\= 3.924062521909681×10^463

n= 13,q= {7.390365571340825×10^926, 1.350885314683385×10^927, 0., 0.}
 ,\q\= 1.539826667585617×10^927

n= 14,q= {-1.278716100646629×10^1854, 1.996707264093201×10^1854, 0., 0.}
 ,\q\= 2.371066166207825×10^1854

n= 15,q= {-2.351725032429633×10^3708, -5.106443453748114×10^3708, 0., 0.}
 ,\q\= 5.621954764535475×10^3708

n= 16,q= {-2.054515411817080×10^7417, 2.401790179373174×10^7417, 0., 0.}
 ,\q\= 3.160637537448312×10^7417

n= 17,q= {-1.547562488339518×10^14834, -9.86902987894619×10^14834, 0., 0.}
 ,\q\= 9.98962964312733×10^14834

n= 18,q= {-9.50028010962171×10^29669, 3.054588087391804×10^29669, 0., 0.}
 ,\q\= 9.97927004068483×10^29669

n= 19,q= {8.092481377763799×10^59339, -5.803888489947155×10^59339, 0., 0.}
 ,\q\= 9.95858305449098×10^59339

n= 20,q= {3.180313324571281×10^118679, -9.39357190470300×10^118679, 0., 0.}
 ,\q\= 9.91733764531949×10^118679
```

In[•]:=

```
P = {-1.5, 0.7, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-1.5, 0.7, 0, 0}

n= 1,q= {-1.5, 0.7, 0, 0},\q\= 1.65529

n= 2,q= {0.26, -1.4, 0., 0.},\q\= 1.42394

n= 3,q= {-3.3924, -0.028, 0., 0.},\q\= 3.39252

n= 4,q= {10.0076, 0.889974, 0., 0.},\q\= 10.0471

n= 5,q= {97.8599, 18.513, 0., 0.},\q\= 99.5956

n= 6,q= {9232.32, 3624.06, 0., 0.},\q\= 9918.15

n= 7,q= $\{7.2102\times10^{7}, 6.6917\times10^{7}, 0., 0.\}$,\q\= 9.83696×10^{7}

n= 8,q= $\{7.20812\times10^{14}, 9.6497\times10^{15}, 0., 0.\}$,\q\= 9.67658×10^{15}

n= 9,q= $\{-9.25971\times10^{31}, 1.39112\times10^{31}, 0., 0.\}$,\q\= 9.36363×10^{31}

n= 10,q= $\{8.38071\times10^{63}, -2.57628\times10^{63}, 0., 0.\}$,\q\= 8.76775×10^{63}

n= 11,q= $\{6.3599\times10^{127}, -4.31821\times10^{127}, 0., 0.\}$,\q\= 7.68735×10^{127}

n= 12,q= $\{2.18014\times10^{255}, -5.49268\times10^{255}, 0., 0.\}$,\q\= 5.90954×10^{255}

n= 13,q= $\{-2.541655728910854\times10^{511}, -2.394967644262645\times10^{511}, 0., 0.\}$
,\q\= $3.492260566076123\times10^{511}$

n= 14,q= $\{7.241438272404024\times10^{1021}, 1.217436646719256\times10^{1023}, 0., 0.\}$
,\q\= $1.219588386137033\times10^{1023}$

n= 15,q= $\{-1.476908145949724\times10^{2046}, 1.763198465556008\times10^{2045}, 0., 0.\}$
,\q\= $1.487395831600332\times10^{2046}$

n= 16,q= $\{2.150168983283261\times10^{4092}, -5.208164353411445\times10^{4091}, 0., 0.\}$
,\q\= $2.212346359862042\times10^{4092}$

n= 17,q= $\{4.351976897351914\times10^{8184}, -2.239686690509361\times10^{8184}, 0., 0.\}$
,\q\= $4.894476415994827\times10^{8184}$

n= 18,q= $\{1.392350644344002\times10^{16\,369}, -1.949412946880661\times10^{16\,369}, 0., 0.\}$
,\q\= $2.395589938672957\times10^{16\,369}$

n= 19,q= $\{-1.861570520660788\times10^{32\,738}, -5.428532745363655\times10^{32\,738}, 0., 0.\}$
,\q\= $5.738851154271100\times10^{32\,738}$

n= 20,q= $\{-2.600352296409219\times10^{65\,477}, 2.021119305842151\times10^{65\,477}, 0., 0.\}$
,\q\= $3.293441257087874\times10^{65\,477}$

In[•]:=
```
P = {-1.5, 0.5, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-1.5, 0.5, 0, 0}

```
n= 1,q= {-1.5, 0.5, 0, 0},\q\= 1.58114
n= 2,q= {0.5, -1., 0., 0.},\q\= 1.11803
n= 3,q= {-2.25, -0.5, 0., 0.},\q\= 2.30489
n= 4,q= {3.3125, 2.75, 0., 0.},\q\= 4.30525
n= 5,q= {1.91016, 18.7188, 0., 0.},\q\= 18.816
n= 6,q= {-348.243, 72.0115, 0., 0.},\q\= 355.61
n= 7,q= {116086., -50154.5, 0., 0.},\q\= 126457.
n= 8,q= {1.09605×10^10, -1.16445×10^10, 0., 0.},\q\= 1.59914×10^10
n= 9,q= {-1.54613×10^19, -2.55258×10^20, 0., 0.},\q\= 2.55726×10^20
n= 10,q= {-6.49175×10^40, 7.89324×10^39, 0., 0.},\q\= 6.53956×10^40
n= 11,q= {4.15198×10^81, -1.02482×10^81, 0., 0.},\q\= 4.27658×10^81
n= 12,q= {1.61887×10^163, -8.51004×10^162, 0., 0.},\q\= 1.82892×10^163
n= 13,q= {1.896516045749107×10^326, -2.755323121004310×10^326, 0., 0.}
 ,\q\= 3.344933274809045×10^326
n= 14,q= {-3.995032389357101×10^652, -1.045102902041637×10^653, 0., 0.}
 ,\q\= 1.118857861292476×10^653
n= 15,q= {-9.32637237935728×10^1305, 8.350439887734880×10^1305, 0., 0.}
 ,\q\= 1.251842913775974×10^1306
n= 16,q= {1.725137543976461×10^2611, -1.557586238489077×10^2612, 0., 0.}
 ,\q\= 1.567110680771121×10^2612
n= 17,q= {-2.396313894874182×10^5224, -5.374100995997164×10^5223, 0., 0.}
 ,\q\= 2.455835885786925×10^5224
n= 18,q= {5.453510667615295×10^10448, 2.575606577833037×10^10448, 0., 0.}
 ,\q\= 6.031129897918849×10^10448
n= 19,q= {2.310702935801701×10^20897, 2.809219589558518×10^20897, 0., 0.}
 ,\q\= 3.637452784557063×10^20897
n= 20,q= {-2.552366644836728×10^41794, 1.298254390580904×10^41795, 0., 0.}
 ,\q\= 1.323106275988193×10^41795
```

In[•]:=
```
P = {-1.5, 0.4, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-1.5, 0.4, 0, 0}

```
n= 1,q= {-1.5, 0.4, 0, 0},\q\= 1.55242

n= 2,q= {0.59, -0.8, 0., 0.},\q\= 0.994032

n= 3,q= {-1.7919, -0.544, 0., 0.},\q\= 1.87266

n= 4,q= {1.41497, 2.34959, 0., 0.},\q\= 2.74275

n= 5,q= {-5.01842, 7.04919, 0., 0.},\q\= 8.65307

n= 6,q= {-26.0065, -70.3516, 0., 0.},\q\= 75.0046

n= 7,q= {-4274.51, 3659.6, 0., 0.},\q\= 5627.09

n= 8,q= {4.87875×10^6, -3.1286×10^7, 0., 0.},\q\= 3.16641×10^7

n= 9,q= {-9.5501×10^14, -3.05273×10^14, 0., 0.},\q\= 1.00261×10^15

n= 10,q= {8.18853×10^29, 5.83077×10^29, 0., 0.},\q\= 1.00524×10^30

n= 11,q= {3.30541×10^59, 9.54909×10^59, 0., 0.},\q\= 1.0105×10^60

n= 12,q= {-8.02595×10^119, 6.31274×10^119, 0., 0.},\q\= 1.02111×10^120

n= 13,q= {2.45652×10^239, -1.01331×10^240, 0., 0.},\q\= 1.04266×10^240

n= 14,q= {-9.66459426368118×10^479, -4.978441367050818×10^479, 0., 0.}
 ,\q\= 1.087148843198308×10^480

n= 15,q= {6.861950383641632×10^959, 9.62292317561448×10^959, 0., 0.}
 ,\q\= 1.181892607267420×10^960

n= 16,q= {-4.551428737621881×10^1919, 1.320640427533235×10^1920, 0., 0.}
 ,\q\= 1.396870135113379×10^1920

n= 17,q= {-1.536936103298664×10^3840, -1.202160158788003×10^3840, 0., 0.}
 ,\q\= 1.951246174371670×10^3840

n= 18,q= {9.16983538245684×10^7679, 3.695286699977072×10^7680, 0., 0.}
 ,\q\= 3.807361633000077×10^7680

n= 19,q= {-1.281428498561386×10^15361, 6.777034145954383×10^15360, 0., 0.}
 ,\q\= 1.449600260444101×10^15361

n= 20,q= {1.182777078770973×10^30722, -1.736856938069914×10^30722, 0., 0.}
 ,\q\= 2.101340915079606×10^30722
```

In[ ]:=
```
P = {-1.5, 0.2, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[ ]= {-1.5, 0.2, 0, 0}

```
n= 1,q= {-1.5, 0.2, 0, 0},\q\= 1.51327
n= 2,q= {0.71, -0.4, 0., 0.},\q\= 0.814923
n= 3,q= {-1.1559, -0.368, 0., 0.},\q\= 1.21307
n= 4,q= {-0.299319, 1.05074, 0., 0.},\q\= 1.09254
n= 5,q= {-2.51447, -0.429015, 0., 0.},\q\= 2.5508
n= 6,q= {4.63849, 2.35749, 0., 0.},\q\= 5.20321
n= 7,q= {14.4579, 22.0704, 0., 0.},\q\= 26.3843
n= 8,q= {-279.571, 638.382, 0., 0.},\q\= 696.916
n= 9,q= {-329 373., -356 946., 0., 0.},\q\= 485 692.
n= 10,q= {-1.89245×10^10, 2.35137×10^11, 0., 0.},\q\= 2.35897×10^11
n= 11,q= {-5.49311×10^22, -8.89967×10^21, 0., 0.},\q\= 5.56474×10^22
n= 12,q= {2.93822×10^45, 9.77738×10^44, 0., 0.},\q\= 3.09663×10^45
n= 13,q= {7.67719×10^90, 5.74562×10^90, 0., 0.},\q\= 9.58913×10^90
n= 14,q= {2.5927×10^181, 8.82205×10^181, 0., 0.},\q\= 9.19514×10^181
n= 15,q= {-7.110641858204215×10^363, 4.574587149368102×10^363, 0., 0.}
 ,\q\= 8.455062106383943×10^363
n= 16,q= {2.963438004848211×10^727, -6.505650173659985×10^727, 0., 0.}
 ,\q\= 7.148807522280967×10^727
n= 17,q= {-3.354151937346345×10^1455, -3.855818194174273×10^1455, 0., 0.}
 ,\q\= 5.110544899062094×10^1455
n= 18,q= {-3.616998727721109×10^2910, 2.586600013208984×10^2911, 0., 0.}
 ,\q\= 2.611766916532959×10^2911
n= 19,q= {-6.559672830369358×10^5822, -1.871145791380060×10^5822, 0., 0.}
 ,\q\= 6.821326426296080×10^5822
n= 20,q= {3.952812106888663×10^11 645, 2.454820841875150×10^11 645, 0., 0.}
 ,\q\= 4.653049421408525×10^11 645
```

In[•]:=

```
P = {-1.5, -0.4, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-1.5, -0.4, 0, 0}

```
n= 1,q= {-1.5, -0.4, 0, 0},\q\= 1.55242

n= 2,q= {0.59, 0.8, 0., 0.},\q\= 0.994032

n= 3,q= {-1.7919, 0.544, 0., 0.},\q\= 1.87266

n= 4,q= {1.41497, -2.34959, 0., 0.},\q\= 2.74275

n= 5,q= {-5.01842, -7.04919, 0., 0.},\q\= 8.65307

n= 6,q= {-26.0065, 70.3516, 0., 0.},\q\= 75.0046

n= 7,q= {-4274.51, -3659.6, 0., 0.},\q\= 5627.09

n= 8,q= {4.87875×10^6, 3.1286×10^7, 0., 0.},\q\= 3.16641×10^7

n= 9,q= {-9.5501×10^14, 3.05273×10^14, 0., 0.},\q\= 1.00261×10^15

n= 10,q= {8.18853×10^29, -5.83077×10^29, 0., 0.},\q\= 1.00524×10^30

n= 11,q= {3.30541×10^59, -9.54909×10^59, 0., 0.},\q\= 1.0105×10^60

n= 12,q= {-8.02595×10^119, -6.31274×10^119, 0., 0.},\q\= 1.02111×10^120

n= 13,q= {2.45652×10^239, 1.01331×10^240, 0., 0.},\q\= 1.04266×10^240

n= 14,q= {-9.66459426368118×10^479, 4.978441367050818×10^479, 0., 0.}
 ,\q\= 1.087148843198308×10^480

n= 15,q= {6.861950383641632×10^959, -9.62292317561448×10^959, 0., 0.}
 ,\q\= 1.181892607267420×10^960

n= 16,q= {-4.551428737621881×10^1919, -1.320640427533235×10^1920, 0., 0.}
 ,\q\= 1.396870135113379×10^1920

n= 17,q= {-1.536936103298664×10^3840, 1.202160158788003×10^3840, 0., 0.}
 ,\q\= 1.951246174371670×10^3840

n= 18,q= {9.16983538245684×10^7679, -3.695286699977072×10^7680, 0., 0.}
 ,\q\= 3.807361633000077×10^7680

n= 19,q= {-1.281428498561386×10^15361, -6.777034145954383×10^15360, 0., 0.}
 ,\q\= 1.449600260444101×10^15361

n= 20,q= {1.182777078770973×10^30722, 1.736856938069914×10^30722, 0., 0.}
 ,\q\= 2.101340915079606×10^30722
```

In[ ]:=
```
P = {-1.5, -0.7, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[ ]=
```
{-1.5, -0.7, 0, 0}
```

```
n= 1,q= {-1.5, -0.7, 0, 0},\q\= 1.65529

n= 2,q= {0.26, 1.4, 0., 0.},\q\= 1.42394

n= 3,q= {-3.3924, 0.028, 0., 0.},\q\= 3.39252

n= 4,q= {10.0076, -0.889974, 0., 0.},\q\= 10.0471

n= 5,q= {97.8599, -18.513, 0., 0.},\q\= 99.5956

n= 6,q= {9232.32, -3624.06, 0., 0.},\q\= 9918.15

n= 7,q= {7.2102×10^7, -6.6917×10^7, 0., 0.},\q\= 9.83696×10^7

n= 8,q= {7.20812×10^14, -9.6497×10^15, 0., 0.},\q\= 9.67658×10^15

n= 9,q= {-9.25971×10^31, -1.39112×10^31, 0., 0.},\q\= 9.36363×10^31

n= 10,q= {8.38071×10^63, 2.57628×10^63, 0., 0.},\q\= 8.76775×10^63

n= 11,q= {6.3599×10^127, 4.31821×10^127, 0., 0.},\q\= 7.68735×10^127

n= 12,q= {2.18014×10^255, 5.49268×10^255, 0., 0.},\q\= 5.90954×10^255

n= 13,q= {-2.541655728910854×10^511, 2.394967644262645×10^511, 0., 0.}
 ,\q\= 3.492260566076123×10^511

n= 14,q= {7.241438272404024×10^1021, -1.217436646719256×10^1023, 0., 0.}
 ,\q\= 1.219588386137033×10^1023

n= 15,q= {-1.476908145949724×10^2046, -1.763198465556008×10^2045, 0., 0.}
 ,\q\= 1.487395831600332×10^2046

n= 16,q= {2.150168983283261×10^4092, 5.208164353411445×10^4091, 0., 0.}
 ,\q\= 2.212346359862042×10^4092

n= 17,q= {4.351976897351914×10^8184, 2.239686690509361×10^8184, 0., 0.}
 ,\q\= 4.894476415994827×10^8184

n= 18,q= {1.392350644344002×10^16369, 1.949412946880661×10^16369, 0., 0.}
 ,\q\= 2.395589938672957×10^16369

n= 19,q= {-1.861570520660788×10^32738, 5.428532745363655×10^32738, 0., 0.}
 ,\q\= 5.738851154271100×10^32738

n= 20,q= {-2.600352296409219×10^65477, -2.021119305842151×10^65477, 0., 0.}
 ,\q\= 3.293441257087874×10^65477
```

In[•]:=
```
P = {-1.5, -1.2, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-1.5, -1.2, 0, 0}

```
n= 1,q= {-1.5, -1.2, 0, 0},\q\= 1.92094

n= 2,q= {-0.69, 2.4, 0., 0.},\q\= 2.49722

n= 3,q= {-6.7839, -4.512, 0., 0.},\q\= 8.14736

n= 4,q= {24.1632, 60.0179, 0., 0.},\q\= 64.6994

n= 5,q= {-3019.79, 2899.24, 0., 0.},\q\= 4186.26

n= 6,q= {713524., -1.75102×10^7, 0., 0.},\q\= 1.75248×10^7

n= 7,q= {-3.06099×10^14, -2.49879×10^13, 0., 0.},\q\= 3.07117×10^14

n= 8,q= {9.30722×10^28, 1.52976×10^28, 0., 0.},\q\= 9.4321×10^28

n= 9,q= {8.42842×10^57, 2.84756×10^57, 0., 0.},\q\= 8.89646×10^57

n= 10,q= {6.29298×10^115, 4.80008×10^115, 0., 0.},\q\= 7.91469×10^115

n= 11,q= {1.65607×10^231, 6.04136×10^231, 0., 0.},\q\= 6.26423×10^231

n= 12,q= {-3.375546788832662×10^463, 2.000987394327528×10^463, 0., 0.}
 ,\q\= 3.924062521909681×10^463

n= 13,q= {7.390365571340825×10^926, -1.350885314683385×10^927, 0., 0.}
 ,\q\= 1.539826667585617×10^927

n= 14,q= {-1.278716100646629×10^1854, -1.996707264093201×10^1854, 0., 0.}
 ,\q\= 2.371066166207825×10^1854

n= 15,q= {-2.351725032429633×10^3708, 5.106443453748114×10^3708, 0., 0.}
 ,\q\= 5.621954764535475×10^3708

n= 16,q= {-2.054515411817080×10^7417, -2.401790179373174×10^7417, 0., 0.}
 ,\q\= 3.160637537448312×10^7417

n= 17,q= {-1.547562488339518×10^14834, 9.86902987894619×10^14834, 0., 0.}
 ,\q\= 9.98962964312733×10^14834

n= 18,q= {-9.50028010962171×10^29669, -3.054588087391804×10^29669, 0., 0.}
 ,\q\= 9.97927004068483×10^29669

n= 19,q= {8.092481377763799×10^59339, 5.803888489947155×10^59339, 0., 0.}
 ,\q\= 9.95858305449098×10^59339

n= 20,q= {3.180313324571281×10^118679, 9.39357190470300×10^118679, 0., 0.}
 ,\q\= 9.91733764531949×10^118679
```

In[•]:=

```
P = {-1.5, -1.4, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-1.5, -1.4, 0, 0}

```
n= 1,q= {-1.5, -1.4, 0, 0},\q\= 2.05183

n= 2,q= {-1.21, 2.8, 0., 0.},\q\= 3.05026

n= 3,q= {-7.8759, -8.176, 0., 0.},\q\= 11.3524

n= 4,q= {-6.31718, 127.387, 0., 0.},\q\= 127.543

n= 5,q= {-16 189., -1610.85, 0., 0.},\q\= 16 268.9

n= 6,q= {2.59488×10^8, 5.21559×10^7, 0., 0.},\q\= 2.64678×10^8

n= 7,q= {6.46137×10^16, 2.70677×10^16, 0., 0.},\q\= 7.00542×10^16

n= 8,q= {3.44227×10^33, 3.49789×10^33, 0., 0.},\q\= 4.90759×10^33

n= 9,q= {-3.85959×10^65, 2.40814×10^67, 0., 0.},\q\= 2.40845×10^67

n= 10,q= {-5.79763×10^134, -1.85888×10^133, 0., 0.},\q\= 5.80061×10^134

n= 11,q= {3.3578×10^269, 2.15542×10^268, 0., 0.},\q\= 3.36471×10^269

n= 12,q= {1.122833072883896×10^539, 1.447494313562347×10^538, 0., 0.}
 ,\q\= 1.132124775561354×10^539

n= 13,q= {1.239801711683940×10^1078, 3.250588976158354×10^1077, 0., 0.}
 ,\q\= 1.281706507439847×10^1078

n= 14,q= {1.431444997375206×10^2156, 8.060171553244148×10^2155, 0., 0.}
 ,\q\= 1.642771571213650×10^2156

n= 15,q= {1.399371125833242×10^4312, 2.307538449575456×10^4312, 0., 0.}
 ,\q\= 2.698698435187765×10^4312

n= 16,q= {-3.366494148453304×10^8624, 6.458205356171798×10^8624, 0., 0.}
 ,\q\= 7.282973244084894×10^8624

n= 17,q= {-3.037513357091577×10^17 249, -4.348302108212429×10^17 249, 0., 0.}
 ,\q\= 5.304169927405644×10^17 249

n= 18,q= {-9.68124382977492×10^34 498, 2.641605146872943×10^34 499, 0., 0.}
 ,\q\= 2.813421861879440×10^34 499

n= 19,q= {-6.040812931070075×10^68 998, -5.114804705773068×10^68 998, 0., 0.}
 ,\q\= 7.915342572901173×10^68 998

n= 20,q= {1.033019368998511×10^137 997, 6.179515681306405×10^137 997, 0., 0.}
 ,\q\= 6.265264804638176×10^137 997
```

In[ ]:=
```
P = {-1.4, 1.4, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[ ]= {-1.4, 1.4, 0, 0}

```
n= 1,q= {-1.4, 1.4, 0, 0},\q\= 1.9799

n= 2,q= {-1.4, -2.52, 0., 0.},\q\= 2.88278

n= 3,q= {-5.7904, 8.456, 0., 0.},\q\= 10.2485

n= 4,q= {-39.3752, -96.5272, 0., 0.},\q\= 104.249

n= 5,q= {-7768.5, 7602.96, 0., 0.},\q\= 10869.9

n= 6,q= {2.54463×10^6, -1.18127×10^8, 0., 0.},\q\= 1.18155×10^8

n= 7,q= {-1.39476×10^16, -6.0118×10^14, 0., 0.},\q\= 1.39605×10^16

n= 8,q= {1.94173×10^32, 1.677×10^31, 0., 0.},\q\= 1.94896×10^32

n= 9,q= {3.7422×10^64, 6.51256×10^63, 0., 0.},\q\= 3.79844×10^64

n= 10,q= {1.35799×10^129, 4.87426×10^128, 0., 0.},\q\= 1.44282×10^129

n= 11,q= {1.60656×10^258, 1.32384×10^258, 0., 0.},\q\= 2.08172×10^258

n= 12,q= {8.284704992926566×10^515, 4.253649742555875×10^516, 0., 0.}
 ,\q\= 4.333578140583586×10^516

n= 13,q= {-1.740717276414744×10^1033, 7.048046652062692×10^1032, 0., 0.}
 ,\q\= 1.877989950054389×10^1033

n= 14,q= {2.533347020312244×10^2066, -2.453731314444525×10^2066, 0., 0.}
 ,\q\= 3.526846252505286×10^2066

n= 15,q= {3.970497618392657×10^4131, -1.243230582818976×10^4133, 0., 0.}
 ,\q\= 1.243864448881058×10^4133

n= 16,q= {-1.544045796922646×10^8266, -9.87248813639132×10^8264, 0., 0.}
 ,\q\= 1.547198767190178×10^8266

n= 17,q= {2.374330820794169×10^16532, 3.048714762432741×10^16531, 0., 0.}
 ,\q\= 2.393824025194807×10^16532

n= 18,q= {5.544500229546361×10^33064, 1.447731484850846×10^33064, 0., 0.}
 ,\q\= 5.730393463599868×10^33064

n= 19,q= {2.864555634321122×10^66129, 1.605389510015402×10^66129, 0., 0.}
 ,\q\= 3.283740924766809×10^66129

n= 20,q= {5.628403503253391×10^132258, 9.19745513238929×10^132258, 0., 0.}
 ,\q\= 1.078295446098838×10^132259
```

In[•]:=

```
P = {-1.4, 1.2, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-1.4, 1.2, 0, 0}

```
n= 1,q= {-1.4, 1.2, 0, 0},\q\= 1.84391

n= 2,q= {-0.88, -2.16, 0., 0.},\q\= 2.33238

n= 3,q= {-5.2912, 5.0016, 0., 0.},\q\= 7.28099

n= 4,q= {1.58079, -51.7289, 0., 0.},\q\= 51.7531

n= 5,q= {-2674.78, -162.346, 0., 0.},\q\= 2679.71

n= 6,q= {7.12811×10^6, 868480., 0., 0.},\q\= 7.18082×10^6

n= 7,q= {5.00557×10^13, 1.23812×10^13, 0., 0.},\q\= 5.15642×10^13

n= 8,q= {2.35228×10^27, 1.2395×10^27, 0., 0.},\q\= 2.65887×10^27

n= 9,q= {3.99683×10^54, 5.83131×10^54, 0., 0.},\q\= 7.06957×10^54

n= 10,q= {-1.80295×10^109, 4.66135×10^109, 0., 0.},\q\= 4.99788×10^109

n= 11,q= {-1.84776×10^219, -1.68083×10^219, 0., 0.},\q\= 2.49788×10^219

n= 12,q= {5.890204334801011×10^437, 6.211558628922021×10^438, 0., 0.}
 ,\q\= 6.239423504747270×10^438

n= 13,q= {-3.823651552947854×10^877, 7.317469912389422×10^876, 0., 0.}
 ,\q\= 3.893040567159271×10^877

n= 14,q= {1.408485753917329×10^1755, -5.595891038831402×10^1754, 0., 0.}
 ,\q\= 1.515576485754778×10^1755

n= 15,q= {1.670692153803330×10^3510, -1.576346561733534×10^3510, 0., 0.}
 ,\q\= 2.296972084172802×10^3510

n= 16,q= {3.063437900908750×10^7019, -5.267179664726144×10^7020, 0., 0.}
 ,\q\= 5.276080755469145×10^7020

n= 17,q= {-2.764933510277738×10^14041, -3.227135563163583×10^14040, 0., 0.}
 ,\q\= 2.783702813823186×10^14041

n= 18,q= {7.540713276826421×10^28082, 1.784563052160002×10^28082, 0., 0.}
 ,\q\= 7.749001355687124×10^28082

n= 19,q= {5.367769143617164×10^56165, 2.691375660151362×10^56165, 0., 0.}
 ,\q\= 6.004702201044089×10^56165

n= 20,q= {2.156944263511337×10^112331, 2.889336644488551×10^112331, 0., 0.}
 ,\q\= 3.605644852322372×10^112331
```

In[•]:=

```
P = {-1.4, 0.7, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-1.4, 0.7, 0, 0}

```
n= 1,q= {-1.4, 0.7, 0, 0},\q\= 1.56525

n= 2,q= {0.07, -1.26, 0., 0.},\q\= 1.26194

n= 3,q= {-2.9827, 0.5236, 0., 0.},\q\= 3.02831

n= 4,q= {7.22234, -2.42348, 0., 0.},\q\= 7.6181

n= 5,q= {44.889, -34.3065, 0., 0.},\q\= 56.4974

n= 6,q= {836.686, -3079.26, 0., 0.},\q\= 3190.91

n= 7,q= {-8.78181×10^6, -5.15275×10^6, 0., 0.},\q\= 1.01819×10^7

n= 8,q= {5.05694×10^13, 9.05009×10^13, 0., 0.},\q\= 1.03671×10^14

n= 9,q= {-5.63315×10^27, 9.15316×10^27, 0., 0.},\q\= 1.07477×10^28

n= 10,q= {-5.20479×10^55, -1.03122×10^56, 0., 0.},\q\= 1.15513×10^56

n= 11,q= {-7.92521×10^111, 1.07346×10^112, 0., 0.},\q\= 1.33432×10^112

n= 12,q= {-5.24225×10^223, -1.70148×10^224, 0., 0.},\q\= 1.78041×10^224

n= 13,q= {-2.620219935058118×10^448, 1.783914851960451×10^448, 0., 0.}
 ,\q\= 3.169843009854123×10^448

n= 14,q= {3.683200309030891×10^896, -9.34849851510605×10^896, 0., 0.}
 ,\q\= 1.004790470712105×10^897

n= 15,q= {-7.382845997049475×10^1793, -6.886478523962686×10^1793, 0., 0.}
 ,\q\= 1.009603890033853×10^1794

n= 16,q= {7.082828555150167×10^3586, 1.016836208088102×10^3588, 0., 0.}
 ,\q\= 1.019300014771488×10^3588

n= 17,q= {-1.028939228044825×10^7176, 1.440415306111405×10^7175, 0., 0.}
 ,\q\= 1.038972520113155×10^7176

n= 18,q= {1.037967972468679×10^14352, -2.964199626268438×10^14351, 0., 0.}
 ,\q\= 1.079463897550280×10^14352

n= 19,q= {9.89512717627042×10^28703, -6.153488552140536×10^28703, 0., 0.}
 ,\q\= 1.165242306114441×10^28704

n= 20,q= {6.004812047324077×10^57407, -1.217791036023094×10^57408, 0., 0.}
 ,\q\= 1.357789631958900×10^57408
```

In[•]:=
```
P = {-1.4, 0.5, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-1.4, 0.5, 0, 0}

```
n= 1,q= {-1.4, 0.5, 0, 0},\q\= 1.48661

n= 2,q= {0.31, -0.9, 0., 0.},\q\= 0.951893

n= 3,q= {-2.1139, -0.058, 0., 0.},\q\= 2.1147

n= 4,q= {3.06521, 0.745212, 0., 0.},\q\= 3.1545

n= 5,q= {7.44017, 5.06846, 0., 0.},\q\= 9.00252

n= 6,q= {28.2667, 75.9204, 0., 0.},\q\= 81.0118

n= 7,q= {-4966.3, 4292.55, 0., 0.},\q\= 6564.31

n= 8,q= {6.2382×10^6, -4.26362×10^7, 0., 0.},\q\= 4.30901×10^7

n= 9,q= {-1.77893×10^15, -5.31946×10^14, 0., 0.},\q\= 1.85676×10^15

n= 10,q= {2.88162×10^30, 1.89259×10^30, 0., 0.},\q\= 3.44755×10^30

n= 11,q= {4.72183×10^60, 1.09074×10^61, 0., 0.},\q\= 1.18856×10^61

n= 12,q= {-9.66759×10^121, 1.03006×10^122, 0., 0.},\q\= 1.41267×10^122

n= 13,q= {-1.26398×10^243, -1.99164×10^244, 0., 0.},\q\= 1.99564×10^244

n= 14,q= {-3.950643493356471×10^488, 5.034781154769981×10^487, 0., 0.}
 ,\q\= 3.982596417459857×10^488

n= 15,q= {1.535409379883555×10^977, -3.978125081913161×10^976, 0., 0.}
 ,\q\= 1.586107422436409×10^977

n= 16,q= {2.199227172160938×10^1954, -1.221610113023901×10^1954, 0., 0.}
 ,\q\= 2.515736755507870×10^1954

n= 17,q= {3.344268886528727×10^3908, -5.373196308697514×10^3908, 0., 0.}
 ,\q\= 6.328931423013263×10^3908

n= 18,q= {-1.768710418639650×10^7817, -3.593882647277620×10^7817, 0., 0.}
 ,\q\= 4.005537295720468×10^7817

n= 19,q= {-9.78765593739875×10^15634, 1.271307536321635×10^15635, 0., 0.}
 ,\q\= 1.604432902740764×10^15635

n= 20,q= {-6.582407644192146×10^31269, -2.488624151227645×10^31270, 0., 0.}
 ,\q\= 2.574204939397155×10^31270
```

In[ ]:=
```
P = {-1.4, 0.4, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[ ]= {-1.4, 0.4, 0, 0}

n= 1,q= {-1.4, 0.4, 0, 0},\q\= 1.45602

n= 2,q= {0.4, -0.72, 0., 0.},\q\= 0.82365

n= 3,q= {-1.7584, -0.176, 0., 0.},\q\= 1.76719

n= 4,q= {1.66099, 1.01896, 0., 0.},\q\= 1.94863

n= 5,q= {0.32063, 3.78496, 0., 0.},\q\= 3.79852

n= 6,q= {-15.6231, 2.82715, 0., 0.},\q\= 15.8769

n= 7,q= {234.69, -87.9378, 0., 0.},\q\= 250.624

n= 8,q= {47 344.9, -41 275.8, 0., 0.},\q\= 62 811.1

n= 9,q= $\{5.37845\times10^{8}, -3.9084\times10^{9}, 0., 0.\}$,\q\= 3.94523×10^{9}

n= 10,q= $\{-1.49863\times10^{19}, -4.20422\times10^{18}, 0., 0.\}$,\q\= 1.55649×10^{19}

n= 11,q= $\{2.06914\times10^{38}, 1.26011\times10^{38}, 0., 0.\}$,\q\= 2.42265×10^{38}

n= 12,q= $\{2.69344\times10^{76}, 5.2147\times10^{76}, 0., 0.\}$,\q\= 5.86922×10^{76}

n= 13,q= $\{-1.99385\times10^{153}, 2.8091\times10^{153}, 0., 0.\}$,\q\= 3.44478×10^{153}

n= 14,q= $\{-3.91561\times10^{306}, -1.12018\times10^{307}, 0., 0.\}$,\q\= 1.18665×10^{307}

n= 15,q= $\{-1.101494188285400\times10^{614}, 8.772414221892157\times10^{613}, 0., 0.\}$
,\q\= $1.408134212222354\times10^{614}$

n= 16,q= $\{4.437369340219544\times10^{1227}, -1.932552656529280\times10^{1228}, 0., 0.\}$
,\q\= $1.982841959631070\times10^{1228}$

n= 17,q= $\{-3.537857303643172\times10^{2456}, -1.715089981288571\times10^{2456}, 0., 0.\}$
,\q\= $3.931662236873581\times10^{2456}$

n= 18,q= $\{9.57490065702491\times10^{4912}, 1.213548723341401\times10^{4913}, 0., 0.\}$
,\q\= $1.545796794485777\times10^{4913}$

n= 19,q= $\{-5.559132780045843\times10^{9825}, 2.323921693690663\times10^{9826}, 0., 0.\}$
,\q\= $2.389487729842504\times10^{9826}$

n= 20,q= $\{-5.091572465744278\times10^{19\,652}, -2.583797853131084\times10^{19\,652}, 0., 0.\}$
,\q\= $5.709651611067882\times10^{19\,652}$

In[•]:=
```
P = {-1.4, 0.2, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-1.4, 0.2, 0, 0}

```
n= 1,q= {-1.4, 0.2, 0, 0},\q\= 1.41421

n= 2,q= {0.52, -0.36, 0., 0.},\q\= 0.632456

n= 3,q= {-1.2592, -0.1744, 0., 0.},\q\= 1.27122

n= 4,q= {0.155169, 0.639209, 0., 0.},\q\= 0.657773

n= 5,q= {-1.78451, 0.398371, 0., 0.},\q\= 1.82844

n= 6,q= {1.62578, -1.2218, 0., 0.},\q\= 2.0337

n= 7,q= {-0.249628, -3.77274, 0., 0.},\q\= 3.78099

n= 8,q= {-15.5712, 2.08356, 0., 0.},\q\= 15.71

n= 9,q= {236.722, -64.6872, 0., 0.},\q\= 245.401

n= 10,q= {51851.4, -30625.6, 0., 0.},\q\= 60220.4

n= 11,q= {1.75064×10^9, -3.17596×10^9, 0., 0.},\q\= 3.62649×10^9

n= 12,q= {-7.02195×10^18, -1.11199×10^19, 0., 0.},\q\= 1.31515×10^19

n= 13,q= {-7.43454×10^37, 1.56167×10^38, 0., 0.},\q\= 1.72961×10^38

n= 14,q= {-1.8861×10^76, -2.32207×10^76, 0., 0.},\q\= 2.99155×10^76

n= 15,q= {-1.83462×10^152, 8.75931×10^152, 0., 0.},\q\= 8.94937×10^152

n= 16,q= {-7.33597×10^305, -3.214×10^305, 0., 0.},\q\= 8.00913×10^305

n= 17,q= {4.348662672976242×10^611, 4.715552369916906×10^611, 0., 0.}
 ,\q\= 6.414616215859358×10^611

n= 18,q= {-3.325567110092071×10^1222, 4.101269314704461×10^1223, 0., 0.}
 ,\q\= 4.114730119676582×10^1223

n= 19,q= {-1.670981602569914×10^2447, -2.727809268522201×10^2446, 0., 0.}
 ,\q\= 1.693100395777366×10^2447

n= 20,q= {2.717770082072762×10^4894, 9.11623820604058×10^4893, 0., 0.}
 ,\q\= 2.866588950181474×10^4894
```

In[•]:=

```
P = {-1.4, -0.2, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-1.4, -0.2, 0, 0}

```
n= 1,q= {-1.4, -0.2, 0, 0},\q\= 1.41421

n= 2,q= {0.52, 0.36, 0., 0.},\q\= 0.632456

n= 3,q= {-1.2592, 0.1744, 0., 0.},\q\= 1.27122

n= 4,q= {0.155169, -0.639209, 0., 0.},\q\= 0.657773

n= 5,q= {-1.78451, -0.398371, 0., 0.},\q\= 1.82844

n= 6,q= {1.62578, 1.2218, 0., 0.},\q\= 2.0337

n= 7,q= {-0.249628, 3.77274, 0., 0.},\q\= 3.78099

n= 8,q= {-15.5712, -2.08356, 0., 0.},\q\= 15.71

n= 9,q= {236.722, 64.6872, 0., 0.},\q\= 245.401

n= 10,q= {51851.4, 30625.6, 0., 0.},\q\= 60220.4

n= 11,q= {1.75064×10^9, 3.17596×10^9, 0., 0.},\q\= 3.62649×10^9

n= 12,q= {-7.02195×10^18, 1.11199×10^19, 0., 0.},\q\= 1.31515×10^19

n= 13,q= {-7.43454×10^37, -1.56167×10^38, 0., 0.},\q\= 1.72961×10^38

n= 14,q= {-1.8861×10^76, 2.32207×10^76, 0., 0.},\q\= 2.99155×10^76

n= 15,q= {-1.83462×10^152, -8.75931×10^152, 0., 0.},\q\= 8.94937×10^152

n= 16,q= {-7.33597×10^305, 3.214×10^305, 0., 0.},\q\= 8.00913×10^305

n= 17,q= {4.348662672976242×10^611, -4.715552369916906×10^611, 0., 0.}
 ,\q\= 6.414616215859358×10^611

n= 18,q= {-3.325567110092071×10^1222, -4.101269314704461×10^1223, 0., 0.}
 ,\q\= 4.114730119676582×10^1223

n= 19,q= {-1.670981602569914×10^2447, 2.727809268522201×10^2446, 0., 0.}
 ,\q\= 1.693100395777366×10^2447

n= 20,q= {2.717770082072762×10^4894, -9.11623820604058×10^4893, 0., 0.}
 ,\q\= 2.866588950181474×10^4894
```

In[•]:=

```
P = {-1.4, -0.4, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-1.4, -0.4, 0, 0}

```
n= 1,q= {-1.4, -0.4, 0, 0},\q\= 1.45602

n= 2,q= {0.4, 0.72, 0., 0.},\q\= 0.82365

n= 3,q= {-1.7584, 0.176, 0., 0.},\q\= 1.76719

n= 4,q= {1.66099, -1.01896, 0., 0.},\q\= 1.94863

n= 5,q= {0.32063, -3.78496, 0., 0.},\q\= 3.79852

n= 6,q= {-15.6231, -2.82715, 0., 0.},\q\= 15.8769

n= 7,q= {234.69, 87.9378, 0., 0.},\q\= 250.624

n= 8,q= {47 344.9, 41 275.8, 0., 0.},\q\= 62 811.1

n= 9,q= {5.37845×10^8, 3.9084×10^9, 0., 0.},\q\= 3.94523×10^9

n= 10,q= {-1.49863×10^19, 4.20422×10^18, 0., 0.},\q\= 1.55649×10^19

n= 11,q= {2.06914×10^38, -1.26011×10^38, 0., 0.},\q\= 2.42265×10^38

n= 12,q= {2.69344×10^76, -5.2147×10^76, 0., 0.},\q\= 5.86922×10^76

n= 13,q= {-1.99385×10^153, -2.8091×10^153, 0., 0.},\q\= 3.44478×10^153

n= 14,q= {-3.91561×10^306, 1.12018×10^307, 0., 0.},\q\= 1.18665×10^307

n= 15,q= {-1.101494188285400×10^614, -8.772414221892157×10^613, 0., 0.}
 ,\q\= 1.408134212222354×10^614

n= 16,q= {4.437369340219544×10^1227, 1.932552656529280×10^1228, 0., 0.}
 ,\q\= 1.982841959631070×10^1228

n= 17,q= {-3.537857303643172×10^2456, 1.715089981288571×10^2456, 0., 0.}
 ,\q\= 3.931662236873581×10^2456

n= 18,q= {9.57490065702491×10^4912, -1.213548723341401×10^4913, 0., 0.}
 ,\q\= 1.545796794485777×10^4913

n= 19,q= {-5.559132780045843×10^9825, -2.323921693690663×10^9826, 0., 0.}
 ,\q\= 2.389487729842504×10^9826

n= 20,q= {-5.091572465744278×10^19 652, 2.583797853131084×10^19 652, 0., 0.}
 ,\q\= 5.709651611067882×10^19 652
```

In[ ]:=
```
P = {-1.4, -0.5, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[ ]= {-1.4, -0.5, 0, 0}

```
n= 1,q= {-1.4, -0.5, 0, 0},\q\= 1.48661

n= 2,q= {0.31, 0.9, 0., 0.},\q\= 0.951893

n= 3,q= {-2.1139, 0.058, 0., 0.},\q\= 2.1147

n= 4,q= {3.06521, -0.745212, 0., 0.},\q\= 3.1545

n= 5,q= {7.44017, -5.06846, 0., 0.},\q\= 9.00252

n= 6,q= {28.2667, -75.9204, 0., 0.},\q\= 81.0118

n= 7,q= {-4966.3, -4292.55, 0., 0.},\q\= 6564.31

n= 8,q= {6.2382×10^6, 4.26362×10^7, 0., 0.},\q\= 4.30901×10^7

n= 9,q= {-1.77893×10^15, 5.31946×10^14, 0., 0.},\q\= 1.85676×10^15

n= 10,q= {2.88162×10^30, -1.89259×10^30, 0., 0.},\q\= 3.44755×10^30

n= 11,q= {4.72183×10^60, -1.09074×10^61, 0., 0.},\q\= 1.18856×10^61

n= 12,q= {-9.66759×10^121, -1.03006×10^122, 0., 0.},\q\= 1.41267×10^122

n= 13,q= {-1.26398×10^243, 1.99164×10^244, 0., 0.},\q\= 1.99564×10^244

n= 14,q= {-3.950643493356471×10^488, -5.034781154769981×10^487, 0., 0.}
 ,\q\= 3.982596417459857×10^488

n= 15,q= {1.535409379883555×10^977, 3.978125081913161×10^976, 0., 0.}
 ,\q\= 1.586107422436409×10^977

n= 16,q= {2.199227172160938×10^1954, 1.221610113023901×10^1954, 0., 0.}
 ,\q\= 2.515736755507870×10^1954

n= 17,q= {3.344268886528727×10^3908, 5.373196308697514×10^3908, 0., 0.}
 ,\q\= 6.328931423013263×10^3908

n= 18,q= {-1.768710418639650×10^7817, 3.593882647277620×10^7817, 0., 0.}
 ,\q\= 4.005537295720468×10^7817

n= 19,q= {-9.78765593739875×10^15634, -1.271307536321635×10^15635, 0., 0.}
 ,\q\= 1.604432902740764×10^15635

n= 20,q= {-6.582407644192146×10^31269, 2.488624151227645×10^31270, 0., 0.}
 ,\q\= 2.574204939397155×10^31270
```

In[ ]:=
```
P = {-1.4, -0.7, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[ ]=
```
{-1.4, -0.7, 0, 0}
```

```
n= 1,q= {-1.4, -0.7, 0, 0},\q\= 1.56525
n= 2,q= {0.07, 1.26, 0., 0.},\q\= 1.26194
n= 3,q= {-2.9827, -0.5236, 0., 0.},\q\= 3.02831
n= 4,q= {7.22234, 2.42348, 0., 0.},\q\= 7.6181
n= 5,q= {44.889, 34.3065, 0., 0.},\q\= 56.4974
n= 6,q= {836.686, 3079.26, 0., 0.},\q\= 3190.91
n= 7,q= {-8.78181×10^6, 5.15275×10^6, 0., 0.},\q\= 1.01819×10^7
n= 8,q= {5.05694×10^13, -9.05009×10^13, 0., 0.},\q\= 1.03671×10^14
n= 9,q= {-5.63315×10^27, -9.15316×10^27, 0., 0.},\q\= 1.07477×10^28
n= 10,q= {-5.20479×10^55, 1.03122×10^56, 0., 0.},\q\= 1.15513×10^56
n= 11,q= {-7.92521×10^111, -1.07346×10^112, 0., 0.},\q\= 1.33432×10^112
n= 12,q= {-5.24225×10^223, 1.70148×10^224, 0., 0.},\q\= 1.78041×10^224
n= 13,q= {-2.620219935058118×10^448, -1.783914851960451×10^448, 0., 0.}
 ,\q\= 3.169843009854123×10^448
n= 14,q= {3.683200309030891×10^896, 9.34849851510605×10^896, 0., 0.}
 ,\q\= 1.004790470712105×10^897
n= 15,q= {-7.382845997049475×10^1793, 6.886478523962686×10^1793, 0., 0.}
 ,\q\= 1.009603890033853×10^1794
n= 16,q= {7.082828555150167×10^3586, -1.016836208088102×10^3588, 0., 0.}
 ,\q\= 1.019300014771488×10^3588
n= 17,q= {-1.028939228044825×10^7176, -1.440415306111405×10^7175, 0., 0.}
 ,\q\= 1.038972520113155×10^7176
n= 18,q= {1.037967972468679×10^14352, 2.964199626268438×10^14351, 0., 0.}
 ,\q\= 1.079463897550280×10^14352
n= 19,q= {9.89512717627042×10^28703, 6.153488552140536×10^28703, 0., 0.}
 ,\q\= 1.165242306114441×10^28704
n= 20,q= {6.004812047324077×10^57407, 1.217791036023094×10^57408, 0., 0.}
 ,\q\= 1.357789631958900×10^57408
```

In[•]:=
```
P = {-1.4, -1.2, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-1.4, -1.2, 0, 0}

```
n= 1,q= {-1.4, -1.2, 0, 0},\q\= 1.84391

n= 2,q= {-0.88, 2.16, 0., 0.},\q\= 2.33238

n= 3,q= {-5.2912, -5.0016, 0., 0.},\q\= 7.28099

n= 4,q= {1.58079, 51.7289, 0., 0.},\q\= 51.7531

n= 5,q= {-2674.78, 162.346, 0., 0.},\q\= 2679.71

n= 6,q= {7.12811×10^6, -868480., 0., 0.},\q\= 7.18082×10^6

n= 7,q= {5.00557×10^13, -1.23812×10^13, 0., 0.},\q\= 5.15642×10^13

n= 8,q= {2.35228×10^27, -1.2395×10^27, 0., 0.},\q\= 2.65887×10^27

n= 9,q= {3.99683×10^54, -5.83131×10^54, 0., 0.},\q\= 7.06957×10^54

n= 10,q= {-1.80295×10^109, -4.66135×10^109, 0., 0.},\q\= 4.99788×10^109

n= 11,q= {-1.84776×10^219, 1.68083×10^219, 0., 0.},\q\= 2.49788×10^219

n= 12,q= {5.890204334801011×10^437, -6.211558628922021×10^438, 0., 0.}
 ,\q\= 6.239423504747270×10^438

n= 13,q= {-3.823651552947854×10^877, -7.317469912389422×10^876, 0., 0.}
 ,\q\= 3.893040567159271×10^877

n= 14,q= {1.408485753917329×10^1755, 5.595891038831402×10^1754, 0., 0.}
 ,\q\= 1.515576485754778×10^1755

n= 15,q= {1.670692153803330×10^3510, 1.576346561733534×10^3510, 0., 0.}
 ,\q\= 2.296972084172802×10^3510

n= 16,q= {3.063437900908750×10^7019, 5.267179664726144×10^7020, 0., 0.}
 ,\q\= 5.276080755469145×10^7020

n= 17,q= {-2.764933510277738×10^14041, 3.227135563163583×10^14040, 0., 0.}
 ,\q\= 2.783702813823186×10^14041

n= 18,q= {7.540713276826421×10^28082, -1.784563052160002×10^28082, 0., 0.}
 ,\q\= 7.749001355687124×10^28082

n= 19,q= {5.367769143617164×10^56165, -2.691375660151362×10^56165, 0., 0.}
 ,\q\= 6.004702201044089×10^56165

n= 20,q= {2.156944263511337×10^112331, -2.889336644488551×10^112331, 0., 0.}
 ,\q\= 3.605644852322372×10^112331
```

In[ ]:=
```
P = {-1.4, -1.4, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[ ]=
```
{-1.4, -1.4, 0, 0}
```

```
n= 1,q= {-1.4, -1.4, 0, 0},\q\= 1.9799

n= 2,q= {-1.4, 2.52, 0., 0.},\q\= 2.88278

n= 3,q= {-5.7904, -8.456, 0., 0.},\q\= 10.2485

n= 4,q= {-39.3752, 96.5272, 0., 0.},\q\= 104.249

n= 5,q= {-7768.5, -7602.96, 0., 0.},\q\= 10869.9

n= 6,q= {2.54463×10^6, 1.18127×10^8, 0., 0.},\q\= 1.18155×10^8

n= 7,q= {-1.39476×10^16, 6.0118×10^14, 0., 0.},\q\= 1.39605×10^16

n= 8,q= {1.94173×10^32, -1.677×10^31, 0., 0.},\q\= 1.94896×10^32

n= 9,q= {3.7422×10^64, -6.51256×10^63, 0., 0.},\q\= 3.79844×10^64

n= 10,q= {1.35799×10^129, -4.87426×10^128, 0., 0.},\q\= 1.44282×10^129

n= 11,q= {1.60656×10^258, -1.32384×10^258, 0., 0.},\q\= 2.08172×10^258

n= 12,q= {8.284704992926566×10^515, -4.253649742555875×10^516, 0., 0.}
 ,\q\= 4.333578140583586×10^516

n= 13,q= {-1.740717276414744×10^1033, -7.048046652062692×10^1032, 0., 0.}
 ,\q\= 1.877989950054389×10^1033

n= 14,q= {2.533347020312244×10^2066, 2.453731314444525×10^2066, 0., 0.}
 ,\q\= 3.526846252505286×10^2066

n= 15,q= {3.970497618392657×10^4131, 1.243230582818976×10^4133, 0., 0.}
 ,\q\= 1.243864448881058×10^4133

n= 16,q= {-1.544045796922646×10^8266, 9.87248813639132×10^8264, 0., 0.}
 ,\q\= 1.547198767190178×10^8266

n= 17,q= {2.374330820794169×10^16532, -3.048714762432741×10^16531, 0., 0.}
 ,\q\= 2.393824025194807×10^16532

n= 18,q= {5.544500229546361×10^33064, -1.447731484850846×10^33064, 0., 0.}
 ,\q\= 5.730393463599868×10^33064

n= 19,q= {2.864555634321122×10^66129, -1.605389510015402×10^66129, 0., 0.}
 ,\q\= 3.283740924766809×10^66129

n= 20,q= {5.628403503253391×10^132258, -9.19745513238929×10^132258, 0., 0.}
 ,\q\= 1.078295446098838×10^132259
```

In[•]:=

```
P = {-1.2, 1.4, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-1.2, 1.4, 0, 0}

```
n= 1,q= {-1.2, 1.4, 0, 0},\q\= 1.84391

n= 2,q= {-1.72, -1.96, 0., 0.},\q\= 2.60768

n= 3,q= {-2.0832, 8.1424, 0., 0.},\q\= 8.40467

n= 4,q= {-63.159, -32.5245, 0., 0.},\q\= 71.0415

n= 5,q= {2930.01, 4109.83, 0., 0.},\q\= 5047.34

n= 6,q= {-8.30571×10^6, 2.40837×10^7, 0., 0.},\q\= 2.54756×10^7

n= 7,q= {-5.11038×10^14, -4.00064×10^14, 0., 0.},\q\= 6.49008×10^14

n= 8,q= {1.01109×10^29, 4.08896×10^29, 0., 0.},\q\= 4.21212×10^29

n= 9,q= {-1.56973×10^59, 8.26863×10^58, 0., 0.},\q\= 1.77419×10^59

n= 10,q= {1.78035×10^118, -2.5959×10^118, 0., 0.},\q\= 3.14776×10^118

n= 11,q= {-3.56906×10^236, -9.24324×10^236, 0., 0.},\q\= 9.90837×10^236

n= 12,q= {-7.269930800602665×10^473, 6.597940593002617×10^473, 0., 0.}
 ,\q\= 9.81757169132689×10^473

n= 13,q= {9.31907377675958×10^946, -9.59331430752327×10^947, 0., 0.},\q\= 9.63847139143430×10^947

n= 14,q= {-9.11632280423638×10^1895, -1.788016075909052×10^1895, 0., 0.}
 ,\q\= 9.29001307634975×10^1895

n= 15,q= {7.991033998333100×10^3791, 3.260026345430187×10^3791, 0., 0.}
 ,\q\= 8.630434295874941×10^3791

n= 16,q= {5.322885258961659×10^7583, 5.210196272358846×10^7583, 0., 0.}
 ,\q\= 7.448439613541439×10^7583

n= 17,q= {1.186962283569322×10^15166, 5.546655386887177×10^15167, 0., 0.}
 ,\q\= 5.547925267657334×10^15167

n= 18,q= {-3.075129718625838×10^30335, 1.316734148838337×10^30334, 0., 0.}
 ,\q\= 3.077947477551070×10^30335

n= 19,q= {9.43908489818866×10^60670, -8.098256625244533×10^60669, 0., 0.}
 ,\q\= 9.47376067456300×10^60670

n= 20,q= {8.844050611152998×10^121341, -1.528802636260038×10^121341, 0., 0.}
 ,\q\= 8.975214131889632×10^121341
```

In[•]:=
```
P = {-1.2, 1.2, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-1.2, 1.2, 0, 0}

```
n= 1,q= {-1.2, 1.2, 0, 0},\q\= 1.69706
n= 2,q= {-1.2, -1.68, 0., 0.},\q\= 2.06456
n= 3,q= {-2.5824, 5.232, 0., 0.},\q\= 5.8346
n= 4,q= {-21.905, -25.8222, 0., 0.},\q\= 33.8618
n= 5,q= {-188.157, 1132.47, 0., 0.},\q\= 1148.
n= 6,q= {-1.2471×10^6, -426165., 0., 0.},\q\= 1.3179×10^6
n= 7,q= {1.37363×10^12, 1.06294×10^12, 0., 0.},\q\= 1.73686×10^12
n= 8,q= {7.57023×10^23, 2.92016×10^24, 0., 0.},\q\= 3.01669×10^24
n= 9,q= {-7.95426×10^48, 4.42126×10^48, 0., 0.},\q\= 9.10043×10^48
n= 10,q= {4.37227×10^97, -7.03357×10^97, 0., 0.},\q\= 8.28178×10^97
n= 11,q= {-3.03544×10^195, -6.15054×10^195, 0., 0.},\q\= 6.85879×10^195
n= 12,q= {-2.861525537922634×10^391, 3.733915561824339×10^391, 0., 0.}
 ,\q\= 4.704301630105938×10^391
n= 13,q= {-5.753797018650549×10^782, -2.136938947321417×10^783, 0., 0.}
 ,\q\= 2.213045382701738×10^783
n= 14,q= {-4.235446263260845×10^1566, 2.459102588827242×10^1566, 0., 0.}
 ,\q\= 4.897569865897483×10^1566
n= 15,q= {1.189181950659341×10^3133, -2.083079374164682×10^3133, 0., 0.}
 ,\q\= 2.398619059134709×10^3133
n= 16,q= {-2.925065967296369×10^6266, -4.954320787094791×10^6266, 0., 0.}
 ,\q\= 5.753373390844279×10^6266
n= 17,q= {-1.598928354840411×10^12533, 2.898343025079986×10^12533, 0., 0.}
 ,\q\= 3.310130537447499×10^12533
n= 18,q= {-5.843820407117144×10^25066, -9.26848568970865×10^25066, 0., 0.}
 ,\q\= 1.095696417494247×10^25067
n= 19,q= {-5.175459002969517×10^50133, 1.083267316331852×10^50134, 0., 0.}
 ,\q\= 1.200550639309727×10^50134
n= 20,q= {-9.05614319718630×10^100267, -1.121281116986462×10^100268, 0., 0.}
 ,\q\= 1.441321837546995×10^100268
```

In[•]:=

```
P = {-1.2, 0.7, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-1.2, 0.7, 0, 0}

```
n= 1,q= {-1.2, 0.7, 0, 0},\q\= 1.38924

n= 2,q= {-0.25, -0.98, 0., 0.},\q\= 1.01139

n= 3,q= {-2.0979, 1.19, 0., 0.},\q\= 2.4119

n= 4,q= {1.78508, -4.293, 0., 0.},\q\= 4.64934

n= 5,q= {-16.4433, -14.6267, 0., 0.},\q\= 22.0074

n= 6,q= {55.2418, 481.725, 0., 0.},\q\= 484.882

n= 7,q= {-229008., 53223.5, 0., 0.},\q\= 235112.

n= 8,q= {4.96122×10^10, -2.43772×10^10, 0., 0.},\q\= 5.52776×10^10

n= 9,q= {1.86712×10^21, -2.41882×10^21, 0., 0.},\q\= 3.05562×10^21

n= 10,q= {-2.36455×10^42, -9.03242×10^42, 0., 0.},\q\= 9.33679×10^42

n= 11,q= {-7.59934×10^85, 4.27151×10^85, 0., 0.},\q\= 8.71756×10^85

n= 12,q= {3.95042×10^171, -6.49214×10^171, 0., 0.},\q\= 7.59959×10^171

n= 13,q= {-2.654206309011530×10^343, -5.129336444277694×10^343, 0., 0.}
 ,\q\= 5.775370420102242×10^343

n= 14,q= {-1.926528122779873×10^687, 2.722863430288925×10^687, 0., 0.}
 ,\q\= 3.335490348939195×10^687

n= 15,q= {-3.702474652143029×10^1374, -1.049134594588097×10^1375, 0., 0.}
 ,\q\= 1.112549586786651×10^1375

n= 16,q= {-9.63600212063915×10^2749, 7.768788486297568×10^2749, 0., 0.}
 ,\q\= 1.237766583059148×10^2750

n= 17,q= {3.249846232413256×10^5499, -1.497201246575208×10^5500, 0., 0.}
 ,\q\= 1.532066114137919×10^5500

n= 18,q= {-2.135996567403049×10^11000, -9.73134766069374×10^10999, 0., 0.}
 ,\q\= 2.347226578089662×10^11000

n= 19,q= {3.615490063024715×10^22000, 4.157225039889503×10^22000, 0., 0.}
 ,\q\= 5.509472608890504×10^22000

n= 20,q= {-4.210751636453822×10^44000, 3.006081164295604×10^44001, 0., 0.}
 ,\q\= 3.035428842811473×10^44001
```

In[•]:=

```
P = {-1.2, 0.5, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-1.2, 0.5, 0, 0}

```
n= 1,q= {-1.2, 0.5, 0, 0},\q\= 1.3
n= 2,q= {-0.01, -0.7, 0., 0.},\q\= 0.700071
n= 3,q= {-1.6899, 0.514, 0., 0.},\q\= 1.76634
n= 4,q= {1.39157, -1.23722, 0., 0.},\q\= 1.86203
n= 5,q= {-0.79425, -2.94334, 0., 0.},\q\= 3.04862
n= 6,q= {-9.23241, 5.1755, 0., 0.},\q\= 10.5841
n= 7,q= {57.2516, -95.0646, 0., 0.},\q\= 110.973
n= 8,q= {-5760.73, -10884.7, 0., 0.},\q\= 12315.1
n= 9,q= {-8.52908×10^7, 1.25408×10^8, 0., 0.},\q\= 1.51663×10^8
n= 10,q= {-8.45257×10^15, -2.13923×10^16, 0., 0.},\q\= 2.30016×10^16
n= 11,q= {-3.86182×10^32, 3.61639×10^32, 0., 0.},\q\= 5.29074×10^32
n= 12,q= {1.83541×10^64, -2.79317×10^65, 0., 0.},\q\= 2.7992×10^65
n= 13,q= {-7.76813×10^130, -1.02532×10^130, 0., 0.},\q\= 7.8355×10^130
n= 14,q= {5.92925×10^261, 1.59297×10^261, 0., 0.},\q\= 6.13951×10^261
n= 15,q= {3.261845244992378×10^523, 1.889019464754236×10^523, 0., 0.}
 ,\q\= 3.769353915527138×10^523
n= 16,q= {7.071239864059008×10^1046, 1.232337831761330×10^1047, 0., 0.}
 ,\q\= 1.420802894049977×10^1047
n= 17,q= {-1.018632199439644×10^2094, 1.742831280387752×10^2094, 0., 0.}
 ,\q\= 2.018680863740789×10^2094
n= 18,q= {-1.999849314162765×10^4188, -3.550608120787173×10^4188, 0., 0.}
 ,\q\= 4.075072429633257×10^4188
n= 19,q= {-8.607420748042535×10^8376, 1.420136243043394×10^8377, 0., 0.}
 ,\q\= 1.660621530675710×10^8377
n= 20,q= {-1.275910029467076×10^16754, -2.444742032683778×10^16754, 0., 0.}
 ,\q\= 2.757663868143738×10^16754
```

In[•]:=
```
P = {-1.2, 0.4, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-1.2, 0.4, 0, 0}

```
n= 1,q= {-1.2, 0.4, 0, 0},\q\= 1.26491
n= 2,q= {0.08, -0.56, 0., 0.},\q\= 0.565685
n= 3,q= {-1.5072, 0.3104, 0., 0.},\q\= 1.53883
n= 4,q= {0.975304, -0.53567, 0., 0.},\q\= 1.11273
n= 5,q= {-0.535725, -0.644881, 0., 0.},\q\= 0.838375
n= 6,q= {-1.32887, 1.09096, 0., 0.},\q\= 1.71933
n= 7,q= {-0.624291, -2.49948, 0., 0.},\q\= 2.57627
n= 8,q= {-7.05768, 3.52081, 0., 0.},\q\= 7.88714
n= 9,q= {36.2148, -49.2976, 0., 0.},\q\= 61.1699
n= 10,q= {-1119.94, -3570.2, 0., 0.},\q\= 3741.74
n= 11,q= {-1.14921×10^7, 7.99682×10^6, 0., 0.},\q\= 1.40006×10^7
n= 12,q= {6.81183×10^13, -1.838×10^14, 0., 0.},\q\= 1.96017×10^14
n= 13,q= {-2.91423×10^28, -2.50403×10^28, 0., 0.},\q\= 3.84225×10^28
n= 14,q= {2.22259×10^56, 1.45946×10^57, 0., 0.},\q\= 1.47629×10^57
n= 15,q= {-2.08063×10^114, 6.48758×10^113, 0., 0.},\q\= 2.17943×10^114
n= 16,q= {3.90813×10^228, -2.69965×10^228, 0., 0.},\q\= 4.7499×10^228
n= 17,q= {7.985359308548102×10^456, -2.110113219638127×10^457, 0., 0.}
 ,\q\= 2.256155453987544×10^457
n= 18,q= {-3.814918166825426×10^914, -3.370002448105545×10^914, 0., 0.}
 ,\q\= 5.090237432557742×10^914
n= 19,q= {3.196684119337301×10^1828, 2.571256712304801×10^1829, 0., 0.}
 ,\q\= 2.591051711981204×10^1829
n= 20,q= {-6.509173186984260×10^3658, 1.643899099792839×10^3658, 0., 0.}
 ,\q\= 6.713548974160726×10^3658
```

In[181]:=
```
P = {-1.3, -0.4, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[181]= {-1.3, -0.4, 0, 0}

```
n= 1,q= {-1.3, -0.4, 0, 0},\q\= 1.36015

n= 2,q= {0.23, 0.64, 0., 0.},\q\= 0.680074

n= 3,q= {-1.6567, -0.1056, 0., 0.},\q\= 1.66006

n= 4,q= {1.4335, -0.050105, 0., 0.},\q\= 1.43438

n= 5,q= {0.752422, -0.543651, 0., 0.},\q\= 0.928275

n= 6,q= {-1.02942, -1.21811, 0., 0.},\q\= 1.59483

n= 7,q= {-1.72409, 2.10789, 0., 0.},\q\= 2.72318

n= 8,q= {-2.77071, -7.66839, 0., 0.},\q\= 8.15359

n= 9,q= {-52.4273, 42.0937, 0., 0.},\q\= 67.2347

n= 10,q= {975.444, -4414.12, 0., 0.},\q\= 4520.61

n= 11,q= {-1.8533×10^7, -8.61145×10^6, 0., 0.},\q\= 2.0436×10^7

n= 12,q= {2.69314×10^14, 3.19192×10^14, 0., 0.},\q\= 4.17628×10^14

n= 13,q= {-2.93533×10^28, 1.71925×10^29, 0., 0.},\q\= 1.74413×10^29

n= 14,q= {-2.86967×10^58, -1.00931×10^58, 0., 0.},\q\= 3.042×10^58

n= 15,q= {7.21631×10^116, 5.79281×10^116, 0., 0.},\q\= 9.25375×10^116

n= 16,q= {1.85186×10^233, 8.36055×10^233, 0., 0.},\q\= 8.56318×10^233

n= 17,q= {-6.646933788163123×10^467, 3.096507333232949×10^467, 0., 0.}
 ,\q\= 7.332808905800695×10^467

n= 18,q= {3.459337111945913×10^935, -4.116455843712195×10^935, 0., 0.}
 ,\q\= 5.377008644898999×10^935

n= 19,q= {-4.978195459145986×10^1870, -2.848041693968044×10^1871, 0., 0.}
 ,\q\= 2.891222196731857×10^1871

n= 20,q= {-7.863517190285748×10^3742, 2.835621645674031×10^3742, 0., 0.}
 ,\q\= 8.359165790874982×10^3742
```

In[•]:=

```
P = {-1.2, -0.5, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-1.2, -0.5, 0, 0}

```
n= 1,q= {-1.2, -0.5, 0, 0},\q\= 1.3
n= 2,q= {-0.01, 0.7, 0., 0.},\q\= 0.700071
n= 3,q= {-1.6899, -0.514, 0., 0.},\q\= 1.76634
n= 4,q= {1.39157, 1.23722, 0., 0.},\q\= 1.86203
n= 5,q= {-0.79425, 2.94334, 0., 0.},\q\= 3.04862
n= 6,q= {-9.23241, -5.1755, 0., 0.},\q\= 10.5841
n= 7,q= {57.2516, 95.0646, 0., 0.},\q\= 110.973
n= 8,q= {-5760.73, 10884.7, 0., 0.},\q\= 12315.1
n= 9,q= {-8.52908×10^7, -1.25408×10^8, 0., 0.},\q\= 1.51663×10^8
n= 10,q= {-8.45257×10^15, 2.13923×10^16, 0., 0.},\q\= 2.30016×10^16
n= 11,q= {-3.86182×10^32, -3.61639×10^32, 0., 0.},\q\= 5.29074×10^32
n= 12,q= {1.83541×10^64, 2.79317×10^65, 0., 0.},\q\= 2.7992×10^65
n= 13,q= {-7.76813×10^130, 1.02532×10^130, 0., 0.},\q\= 7.8355×10^130
n= 14,q= {5.92925×10^261, -1.59297×10^261, 0., 0.},\q\= 6.13951×10^261
n= 15,q= {3.261845244992378×10^523, -1.889019464754236×10^523, 0., 0.}
 ,\q\= 3.769353915527138×10^523
n= 16,q= {7.071239864059008×10^1046, -1.232337831761330×10^1047, 0., 0.}
 ,\q\= 1.420802894049977×10^1047
n= 17,q= {-1.018632199439644×10^2094, -1.742831280387752×10^2094, 0., 0.}
 ,\q\= 2.018680863740789×10^2094
n= 18,q= {-1.999849314162765×10^4188, 3.550608120787173×10^4188, 0., 0.}
 ,\q\= 4.075072429633257×10^4188
n= 19,q= {-8.607420748042535×10^8376, -1.420136243043394×10^8377, 0., 0.}
 ,\q\= 1.660621530675710×10^8377
n= 20,q= {-1.275910029467076×10^16754, 2.444742032683778×10^16754, 0., 0.}
 ,\q\= 2.757663868143738×10^16754
```

In[•]:=

```
P = {-1.2, -0.7, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-1.2, -0.7, 0, 0}

```
n= 1,q= {-1.2, -0.7, 0, 0},\q\= 1.38924

n= 2,q= {-0.25, 0.98, 0., 0.},\q\= 1.01139

n= 3,q= {-2.0979, -1.19, 0., 0.},\q\= 2.4119

n= 4,q= {1.78508, 4.293, 0., 0.},\q\= 4.64934

n= 5,q= {-16.4433, 14.6267, 0., 0.},\q\= 22.0074

n= 6,q= {55.2418, -481.725, 0., 0.},\q\= 484.882

n= 7,q= {-229008., -53223.5, 0., 0.},\q\= 235112.

n= 8,q= {4.96122×10^10, 2.43772×10^10, 0., 0.},\q\= 5.52776×10^10

n= 9,q= {1.86712×10^21, 2.41882×10^21, 0., 0.},\q\= 3.05562×10^21

n= 10,q= {-2.36455×10^42, 9.03242×10^42, 0., 0.},\q\= 9.33679×10^42

n= 11,q= {-7.59934×10^85, -4.27151×10^85, 0., 0.},\q\= 8.71756×10^85

n= 12,q= {3.95042×10^171, 6.49214×10^171, 0., 0.},\q\= 7.59959×10^171

n= 13,q= {-2.654206309011530×10^343, 5.129336444277694×10^343, 0., 0.}
 ,\q\= 5.775370420102242×10^343

n= 14,q= {-1.926528122779873×10^687, -2.722863430288925×10^687, 0., 0.}
 ,\q\= 3.335490348939195×10^687

n= 15,q= {-3.702474652143029×10^1374, 1.049134594588097×10^1375, 0., 0.}
 ,\q\= 1.112549586786651×10^1375

n= 16,q= {-9.63600212063915×10^2749, -7.768788486297568×10^2749, 0., 0.}
 ,\q\= 1.237766583059148×10^2750

n= 17,q= {3.249846232413256×10^5499, 1.497201246575208×10^5500, 0., 0.}
 ,\q\= 1.532066114137919×10^5500

n= 18,q= {-2.135996567403049×10^11000, 9.73134766069374×10^10999, 0., 0.}
 ,\q\= 2.347226578089662×10^11000

n= 19,q= {3.615490063024715×10^22000, -4.157225039889503×10^22000, 0., 0.}
 ,\q\= 5.509472608890504×10^22000

n= 20,q= {-4.210751636453822×10^44000, -3.006081164295604×10^44001, 0., 0.}
 ,\q\= 3.035428842811473×10^44001
```

In[•]:=
```
P = {-1.2, -1.2, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]=
```
{-1.2, -1.2, 0, 0}
```

```
n= 1,q= {-1.2, -1.2, 0, 0},\q\= 1.69706

n= 2,q= {-1.2, 1.68, 0., 0.},\q\= 2.06456

n= 3,q= {-2.5824, -5.232, 0., 0.},\q\= 5.8346

n= 4,q= {-21.905, 25.8222, 0., 0.},\q\= 33.8618

n= 5,q= {-188.157, -1132.47, 0., 0.},\q\= 1148.

n= 6,q= {-1.2471×10^6, 426165., 0., 0.},\q\= 1.3179×10^6

n= 7,q= {1.37363×10^12, -1.06294×10^12, 0., 0.},\q\= 1.73686×10^12

n= 8,q= {7.57023×10^23, -2.92016×10^24, 0., 0.},\q\= 3.01669×10^24

n= 9,q= {-7.95426×10^48, -4.42126×10^48, 0., 0.},\q\= 9.10043×10^48

n= 10,q= {4.37227×10^97, 7.03357×10^97, 0., 0.},\q\= 8.28178×10^97

n= 11,q= {-3.03544×10^195, 6.15054×10^195, 0., 0.},\q\= 6.85879×10^195

n= 12,q= {-2.861525537922634×10^391, -3.733915561824339×10^391, 0., 0.}
 ,\q\= 4.704301630105938×10^391

n= 13,q= {-5.753797018650549×10^782, 2.136938947321417×10^783, 0., 0.}
 ,\q\= 2.213045382701738×10^783

n= 14,q= {-4.235446263260845×10^1566, -2.459102588827242×10^1566, 0., 0.}
 ,\q\= 4.897569865897483×10^1566

n= 15,q= {1.189181950659341×10^3133, 2.083079374164682×10^3133, 0., 0.}
 ,\q\= 2.398619059134709×10^3133

n= 16,q= {-2.925065967296369×10^6266, 4.954320787094791×10^6266, 0., 0.}
 ,\q\= 5.753373390844279×10^6266

n= 17,q= {-1.598928354840411×10^12533, -2.898343025079986×10^12533, 0., 0.}
 ,\q\= 3.310130537447499×10^12533

n= 18,q= {-5.843820407117144×10^25066, 9.26848568970865×10^25066, 0., 0.}
 ,\q\= 1.095696417494247×10^25067

n= 19,q= {-5.175459002969517×10^50133, -1.083267316331852×10^50134, 0., 0.}
 ,\q\= 1.200550639309727×10^50134

n= 20,q= {-9.05614319718630×10^100267, 1.121281116986462×10^100268, 0., 0.}
 ,\q\= 1.441321837546995×10^100268
```

In[•]:=

```
P = {-1.2, -1.4, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-1.2, -1.4, 0, 0}

```
n= 1,q= {-1.2, -1.4, 0, 0},\q\= 1.84391

n= 2,q= {-1.72, 1.96, 0., 0.},\q\= 2.60768

n= 3,q= {-2.0832, -8.1424, 0., 0.},\q\= 8.40467

n= 4,q= {-63.159, 32.5245, 0., 0.},\q\= 71.0415

n= 5,q= {2930.01, -4109.83, 0., 0.},\q\= 5047.34

n= 6,q= {-8.30571×10^6, -2.40837×10^7, 0., 0.},\q\= 2.54756×10^7

n= 7,q= {-5.11038×10^14, 4.00064×10^14, 0., 0.},\q\= 6.49008×10^14

n= 8,q= {1.01109×10^29, -4.08896×10^29, 0., 0.},\q\= 4.21212×10^29

n= 9,q= {-1.56973×10^59, -8.26863×10^58, 0., 0.},\q\= 1.77419×10^59

n= 10,q= {1.78035×10^118, 2.5959×10^118, 0., 0.},\q\= 3.14776×10^118

n= 11,q= {-3.56906×10^236, 9.24324×10^236, 0., 0.},\q\= 9.90837×10^236

n= 12,q= {-7.269930800602665×10^473, -6.597940593002617×10^473, 0., 0.}
 ,\q\= 9.81757169132689×10^473

n= 13,q= {9.31907377675958×10^946, 9.59331430752327×10^947, 0., 0.},\q\= 9.63847139143430×10^947

n= 14,q= {-9.11632280423638×10^1895, 1.788016075909052×10^1895, 0., 0.}
 ,\q\= 9.29001307634975×10^1895

n= 15,q= {7.991033998333100×10^3791, -3.260026345430187×10^3791, 0., 0.}
 ,\q\= 8.630434295874941×10^3791

n= 16,q= {5.322885258961659×10^7583, -5.210196272358846×10^7583, 0., 0.}
 ,\q\= 7.448439613541439×10^7583

n= 17,q= {1.186962283569322×10^15166, -5.546655386887177×10^15167, 0., 0.}
 ,\q\= 5.547925267657334×10^15167

n= 18,q= {-3.075129718625838×10^30335, -1.316734148838337×10^30334, 0., 0.}
 ,\q\= 3.077947477551070×10^30335

n= 19,q= {9.43908489818866×10^60670, 8.098256625244533×10^60669, 0., 0.}
 ,\q\= 9.47376067456300×10^60670

n= 20,q= {8.844050611152998×10^121341, 1.528802636260038×10^121341, 0., 0.}
 ,\q\= 8.975214131889632×10^121341
```

In[•]:=
```
P = {-0.76, 1.4, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-0.76, 1.4, 0, 0}

```
n= 1,q= {-0.76, 1.4, 0, 0},\q\= 1.59298

n= 2,q= {-2.1424, -0.728, 0., 0.},\q\= 2.26271

n= 3,q= {3.29989, 4.51933, 0., 0.},\q\= 5.59586

n= 4,q= {-10.2951, 31.2266, 0., 0.},\q\= 32.88

n= 5,q= {-869.875, -641.562, 0., 0.},\q\= 1080.87

n= 6,q= {345 080., 1.11616×10^6, 0., 0.},\q\= 1.16828×10^6

n= 7,q= {-1.12673×10^12, 7.70327×10^11, 0., 0.},\q\= 1.36489×10^12

n= 8,q= {6.76116×10^23, -1.7359×10^24, 0., 0.},\q\= 1.86292×10^24

n= 9,q= {-2.55622×10^48, -2.34734×10^48, 0., 0.},\q\= 3.47048×10^48

n= 10,q= {1.02423×10^96, 1.20006×10^97, 0., 0.},\q\= 1.20443×10^97

n= 11,q= {-1.42966×10^194, 2.45828×10^193, 0., 0.},\q\= 1.45064×10^194

n= 12,q= {1.983493845087599×10^388, -7.028993412131522×10^387, 0., 0.}
 ,\q\= 2.104356271494509×10^388

n= 13,q= {3.440180349622503×10^776, -2.788393034024830×10^776, 0., 0.}
 ,\q\= 4.428315317378270×10^776

n= 14,q= {4.059705125730606×10^1552, -1.918514984535299×10^1553, 0., 0.}
 ,\q\= 1.960997655012701×10^1553

n= 15,q= {-3.515887688807643×10^3106, -1.557721023301785×10^3106, 0., 0.}
 ,\q\= 3.845511802965310×10^3106

n= 16,q= {9.93497145387279×10^6212, 1.095354433684718×10^6213, 0., 0.}
 ,\q\= 1.478796102674551×10^6213

n= 17,q= {-2.127647575000976×10^12 425, 2.176463006106134×10^12 426, 0., 0.}
 ,\q\= 2.186837913285442×10^12 426

n= 18,q= {-4.691722374914475×10^24 852, -9.26149247404210×10^24 851, 0., 0.}
 ,\q\= 4.782260058982626×10^24 852

n= 19,q= {2.115450641480574×10^49 705, 8.690470293113068×10^49 704, 0., 0.}
 ,\q\= 2.287001127174051×10^49 705

n= 20,q= {3.719888677385763×10^99 410, 3.676852191266782×10^99 410, 0., 0.}
 ,\q\= 5.230374155695378×10^99 410
```

In[•]:=
```
P = {-0.76, 1.2, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-0.76, 1.2, 0, 0}

```
n= 1,q= {-0.76, 1.2, 0, 0},\q\= 1.42042

n= 2,q= {-1.6224, -0.624, 0., 0.},\q\= 1.73826

n= 3,q= {1.48281, 3.22476, 0., 0.},\q\= 3.54933

n= 4,q= {-8.96033, 10.7634, 0., 0.},\q\= 14.0049

n= 5,q= {-36.3226, -191.687, 0., 0.},\q\= 195.098

n= 6,q= {-35425.3, 13926.3, 0., 0.},\q\= 38064.3

n= 7,q= {1.06101×10^9, -9.86687×10^8, 0., 0.},\q\= 1.44889×10^9

n= 8,q= {1.52183×10^17, -2.09376×10^18, 0., 0.},\q\= 2.09928×10^18

n= 9,q= {-4.36068×10^36, -6.3727×10^35, 0., 0.},\q\= 4.407×10^36

n= 10,q= {1.86094×10^73, 5.55786×10^72, 0., 0.},\q\= 1.94216×10^73

n= 11,q= {3.1542×10^146, 2.06857×10^146, 0., 0.},\q\= 3.77199×10^146

n= 12,q= {5.66999×10^292, 1.30493×10^293, 0., 0.},\q\= 1.42279×10^293

n= 13,q= {-1.381367456221049×10^586, 1.479793520389373×10^586, 0., 0.}
 ,\q\= 2.024343081617587×10^586

n= 14,q= {-2.816128138797619×10^1171, -4.088277221985320×10^1172, 0., 0.}
 ,\q\= 4.097964912092987×10^1172

n= 15,q= {-1.663470486686272×10^2345, 2.302622504807644×10^2344, 0., 0.}
 ,\q\= 1.679331642074528×10^2345

n= 16,q= {2.714113356079798×10^4690, -7.660689157454269×10^4689, 0., 0.}
 ,\q\= 2.820154764072730×10^4690

n= 17,q= {6.779549725979369×10^9380, -4.158395751804465×10^9380, 0., 0.}
 ,\q\= 7.953272893322117×10^9380

n= 18,q= {2.867003925840152×10^18761, -5.638410155931947×10^18761, 0., 0.}
 ,\q\= 6.325454971565236×10^18761

n= 19,q= {-2.357195757573368×10^37523, -3.233068810510775×10^37523, 0., 0.}
 ,\q\= 4.001138059729936×10^37523

n= 20,q= {-4.896362093975675×10^75046, 1.524195216815755×10^75047, 0., 0.}
 ,\q\= 1.600910577301944×10^75047
```

In[•]:=
```
P = {-0.76, 0.7, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-0.76, 0.7, 0, 0}

```
n= 1,q= {-0.76, 0.7, 0, 0},\q\= 1.03325

n= 2,q= {-0.6724, -0.364, 0., 0.},\q\= 0.764603

n= 3,q= {-0.440374, 1.18951, 0., 0.},\q\= 1.26841

n= 4,q= {-1.981, -0.347657, 0., 0.},\q\= 2.01127

n= 5,q= {3.04349, 2.07741, 0., 0.},\q\= 3.6849

n= 6,q= {4.18717, 13.3452, 0., 0.},\q\= 13.9866

n= 7,q= {-161.321, 112.457, 0., 0.},\q\= 196.65

n= 8,q= {13 377.2, -36 282.7, 0., 0.},\q\= 38 670.2

n= 9,q= {-1.13748×10^9, -9.70721×10^8, 0., 0.},\q\= 1.49538×10^9

n= 10,q= {3.51564×10^17, 2.20835×10^18, 0., 0.},\q\= 2.23616×10^18

n= 11,q= {-4.75323×10^36, 1.55276×10^36, 0., 0.},\q\= 5.00042×10^36

n= 12,q= {2.01821×10^73, -1.47612×10^73, 0., 0.},\q\= 2.50042×10^73

n= 13,q= {1.89425×10^146, -5.95826×10^146, 0., 0.},\q\= 6.25212×10^146

n= 14,q= {-3.19127×10^293, -2.25729×10^293, 0., 0.},\q\= 3.9089×10^293

n= 15,q= {5.088852345853266×10^586, 1.440720366790744×10^587, 0., 0.}
 ,\q\= 1.527952668528911×10^587

n= 16,q= {-1.816710993306693×10^1174, 1.466322643652331×10^1174, 0., 0.}
 ,\q\= 2.334639357264619×10^1174

n= 17,q= {1.150336737913830×10^2348, -5.327768932915444×10^2348, 0., 0.}
 ,\q\= 5.450540928488952×10^2348

n= 18,q= {-2.706184719194474×10^4697, -1.225745666929720×10^4697, 0., 0.}
 ,\q\= 2.970839641313320×10^4697

n= 19,q= {5.820983294404689×10^9394, 6.634188386928096×10^9394, 0., 0.}
 ,\q\= 8.825888174398658×10^9394

n= 20,q= {-1.012860903951314×10^18 789, 7.723499954448408×10^18 789, 0., 0.}
 ,\q\= 7.789630206699008×10^18 789
```

In[ ]:=
```
P = {-0.76, 0.5, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[ ]=
```
{-0.76, 0.5, 0, 0}
```

```
n= 1,q= {-0.76, 0.5, 0, 0},\q\= 0.909725

n= 2,q= {-0.4324, -0.26, 0., 0.},\q\= 0.504549

n= 3,q= {-0.64063, 0.724848, 0., 0.},\q\= 0.967374

n= 4,q= {-0.874998, -0.428719, 0., 0.},\q\= 0.974382

n= 5,q= {-0.178179, 1.25026, 0., 0.},\q\= 1.26289

n= 6,q= {-2.29139, 0.0544602, 0., 0.},\q\= 2.29204

n= 7,q= {4.48752, 0.250421, 0., 0.},\q\= 4.4945

n= 8,q= {19.3151, 2.74753, 0., 0.},\q\= 19.5095

n= 9,q= {364.764, 106.638, 0., 0.},\q\= 380.032

n= 10,q= {121 680., 77 795.6, 0., 0.},\q\= 144 424.

n= 11,q= {8.75389×10^9, 1.89324×10^10, 0., 0.},\q\= 2.08582×10^10

n= 12,q= {-2.81803×10^20, 3.31463×10^20, 0., 0.},\q\= 4.35064×10^20

n= 13,q= {-3.04548×10^40, -1.86815×10^41, 0., 0.},\q\= 1.89281×10^41

n= 14,q= {-3.39723×10^82, 1.13788×10^82, 0., 0.},\q\= 3.58273×10^82

n= 15,q= {1.02464×10^165, -7.73131×10^164, 0., 0.},\q\= 1.2836×10^165

n= 16,q= {4.521601872800172×10^329, -1.584364420914123×10^330, 0., 0.}
 ,\q\= 1.647622363656079×10^330

n= 17,q= {-2.305761783297446×10^660, -1.432773026560652×10^660, 0., 0.}
 ,\q\= 2.714659453219646×10^660

n= 18,q= {3.263698855675246×10^1320, 6.607266577565935×10^1320, 0., 0.}
 ,\q\= 7.369375946954788×10^1320

n= 19,q= {-3.300424140648396×10^2641, 4.312825673668648×10^2641, 0., 0.}
 ,\q\= 5.430770184755578×10^2641

n= 20,q= {-7.707665783280729×10^5282, -2.846830793556837×10^5283, 0., 0.}
 ,\q\= 2.949326479963013×10^5283
```

In[•]:=

```
P = {-0.76, 0.4, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-0.76, 0.4, 0, 0}

```
n= 1,q= {-0.76, 0.4, 0, 0},\q\= 0.858836

n= 2,q= {-0.3424, -0.208, 0., 0.},\q\= 0.400627

n= 3,q= {-0.686026, 0.542438, 0., 0.},\q\= 0.874569

n= 4,q= {-0.583607, -0.344254, 0., 0.},\q\= 0.677575

n= 5,q= {-0.537913, 0.801818, 0., 0.},\q\= 0.965538

n= 6,q= {-1.11356, -0.462617, 0., 0.},\q\= 1.20583

n= 7,q= {0.266006, 1.43031, 0., 0.},\q\= 1.45483

n= 8,q= {-2.73502, 1.16094, 0., 0.},\q\= 2.97121

n= 9,q= {5.37253, -5.95037, 0., 0.},\q\= 8.01693

n= 10,q= {-7.30283, -63.5372, 0., 0.},\q\= 63.9555

n= 11,q= {-3984.4, 928.402, 0., 0.},\q\= 4091.14

n= 12,q= {1.50135×10^7, -7.39826×10^6, 0., 0.},\q\= 1.67374×10^7

n= 13,q= {1.70672×10^14, -2.22148×10^14, 0., 0.},\q\= 2.80141×10^14

n= 14,q= {-2.02208×10^28, -7.5829×10^28, 0., 0.},\q\= 7.84788×10^28

n= 15,q= {-5.34116×10^57, 3.06665×10^57, 0., 0.},\q\= 6.15892×10^57

n= 16,q= {1.91236×10^115, -3.27589×10^115, 0., 0.},\q\= 3.79323×10^115

n= 17,q= {-7.0743×10^230, -1.25294×10^231, 0., 0.},\q\= 1.43886×10^231

n= 18,q= {-1.069392274423501×10^462, 1.772731165321300×10^462, 0., 0.}
 ,\q\= 2.070308098109574×10^462

n= 19,q= {-1.998975947904746×10^924, -3.791490025648736×10^924, 0., 0.}
 ,\q\= 4.286175621098083×10^924

n= 20,q= {-1.037949177429218×10^1849, 1.515819473598514×10^1849, 0., 0.}
 ,\q\= 1.837130145489553×10^1849
```

In[•]:=

```
P = {-0.76, 0.2, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-0.76, 0.2, 0, 0}

```
n= 1,q= {-0.76, 0.2, 0, 0},\q\= 0.785875
n= 2,q= {-0.2224, -0.104, 0., 0.},\q\= 0.245515
n= 3,q= {-0.721354, 0.246259, 0., 0.},\q\= 0.762231
n= 4,q= {-0.300292, -0.15528, 0., 0.},\q\= 0.338064
n= 5,q= {-0.693937, 0.293259, 0., 0.},\q\= 0.753359
n= 6,q= {-0.364452, -0.207006, 0., 0.},\q\= 0.419138
n= 7,q= {-0.670026, 0.350888, 0., 0.},\q\= 0.756345
n= 8,q= {-0.434187, -0.270208, 0., 0.},\q\= 0.511401
n= 9,q= {-0.644494, 0.434642, 0., 0.},\q\= 0.777358
n= 10,q= {-0.533541, -0.360247, 0., 0.},\q\= 0.643774
n= 11,q= {-0.605112, 0.584414, 0., 0.},\q\= 0.841249
n= 12,q= {-0.735379, -0.507271, 0., 0.},\q\= 0.893368
n= 13,q= {-0.476542, 0.946073, 0., 0.},\q\= 1.05931
n= 14,q= {-1.42796, -0.701688, 0., 0.},\q\= 1.59105
n= 15,q= {0.78671, 2.20397, 0., 0.},\q\= 2.34017
n= 16,q= {-4.99856, 3.66777, 0., 0.},\q\= 6.19985
n= 17,q= {10.7731, -36.4671, 0., 0.},\q\= 38.0252
n= 18,q= {-1214.55, -785.529, 0., 0.},\q\= 1446.44
n= 19,q= {858081., 1.90813×10^6, 0., 0.},\q\= 2.09219×10^6
n= 20,q= {-2.90467×10^12, 3.27466×10^12, 0., 0.},\q\= 4.37727×10^12
```

In[•]:=
```
P = {-0.76, -0.2, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-0.76, -0.2, 0, 0}

```
n= 1,q= {-0.76, -0.2, 0, 0},\q\= 0.785875
n= 2,q= {-0.2224, 0.104, 0., 0.},\q\= 0.245515
n= 3,q= {-0.721354, -0.246259, 0., 0.},\q\= 0.762231
n= 4,q= {-0.300292, 0.15528, 0., 0.},\q\= 0.338064
n= 5,q= {-0.693937, -0.293259, 0., 0.},\q\= 0.753359
n= 6,q= {-0.364452, 0.207006, 0., 0.},\q\= 0.419138
n= 7,q= {-0.670026, -0.350888, 0., 0.},\q\= 0.756345
n= 8,q= {-0.434187, 0.270208, 0., 0.},\q\= 0.511401
n= 9,q= {-0.644494, -0.434642, 0., 0.},\q\= 0.777358
n= 10,q= {-0.533541, 0.360247, 0., 0.},\q\= 0.643774
n= 11,q= {-0.605112, -0.584414, 0., 0.},\q\= 0.841249
n= 12,q= {-0.735379, 0.507271, 0., 0.},\q\= 0.893368
n= 13,q= {-0.476542, -0.946073, 0., 0.},\q\= 1.05931
n= 14,q= {-1.42796, 0.701688, 0., 0.},\q\= 1.59105
n= 15,q= {0.78671, -2.20397, 0., 0.},\q\= 2.34017
n= 16,q= {-4.99856, -3.66777, 0., 0.},\q\= 6.19985
n= 17,q= {10.7731, 36.4671, 0., 0.},\q\= 38.0252
n= 18,q= {-1214.55, 785.529, 0., 0.},\q\= 1446.44
n= 19,q= {858081., -1.90813*10^6, 0., 0.},\q\= 2.09219*10^6
n= 20,q= {-2.90467*10^12, -3.27466*10^12, 0., 0.},\q\= 4.37727*10^12
```

In[•]:=
```
P = {-0.76, -0.4, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-0.76, -0.4, 0, 0}

```
n= 1,q= {-0.76, -0.4, 0, 0},\q\= 0.858836

n= 2,q= {-0.3424, 0.208, 0., 0.},\q\= 0.400627

n= 3,q= {-0.686026, -0.542438, 0., 0.},\q\= 0.874569

n= 4,q= {-0.583607, 0.344254, 0., 0.},\q\= 0.677575

n= 5,q= {-0.537913, -0.801818, 0., 0.},\q\= 0.965538

n= 6,q= {-1.11356, 0.462617, 0., 0.},\q\= 1.20583

n= 7,q= {0.266006, -1.43031, 0., 0.},\q\= 1.45483

n= 8,q= {-2.73502, -1.16094, 0., 0.},\q\= 2.97121

n= 9,q= {5.37253, 5.95037, 0., 0.},\q\= 8.01693

n= 10,q= {-7.30283, 63.5372, 0., 0.},\q\= 63.9555

n= 11,q= {-3984.4, -928.402, 0., 0.},\q\= 4091.14

n= 12,q= {1.50135×10^7, 7.39826×10^6, 0., 0.},\q\= 1.67374×10^7

n= 13,q= {1.70672×10^14, 2.22148×10^14, 0., 0.},\q\= 2.80141×10^14

n= 14,q= {-2.02208×10^28, 7.5829×10^28, 0., 0.},\q\= 7.84788×10^28

n= 15,q= {-5.34116×10^57, -3.06665×10^57, 0., 0.},\q\= 6.15892×10^57

n= 16,q= {1.91236×10^115, 3.27589×10^115, 0., 0.},\q\= 3.79323×10^115

n= 17,q= {-7.0743×10^230, 1.25294×10^231, 0., 0.},\q\= 1.43886×10^231

n= 18,q= {-1.069392274423501×10^462, -1.772731165321300×10^462, 0., 0.}
 ,\q\= 2.070308098109574×10^462

n= 19,q= {-1.998975947904746×10^924, 3.791490025648736×10^924, 0., 0.}
 ,\q\= 4.286175621098083×10^924

n= 20,q= {-1.037949177429218×10^1849, -1.515819473598514×10^1849, 0., 0.}
 ,\q\= 1.837130145489553×10^1849
```

In[185]:=
```
P = {-0.76, -0.7, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[185]= {-0.76, -0.7, 0, 0}

```
n= 1,q= {-0.76, -0.7, 0, 0},\q\= 1.03325

n= 2,q= {-0.6724, 0.364, 0., 0.},\q\= 0.764603

n= 3,q= {-0.440374, -1.18951, 0., 0.},\q\= 1.26841

n= 4,q= {-1.981, 0.347657, 0., 0.},\q\= 2.01127

n= 5,q= {3.04349, -2.07741, 0., 0.},\q\= 3.6849

n= 6,q= {4.18717, -13.3452, 0., 0.},\q\= 13.9866

n= 7,q= {-161.321, -112.457, 0., 0.},\q\= 196.65

n= 8,q= {13 377.2, 36 282.7, 0., 0.},\q\= 38 670.2

n= 9,q= {-1.13748×10^9, 9.70721×10^8, 0., 0.},\q\= 1.49538×10^9

n= 10,q= {3.51564×10^17, -2.20835×10^18, 0., 0.},\q\= 2.23616×10^18

n= 11,q= {-4.75323×10^36, -1.55276×10^36, 0., 0.},\q\= 5.00042×10^36

n= 12,q= {2.01821×10^73, 1.47612×10^73, 0., 0.},\q\= 2.50042×10^73

n= 13,q= {1.89425×10^146, 5.95826×10^146, 0., 0.},\q\= 6.25212×10^146

n= 14,q= {-3.19127×10^293, 2.25729×10^293, 0., 0.},\q\= 3.9089×10^293

n= 15,q= {5.088852345853266×10^586, -1.440720366790744×10^587, 0., 0.}
 ,\q\= 1.527952668528911×10^587

n= 16,q= {-1.816710993306693×10^1174, -1.466322643652331×10^1174, 0., 0.}
 ,\q\= 2.334639357264619×10^1174

n= 17,q= {1.150336737913830×10^2348, 5.327768932915444×10^2348, 0., 0.}
 ,\q\= 5.450540928488952×10^2348

n= 18,q= {-2.706184719194474×10^4697, 1.225745666929720×10^4697, 0., 0.}
 ,\q\= 2.970839641313320×10^4697

n= 19,q= {5.820983294404689×10^9394, -6.634188386928096×10^9394, 0., 0.}
 ,\q\= 8.825888174398658×10^9394

n= 20,q= {-1.012860903951314×10^18 789, -7.723499954448408×10^18 789, 0., 0.}
 ,\q\= 7.789630206699008×10^18 789
```

In[ ]:=
```
P = {-0.76, -1.2, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[ ]= {-0.76, -1.2, 0, 0}

```
n= 1,q= {-0.76, -1.2, 0, 0},\q\= 1.42042

n= 2,q= {-1.6224, 0.624, 0., 0.},\q\= 1.73826

n= 3,q= {1.48281, -3.22476, 0., 0.},\q\= 3.54933

n= 4,q= {-8.96033, -10.7634, 0., 0.},\q\= 14.0049

n= 5,q= {-36.3226, 191.687, 0., 0.},\q\= 195.098

n= 6,q= {-35425.3, -13926.3, 0., 0.},\q\= 38064.3

n= 7,q= {1.06101×10^9, 9.86687×10^8, 0., 0.},\q\= 1.44889×10^9

n= 8,q= {1.52183×10^17, 2.09376×10^18, 0., 0.},\q\= 2.09928×10^18

n= 9,q= {-4.36068×10^36, 6.3727×10^35, 0., 0.},\q\= 4.407×10^36

n= 10,q= {1.86094×10^73, -5.55786×10^72, 0., 0.},\q\= 1.94216×10^73

n= 11,q= {3.1542×10^146, -2.06857×10^146, 0., 0.},\q\= 3.77199×10^146

n= 12,q= {5.66999×10^292, -1.30493×10^293, 0., 0.},\q\= 1.42279×10^293

n= 13,q= {-1.381367456221049×10^586, -1.479793520389373×10^586, 0., 0.}
 ,\q\= 2.024343081617587×10^586

n= 14,q= {-2.816128138797619×10^1171, 4.088277221985320×10^1172, 0., 0.}
 ,\q\= 4.097964912092987×10^1172

n= 15,q= {-1.663470486686272×10^2345, -2.302622504807644×10^2344, 0., 0.}
 ,\q\= 1.679331642074528×10^2345

n= 16,q= {2.714113356079798×10^4690, 7.660689157454269×10^4689, 0., 0.}
 ,\q\= 2.820154764072730×10^4690

n= 17,q= {6.779549725979369×10^9380, 4.158395751804465×10^9380, 0., 0.}
 ,\q\= 7.953272893322117×10^9380

n= 18,q= {2.867003925840152×10^18761, 5.638410155931947×10^18761, 0., 0.}
 ,\q\= 6.325454971565236×10^18761

n= 19,q= {-2.357195757573368×10^37523, 3.233068810510775×10^37523, 0., 0.}
 ,\q\= 4.001138059729936×10^37523

n= 20,q= {-4.896362093975675×10^75046, -1.524195216815755×10^75047, 0., 0.}
 ,\q\= 1.600910577301944×10^75047
```

In[•]:=
```
P = {-0.76, -0.7, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-0.76, -0.7, 0, 0}

```
n= 1,q= {-0.76, -0.7, 0, 0},\q\= 1.03325

n= 2,q= {-0.6724, 0.364, 0., 0.},\q\= 0.764603

n= 3,q= {-0.440374, -1.18951, 0., 0.},\q\= 1.26841

n= 4,q= {-1.981, 0.347657, 0., 0.},\q\= 2.01127

n= 5,q= {3.04349, -2.07741, 0., 0.},\q\= 3.6849

n= 6,q= {4.18717, -13.3452, 0., 0.},\q\= 13.9866

n= 7,q= {-161.321, -112.457, 0., 0.},\q\= 196.65

n= 8,q= {13 377.2, 36 282.7, 0., 0.},\q\= 38 670.2

n= 9,q= {-1.13748×10^9, 9.70721×10^8, 0., 0.},\q\= 1.49538×10^9

n= 10,q= {3.51564×10^17, -2.20835×10^18, 0., 0.},\q\= 2.23616×10^18

n= 11,q= {-4.75323×10^36, -1.55276×10^36, 0., 0.},\q\= 5.00042×10^36

n= 12,q= {2.01821×10^73, 1.47612×10^73, 0., 0.},\q\= 2.50042×10^73

n= 13,q= {1.89425×10^146, 5.95826×10^146, 0., 0.},\q\= 6.25212×10^146

n= 14,q= {-3.19127×10^293, 2.25729×10^293, 0., 0.},\q\= 3.9089×10^293

n= 15,q= {5.088852345853266×10^586, -1.440720366790744×10^587, 0., 0.}
 ,\q\= 1.527952668528911×10^587

n= 16,q= {-1.816710993306693×10^1174, -1.466322643652331×10^1174, 0., 0.}
 ,\q\= 2.334639357264619×10^1174

n= 17,q= {1.150336737913830×10^2348, 5.327768932915444×10^2348, 0., 0.}
 ,\q\= 5.450540928488952×10^2348

n= 18,q= {-2.706184719194474×10^4697, 1.225745666929720×10^4697, 0., 0.}
 ,\q\= 2.970839641313320×10^4697

n= 19,q= {5.820983294404689×10^9394, -6.634188386928096×10^9394, 0., 0.}
 ,\q\= 8.825888174398658×10^9394

n= 20,q= {-1.012860903951314×10^18 789, -7.723499954448408×10^18 789, 0., 0.}
 ,\q\= 7.789630206699008×10^18 789
```

In[ ]:=
```
P = {-0.76, -1.4, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[ ]= {-0.76, -1.4, 0, 0}

```
n= 1,q= {-0.76, -1.4, 0, 0},\q\= 1.59298

n= 2,q= {-2.1424, 0.728, 0., 0.},\q\= 2.26271

n= 3,q= {3.29989, -4.51933, 0., 0.},\q\= 5.59586

n= 4,q= {-10.2951, -31.2266, 0., 0.},\q\= 32.88

n= 5,q= {-869.875, 641.562, 0., 0.},\q\= 1080.87

n= 6,q= {345 080., -1.11616×10^6, 0., 0.},\q\= 1.16828×10^6

n= 7,q= {-1.12673×10^12, -7.70327×10^11, 0., 0.},\q\= 1.36489×10^12

n= 8,q= {6.76116×10^23, 1.7359×10^24, 0., 0.},\q\= 1.86292×10^24

n= 9,q= {-2.55622×10^48, 2.34734×10^48, 0., 0.},\q\= 3.47048×10^48

n= 10,q= {1.02423×10^96, -1.20006×10^97, 0., 0.},\q\= 1.20443×10^97

n= 11,q= {-1.42966×10^194, -2.45828×10^193, 0., 0.},\q\= 1.45064×10^194

n= 12,q= {1.983493845087599×10^388, 7.028993412131522×10^387, 0., 0.}
 ,\q\= 2.104356271494509×10^388

n= 13,q= {3.440180349622503×10^776, 2.788393034024830×10^776, 0., 0.}
 ,\q\= 4.428315317378270×10^776

n= 14,q= {4.059705125730606×10^1552, 1.918514984535299×10^1553, 0., 0.}
 ,\q\= 1.960997655012701×10^1553

n= 15,q= {-3.515887688807643×10^3106, 1.557721023301785×10^3106, 0., 0.}
 ,\q\= 3.845511802965310×10^3106

n= 16,q= {9.93497145387279×10^6212, -1.095354433684718×10^6213, 0., 0.}
 ,\q\= 1.478796102674551×10^6213

n= 17,q= {-2.127647575000976×10^12 425, -2.176463006106134×10^12 426, 0., 0.}
 ,\q\= 2.186837913285442×10^12 426

n= 18,q= {-4.691722374914475×10^24 852, 9.26149247404210×10^24 851, 0., 0.}
 ,\q\= 4.782260058982626×10^24 852

n= 19,q= {2.115450641480574×10^49 705, -8.690470293113068×10^49 704, 0., 0.}
 ,\q\= 2.287001127174051×10^49 705

n= 20,q= {3.719888677385763×10^99 410, -3.676852191266782×10^99 410, 0., 0.}
 ,\q\= 5.230374155695378×10^99 410
```

In[ ]:=
```
P = {-0.6, 1.4, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[ ]= {-0.6, 1.4, 0, 0}

```
n= 1,q= {-0.6, 1.4, 0, 0},\q\= 1.52315
n= 2,q= {-2.2, -0.28, 0., 0.},\q\= 2.21775
n= 3,q= {4.1616, 2.632, 0., 0.},\q\= 4.92406
n= 4,q= {9.79149, 23.3067, 0., 0.},\q\= 25.2799
n= 5,q= {-447.927, 457.814, 0., 0.},\q\= 640.494
n= 6,q= {-8955.4, -410133., 0., 0.},\q\= 410231.
n= 7,q= {-1.68129×10^11, 7.34581×10^9, 0., 0.},\q\= 1.68289×10^11
n= 8,q= {2.82134×10^22, -2.47009×10^21, 0., 0.},\q\= 2.83213×10^22
n= 9,q= {7.89896×10^44, -1.39379×10^44, 0., 0.},\q\= 8.02099×10^44
n= 10,q= {6.04509×10^89, -2.2019×10^89, 0., 0.},\q\= 6.43362×10^89
n= 11,q= {3.16948×10^179, -2.66214×10^179, 0., 0.},\q\= 4.13915×10^179
n= 12,q= {2.958576594875668×10^358, -1.687519702024897×10^359, 0., 0.}
 ,\q\= 1.713258445010460×10^359
n= 13,q= {-2.760190990044736×10^718, -9.98531258760484×10^717, 0., 0.}
 ,\q\= 2.935254499399658×10^718
n= 14,q= {6.621589626802344×10^1436, 5.512273967417436×10^1436, 0., 0.}
 ,\q\= 8.615718976245939×10^1436
n= 15,q= {1.346028489390845×10^2873, 7.300003224548780×10^2873, 0., 0.}
 ,\q\= 7.423061347764437×10^2873
n= 16,q= {-5.147825438417078×10^5747, 1.965202462577538×10^5747, 0., 0.}
 ,\q\= 5.510183977267438×10^5747
n= 17,q= {2.263808602549316×10^11495, -2.023303845699307×10^11495, 0., 0.}
 ,\q\= 3.036212746333480×10^11495
n= 18,q= {1.031070936954682×10^22990, -9.16074530293041×10^22990, 0., 0.}
 ,\q\= 9.21858784099790×10^22990
n= 19,q= {-8.285614722812904×10^45981, -1.889075648539133×10^45981, 0., 0.}
 ,\q\= 8.498236178219425×10^45981
n= 20,q= {6.508280452899040×10^91963, 3.130430601208634×10^91963, 0., 0.}
 ,\q\= 7.222001814079749×10^91963
```

In[•]:=

```
P = {-0.6, 1.2, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-0.6, 1.2, 0, 0}

```
n= 1,q= {-0.6, 1.2, 0, 0},\q\= 1.34164

n= 2,q= {-1.68, -0.24, 0., 0.},\q\= 1.69706

n= 3,q= {2.1648, 2.0064, 0., 0.},\q\= 2.95161

n= 4,q= {0.0607181, 9.88691, 0., 0.},\q\= 9.8871

n= 5,q= {-98.3473, 2.40063, 0., 0.},\q\= 98.3766

n= 6,q= {9665.83, -470.991, 0., 0.},\q\= 9677.3

n= 7,q= {9.32064×10^7, -9.10503×10^6, 0., 0.},\q\= 9.365×10^7

n= 8,q= {8.60453×10^15, -1.69729×10^15, 0., 0.},\q\= 8.77033×10^15

n= 9,q= {7.11571×10^31, -2.92088×10^31, 0., 0.},\q\= 7.69187×10^31

n= 10,q= {4.21018×10^63, -4.15683×10^63, 0., 0.},\q\= 5.91648×10^63

n= 11,q= {4.46373×10^125, -3.50019×10^127, 0., 0.},\q\= 3.50048×10^127

n= 12,q= {-1.22494×10^255, -3.12479×10^253, 0., 0.},\q\= 1.22533×10^255

n= 13,q= {1.499491845522758×10^510, 7.655324534377576×10^508, 0., 0.}
 ,\q\= 1.501444702332360×10^510

n= 14,q= {2.242615395416582×10^1020, 2.295819342825895×10^1019, 0., 0.}
 ,\q\= 2.254336194161910×10^1020

n= 15,q= {4.976615947210536×10^2040, 1.029727960663307×10^2040, 0., 0.}
 ,\q\= 5.082031676308407×10^2040

n= 16,q= {2.370636661305841×10^4081, 1.024912118065119×10^4081, 0., 0.}
 ,\q\= 2.582704595900204×10^4081

n= 17,q= {4.569473330170578×10^8162, 4.859388483403584×10^8162, 0., 0.}
 ,\q\= 6.670363029684035×10^8162

n= 18,q= {-2.733569917495197×10^16324, 4.440969215170145×10^16325, 0., 0.}
 ,\q\= 4.449374294777557×10^16325

n= 19,q= {-1.964748352515059×10^32651, -2.427939970222273×10^32650, 0., 0.}
 ,\q\= 1.979693161502728×10^32651

n= 20,q= {3.801287163720610×10^65302, 9.54058211299935×10^65301, 0., 0.}
 ,\q\= 3.919185013700668×10^65302
```

In[•]:=
```
P = {-0.6, 0.7, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-0.6, 0.7, 0, 0}

```
n= 1,q= {-0.6, 0.7, 0, 0},\q\= 0.921954
n= 2,q= {-0.73, -0.14, 0., 0.},\q\= 0.743303
n= 3,q= {-0.0867, 0.9044, 0., 0.},\q\= 0.908546
n= 4,q= {-1.41042, 0.543177, 0., 0.},\q\= 1.5114
n= 5,q= {1.09425, -0.832218, 0., 0.},\q\= 1.37476
n= 6,q= {-0.0952035, -1.12131, 0., 0.},\q\= 1.12534
n= 7,q= {-1.84827, 0.913505, 0., 0.},\q\= 2.0617
n= 8,q= {1.98162, -2.67681, 0., 0.},\q\= 3.33049
n= 9,q= {-3.83852, -9.90885, 0., 0.},\q\= 10.6264
n= 10,q= {-84.051, 76.7705, 0., 0.},\q\= 113.834
n= 11,q= {1170.25, -12904.6, 0., 0.},\q\= 12957.5
n= 12,q= {-1.65159×10^8, -3.02032×10^7, 0., 0.},\q\= 1.67898×10^8
n= 13,q= {2.63652×10^16, 9.97666×10^15, 0., 0.},\q\= 2.81896×10^16
n= 14,q= {5.95589×10^32, 5.26073×10^32, 0., 0.},\q\= 7.94656×10^32
n= 15,q= {7.79736×10^64, 6.26646×10^65, 0., 0.},\q\= 6.31479×10^65
n= 16,q= {-3.86606×10^131, 9.77238×10^130, 0., 0.},\q\= 3.98765×10^131
n= 17,q= {1.39914×10^263, -7.55611×10^262, 0., 0.},\q\= 1.59014×10^263
n= 18,q= {1.386642056834385×10^526, -2.114409520858638×10^526, 0., 0.}
 ,\q\= 2.528537881005454×10^526
n= 19,q= {-2.547951428115762×10^1052, -5.863858333987257×10^1052, 0., 0.}
 ,\q\= 6.393503815679550×10^1052
n= 20,q= {-2.789277808103465×10^2105, 2.988165243270269×10^2105, 0., 0.}
 ,\q\= 4.087689104110896×10^2105
```

In[•]:=

```
P = {-0.6, 0.5, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-0.6, 0.5, 0, 0}

```
n= 1,q= {-0.6, 0.5, 0, 0},\q\= 0.781025
n= 2,q= {-0.49, -0.1, 0., 0.},\q\= 0.5001
n= 3,q= {-0.3699, 0.598, 0., 0.},\q\= 0.703157
n= 4,q= {-0.820778, 0.0575996, 0., 0.},\q\= 0.822797
n= 5,q= {0.0703588, 0.405447, 0., 0.},\q\= 0.411507
n= 6,q= {-0.759437, 0.557054, 0., 0.},\q\= 0.941835
n= 7,q= {-0.333564, -0.346094, 0., 0.},\q\= 0.480673
n= 8,q= {-0.608516, 0.730889, 0., 0.},\q\= 0.951047
n= 9,q= {-0.763907, -0.389516, 0., 0.},\q\= 0.857483
n= 10,q= {-0.168168, 1.09511, 0., 0.},\q\= 1.10794
n= 11,q= {-1.77098, 0.131676, 0., 0.},\q\= 1.77587
n= 12,q= {2.51903, 0.0336103, 0., 0.},\q\= 2.51926
n= 13,q= {5.74439, 0.669331, 0., 0.},\q\= 5.78325
n= 14,q= {31.95, 8.18979, 0., 0.},\q\= 32.9829
n= 15,q= {953.128, 523.827, 0., 0.},\q\= 1087.59
n= 16,q= {634058., 998550., 0., 0.},\q\= 1.18285×10^6
n= 17,q= {-5.95072×10^11, 1.26628×10^12, 0., 0.},\q\= 1.39913×10^12
n= 18,q= {-1.24935×10^24, -1.50705×10^24, 0., 0.},\q\= 1.95757×10^24
n= 19,q= {-7.10343×10^47, 3.76566×10^48, 0., 0.},\q\= 3.83208×10^48
n= 20,q= {-1.36756×10^97, -5.34982×10^96, 0., 0.},\q\= 1.46848×10^97
```

In[ ]:=
```
P = {-0.6, 0.4, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[ ]= {-0.6, 0.4, 0, 0}

```
n= 1,q= {-0.6, 0.4, 0, 0},\q\= 0.72111
n= 2,q= {-0.4, -0.08, 0., 0.},\q\= 0.407922
n= 3,q= {-0.4464, 0.464, 0., 0.},\q\= 0.64387
n= 4,q= {-0.616023, -0.0142592, 0., 0.},\q\= 0.616188
n= 5,q= {-0.220719, 0.417568, 0., 0.},\q\= 0.472313
n= 6,q= {-0.725646, 0.21567, 0., 0.},\q\= 0.757018
n= 7,q= {-0.119951, 0.0870003, 0., 0.},\q\= 0.14818
n= 8,q= {-0.593181, 0.379128, 0., 0.},\q\= 0.70399
n= 9,q= {-0.391875, -0.0497834, 0., 0.},\q\= 0.395024
n= 10,q= {-0.448912, 0.439018, 0., 0.},\q\= 0.6279
n= 11,q= {-0.591214, 0.00583894, 0., 0.},\q\= 0.591243
n= 12,q= {-0.2505, 0.393096, 0., 0.},\q\= 0.466127
n= 13,q= {-0.691774, 0.203059, 0., 0.},\q\= 0.720961
n= 14,q= {-0.162681, 0.119058, 0., 0.},\q\= 0.201594
n= 15,q= {-0.58771, 0.361263, 0., 0.},\q\= 0.689865
n= 16,q= {-0.385108, -0.0246354, 0., 0.},\q\= 0.385896
n= 17,q= {-0.452298, 0.418975, 0., 0.},\q\= 0.616533
n= 18,q= {-0.570966, 0.0209969, 0., 0.},\q\= 0.571352
n= 19,q= {-0.274439, 0.376023, 0., 0.},\q\= 0.465521
n= 20,q= {-0.666077, 0.193609, 0., 0.},\q\= 0.693644
```

In[ ]:=
```
P = {-0.6, 0.2, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[ ]= {-0.6, 0.2, 0, 0}

```
n= 1,q= {-0.6, 0.2, 0, 0},\q\= 0.632456
n= 2,q= {-0.28, -0.04, 0., 0.},\q\= 0.282843
n= 3,q= {-0.5232, 0.2224, 0., 0.},\q\= 0.568507
n= 4,q= {-0.375724, -0.0327194, 0., 0.},\q\= 0.377145
n= 5,q= {-0.459902, 0.224587, 0., 0.},\q\= 0.51181
n= 6,q= {-0.438929, -0.00657607, 0., 0.},\q\= 0.438978
n= 7,q= {-0.407385, 0.205773, 0., 0.},\q\= 0.456404
n= 8,q= {-0.47638, 0.0323426, 0., 0.},\q\= 0.477477
n= 9,q= {-0.374108, 0.169185, 0., 0.},\q\= 0.410585
n= 10,q= {-0.488667, 0.073413, 0., 0.},\q\= 0.494151
n= 11,q= {-0.366594, 0.128251, 0., 0.},\q\= 0.388381
n= 12,q= {-0.482057, 0.105968, 0., 0.},\q\= 0.493567
n= 13,q= {-0.37885, 0.0978349, 0., 0.},\q\= 0.391279
n= 14,q= {-0.466044, 0.12587, 0., 0.},\q\= 0.482743
n= 15,q= {-0.398646, 0.0826776, 0., 0.},\q\= 0.407129
n= 16,q= {-0.447917, 0.134082, 0., 0.},\q\= 0.467555
n= 17,q= {-0.417348, 0.079885, 0., 0.},\q\= 0.424925
n= 18,q= {-0.432202, 0.13332, 0., 0.},\q\= 0.452297
n= 19,q= {-0.430976, 0.0847575, 0., 0.},\q\= 0.439231
n= 20,q= {-0.421444, 0.126943, 0., 0.},\q\= 0.440147
```

In[ ]:=
```
P = {-0.6, -0.2, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[ ]= {-0.6, -0.2, 0, 0}

```
n= 1,q= {-0.6, -0.2, 0, 0},\q\= 0.632456
n= 2,q= {-0.28, 0.04, 0., 0.},\q\= 0.282843
n= 3,q= {-0.5232, -0.2224, 0., 0.},\q\= 0.568507
n= 4,q= {-0.375724, 0.0327194, 0., 0.},\q\= 0.377145
n= 5,q= {-0.459902, -0.224587, 0., 0.},\q\= 0.51181
n= 6,q= {-0.438929, 0.00657607, 0., 0.},\q\= 0.438978
n= 7,q= {-0.407385, -0.205773, 0., 0.},\q\= 0.456404
n= 8,q= {-0.47638, -0.0323426, 0., 0.},\q\= 0.477477
n= 9,q= {-0.374108, -0.169185, 0., 0.},\q\= 0.410585
n= 10,q= {-0.488667, -0.073413, 0., 0.},\q\= 0.494151
n= 11,q= {-0.366594, -0.128251, 0., 0.},\q\= 0.388381
n= 12,q= {-0.482057, -0.105968, 0., 0.},\q\= 0.493567
n= 13,q= {-0.37885, -0.0978349, 0., 0.},\q\= 0.391279
n= 14,q= {-0.466044, -0.12587, 0., 0.},\q\= 0.482743
n= 15,q= {-0.398646, -0.0826776, 0., 0.},\q\= 0.407129
n= 16,q= {-0.447917, -0.134082, 0., 0.},\q\= 0.467555
n= 17,q= {-0.417348, -0.079885, 0., 0.},\q\= 0.424925
n= 18,q= {-0.432202, -0.13332, 0., 0.},\q\= 0.452297
n= 19,q= {-0.430976, -0.0847575, 0., 0.},\q\= 0.439231
n= 20,q= {-0.421444, -0.126943, 0., 0.},\q\= 0.440147
```

In[•]:=
```
P = {-0.6, -0.4, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-0.6, -0.4, 0, 0}

```
n= 1,q= {-0.6, -0.4, 0, 0},\q\= 0.72111
n= 2,q= {-0.4, 0.08, 0., 0.},\q\= 0.407922
n= 3,q= {-0.4464, -0.464, 0., 0.},\q\= 0.64387
n= 4,q= {-0.616023, 0.0142592, 0., 0.},\q\= 0.616188
n= 5,q= {-0.220719, -0.417568, 0., 0.},\q\= 0.472313
n= 6,q= {-0.725646, -0.21567, 0., 0.},\q\= 0.757018
n= 7,q= {-0.119951, -0.0870003, 0., 0.},\q\= 0.14818
n= 8,q= {-0.593181, -0.379128, 0., 0.},\q\= 0.70399
n= 9,q= {-0.391875, 0.0497834, 0., 0.},\q\= 0.395024
n= 10,q= {-0.448912, -0.439018, 0., 0.},\q\= 0.6279
n= 11,q= {-0.591214, -0.00583894, 0., 0.},\q\= 0.591243
n= 12,q= {-0.2505, -0.393096, 0., 0.},\q\= 0.466127
n= 13,q= {-0.691774, -0.203059, 0., 0.},\q\= 0.720961
n= 14,q= {-0.162681, -0.119058, 0., 0.},\q\= 0.201594
n= 15,q= {-0.58771, -0.361263, 0., 0.},\q\= 0.689865
n= 16,q= {-0.385108, 0.0246354, 0., 0.},\q\= 0.385896
n= 17,q= {-0.452298, -0.418975, 0., 0.},\q\= 0.616533
n= 18,q= {-0.570966, -0.0209969, 0., 0.},\q\= 0.571352
n= 19,q= {-0.274439, -0.376023, 0., 0.},\q\= 0.465521
n= 20,q= {-0.666077, -0.193609, 0., 0.},\q\= 0.693644
```

In[•]:=
```
P = {-0.6, -0.5, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]=
```
{-0.6, -0.5, 0, 0}
```

```
n= 1,q= {-0.6, -0.5, 0, 0},\q\= 0.781025
n= 2,q= {-0.49, 0.1, 0., 0.},\q\= 0.5001
n= 3,q= {-0.3699, -0.598, 0., 0.},\q\= 0.703157
n= 4,q= {-0.820778, -0.0575996, 0., 0.},\q\= 0.822797
n= 5,q= {0.0703588, -0.405447, 0., 0.},\q\= 0.411507
n= 6,q= {-0.759437, -0.557054, 0., 0.},\q\= 0.941835
n= 7,q= {-0.333564, 0.346094, 0., 0.},\q\= 0.480673
n= 8,q= {-0.608516, -0.730889, 0., 0.},\q\= 0.951047
n= 9,q= {-0.763907, 0.389516, 0., 0.},\q\= 0.857483
n= 10,q= {-0.168168, -1.09511, 0., 0.},\q\= 1.10794
n= 11,q= {-1.77098, -0.131676, 0., 0.},\q\= 1.77587
n= 12,q= {2.51903, -0.0336103, 0., 0.},\q\= 2.51926
n= 13,q= {5.74439, -0.669331, 0., 0.},\q\= 5.78325
n= 14,q= {31.95, -8.18979, 0., 0.},\q\= 32.9829
n= 15,q= {953.128, -523.827, 0., 0.},\q\= 1087.59
n= 16,q= {634058., -998550., 0., 0.},\q\= 1.18285×10^6
n= 17,q= {-5.95072×10^11, -1.26628×10^12, 0., 0.},\q\= 1.39913×10^12
n= 18,q= {-1.24935×10^24, 1.50705×10^24, 0., 0.},\q\= 1.95757×10^24
n= 20,q= {-1.36756×10^97, 5.34982×10^96, 0., 0.},\q\= 1.46848×10^97
```

In[ ]:=
```
P = {-0.6, -0.7, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[ ]= {-0.6, -0.7, 0, 0}

```
n= 1,q= {-0.6, -0.7, 0, 0},\q\= 0.921954
n= 2,q= {-0.73, 0.14, 0., 0.},\q\= 0.743303
n= 3,q= {-0.0867, -0.9044, 0., 0.},\q\= 0.908546
n= 4,q= {-1.41042, -0.543177, 0., 0.},\q\= 1.5114
n= 5,q= {1.09425, 0.832218, 0., 0.},\q\= 1.37476
n= 6,q= {-0.0952035, 1.12131, 0., 0.},\q\= 1.12534
n= 7,q= {-1.84827, -0.913505, 0., 0.},\q\= 2.0617
n= 8,q= {1.98162, 2.67681, 0., 0.},\q\= 3.33049
n= 9,q= {-3.83852, 9.90885, 0., 0.},\q\= 10.6264
n= 10,q= {-84.051, -76.7705, 0., 0.},\q\= 113.834
n= 11,q= {1170.25, 12904.6, 0., 0.},\q\= 12957.5
n= 12,q= {-1.65159×10^8, 3.02032×10^7, 0., 0.},\q\= 1.67898×10^8
n= 13,q= {2.63652×10^16, -9.97666×10^15, 0., 0.},\q\= 2.81896×10^16
n= 14,q= {5.95589×10^32, -5.26073×10^32, 0., 0.},\q\= 7.94656×10^32
n= 15,q= {7.79736×10^64, -6.26646×10^65, 0., 0.},\q\= 6.31479×10^65
n= 16,q= {-3.86606×10^131, -9.77238×10^130, 0., 0.},\q\= 3.98765×10^131
n= 17,q= {1.39914×10^263, 7.55611×10^262, 0., 0.},\q\= 1.59014×10^263
n= 18,q= {1.386642056834385×10^526, 2.114409520858638×10^526, 0., 0.}
 ,\q\= 2.528537881005454×10^526
n= 19,q= {-2.547951428115762×10^1052, 5.863858333987257×10^1052, 0., 0.}
 ,\q\= 6.393503815679550×10^1052
n= 20,q= {-2.789277808103465×10^2105, -2.988165243270269×10^2105, 0., 0.}
 ,\q\= 4.087689104110896×10^2105
```

In[•]:=

```
P = {-0.6, -1.2, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-0.6, -1.2, 0, 0}

```
n= 1,q= {-0.6, -1.2, 0, 0},\q\= 1.34164

n= 2,q= {-1.68, 0.24, 0., 0.},\q\= 1.69706

n= 3,q= {2.1648, -2.0064, 0., 0.},\q\= 2.95161

n= 4,q= {0.0607181, -9.88691, 0., 0.},\q\= 9.8871

n= 5,q= {-98.3473, -2.40063, 0., 0.},\q\= 98.3766

n= 6,q= {9665.83, 470.991, 0., 0.},\q\= 9677.3

n= 7,q= {9.32064×10^7, 9.10503×10^6, 0., 0.},\q\= 9.365×10^7

n= 8,q= {8.60453×10^15, 1.69729×10^15, 0., 0.},\q\= 8.77033×10^15

n= 9,q= {7.11571×10^31, 2.92088×10^31, 0., 0.},\q\= 7.69187×10^31

n= 10,q= {4.21018×10^63, 4.15683×10^63, 0., 0.},\q\= 5.91648×10^63

n= 11,q= {4.46373×10^125, 3.50019×10^127, 0., 0.},\q\= 3.50048×10^127

n= 12,q= {-1.22494×10^255, 3.12479×10^253, 0., 0.},\q\= 1.22533×10^255

n= 13,q= {1.499491845522758×10^510, -7.655324534377576×10^508, 0., 0.}
 ,\q\= 1.501444702332360×10^510

n= 14,q= {2.242615395416582×10^1020, -2.295819342825895×10^1019, 0., 0.}
 ,\q\= 2.254336194161910×10^1020

n= 15,q= {4.976615947210536×10^2040, -1.029727960663307×10^2040, 0., 0.}
 ,\q\= 5.082031676308407×10^2040

n= 16,q= {2.370636661305841×10^4081, -1.024912118065119×10^4081, 0., 0.}
 ,\q\= 2.582704595900204×10^4081

n= 17,q= {4.569473330170578×10^8162, -4.859388483403584×10^8162, 0., 0.}
 ,\q\= 6.670363029684035×10^8162

n= 18,q= {-2.733569917495197×10^16324, -4.440969215170145×10^16325, 0., 0.}
 ,\q\= 4.449374294777557×10^16325

n= 19,q= {-1.964748352515059×10^32651, 2.427939970222273×10^32650, 0., 0.}
 ,\q\= 1.979693161502728×10^32651

n= 20,q= {3.801287163720610×10^65302, -9.54058211299935×10^65301, 0., 0.}
 ,\q\= 3.919185013700668×10^65302
```

In[•]:=
```
P = {-0.6, -1.4, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-0.6, -1.4, 0, 0}

```
n= 1,q= {-0.6, -1.4, 0, 0},\q\= 1.52315

n= 2,q= {-2.2, 0.28, 0., 0.},\q\= 2.21775

n= 3,q= {4.1616, -2.632, 0., 0.},\q\= 4.92406

n= 4,q= {9.79149, -23.3067, 0., 0.},\q\= 25.2799

n= 5,q= {-447.927, -457.814, 0., 0.},\q\= 640.494

n= 6,q= {-8955.4, 410133., 0., 0.},\q\= 410231.

n= 7,q= {-1.68129×10^11, -7.34581×10^9, 0., 0.},\q\= 1.68289×10^11

n= 8,q= {2.82134×10^22, 2.47009×10^21, 0., 0.},\q\= 2.83213×10^22

n= 9,q= {7.89896×10^44, 1.39379×10^44, 0., 0.},\q\= 8.02099×10^44

n= 10,q= {6.04509×10^89, 2.2019×10^89, 0., 0.},\q\= 6.43362×10^89

n= 11,q= {3.16948×10^179, 2.66214×10^179, 0., 0.},\q\= 4.13915×10^179

n= 12,q= {2.958576594875668×10^358, 1.687519702024897×10^359, 0., 0.}
 ,\q\= 1.713258445010460×10^359

n= 13,q= {-2.760190990044736×10^718, 9.98531258760484×10^717, 0., 0.}
 ,\q\= 2.935254499399658×10^718

n= 14,q= {6.621589626802344×10^1436, -5.512273967417436×10^1436, 0., 0.}
 ,\q\= 8.615718976245939×10^1436

n= 15,q= {1.346028489390845×10^2873, -7.300003224548780×10^2873, 0., 0.}
 ,\q\= 7.423061347764437×10^2873

n= 16,q= {-5.147825438417078×10^5747, -1.965202462577538×10^5747, 0., 0.}
 ,\q\= 5.510183977267438×10^5747

n= 17,q= {2.263808602549316×10^11495, 2.023303845699307×10^11495, 0., 0.}
 ,\q\= 3.036212746333480×10^11495

n= 18,q= {1.031070936954682×10^22990, 9.16074530293041×10^22990, 0., 0.}
 ,\q\= 9.21858784099790×10^22990

n= 19,q= {-8.285614722812904×10^45981, 1.889075648539133×10^45981, 0., 0.}
 ,\q\= 8.498236178219425×10^45981

n= 20,q= {6.508280452899040×10^91963, -3.130430601208634×10^91963, 0., 0.}
 ,\q\= 7.222001814079749×10^91963
```

In[•]:=
```
P = {-0.4, 1.4, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-0.4, 1.4, 0, 0}

```
n= 1,q= {-0.4, 1.4, 0, 0},\q\= 1.45602

n= 2,q= {-2.2, 0.28, 0., 0.},\q\= 2.21775

n= 3,q= {4.3616, 0.168, 0., 0.},\q\= 4.36483

n= 4,q= {18.5953, 2.8655, 0., 0.},\q\= 18.8148

n= 5,q= {337.175, 107.97, 0., 0.},\q\= 354.04

n= 6,q= {102 029., 72 810.9, 0., 0.},\q\= 125 345.

n= 7,q= {5.10855×10^9, 1.48577×10^10, 0., 0.},\q\= 1.57114×10^10

n= 8,q= {-1.94653×10^20, 1.51802×10^20, 0., 0.},\q\= 2.46848×10^20

n= 9,q= {1.48459×10^40, -5.90977×10^40, 0., 0.},\q\= 6.09339×10^40

n= 10,q= {-3.27214×10^81, -1.75472×10^81, 0., 0.},\q\= 3.71294×10^81

n= 11,q= {7.62784×10^162, 1.14833×10^163, 0., 0.},\q\= 1.37859×10^163

n= 12,q= {-7.368332879060586×10^325, 1.751863389089434×10^326, 0., 0.}
 ,\q\= 1.900512727712806×10^326

n= 13,q= {-2.526102039865464×10^652, -2.581662521890037×10^652, 0., 0.}
 ,\q\= 3.611948628198369×10^652

n= 14,q= {-2.837898611191654×10^1303, 1.304308592558128×10^1305, 0., 0.}
 ,\q\= 1.304617289274408×10^1305

n= 15,q= {-1.700415537768224×10^2610, -7.402991086772104×10^2608, 0., 0.}
 ,\q\= 1.702026271473705×10^2610

n= 16,q= {2.885932573380517×10^5220, 2.517632213981392×10^5219, 0., 0.}
 ,\q\= 2.896893428786683×10^5220

n= 17,q= {8.265222098449927×10^10 440, 1.453143362824201×10^10 440, 0., 0.}
 ,\q\= 8.391991537747464×10^10 440

n= 18,q= {6.620227070378498×10^20 881, 2.402110526926086×10^20 881, 0., 0.}
 ,\q\= 7.042552196962504×10^20 881

n= 19,q= {3.805727147980315×10^41 763, 3.180503427279446×10^41 763, 0., 0.}
 ,\q\= 4.959754144694139×10^41 763

n= 20,q= {4.367957073938079×10^83 526, 2.420825647488365×10^83 527, 0., 0.}
 ,\q\= 2.459916117581069×10^83 527
```

In[ ]:=
```
P = {-0.4, 1.2, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[ ]= {-0.4, 1.2, 0, 0}

```
n= 1,q= {-0.4, 1.2, 0, 0},\q\= 1.26491

n= 2,q= {-1.68, 0.24, 0., 0.},\q\= 1.69706

n= 3,q= {2.3648, 0.3936, 0., 0.},\q\= 2.39733

n= 4,q= {5.03736, 3.06157, 0., 0.},\q\= 5.89476

n= 5,q= {15.6018, 32.0445, 0., 0.},\q\= 35.6407

n= 6,q= {-783.832, 1001.1, 0., 0.},\q\= 1271.45

n= 7,q= {-387809., -1.56939×10^6, 0., 0.},\q\= 1.61659×10^6

n= 8,q= {-2.31258×10^12, 1.21724×10^12, 0., 0.},\q\= 2.61337×10^12

n= 9,q= {3.86635×10^24, -5.62995×10^24, 0., 0.},\q\= 6.82971×10^24

n= 10,q= {-1.67477×10^49, -4.35347×10^49, 0., 0.},\q\= 4.6645×10^49

n= 11,q= {-1.61478×10^99, 1.45821×10^99, 0., 0.},\q\= 2.17575×10^99

n= 12,q= {4.8114×10^197, -4.70939×10^198, 0., 0.},\q\= 4.7339×10^198

n= 13,q= {-2.194686007948114×10^397, -4.531754507338190×10^396, 0., 0.}
 ,\q\= 2.240985199110210×10^397

n= 14,q= {4.611278684335427×10^794, 1.989155641742184×10^794, 0., 0.}
 ,\q\= 5.022014662631027×10^794

n= 15,q= {1.730715093753151×10^1589, 1.834510202118258×10^1589, 0., 0.}
 ,\q\= 2.522063127168103×10^1589

n= 16,q= {-3.700529459309967×10^3177, 6.350028992900426×10^3178, 0., 0.}
 ,\q\= 6.360802417420950×10^3178

n= 17,q= {-4.018592902788379×10^6357, -4.699693871140086×10^6356, 0., 0.}
 ,\q\= 4.045980739346820×10^6357

n= 18,q= {1.592821769351681×10^12715, 3.777231287168318×10^12714, 0., 0.}
 ,\q\= 1.636996014316544×10^12715

n= 19,q= {2.394406426952987×10^25430, 1.203291244415593×10^25430, 0., 0.}
 ,\q\= 2.679755950888252×10^25430

n= 20,q= {4.285272318546543×10^50860, 5.762336578249909×10^50860, 0., 0.}
 ,\q\= 7.181091956320998×10^50860
```

In[•]:=
```
P = {-0.4, 0.7, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-0.4, 0.7, 0, 0}

```
n= 1,q= {-0.4, 0.7, 0, 0},\q\= 0.806226

n= 2,q= {-0.73, 0.14, 0., 0.},\q\= 0.743303

n= 3,q= {0.1133, 0.4956, 0., 0.},\q\= 0.508386

n= 4,q= {-0.632782, 0.812303, 0., 0.},\q\= 1.02968

n= 5,q= {-0.659422, -0.328022, 0., 0.},\q\= 0.736503

n= 6,q= {-0.0727606, 1.13261, 0., 0.},\q\= 1.13495

n= 7,q= {-1.67751, 0.535181, 0., 0.},\q\= 1.76081

n= 8,q= {2.12763, -1.09555, 0., 0.},\q\= 2.39312

n= 9,q= {2.92658, -3.96183, 0., 0.},\q\= 4.92554

n= 10,q= {-7.53122, -22.4892, 0., 0.},\q\= 23.7167

n= 11,q= {-449.445, 339.442, 0., 0.},\q\= 563.225

n= 12,q= {86 779.4, -305 121., 0., 0.},\q\= 317 221.

n= 13,q= {-8.55679×10^10, -5.29564×10^10, 0., 0.},\q\= 1.00629×10^11

n= 14,q= {4.5175×10^21, 9.06273×10^21, 0., 0.},\q\= 1.01262×10^22

n= 15,q= {-6.17253×10^43, 8.18817×10^43, 0., 0.},\q\= 1.02541×10^44

n= 16,q= {-2.8946×10^87, -1.01083×10^88, 0., 0.},\q\= 1.05146×10^88

n= 17,q= {-9.38×10^175, 5.85192×10^175, 0., 0.},\q\= 1.10557×10^176

n= 18,q= {5.373953760047012×10^351, -1.097820054054608×10^352, 0., 0.}
 ,\q\= 1.222294015871671×10^352

n= 19,q= {-9.16415080933229×10^703, -1.179926841468355×10^704, 0., 0.}
 ,\q\= 1.494002661235697×10^704

n= 20,q= {-5.524107506556323×10^1407, 2.162605503839024×10^1408, 0., 0.}
 ,\q\= 2.232043951779346×10^1408
```

In[•]:=

```
P = {-0.4, 0.5, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-0.4, 0.5, 0, 0}

```
n= 1,q= {-0.4, 0.5, 0, 0},\q\= 0.640312
n= 2,q= {-0.49, 0.1, 0., 0.},\q\= 0.5001
n= 3,q= {-0.1699, 0.402, 0., 0.},\q\= 0.436429
n= 4,q= {-0.532738, 0.3634, 0., 0.},\q\= 0.64488
n= 5,q= {-0.24825, 0.112806, 0., 0.},\q\= 0.272678
n= 6,q= {-0.351097, 0.443992, 0., 0.},\q\= 0.566037
n= 7,q= {-0.47386, 0.188231, 0., 0.},\q\= 0.509877
n= 8,q= {-0.210888, 0.321609, 0., 0.},\q\= 0.384586
n= 9,q= {-0.458959, 0.364353, 0., 0.},\q\= 0.586
n= 10,q= {-0.32211, 0.165554, 0., 0.},\q\= 0.362164
n= 11,q= {-0.323653, 0.393347, 0., 0.},\q\= 0.509385
n= 12,q= {-0.44997, 0.245384, 0., 0.},\q\= 0.512529
n= 13,q= {-0.25774, 0.279169, 0., 0.},\q\= 0.379954
n= 14,q= {-0.411505, 0.356094, 0., 0.},\q\= 0.544187
n= 15,q= {-0.357466, 0.206931, 0., 0.},\q\= 0.41304
n= 16,q= {-0.315038, 0.352058, 0., 0.},\q\= 0.472434
n= 17,q= {-0.424696, 0.278176, 0., 0.},\q\= 0.50769
n= 18,q= {-0.297015, 0.263719, 0., 0.},\q\= 0.397198
n= 19,q= {-0.38133, 0.343343, 0., 0.},\q\= 0.513124
n= 20,q= {-0.372472, 0.238146, 0., 0.},\q\= 0.442096
```

In[ ]:=
```
P = {-0.4, 0.4, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[ ]= {-0.4, 0.4, 0, 0}

```
n= 1,q= {-0.4, 0.4, 0, 0},\q\= 0.565685
n= 2,q= {-0.4, 0.08, 0., 0.},\q\= 0.407922
n= 3,q= {-0.2464, 0.336, 0., 0.},\q\= 0.416664
n= 4,q= {-0.452183, 0.234419, 0., 0.},\q\= 0.509335
n= 5,q= {-0.250483, 0.187999, 0., 0.},\q\= 0.313186
n= 6,q= {-0.372602, 0.305819, 0., 0.},\q\= 0.482035
n= 7,q= {-0.354693, 0.172103, 0., 0.},\q\= 0.394241
n= 8,q= {-0.303812, 0.277913, 0., 0.},\q\= 0.411749
n= 9,q= {-0.384934, 0.231133, 0., 0.},\q\= 0.448995
n= 10,q= {-0.305249, 0.222058, 0., 0.},\q\= 0.377474
n= 11,q= {-0.356133, 0.264434, 0., 0.},\q\= 0.443572
n= 12,q= {-0.343095, 0.211653, 0., 0.},\q\= 0.403126
n= 13,q= {-0.327083, 0.254766, 0., 0.},\q\= 0.414595
n= 14,q= {-0.357923, 0.233341, 0., 0.},\q\= 0.427266
n= 15,q= {-0.326339, 0.232964, 0., 0.},\q\= 0.400961
n= 16,q= {-0.347775, 0.247949, 0., 0.},\q\= 0.427114
n= 17,q= {-0.340531, 0.227539, 0., 0.},\q\= 0.409555
n= 18,q= {-0.335812, 0.245032, 0., 0.},\q\= 0.415705
n= 19,q= {-0.347271, 0.235431, 0., 0.},\q\= 0.419553
n= 20,q= {-0.334831, 0.236484, 0., 0.},\q\= 0.409922
```

In[ ]:=
```
P = {-0.4, 0.2, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[ ]=
```
{-0.4, 0.2, 0, 0}
```

```
n= 1,q= {-0.4, 0.2, 0, 0},\q\= 0.447214
n= 2,q= {-0.28, 0.04, 0., 0.},\q\= 0.282843
n= 3,q= {-0.3232, 0.1776, 0., 0.},\q\= 0.368782
n= 4,q= {-0.327084, 0.0851994, 0., 0.},\q\= 0.337998
n= 5,q= {-0.300275, 0.144265, 0., 0.},\q\= 0.333133
n= 6,q= {-0.330647, 0.113361, 0., 0.},\q\= 0.34954
n= 7,q= {-0.303523, 0.125035, 0., 0.},\q\= 0.328268
n= 8,q= {-0.323507, 0.124098, 0., 0.},\q\= 0.346493
n= 9,q= {-0.310743, 0.119707, 0., 0.},\q\= 0.333003
n= 10,q= {-0.317768, 0.125604, 0., 0.},\q\= 0.341691
n= 11,q= {-0.3148, 0.120174, 0., 0.},\q\= 0.336958
n= 12,q= {-0.315343, 0.124338, 0., 0.},\q\= 0.338971
n= 13,q= {-0.316019, 0.121581, 0., 0.},\q\= 0.3386
n= 14,q= {-0.314914, 0.123156, 0., 0.},\q\= 0.338139
n= 15,q= {-0.315996, 0.122433, 0., 0.},\q\= 0.338886
n= 16,q= {-0.315136, 0.122623, 0., 0.},\q\= 0.338153
n= 17,q= {-0.315726, 0.122714, 0., 0.},\q\= 0.338735
n= 18,q= {-0.315376, 0.122512, 0., 0.},\q\= 0.338336
n= 19,q= {-0.315547, 0.122725, 0., 0.},\q\= 0.338573
n= 20,q= {-0.315491, 0.122549, 0., 0.},\q\= 0.338457
```

In[ ]:=
```
P = {-0.4, -0.2, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[ ]=
```
{-0.4, -0.2, 0, 0}
```

```
n= 1,q= {-0.4, -0.2, 0, 0},\q\= 0.447214
n= 2,q= {-0.28, -0.04, 0., 0.},\q\= 0.282843
n= 3,q= {-0.3232, -0.1776, 0., 0.},\q\= 0.368782
n= 4,q= {-0.327084, -0.0851994, 0., 0.},\q\= 0.337998
n= 5,q= {-0.300275, -0.144265, 0., 0.},\q\= 0.333133
n= 6,q= {-0.330647, -0.113361, 0., 0.},\q\= 0.34954
n= 7,q= {-0.303523, -0.125035, 0., 0.},\q\= 0.328268
n= 8,q= {-0.323507, -0.124098, 0., 0.},\q\= 0.346493
n= 9,q= {-0.310743, -0.119707, 0., 0.},\q\= 0.333003
n= 10,q= {-0.317768, -0.125604, 0., 0.},\q\= 0.341691
n= 11,q= {-0.3148, -0.120174, 0., 0.},\q\= 0.336958
n= 12,q= {-0.315343, -0.124338, 0., 0.},\q\= 0.338971
n= 13,q= {-0.316019, -0.121581, 0., 0.},\q\= 0.3386
n= 14,q= {-0.314914, -0.123156, 0., 0.},\q\= 0.338139
n= 15,q= {-0.315996, -0.122433, 0., 0.},\q\= 0.338886
n= 16,q= {-0.315136, -0.122623, 0., 0.},\q\= 0.338153
n= 17,q= {-0.315726, -0.122714, 0., 0.},\q\= 0.338735
n= 18,q= {-0.315376, -0.122512, 0., 0.},\q\= 0.338336
n= 19,q= {-0.315547, -0.122725, 0., 0.},\q\= 0.338573
n= 20,q= {-0.315491, -0.122549, 0., 0.},\q\= 0.338457
```

In[•]:=

```
P = {-0.4, -0.4, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-0.4, -0.4, 0, 0}

```
n= 1,q= {-0.4, -0.4, 0, 0},\q\= 0.565685
n= 2,q= {-0.4, -0.08, 0., 0.},\q\= 0.407922
n= 3,q= {-0.2464, -0.336, 0., 0.},\q\= 0.416664
n= 4,q= {-0.452183, -0.234419, 0., 0.},\q\= 0.509335
n= 5,q= {-0.250483, -0.187999, 0., 0.},\q\= 0.313186
n= 6,q= {-0.372602, -0.305819, 0., 0.},\q\= 0.482035
n= 7,q= {-0.354693, -0.172103, 0., 0.},\q\= 0.394241
n= 8,q= {-0.303812, -0.277913, 0., 0.},\q\= 0.411749
n= 9,q= {-0.384934, -0.231133, 0., 0.},\q\= 0.448995
n= 10,q= {-0.305249, -0.222058, 0., 0.},\q\= 0.377474
n= 11,q= {-0.356133, -0.264434, 0., 0.},\q\= 0.443572
n= 12,q= {-0.343095, -0.211653, 0., 0.},\q\= 0.403126
n= 13,q= {-0.327083, -0.254766, 0., 0.},\q\= 0.414595
n= 14,q= {-0.357923, -0.233341, 0., 0.},\q\= 0.427266
n= 15,q= {-0.326339, -0.232964, 0., 0.},\q\= 0.400961
n= 16,q= {-0.347775, -0.247949, 0., 0.},\q\= 0.427114
n= 17,q= {-0.340531, -0.227539, 0., 0.},\q\= 0.409555
n= 18,q= {-0.335812, -0.245032, 0., 0.},\q\= 0.415705
n= 19,q= {-0.347271, -0.235431, 0., 0.},\q\= 0.419553
n= 20,q= {-0.334831, -0.236484, 0., 0.},\q\= 0.409922
```

In[ ]:=
```
P = {-0.4, -0.5, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[ ]=
```
{-0.4, -0.5, 0, 0}
```

```
n= 1,q= {-0.4, -0.5, 0, 0},\q\= 0.640312
n= 2,q= {-0.49, -0.1, 0., 0.},\q\= 0.5001
n= 3,q= {-0.1699, -0.402, 0., 0.},\q\= 0.436429
n= 4,q= {-0.532738, -0.3634, 0., 0.},\q\= 0.64488
n= 5,q= {-0.24825, -0.112806, 0., 0.},\q\= 0.272678
n= 6,q= {-0.351097, -0.443992, 0., 0.},\q\= 0.566037
n= 7,q= {-0.47386, -0.188231, 0., 0.},\q\= 0.509877
n= 8,q= {-0.210888, -0.321609, 0., 0.},\q\= 0.384586
n= 9,q= {-0.458959, -0.364353, 0., 0.},\q\= 0.586
n= 10,q= {-0.32211, -0.165554, 0., 0.},\q\= 0.362164
n= 11,q= {-0.323653, -0.393347, 0., 0.},\q\= 0.509385
n= 12,q= {-0.44997, -0.245384, 0., 0.},\q\= 0.512529
n= 13,q= {-0.25774, -0.279169, 0., 0.},\q\= 0.379954
n= 14,q= {-0.411505, -0.356094, 0., 0.},\q\= 0.544187
n= 15,q= {-0.357466, -0.206931, 0., 0.},\q\= 0.41304
n= 16,q= {-0.315038, -0.352058, 0., 0.},\q\= 0.472434
n= 17,q= {-0.424696, -0.278176, 0., 0.},\q\= 0.50769
n= 18,q= {-0.297015, -0.263719, 0., 0.},\q\= 0.397198
n= 19,q= {-0.38133, -0.343343, 0., 0.},\q\= 0.513124
n= 20,q= {-0.372472, -0.238146, 0., 0.},\q\= 0.442096
```

In[•]:=
```
P = {-0.4, -0.7, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]=
```
{-0.4, -0.7, 0, 0}
```

```
n= 1,q= {-0.4, -0.7, 0, 0},\q\= 0.806226

n= 2,q= {-0.73, -0.14, 0., 0.},\q\= 0.743303

n= 3,q= {0.1133, -0.4956, 0., 0.},\q\= 0.508386

n= 4,q= {-0.632782, -0.812303, 0., 0.},\q\= 1.02968

n= 5,q= {-0.659422, 0.328022, 0., 0.},\q\= 0.736503

n= 6,q= {-0.0727606, -1.13261, 0., 0.},\q\= 1.13495

n= 7,q= {-1.67751, -0.535181, 0., 0.},\q\= 1.76081

n= 8,q= {2.12763, 1.09555, 0., 0.},\q\= 2.39312

n= 9,q= {2.92658, 3.96183, 0., 0.},\q\= 4.92554

n= 10,q= {-7.53122, 22.4892, 0., 0.},\q\= 23.7167

n= 11,q= {-449.445, -339.442, 0., 0.},\q\= 563.225

n= 12,q= {86 779.4, 305 121., 0., 0.},\q\= 317 221.

n= 13,q= {-8.55679×10^10, 5.29564×10^10, 0., 0.},\q\= 1.00629×10^11

n= 14,q= {4.5175×10^21, -9.06273×10^21, 0., 0.},\q\= 1.01262×10^22

n= 15,q= {-6.17253×10^43, -8.18817×10^43, 0., 0.},\q\= 1.02541×10^44

n= 16,q= {-2.8946×10^87, 1.01083×10^88, 0., 0.},\q\= 1.05146×10^88

n= 17,q= {-9.38×10^175, -5.85192×10^175, 0., 0.},\q\= 1.10557×10^176

n= 18,q= {5.373953760047012×10^351, 1.097820054054608×10^352, 0., 0.}
 ,\q\= 1.222294015871671×10^352

n= 19,q= {-9.16415080933229×10^703, 1.179926841468355×10^704, 0., 0.}
 ,\q\= 1.494002661235697×10^704

n= 20,q= {-5.524107506556323×10^1407, -2.162605503839024×10^1408, 0., 0.}
 ,\q\= 2.232043951779346×10^1408
```

In[•]:=

```
P = {-0.4, -1.2, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-0.4, -1.2, 0, 0}

```
n= 1,q= {-0.4, -1.2, 0, 0},\q\= 1.26491

n= 2,q= {-1.68, -0.24, 0., 0.},\q\= 1.69706

n= 3,q= {2.3648, -0.3936, 0., 0.},\q\= 2.39733

n= 4,q= {5.03736, -3.06157, 0., 0.},\q\= 5.89476

n= 5,q= {15.6018, -32.0445, 0., 0.},\q\= 35.6407

n= 6,q= {-783.832, -1001.1, 0., 0.},\q\= 1271.45

n= 7,q= {-387809., 1.56939×10^6, 0., 0.},\q\= 1.61659×10^6

n= 8,q= {-2.31258×10^12, -1.21724×10^12, 0., 0.},\q\= 2.61337×10^12

n= 9,q= {3.86635×10^24, 5.62995×10^24, 0., 0.},\q\= 6.82971×10^24

n= 10,q= {-1.67477×10^49, 4.35347×10^49, 0., 0.},\q\= 4.6645×10^49

n= 11,q= {-1.61478×10^99, -1.45821×10^99, 0., 0.},\q\= 2.17575×10^99

n= 12,q= {4.8114×10^197, 4.70939×10^198, 0., 0.},\q\= 4.7339×10^198

n= 13,q= {-2.194686007948114×10^397, 4.531754507338190×10^396, 0., 0.}
 ,\q\= 2.240985199110210×10^397

n= 14,q= {4.611278684335427×10^794, -1.989155641742184×10^794, 0., 0.}
 ,\q\= 5.022014662631027×10^794

n= 15,q= {1.730715093753151×10^1589, -1.834510202118258×10^1589, 0., 0.}
 ,\q\= 2.522063127168103×10^1589

n= 16,q= {-3.700529459309967×10^3177, -6.350028992900426×10^3178, 0., 0.}
 ,\q\= 6.360802417420950×10^3178

n= 17,q= {-4.018592902788379×10^6357, 4.699693871140086×10^6356, 0., 0.}
 ,\q\= 4.045980739346820×10^6357

n= 18,q= {1.592821769351681×10^12715, -3.777231287168318×10^12714, 0., 0.}
 ,\q\= 1.636996014316544×10^12715

n= 19,q= {2.394406426952987×10^25430, -1.203291244415593×10^25430, 0., 0.}
 ,\q\= 2.679755950888252×10^25430

n= 20,q= {4.285272318546543×10^50860, -5.762336578249909×10^50860, 0., 0.}
 ,\q\= 7.181091956320998×10^50860
```

In[•]:=

```
P = {-0.4, -1.4, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-0.4, -1.4, 0, 0}

```
n= 1,q= {-0.4, -1.4, 0, 0},\q\= 1.45602

n= 2,q= {-2.2, -0.28, 0., 0.},\q\= 2.21775

n= 3,q= {4.3616, -0.168, 0., 0.},\q\= 4.36483

n= 4,q= {18.5953, -2.8655, 0., 0.},\q\= 18.8148

n= 5,q= {337.175, -107.97, 0., 0.},\q\= 354.04

n= 6,q= {102029., -72810.9, 0., 0.},\q\= 125345.

n= 7,q= {5.10855×10^9, -1.48577×10^10, 0., 0.},\q\= 1.57114×10^10

n= 8,q= {-1.94653×10^20, -1.51802×10^20, 0., 0.},\q\= 2.46848×10^20

n= 9,q= {1.48459×10^40, 5.90977×10^40, 0., 0.},\q\= 6.09339×10^40

n= 10,q= {-3.27214×10^81, 1.75472×10^81, 0., 0.},\q\= 3.71294×10^81

n= 11,q= {7.62784×10^162, -1.14833×10^163, 0., 0.},\q\= 1.37859×10^163

n= 12,q= {-7.368332879060586×10^325, -1.751863389089434×10^326, 0., 0.}
 ,\q\= 1.900512727712806×10^326

n= 13,q= {-2.526102039865464×10^652, 2.581662521890037×10^652, 0., 0.}
 ,\q\= 3.611948628198369×10^652

n= 14,q= {-2.837898611191654×10^1303, -1.304308592558128×10^1305, 0., 0.}
 ,\q\= 1.304617289274408×10^1305

n= 15,q= {-1.700415537768224×10^2610, 7.402991086772104×10^2608, 0., 0.}
 ,\q\= 1.702026271473705×10^2610

n= 16,q= {2.885932573380517×10^5220, -2.517632213981392×10^5219, 0., 0.}
 ,\q\= 2.896893428786683×10^5220

n= 17,q= {8.265222098449927×10^10440, -1.453143362824201×10^10440, 0., 0.}
 ,\q\= 8.391991537747464×10^10440

n= 18,q= {6.620227070378498×10^20881, -2.402110526926086×10^20881, 0., 0.}
 ,\q\= 7.042552196962504×10^20881

n= 19,q= {3.805727147980315×10^41763, -3.180503427279446×10^41763, 0., 0.}
 ,\q\= 4.959754144694139×10^41763

n= 20,q= {4.367957073938079×10^83526, -2.420825647488365×10^83527, 0., 0.}
 ,\q\= 2.459916117581069×10^83527
```

In[•]:=
```
P = {-0.2, 1.4, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-0.2, 1.4, 0, 0}

```
n= 1,q= {-0.2, 1.4, 0, 0},\q\= 1.41421

n= 2,q= {-2.12, 0.84, 0., 0.},\q\= 2.28035

n= 3,q= {3.5888, -2.1616, 0., 0.},\q\= 4.18951

n= 4,q= {8.00697, -14.1151, 0., 0.},\q\= 16.228

n= 5,q= {-135.324, -224.638, 0., 0.},\q\= 262.25

n= 6,q= {-32149.9, 60799.5, 0., 0.},\q\= 68776.5

n= 7,q= {-2.66297×10^9, -3.9094×10^9, 0., 0.},\q\= 4.7302×10^9

n= 8,q= {-8.19199×10^18, 2.08212×10^19, 0., 0.},\q\= 2.23748×10^19

n= 9,q= {-3.66414×10^38, -3.41134×10^38, 0., 0.},\q\= 5.00631×10^38

n= 10,q= {1.78867×10^76, 2.49993×10^77, 0., 0.},\q\= 2.50632×10^77

n= 11,q= {-6.21764×10^154, 8.94307×10^153, 0., 0.},\q\= 6.28163×10^154

n= 12,q= {3.785928632868169×10^309, -1.112095870419438×10^309, 0., 0.}
 ,\q\= 3.945885558170056×10^309

n= 13,q= {1.309649838816708×10^619, -8.420631196630800×10^618, 0., 0.}
 ,\q\= 1.557001283817501×10^619

n= 14,q= {1.006112402815910×10^1238, -2.205615657880493×10^1238, 0., 0.}
 ,\q\= 2.424252997809347×10^1238

n= 15,q= {-3.852478263187599×10^2476, -4.438194538477073×10^2476, 0., 0.}
 ,\q\= 5.877002597387605×10^2476

n= 16,q= {-4.855981993034777×10^4952, 3.419609597456168×10^4953, 0., 0.}
 ,\q\= 3.453915952970065×10^4953

n= 17,q= {-1.145792418784755×10^9907, -3.321112525691211×10^9906, 0., 0.}
 ,\q\= 1.192953541018111×10^9907

n= 18,q= {1.202542382861590×10^19814, 7.610611107736162×10^19813, 0., 0.}
 ,\q\= 1.423138151027651×10^19814

n= 19,q= {8.668941682464599×10^39627, 1.830416483305985×10^39628, 0., 0.}
 ,\q\= 2.025322196910401×10^39628

n= 20,q= {-2.598919003418529×10^79256, 3.173554749680305×10^79256, 0., 0.}
 ,\q\= 4.101930001297973×10^79256
```

In[•]:=
```
P = {-0.2, 1.2, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-0.2, 1.2, 0, 0}

```
n= 1,q= {-0.2, 1.2, 0, 0},\q\= 1.21655

n= 2,q= {-1.6, 0.72, 0., 0.},\q\= 1.75454

n= 3,q= {1.8416, -1.104, 0., 0.},\q\= 2.14716

n= 4,q= {1.97267, -2.86625, 0., 0.},\q\= 3.47949

n= 5,q= {-4.52396, -10.1084, 0., 0.},\q\= 11.0745

n= 6,q= {-81.9129, 92.6597, 0., 0.},\q\= 123.675

n= 7,q= {-1876.3, -15178.8, 0., 0.},\q\= 15294.4

n= 8,q= {-2.26877×10^8, 5.69602×10^7, 0., 0.},\q\= 2.33918×10^8

n= 9,q= {4.82287×10^16, -2.58459×10^16, 0., 0.},\q\= 5.47176×10^16

n= 10,q= {1.658×10^33, -2.49303×10^33, 0., 0.},\q\= 2.99402×10^33

n= 11,q= {-3.46623×10^66, -8.26686×10^66, 0., 0.},\q\= 8.96413×10^66

n= 12,q= {-5.63261×10^133, 5.73097×10^133, 0., 0.},\q\= 8.03557×10^133

n= 13,q= {-1.1177×10^266, -6.45607×10^267, 0., 0.},\q\= 6.45704×10^267

n= 14,q= {-4.166834615242078×10^535, 1.443195247254052×10^534, 0., 0.}
 ,\q\= 4.169333140443032×10^535

n= 15,q= {1.734168258556263×10^1071, -1.202711182562207×10^1070, 0., 0.}
 ,\q\= 1.738333883599656×10^1071

n= 16,q= {2.992874407097459×10^2142, -4.171407114020091×10^2141, 0., 0.}
 ,\q\= 3.021804690870662×10^2142

n= 17,q= {8.783290843549990×10^4284, -2.496899518627000×10^4284, 0., 0.}
 ,\q\= 9.13130358976794×10^4284

n= 18,q= {7.091169083626936×10^8569, -4.386198935844181×10^8569, 0., 0.}
 ,\q\= 8.338070524850885×10^8569

n= 19,q= {3.104593786778585×10^17139, -6.220655657699125×10^17139, 0., 0.}
 ,\q\= 6.952342007738710×10^17139

n= 20,q= {-2.905805423075994×10^34279, -3.862521780916351×10^34279, 0., 0.}
 ,\q\= 4.833505939256832×10^34279
```

In[•]:=
```
P = {-0.2, 0.7, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-0.2, 0.7, 0, 0}

```
n= 1,q= {-0.2, 0.7, 0, 0},\q\= 0.728011
n= 2,q= {-0.65, 0.42, 0., 0.},\q\= 0.773886
n= 3,q= {0.0461, 0.154, 0., 0.},\q\= 0.160752
n= 4,q= {-0.221591, 0.714199, 0., 0.},\q\= 0.747785
n= 5,q= {-0.660977, 0.38348, 0., 0.},\q\= 0.764165
n= 6,q= {0.0898341, 0.193056, 0., 0.},\q\= 0.212934
n= 7,q= {-0.229201, 0.734686, 0., 0.},\q\= 0.769608
n= 8,q= {-0.687231, 0.363219, 0., 0.},\q\= 0.777312
n= 9,q= {0.140358, 0.200769, 0., 0.},\q\= 0.244967
n= 10,q= {-0.220608, 0.756359, 0., 0.},\q\= 0.787875
n= 11,q= {-0.723411, 0.366282, 0., 0.},\q\= 0.810856
n= 12,q= {0.189161, 0.170055, 0., 0.},\q\= 0.254363
n= 13,q= {-0.193137, 0.764336, 0., 0.},\q\= 0.788359
n= 14,q= {-0.746907, 0.404758, 0., 0.},\q\= 0.849529
n= 15,q= {0.194041, 0.0953671, 0., 0.},\q\= 0.21621
n= 16,q= {-0.171443, 0.73701, 0., 0.},\q\= 0.756688
n= 17,q= {-0.713792, 0.44729, 0., 0.},\q\= 0.842358
n= 18,q= {0.10943, 0.0614568, 0., 0.},\q\= 0.125507
n= 19,q= {-0.191802, 0.71345, 0., 0.},\q\= 0.738782
n= 20,q= {-0.672224, 0.426318, 0., 0.},\q\= 0.79601
```

In[•]:=

```
P = {-0.2, 0.5, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]=

```
{-0.2, 0.5, 0, 0}
```

```
n= 1,q= {-0.2, 0.5, 0, 0},\q\= 0.538516
n= 2,q= {-0.41, 0.3, 0., 0.},\q\= 0.508035
n= 3,q= {-0.1219, 0.254, 0., 0.},\q\= 0.281737
n= 4,q= {-0.249656, 0.438075, 0., 0.},\q\= 0.50422
n= 5,q= {-0.329581, 0.281264, 0., 0.},\q\= 0.433282
n= 6,q= {-0.170485, 0.314602, 0., 0.},\q\= 0.357826
n= 7,q= {-0.269909, 0.39273, 0., 0.},\q\= 0.476537
n= 8,q= {-0.281386, 0.287997, 0., 0.},\q\= 0.402642
n= 9,q= {-0.203764, 0.337923, 0., 0.},\q\= 0.394604
n= 10,q= {-0.272672, 0.362287, 0., 0.},\q\= 0.453433
n= 11,q= {-0.256902, 0.302429, 0., 0.},\q\= 0.396815
n= 12,q= {-0.225465, 0.344611, 0., 0.},\q\= 0.411815
n= 13,q= {-0.267922, 0.344605, 0., 0.},\q\= 0.436503
n= 14,q= {-0.24697, 0.315345, 0., 0.},\q\= 0.400546
n= 15,q= {-0.238449, 0.344238, 0., 0.},\q\= 0.418757
n= 16,q= {-0.261642, 0.335834, 0., 0.},\q\= 0.425724
n= 17,q= {-0.244328, 0.324263, 0., 0.},\q\= 0.406008
n= 18,q= {-0.245451, 0.341547, 0., 0.},\q\= 0.420595
n= 19,q= {-0.256408, 0.332334, 0., 0.},\q\= 0.419751
n= 20,q= {-0.244701, 0.329574, 0., 0.},\q\= 0.410484
```

In[ ]:=
```
P = {-0.2, 0.4, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[ ]= {-0.2, 0.4, 0, 0}

```
n= 1,q= {-0.2, 0.4, 0, 0},\q\= 0.447214
n= 2,q= {-0.32, 0.24, 0., 0.},\q\= 0.4
n= 3,q= {-0.1552, 0.2464, 0., 0.},\q\= 0.291204
n= 4,q= {-0.236626, 0.323517, 0., 0.},\q\= 0.400818
n= 5,q= {-0.248672, 0.246895, 0., 0.},\q\= 0.350421
n= 6,q= {-0.199119, 0.277209, 0., 0.},\q\= 0.341311
n= 7,q= {-0.237196, 0.289605, 0., 0.},\q\= 0.374343
n= 8,q= {-0.227609, 0.262614, 0., 0.},\q\= 0.347522
n= 9,q= {-0.21716, 0.280453, 0., 0.},\q\= 0.354701
n= 10,q= {-0.231496, 0.278193, 0., 0.},\q\= 0.361914
n= 11,q= {-0.223801, 0.271199, 0., 0.},\q\= 0.351619
n= 12,q= {-0.223462, 0.278611, 0., 0.},\q\= 0.357154
n= 13,q= {-0.227689, 0.275482, 0., 0.},\q\= 0.357397
n= 14,q= {-0.224048, 0.274552, 0., 0.},\q\= 0.354367
n= 15,q= {-0.225181, 0.276974, 0., 0.},\q\= 0.356961
n= 16,q= {-0.226008, 0.275261, 0., 0.},\q\= 0.356158
n= 17,q= {-0.224689, 0.275577, 0., 0.},\q\= 0.355567
n= 18,q= {-0.225458, 0.276162, 0., 0.},\q\= 0.356506
n= 19,q= {-0.225434, 0.275474, 0., 0.},\q\= 0.355959
n= 20,q= {-0.225066, 0.275797, 0., 0.},\q\= 0.355976
```

In[ ]:=
```
P = {-0.2, 0.2, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[ ]=
```
{-0.2, 0.2, 0, 0}
```

```
n= 1,q= {-0.2, 0.2, 0, 0},\q\= 0.282843
n= 2,q= {-0.2, 0.12, 0., 0.},\q\= 0.233238
n= 3,q= {-0.1744, 0.152, 0., 0.},\q\= 0.231343
n= 4,q= {-0.192689, 0.146982, 0., 0.},\q\= 0.242348
n= 5,q= {-0.184475, 0.143356, 0., 0.},\q\= 0.233628
n= 6,q= {-0.18652, 0.147109, 0., 0.},\q\= 0.237551
n= 7,q= {-0.186851, 0.145123, 0., 0.},\q\= 0.236588
n= 8,q= {-0.186147, 0.145767, 0., 0.},\q\= 0.236429
n= 9,q= {-0.186597, 0.145732, 0., 0.},\q\= 0.236762
n= 10,q= {-0.186419, 0.145614, 0., 0.},\q\= 0.236549
n= 11,q= {-0.186451, 0.14571, 0., 0.},\q\= 0.236633
n= 12,q= {-0.186467, 0.145665, 0., 0.},\q\= 0.236618
n= 13,q= {-0.186448, 0.145677, 0., 0.},\q\= 0.236611
n= 14,q= {-0.186459, 0.145678, 0., 0.},\q\= 0.23662
n= 15,q= {-0.186455, 0.145674, 0., 0.},\q\= 0.236615
n= 16,q= {-0.186455, 0.145677, 0., 0.},\q\= 0.236616
n= 17,q= {-0.186456, 0.145676, 0., 0.},\q\= 0.236616
n= 18,q= {-0.186456, 0.145676, 0., 0.},\q\= 0.236616
n= 19,q= {-0.186456, 0.145676, 0., 0.},\q\= 0.236616
n= 20,q= {-0.186456, 0.145676, 0., 0.},\q\= 0.236616
```

In[ ]:=
```
P = {-0.2, -0.2, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[ ]= {-0.2, -0.2, 0, 0}

```
n= 1,q= {-0.2, -0.2, 0, 0},\q\= 0.282843
n= 2,q= {-0.2, -0.12, 0., 0.},\q\= 0.233238
n= 3,q= {-0.1744, -0.152, 0., 0.},\q\= 0.231343
n= 4,q= {-0.192689, -0.146982, 0., 0.},\q\= 0.242348
n= 5,q= {-0.184475, -0.143356, 0., 0.},\q\= 0.233628
n= 6,q= {-0.18652, -0.147109, 0., 0.},\q\= 0.237551
n= 7,q= {-0.186851, -0.145123, 0., 0.},\q\= 0.236588
n= 8,q= {-0.186147, -0.145767, 0., 0.},\q\= 0.236429
n= 9,q= {-0.186597, -0.145732, 0., 0.},\q\= 0.236762
n= 10,q= {-0.186419, -0.145614, 0., 0.},\q\= 0.236549
n= 11,q= {-0.186451, -0.14571, 0., 0.},\q\= 0.236633
n= 12,q= {-0.186467, -0.145665, 0., 0.},\q\= 0.236618
n= 13,q= {-0.186448, -0.145677, 0., 0.},\q\= 0.236611
n= 14,q= {-0.186459, -0.145678, 0., 0.},\q\= 0.23662
n= 15,q= {-0.186455, -0.145674, 0., 0.},\q\= 0.236615
n= 16,q= {-0.186455, -0.145677, 0., 0.},\q\= 0.236616
n= 17,q= {-0.186456, -0.145676, 0., 0.},\q\= 0.236616
n= 18,q= {-0.186456, -0.145676, 0., 0.},\q\= 0.236616
n= 19,q= {-0.186456, -0.145676, 0., 0.},\q\= 0.236616
n= 20,q= {-0.186456, -0.145676, 0., 0.},\q\= 0.236616
```

In[ ]:=
```
P = {-0.2, -0.4, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[ ]=
```
{-0.2, -0.4, 0, 0}
```

```
n= 1,q= {-0.2, -0.4, 0, 0},\q\= 0.447214
n= 2,q= {-0.32, -0.24, 0., 0.},\q\= 0.4
n= 3,q= {-0.1552, -0.2464, 0., 0.},\q\= 0.291204
n= 4,q= {-0.236626, -0.323517, 0., 0.},\q\= 0.400818
n= 5,q= {-0.248672, -0.246895, 0., 0.},\q\= 0.350421
n= 6,q= {-0.199119, -0.277209, 0., 0.},\q\= 0.341311
n= 7,q= {-0.237196, -0.289605, 0., 0.},\q\= 0.374343
n= 8,q= {-0.227609, -0.262614, 0., 0.},\q\= 0.347522
n= 9,q= {-0.21716, -0.280453, 0., 0.},\q\= 0.354701
n= 10,q= {-0.231496, -0.278193, 0., 0.},\q\= 0.361914
n= 11,q= {-0.223801, -0.271199, 0., 0.},\q\= 0.351619
n= 12,q= {-0.223462, -0.278611, 0., 0.},\q\= 0.357154
n= 13,q= {-0.227689, -0.275482, 0., 0.},\q\= 0.357397
n= 14,q= {-0.224048, -0.274552, 0., 0.},\q\= 0.354367
n= 15,q= {-0.225181, -0.276974, 0., 0.},\q\= 0.356961
n= 16,q= {-0.226008, -0.275261, 0., 0.},\q\= 0.356158
n= 17,q= {-0.224689, -0.275577, 0., 0.},\q\= 0.355567
n= 18,q= {-0.225458, -0.276162, 0., 0.},\q\= 0.356506
n= 19,q= {-0.225434, -0.275474, 0., 0.},\q\= 0.355959
n= 20,q= {-0.225066, -0.275797, 0., 0.},\q\= 0.355976
```

In[ ]:=
```
P = {-0.2, -0.5, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[ ]=
```
{-0.2, -0.5, 0, 0}
```

```
n= 1,q= {-0.2, -0.5, 0, 0},\q\= 0.538516

n= 2,q= {-0.41, -0.3, 0., 0.},\q\= 0.508035

n= 3,q= {-0.1219, -0.254, 0., 0.},\q\= 0.281737

n= 4,q= {-0.249656, -0.438075, 0., 0.},\q\= 0.50422

n= 5,q= {-0.329581, -0.281264, 0., 0.},\q\= 0.433282

n= 6,q= {-0.170485, -0.314602, 0., 0.},\q\= 0.357826

n= 7,q= {-0.269909, -0.39273, 0., 0.},\q\= 0.476537

n= 8,q= {-0.281386, -0.287997, 0., 0.},\q\= 0.402642

n= 9,q= {-0.203764, -0.337923, 0., 0.},\q\= 0.394604

n= 10,q= {-0.272672, -0.362287, 0., 0.},\q\= 0.453433

n= 11,q= {-0.256902, -0.302429, 0., 0.},\q\= 0.396815

n= 12,q= {-0.225465, -0.344611, 0., 0.},\q\= 0.411815

n= 13,q= {-0.267922, -0.344605, 0., 0.},\q\= 0.436503

n= 14,q= {-0.24697, -0.315345, 0., 0.},\q\= 0.400546

n= 15,q= {-0.238449, -0.344238, 0., 0.},\q\= 0.418757

n= 16,q= {-0.261642, -0.335834, 0., 0.},\q\= 0.425724

n= 17,q= {-0.244328, -0.324263, 0., 0.},\q\= 0.406008

n= 18,q= {-0.245451, -0.341547, 0., 0.},\q\= 0.420595

n= 19,q= {-0.256408, -0.332334, 0., 0.},\q\= 0.419751

n= 20,q= {-0.244701, -0.329574, 0., 0.},\q\= 0.410484
```

In[•]:=
```
P = {-0.2, -0.7, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]=
```
{-0.2, -0.7, 0, 0}
```

```
n= 1,q= {-0.2, -0.7, 0, 0},\q\= 0.728011
n= 2,q= {-0.65, -0.42, 0., 0.},\q\= 0.773886
n= 3,q= {0.0461, -0.154, 0., 0.},\q\= 0.160752
n= 4,q= {-0.221591, -0.714199, 0., 0.},\q\= 0.747785
n= 5,q= {-0.660977, -0.38348, 0., 0.},\q\= 0.764165
n= 6,q= {0.0898341, -0.193056, 0., 0.},\q\= 0.212934
n= 7,q= {-0.229201, -0.734686, 0., 0.},\q\= 0.769608
n= 8,q= {-0.687231, -0.363219, 0., 0.},\q\= 0.777312
n= 9,q= {0.140358, -0.200769, 0., 0.},\q\= 0.244967
n= 10,q= {-0.220608, -0.756359, 0., 0.},\q\= 0.787875
n= 11,q= {-0.723411, -0.366282, 0., 0.},\q\= 0.810856
n= 12,q= {0.189161, -0.170055, 0., 0.},\q\= 0.254363
n= 13,q= {-0.193137, -0.764336, 0., 0.},\q\= 0.788359
n= 14,q= {-0.746907, -0.404758, 0., 0.},\q\= 0.849529
n= 15,q= {0.194041, -0.0953671, 0., 0.},\q\= 0.21621
n= 16,q= {-0.171443, -0.73701, 0., 0.},\q\= 0.756688
n= 17,q= {-0.713792, -0.44729, 0., 0.},\q\= 0.842358
n= 18,q= {0.10943, -0.0614568, 0., 0.},\q\= 0.125507
n= 19,q= {-0.191802, -0.71345, 0., 0.},\q\= 0.738782
n= 20,q= {-0.672224, -0.426318, 0., 0.},\q\= 0.79601
```

In[ ]:=
```
P = {-0.2, -1.2, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[ ]=
```
{-0.2, -1.2, 0, 0}
```

```
n= 1,q= {-0.2, -1.2, 0, 0},\q\= 1.21655

n= 2,q= {-1.6, -0.72, 0., 0.},\q\= 1.75454

n= 3,q= {1.8416, 1.104, 0., 0.},\q\= 2.14716

n= 4,q= {1.97267, 2.86625, 0., 0.},\q\= 3.47949

n= 5,q= {-4.52396, 10.1084, 0., 0.},\q\= 11.0745

n= 6,q= {-81.9129, -92.6597, 0., 0.},\q\= 123.675

n= 7,q= {-1876.3, 15178.8, 0., 0.},\q\= 15294.4

n= 8,q= {-2.26877×10^8, -5.69602×10^7, 0., 0.},\q\= 2.33918×10^8

n= 9,q= {4.82287×10^16, 2.58459×10^16, 0., 0.},\q\= 5.47176×10^16

n= 10,q= {1.658×10^33, 2.49303×10^33, 0., 0.},\q\= 2.99402×10^33

n= 11,q= {-3.46623×10^66, 8.26686×10^66, 0., 0.},\q\= 8.96413×10^66

n= 12,q= {-5.63261×10^133, -5.73097×10^133, 0., 0.},\q\= 8.03557×10^133

n= 13,q= {-1.1177×10^266, 6.45607×10^267, 0., 0.},\q\= 6.45704×10^267

n= 14,q= {-4.166834615242078×10^535, -1.443195247254052×10^534, 0., 0.}
 ,\q\= 4.169333140443032×10^535

n= 15,q= {1.734168258556263×10^1071, 1.202711182562207×10^1070, 0., 0.}
 ,\q\= 1.738333883599656×10^1071

n= 16,q= {2.992874407097459×10^2142, 4.171407114020091×10^2141, 0., 0.}
 ,\q\= 3.021804690870662×10^2142

n= 17,q= {8.783290843549990×10^4284, 2.496899518627000×10^4284, 0., 0.}
 ,\q\= 9.13130358976794×10^4284

n= 18,q= {7.091169083626936×10^8569, 4.386198935844181×10^8569, 0., 0.}
 ,\q\= 8.338070524850885×10^8569

n= 19,q= {3.104593786778585×10^17139, 6.220655657699125×10^17139, 0., 0.}
 ,\q\= 6.952342007738710×10^17139

n= 20,q= {-2.905805423075994×10^34279, 3.862521780916351×10^34279, 0., 0.}
 ,\q\= 4.833505939256832×10^34279
```

In[•]:=
```
P = {-0.2, -1.4, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {-0.2, -1.4, 0, 0}

```
n= 1,q= {-0.2, -1.4, 0, 0},\q\= 1.41421

n= 2,q= {-2.12, -0.84, 0., 0.},\q\= 2.28035

n= 3,q= {3.5888, 2.1616, 0., 0.},\q\= 4.18951

n= 4,q= {8.00697, 14.1151, 0., 0.},\q\= 16.228

n= 5,q= {-135.324, 224.638, 0., 0.},\q\= 262.25

n= 6,q= {-32149.9, -60799.5, 0., 0.},\q\= 68776.5

n= 7,q= {-2.66297×10^9, 3.9094×10^9, 0., 0.},\q\= 4.7302×10^9

n= 8,q= {-8.19199×10^18, -2.08212×10^19, 0., 0.},\q\= 2.23748×10^19

n= 9,q= {-3.66414×10^38, 3.41134×10^38, 0., 0.},\q\= 5.00631×10^38

n= 10,q= {1.78867×10^76, -2.49993×10^77, 0., 0.},\q\= 2.50632×10^77

n= 11,q= {-6.21764×10^154, -8.94307×10^153, 0., 0.},\q\= 6.28163×10^154

n= 12,q= {3.785928632868169×10^309, 1.112095870419438×10^309, 0., 0.}
 ,\q\= 3.945885558170056×10^309

n= 13,q= {1.309649838816708×10^619, 8.420631196630800×10^618, 0., 0.}
 ,\q\= 1.557001283817501×10^619

n= 14,q= {1.006112402815910×10^1238, 2.205615657880493×10^1238, 0., 0.}
 ,\q\= 2.424252997809347×10^1238

n= 15,q= {-3.852478263187599×10^2476, 4.438194538477073×10^2476, 0., 0.}
 ,\q\= 5.877002597387605×10^2476

n= 16,q= {-4.855981993034777×10^4952, -3.419609597456168×10^4953, 0., 0.}
 ,\q\= 3.453915952970065×10^4953

n= 17,q= {-1.145792418784755×10^9907, 3.321112525691211×10^9906, 0., 0.}
 ,\q\= 1.192953541018111×10^9907

n= 18,q= {1.202542382861590×10^19814, -7.610611107736162×10^19813, 0., 0.}
 ,\q\= 1.423138151027651×10^19814

n= 19,q= {8.668941682464599×10^39627, -1.830416483305985×10^39628, 0., 0.}
 ,\q\= 2.025322196910401×10^39628

n= 20,q= {-2.598919003418529×10^79256, -3.173554749680305×10^79256, 0., 0.}
 ,\q\= 4.101930001297973×10^79256
```

In[•]:=

```
P = {0.2, 1.4, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {0.2, 1.4, 0, 0}

```
n= 1,q= {0.2, 1.4, 0, 0},\q\= 1.41421

n= 2,q= {-1.72, 1.96, 0., 0.},\q\= 2.60768

n= 3,q= {-0.6832, -5.3424, 0., 0.},\q\= 5.38591

n= 4,q= {-27.8745, 8.69986, 0., 0.},\q\= 29.2006

n= 5,q= {701.499, -483.608, 0., 0.},\q\= 852.043

n= 6,q= {258 224., -678 499., 0., 0.},\q\= 725 976.

n= 7,q= {-3.93681×10^11, -3.5041×10^11, 0., 0.},\q\= 5.27041×10^11

n= 8,q= {3.21978×10^22, 2.759×10^23, 0., 0.},\q\= 2.77772×10^23

n= 9,q= {-7.50841×10^46, 1.77668×10^46, 0., 0.},\q\= 7.71575×10^46

n= 10,q= {5.32196×10^93, -2.668×10^93, 0., 0.},\q\= 5.95328×10^93

n= 11,q= {2.1205×10^187, -2.8398×10^187, 0., 0.},\q\= 3.54415×10^187

n= 12,q= {-3.567922784821928×10^374, -1.204361909176134×10^375, 0., 0.}
 ,\q\= 1.256100449111812×10^375

n= 13,q= {-1.323186878289867×10^750, 8.594140593842332×10^749, 0., 0.}
 ,\q\= 1.577788338258897×10^750

n= 14,q= {1.012230989411198×10^1500, -2.274330812790092×10^1500, 0., 0.}
 ,\q\= 2.489416040345771×10^1500

n= 15,q= {-4.147969070082069×10^3000, -4.604296257757779×10^3000, 0., 0.}
 ,\q\= 6.197192221930815×10^3000

n= 16,q= {-3.993896622844785×10^6000, 3.819695693334777×10^6001, 0., 0.}
 ,\q\= 3.840519143555980×10^6001

n= 17,q= {-1.443056308734054×10^12 003, -3.051093945980907×10^12 002, 0., 0.}
 ,\q\= 1.474958729201996×10^12 003

n= 18,q= {1.989319767505139×10^24 006, 8.805800734576052×10^24 005, 0., 0.}
 ,\q\= 2.175503252849166×10^24 006

n= 19,q= {3.181971871616098×10^48 012, 3.503510694000682×10^48 012, 0., 0.}
 ,\q\= 4.732814403157301×10^48 012

n= 20,q= {-2.149642191221089×10^96 024, 2.229614496043273×10^96 025, 0., 0.}
 ,\q\= 2.239953217473320×10^96 025
```

In[•]:=
```
P = {0.2, 1.2, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {0.2, 1.2, 0, 0}

```
n= 1,q= {0.2, 1.2, 0, 0},\q\= 1.21655
n= 2,q= {-1.2, 1.68, 0., 0.},\q\= 2.06456
n= 3,q= {-1.1824, -2.832, 0., 0.},\q\= 3.06892
n= 4,q= {-6.42215, 7.89711, 0., 0.},\q\= 10.1788
n= 5,q= {-20.9203, -100.233, 0., 0.},\q\= 102.393
n= 6,q= {-9608.79, 4195.01, 0., 0.},\q\= 10484.6
n= 7,q= {7.47306×10^7, -8.0618×10^7, 0., 0.},\q\= 1.09927×10^8
n= 8,q= {-9.14596×10^14, -1.20493×10^16, 0., 0.},\q\= 1.20839×10^16
n= 9,q= {-1.44348×10^32, 2.20404×10^31, 0., 0.},\q\= 1.46021×10^32
n= 10,q= {2.03507×10^64, -6.363×10^63, 0., 0.},\q\= 2.13222×10^64
n= 11,q= {3.73662×10^128, -2.58983×10^128, 0., 0.},\q\= 4.54638×10^128
n= 12,q= {7.25513×10^256, -1.93544×10^257, 0., 0.},\q\= 2.06695×10^257
n= 13,q= {-3.219556164276026×10^514, -2.808371994655656×10^514, 0., 0.}
 ,\q\= 4.272293898515638×10^514
n= 14,q= {2.478588634561570×10^1028, 1.808342273394755×10^1029, 0., 0.}
 ,\q\= 1.825249515529395×10^1029
n= 15,q= {-3.208667761552735×10^2058, 8.964273212466944×10^2057, 0., 0.}
 ,\q\= 3.331535793940290×10^2058
n= 16,q= {9.49196686175031×10^4116, -5.752674892518690×10^4116, 0., 0.}
 ,\q\= 1.109913074630536×10^4117
n= 17,q= {5.700416648555115×10^8233, -1.092083988924209×10^8234, 0., 0.}
 ,\q\= 1.231907033235810×10^8234
n= 18,q= {-8.676999391933682×10^16467, -1.245066750416808×10^16468, 0., 0.}
 ,\q\= 1.517594938535855×10^16468
n= 19,q= {-7.972880285172952×10^32935, 2.160688687256698×10^32936, 0., 0.}
 ,\q\= 2.303094397469645×10^32936
n= 20,q= {-4.032907402822076×10^65872, -3.445382447405030×10^65872, 0., 0.}
 ,\q\= 5.304243803656067×10^65872
```

In[•]:=
```
P = {0.2, 0.7, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {0.2, 0.7, 0, 0}

```
n= 1,q= {0.2, 0.7, 0, 0},\q\= 0.728011

n= 2,q= {-0.25, 0.98, 0., 0.},\q\= 1.01139

n= 3,q= {-0.6979, 0.21, 0., 0.},\q\= 0.72881

n= 4,q= {0.642964, 0.406882, 0., 0.},\q\= 0.760892

n= 5,q= {0.44785, 1.22322, 0., 0.},\q\= 1.30263

n= 6,q= {-1.0957, 1.79564, 0., 0.},\q\= 2.10354

n= 7,q= {-1.82376, -3.23497, 0., 0.},\q\= 3.71364

n= 8,q= {-6.9389, 12.4996, 0., 0.},\q\= 14.2965

n= 9,q= {-107.892, -172.767, 0., 0.},\q\= 203.689

n= 10,q= {-18 207.6, 37 281.3, 0., 0.},\q\= 41 489.9

n= 11,q= {-1.05838×10^9, -1.3576×10^9, 0., 0.},\q\= 1.72141×10^9

n= 12,q= {-7.22925×10^17, 2.87371×10^18, 0., 0.},\q\= 2.96325×10^18

n= 13,q= {-7.7356×10^36, -4.15495×10^36, 0., 0.},\q\= 8.78084×10^36

n= 14,q= {4.25759×10^73, 6.42821×10^73, 0., 0.},\q\= 7.71032×10^73

n= 15,q= {-2.31949×10^147, 5.47374×10^147, 0., 0.},\q\= 5.9449×10^147

n= 16,q= {-2.45818×10^295, -2.53925×10^295, 0., 0.},\q\= 3.53418×10^295

n= 17,q= {-4.051753532351323×10^589, 1.248385573817264×10^591, 0., 0.}
 ,\q\= 1.249042918231296×10^591

n= 18,q= {-1.556824870246367×10^1182, -1.011630131690107×10^1181, 0., 0.}
 ,\q\= 1.560108211583752×10^1182

n= 19,q= {2.413469721384185×10^2364, 3.149861897011531×10^2363, 0., 0.}
 ,\q\= 2.433937631851052×10^2364

n= 20,q= {5.725619796335804×10^4728, 1.520419262995816×10^4728, 0., 0.}
 ,\q\= 5.924052395740706×10^4728
```

In[•]:=

```
P = {0.2, 0.5, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {0.2, 0.5, 0, 0}

```
n= 1,q= {0.2, 0.5, 0, 0},\q\= 0.538516
n= 2,q= {-0.01, 0.7, 0., 0.},\q\= 0.700071
n= 3,q= {-0.2899, 0.486, 0., 0.},\q\= 0.565896
n= 4,q= {0.047846, 0.218217, 0., 0.},\q\= 0.223401
n= 5,q= {0.15467, 0.520882, 0., 0.},\q\= 0.543361
n= 6,q= {-0.0473947, 0.66113, 0., 0.},\q\= 0.662827
n= 7,q= {-0.234847, 0.437332, 0., 0.},\q\= 0.496399
n= 8,q= {0.0638938, 0.294588, 0., 0.},\q\= 0.301438
n= 9,q= {0.1173, 0.537645, 0., 0.},\q\= 0.550292
n= 10,q= {-0.0753025, 0.626132, 0., 0.},\q\= 0.630644
n= 11,q= {-0.18637, 0.405701, 0., 0.},\q\= 0.446461
n= 12,q= {0.0701403, 0.348778, 0., 0.},\q\= 0.355761
n= 13,q= {0.0832732, 0.548927, 0., 0.},\q\= 0.555207
n= 14,q= {-0.0943863, 0.591422, 0., 0.},\q\= 0.598906
n= 15,q= {-0.140871, 0.388356, 0., 0.},\q\= 0.413116
n= 16,q= {0.0690244, 0.390584, 0., 0.},\q\= 0.396636
n= 17,q= {0.0522086, 0.55392, 0., 0.},\q\= 0.556375
n= 18,q= {-0.104101, 0.557839, 0., 0.},\q\= 0.567469
n= 19,q= {-0.100347, 0.383857, 0., 0.},\q\= 0.396756
n= 20,q= {0.0627236, 0.422962, 0., 0.},\q\= 0.427588
```

In[ ]:=
```
P = {0.2, 0.4, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[ ]= {0.2, 0.4, 0, 0}

```
n= 1,q= {0.2, 0.4, 0, 0},\q\= 0.447214
n= 2,q= {0.08, 0.56, 0., 0.},\q\= 0.565685
n= 3,q= {-0.1072, 0.4896, 0., 0.},\q\= 0.501199
n= 4,q= {-0.0282163, 0.29503, 0., 0.},\q\= 0.296376
n= 5,q= {0.113754, 0.383351, 0., 0.},\q\= 0.399872
n= 6,q= {0.0659821, 0.487215, 0., 0.},\q\= 0.491663
n= 7,q= {-0.0330249, 0.464295, 0., 0.},\q\= 0.465468
n= 8,q= {-0.0144792, 0.369333, 0., 0.},\q\= 0.369617
n= 9,q= {0.0638024, 0.389305, 0., 0.},\q\= 0.394498
n= 10,q= {0.0525126, 0.449677, 0., 0.},\q\= 0.452733
n= 11,q= {0.000547999, 0.447227, 0., 0.},\q\= 0.447228
n= 12,q= {-0.0000120764, 0.40049, 0., 0.},\q\= 0.40049
n= 13,q= {0.0396076, 0.39999, 0., 0.},\q\= 0.401947
n= 14,q= {0.0415765, 0.431685, 0., 0.},\q\= 0.433683
n= 15,q= {0.0153764, 0.435896, 0., 0.},\q\= 0.436167
n= 16,q= {0.0102312, 0.413405, 0., 0.},\q\= 0.413532
n= 17,q= {0.029201, 0.408459, 0., 0.},\q\= 0.409502
n= 18,q= {0.0340138, 0.423855, 0., 0.},\q\= 0.425217
n= 19,q= {0.021504, 0.428834, 0., 0.},\q\= 0.429373
n= 20,q= {0.016564, 0.418443, 0., 0.},\q\= 0.418771
```

In[ ]:=
```
P = {0.2, 0.2, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[ ]=
```
{0.2, 0.2, 0, 0}
```

```
n= 1,q= {0.2, 0.2, 0, 0},\q\= 0.282843
n= 2,q= {0.2, 0.28, 0., 0.},\q\= 0.344093
n= 3,q= {0.1616, 0.312, 0., 0.},\q\= 0.351367
n= 4,q= {0.128771, 0.300838, 0., 0.},\q\= 0.327239
n= 5,q= {0.126078, 0.277478, 0., 0.},\q\= 0.304778
n= 6,q= {0.138902, 0.269968, 0., 0.},\q\= 0.303605
n= 7,q= {0.146411, 0.274998, 0., 0.},\q\= 0.311545
n= 8,q= {0.145812, 0.280525, 0., 0.},\q\= 0.316158
n= 9,q= {0.142567, 0.281808, 0., 0.},\q\= 0.315818
n= 10,q= {0.140909, 0.280353, 0., 0.},\q\= 0.313773
n= 11,q= {0.141258, 0.279009, 0., 0.},\q\= 0.312729
n= 12,q= {0.142108, 0.278824, 0., 0.},\q\= 0.31295
n= 13,q= {0.142452, 0.279246, 0., 0.},\q\= 0.313482
n= 14,q= {0.142314, 0.279558, 0., 0.},\q\= 0.313697
n= 15,q= {0.142101, 0.27957, 0., 0.},\q\= 0.313611
n= 16,q= {0.142033, 0.279454, 0., 0.},\q\= 0.313477
n= 17,q= {0.142079, 0.279383, 0., 0.},\q\= 0.313435
n= 18,q= {0.142131, 0.279389, 0., 0.},\q\= 0.313464
n= 19,q= {0.142143, 0.27942, 0., 0.},\q\= 0.313497
n= 20,q= {0.142129, 0.279435, 0., 0.},\q\= 0.313504
```

In[ ]:=
```
P = {0.2, -0.2, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[ ]=
```
{0.2, -0.2, 0, 0}
```

```
n= 1,q= {0.2, -0.2, 0, 0},\q\= 0.282843
n= 2,q= {0.2, -0.28, 0., 0.},\q\= 0.344093
n= 3,q= {0.1616, -0.312, 0., 0.},\q\= 0.351367
n= 4,q= {0.128771, -0.300838, 0., 0.},\q\= 0.327239
n= 5,q= {0.126078, -0.277478, 0., 0.},\q\= 0.304778
n= 6,q= {0.138902, -0.269968, 0., 0.},\q\= 0.303605
n= 7,q= {0.146411, -0.274998, 0., 0.},\q\= 0.311545
n= 8,q= {0.145812, -0.280525, 0., 0.},\q\= 0.316158
n= 9,q= {0.142567, -0.281808, 0., 0.},\q\= 0.315818
n= 10,q= {0.140909, -0.280353, 0., 0.},\q\= 0.313773
n= 11,q= {0.141258, -0.279009, 0., 0.},\q\= 0.312729
n= 12,q= {0.142108, -0.278824, 0., 0.},\q\= 0.31295
n= 13,q= {0.142452, -0.279246, 0., 0.},\q\= 0.313482
n= 14,q= {0.142314, -0.279558, 0., 0.},\q\= 0.313697
n= 15,q= {0.142101, -0.27957, 0., 0.},\q\= 0.313611
n= 16,q= {0.142033, -0.279454, 0., 0.},\q\= 0.313477
n= 17,q= {0.142079, -0.279383, 0., 0.},\q\= 0.313435
n= 18,q= {0.142131, -0.279389, 0., 0.},\q\= 0.313464
n= 19,q= {0.142143, -0.27942, 0., 0.},\q\= 0.313497
n= 20,q= {0.142129, -0.279435, 0., 0.},\q\= 0.313504
```

In[ ]:=
```
P = {0.2, -0.4, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[ ]=
```
{0.2, -0.4, 0, 0}
```

```
n= 1,q= {0.2, -0.4, 0, 0},\q\= 0.447214
n= 2,q= {0.08, -0.56, 0., 0.},\q\= 0.565685
n= 3,q= {-0.1072, -0.4896, 0., 0.},\q\= 0.501199
n= 4,q= {-0.0282163, -0.29503, 0., 0.},\q\= 0.296376
n= 5,q= {0.113754, -0.383351, 0., 0.},\q\= 0.399872
n= 6,q= {0.0659821, -0.487215, 0., 0.},\q\= 0.491663
n= 7,q= {-0.0330249, -0.464295, 0., 0.},\q\= 0.465468
n= 8,q= {-0.0144792, -0.369333, 0., 0.},\q\= 0.369617
n= 9,q= {0.0638024, -0.389305, 0., 0.},\q\= 0.394498
n= 10,q= {0.0525126, -0.449677, 0., 0.},\q\= 0.452733
n= 11,q= {0.000547999, -0.447227, 0., 0.},\q\= 0.447228
n= 12,q= {-0.0000120764, -0.40049, 0., 0.},\q\= 0.40049
n= 13,q= {0.0396076, -0.39999, 0., 0.},\q\= 0.401947
n= 14,q= {0.0415765, -0.431685, 0., 0.},\q\= 0.433683
n= 15,q= {0.0153764, -0.435896, 0., 0.},\q\= 0.436167
n= 16,q= {0.0102312, -0.413405, 0., 0.},\q\= 0.413532
n= 17,q= {0.029201, -0.408459, 0., 0.},\q\= 0.409502
n= 18,q= {0.0340138, -0.423855, 0., 0.},\q\= 0.425217
n= 19,q= {0.021504, -0.428834, 0., 0.},\q\= 0.429373
n= 20,q= {0.016564, -0.418443, 0., 0.},\q\= 0.418771
```

In[ ]:=
```
P = {0.2, -0.5, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[ ]=
```
{0.2, -0.5, 0, 0}
```

```
n= 1,q= {0.2, -0.5, 0, 0},\q\= 0.538516
n= 2,q= {-0.01, -0.7, 0., 0.},\q\= 0.700071
n= 3,q= {-0.2899, -0.486, 0., 0.},\q\= 0.565896
n= 4,q= {0.047846, -0.218217, 0., 0.},\q\= 0.223401
n= 5,q= {0.15467, -0.520882, 0., 0.},\q\= 0.543361
n= 6,q= {-0.0473947, -0.66113, 0., 0.},\q\= 0.662827
n= 7,q= {-0.234847, -0.437332, 0., 0.},\q\= 0.496399
n= 8,q= {0.0638938, -0.294588, 0., 0.},\q\= 0.301438
n= 9,q= {0.1173, -0.537645, 0., 0.},\q\= 0.550292
n= 10,q= {-0.0753025, -0.626132, 0., 0.},\q\= 0.630644
n= 11,q= {-0.18637, -0.405701, 0., 0.},\q\= 0.446461
n= 12,q= {0.0701403, -0.348778, 0., 0.},\q\= 0.355761
n= 13,q= {0.0832732, -0.548927, 0., 0.},\q\= 0.555207
n= 14,q= {-0.0943863, -0.591422, 0., 0.},\q\= 0.598906
n= 15,q= {-0.140871, -0.388356, 0., 0.},\q\= 0.413116
n= 16,q= {0.0690244, -0.390584, 0., 0.},\q\= 0.396636
n= 17,q= {0.0522086, -0.55392, 0., 0.},\q\= 0.556375
n= 18,q= {-0.104101, -0.557839, 0., 0.},\q\= 0.567469
n= 19,q= {-0.100347, -0.383857, 0., 0.},\q\= 0.396756
n= 20,q= {0.0627236, -0.422962, 0., 0.},\q\= 0.427588
```

In[ ]:=
```
P = {0.2, -0.7, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[ ]=
```
{0.2, -0.7, 0, 0}
```

```
n= 1,q= {0.2, -0.7, 0, 0},\q\= 0.728011

n= 2,q= {-0.25, -0.98, 0., 0.},\q\= 1.01139

n= 3,q= {-0.6979, -0.21, 0., 0.},\q\= 0.72881

n= 4,q= {0.642964, -0.406882, 0., 0.},\q\= 0.760892

n= 5,q= {0.44785, -1.22322, 0., 0.},\q\= 1.30263

n= 6,q= {-1.0957, -1.79564, 0., 0.},\q\= 2.10354

n= 7,q= {-1.82376, 3.23497, 0., 0.},\q\= 3.71364

n= 8,q= {-6.9389, -12.4996, 0., 0.},\q\= 14.2965

n= 9,q= {-107.892, 172.767, 0., 0.},\q\= 203.689

n= 10,q= {-18 207.6, -37 281.3, 0., 0.},\q\= 41 489.9

n= 11,q= {-1.05838×10^9, 1.3576×10^9, 0., 0.},\q\= 1.72141×10^9

n= 12,q= {-7.22925×10^17, -2.87371×10^18, 0., 0.},\q\= 2.96325×10^18

n= 13,q= {-7.7356×10^36, 4.15495×10^36, 0., 0.},\q\= 8.78084×10^36

n= 14,q= {4.25759×10^73, -6.42821×10^73, 0., 0.},\q\= 7.71032×10^73

n= 15,q= {-2.31949×10^147, -5.47374×10^147, 0., 0.},\q\= 5.9449×10^147

n= 16,q= {-2.45818×10^295, 2.53925×10^295, 0., 0.},\q\= 3.53418×10^295

n= 17,q= {-4.051753532351323×10^589, -1.248385573817264×10^591, 0., 0.}
 ,\q\= 1.249042918231296×10^591

n= 18,q= {-1.556824870246367×10^1182, 1.011630131690107×10^1181, 0., 0.}
 ,\q\= 1.560108211583752×10^1182

n= 19,q= {2.413469721384185×10^2364, -3.149861897011531×10^2363, 0., 0.}
 ,\q\= 2.433937631851052×10^2364

n= 20,q= {5.725619796335804×10^4728, -1.520419262995816×10^4728, 0., 0.}
 ,\q\= 5.924052395740706×10^4728
```

In[•]:=

```
P = {0.2, -1.2, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {0.2, -1.2, 0, 0}

```
n= 1,q= {0.2, -1.2, 0, 0},\q\= 1.21655
n= 2,q= {-1.2, -1.68, 0., 0.},\q\= 2.06456
n= 3,q= {-1.1824, 2.832, 0., 0.},\q\= 3.06892
n= 4,q= {-6.42215, -7.89711, 0., 0.},\q\= 10.1788
n= 5,q= {-20.9203, 100.233, 0., 0.},\q\= 102.393
n= 6,q= {-9608.79, -4195.01, 0., 0.},\q\= 10484.6
n= 7,q= {7.47306×10^7, 8.0618×10^7, 0., 0.},\q\= 1.09927×10^8
n= 8,q= {-9.14596×10^14, 1.20493×10^16, 0., 0.},\q\= 1.20839×10^16
n= 9,q= {-1.44348×10^32, -2.20404×10^31, 0., 0.},\q\= 1.46021×10^32
n= 10,q= {2.03507×10^64, 6.363×10^63, 0., 0.},\q\= 2.13222×10^64
n= 11,q= {3.73662×10^128, 2.58983×10^128, 0., 0.},\q\= 4.54638×10^128
n= 12,q= {7.25513×10^256, 1.93544×10^257, 0., 0.},\q\= 2.06695×10^257
n= 13,q= {-3.219556164276026×10^514, 2.808371994655656×10^514, 0., 0.}
 ,\q\= 4.272293898515638×10^514
n= 14,q= {2.478588634561570×10^1028, -1.808342273394755×10^1029, 0., 0.}
 ,\q\= 1.825249515529395×10^1029
n= 15,q= {-3.208667761552735×10^2058, -8.964273212466944×10^2057, 0., 0.}
 ,\q\= 3.331535793940290×10^2058
n= 16,q= {9.49196686175031×10^4116, 5.752674892518690×10^4116, 0., 0.}
 ,\q\= 1.109913074630536×10^4117
n= 17,q= {5.700416648555115×10^8233, 1.092083988924209×10^8234, 0., 0.}
 ,\q\= 1.231907033235810×10^8234
n= 18,q= {-8.676999391933682×10^16467, 1.245066750416808×10^16468, 0., 0.}
 ,\q\= 1.517594938535855×10^16468
n= 19,q= {-7.972880285172952×10^32935, -2.160688687256698×10^32936, 0., 0.}
 ,\q\= 2.303094397469645×10^32936
n= 20,q= {-4.032907402822076×10^65872, 3.445382447405030×10^65872, 0., 0.}
 ,\q\= 5.304243803656067×10^65872
```

In[•]:=
```
P = {0.2, -1.4, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {0.2, -1.4, 0, 0}

```
n= 1,q= {0.2, -1.4, 0, 0},\q\= 1.41421

n= 2,q= {-1.72, -1.96, 0., 0.},\q\= 2.60768

n= 3,q= {-0.6832, 5.3424, 0., 0.},\q\= 5.38591

n= 4,q= {-27.8745, -8.69986, 0., 0.},\q\= 29.2006

n= 5,q= {701.499, 483.608, 0., 0.},\q\= 852.043

n= 6,q= {258 224., 678 499., 0., 0.},\q\= 725 976.

n= 7,q= {-3.93681×10^11, 3.5041×10^11, 0., 0.},\q\= 5.27041×10^11

n= 8,q= {3.21978×10^22, -2.759×10^23, 0., 0.},\q\= 2.77772×10^23

n= 9,q= {-7.50841×10^46, -1.77668×10^46, 0., 0.},\q\= 7.71575×10^46

n= 10,q= {5.32196×10^93, 2.668×10^93, 0., 0.},\q\= 5.95328×10^93

n= 11,q= {2.1205×10^187, 2.8398×10^187, 0., 0.},\q\= 3.54415×10^187

n= 12,q= {-3.567922784821928×10^374, 1.204361909176134×10^375, 0., 0.}
 ,\q\= 1.256100449111812×10^375

n= 13,q= {-1.323186878289867×10^750, -8.594140593842332×10^749, 0., 0.}
 ,\q\= 1.577788338258897×10^750

n= 14,q= {1.012230989411198×10^1500, 2.274330812790092×10^1500, 0., 0.}
 ,\q\= 2.489416040345771×10^1500

n= 15,q= {-4.147969070082069×10^3000, 4.604296257757779×10^3000, 0., 0.}
 ,\q\= 6.197192221930815×10^3000

n= 16,q= {-3.993896622844785×10^6000, -3.819695693334777×10^6001, 0., 0.}
 ,\q\= 3.840519143555980×10^6001

n= 17,q= {-1.443056308734054×10^12 003, 3.051093945980907×10^12 002, 0., 0.}
 ,\q\= 1.474958729201996×10^12 003

n= 18,q= {1.989319767505139×10^24 006, -8.805800734576052×10^24 005, 0., 0.}
 ,\q\= 2.175503252849166×10^24 006

n= 19,q= {3.181971871616098×10^48 012, -3.503510694000682×10^48 012, 0., 0.}
 ,\q\= 4.732814403157301×10^48 012

n= 20,q= {-2.149642191221089×10^96 024, -2.229614496043273×10^96 025, 0., 0.}
 ,\q\= 2.239953217473320×10^96 025
```

In[ ]:=
```
P = {0.4, 1.4, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[ ]= {0.4, 1.4, 0, 0}

```
n= 1,q= {0.4, 1.4, 0, 0},\q\= 1.45602

n= 2,q= {-1.4, 2.52, 0., 0.},\q\= 2.88278

n= 3,q= {-3.9904, -5.656, 0., 0.},\q\= 6.92197

n= 4,q= {-15.667, 46.5394, 0., 0.},\q\= 49.1057

n= 5,q= {-1920.06, -1456.87, 0., 0.},\q\= 2410.21

n= 6,q= {1.56416×10^6, 5.59456×10^6, 0., 0.},\q\= 5.8091×10^6

n= 7,q= {-2.88525×10^13, 1.75016×10^13, 0., 0.},\q\= 3.37457×10^13

n= 8,q= {5.26159×10^26, -1.00993×10^27, 0., 0.},\q\= 1.13877×10^27

n= 9,q= {-7.43108×10^53, -1.06276×10^54, 0., 0.},\q\= 1.2968×10^54

n= 10,q= {-5.77259×10^107, 1.5795×10^108, 0., 0.},\q\= 1.68168×10^108

n= 11,q= {-2.16159×10^216, -1.82356×10^216, 0., 0.},\q\= 2.82804×10^216

n= 12,q= {1.347102556624021×10^432, 7.883568009646126×10^432, 0., 0.}
 ,\q\= 7.997832822757598×10^432

n= 13,q= {-6.033595926465281×10^865, 2.123994924222728×10^865, 0., 0.}
 ,\q\= 6.396532986077876×10^865

n= 14,q= {3.189292536573453×10^1731, -2.563065424524637×10^1731, 0., 0.}
 ,\q\= 4.091563424198235×10^1731

n= 15,q= {3.602282513449470×10^3462, -1.634873085837179×10^3463, 0., 0.}
 ,\q\= 1.674089125423679×10^3463

n= 16,q= {-2.543045613727740×10^6926, -1.177854945764089×10^6926, 0., 0.}
 ,\q\= 2.802574399861817×10^6926

n= 17,q= {5.079738720238976×10^13852, 5.990677706865782×10^13852, 0., 0.}
 ,\q\= 7.854423266760824×10^13852

n= 18,q= {-1.008447392164355×10^27705, 6.086215501607711×10^27705, 0., 0.}
 ,\q\= 6.169196485343378×10^27705

n= 19,q= {-3.602505298924691×10^55411, -1.227525630149313×10^55411, 0., 0.}
 ,\q\= 3.805898527477308×10^55411

n= 20,q= {1.147122525610701×10^110823, 8.844335174357543×10^110822, 0., 0.}
 ,\q\= 1.448486360145394×10^110823
```

In[•]:=
```
P = {0.4, 1.2, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {0.4, 1.2, 0, 0}

```
n= 1,q= {0.4, 1.2, 0, 0},\q\= 1.26491

n= 2,q= {-0.88, 2.16, 0., 0.},\q\= 2.33238

n= 3,q= {-3.4912, -2.6016, 0., 0.},\q\= 4.35394

n= 4,q= {5.82015, 19.3654, 0., 0.},\q\= 20.2211

n= 5,q= {-340.745, 226.619, 0., 0.},\q\= 409.223

n= 6,q= {64751.2, -154438., 0., 0.},\q\= 167463.

n= 7,q= {-1.96583×10^10, -2.×10^10, 0., 0.},\q\= 2.80437×10^10

n= 8,q= {-1.35541×10^19, 7.86332×10^20, 0., 0.},\q\= 7.86449×10^20

n= 9,q= {-6.18135×10^41, -2.13161×10^40, 0., 0.},\q\= 6.18502×10^41

n= 10,q= {3.81636×10^83, 2.63525×10^82, 0., 0.},\q\= 3.82545×10^83

n= 11,q= {1.44952×10^167, 2.01141×10^166, 0., 0.},\q\= 1.46341×10^167

n= 12,q= {2.060643558121792×10^334, 5.831156125852581×10^333, 0., 0.}
 ,\q\= 2.141559172955424×10^334

n= 13,q= {3.906228055988158×10^668, 2.403186861428109×10^668, 0., 0.}
 ,\q\= 4.586275691269520×10^668

n= 14,q= {9.48331053444834×10^1336, 1.877479188378521×10^1337, 0., 0.}
 ,\q\= 2.103392471632971×10^1337

n= 15,q= {-2.625596315866682×10^2674, 3.560943633071510×10^2674, 0., 0.}
 ,\q\= 4.424259889722260×10^2674

n= 16,q= {-5.786563544019832×10^5348, -1.869920096800295×10^5349, 0., 0.}
 ,\q\= 1.957407557180522×10^5349

n= 17,q= {-3.161757991927832×10^10698, 2.164082292474925×10^10698, 0., 0.}
 ,\q\= 3.831444344907420×10^10698

n= 18,q= {5.313461430915991×10^21396, -1.368460896684420×10^21397, 0., 0.}
 ,\q\= 1.467996576812304×10^21397

n= 19,q= {-1.590356501976008×10^42794, -1.454252838849876×10^42794, 0., 0.}
 ,\q\= 2.155013949532644×10^42794

n= 20,q= {4.143824840744420×10^85587, 4.625560915563934×10^85588, 0., 0.}
 ,\q\= 4.644085122680286×10^85588
```

In[•]:=
```
P = {0.4, 0.7, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {0.4, 0.7, 0, 0}

```
n= 1,q= {0.4, 0.7, 0, 0},\q\= 0.806226

n= 2,q= {0.07, 1.26, 0., 0.},\q\= 1.26194

n= 3,q= {-1.1827, 0.8764, 0., 0.},\q\= 1.47202

n= 4,q= {1.0307, -1.37304, 0., 0.},\q\= 1.71685

n= 5,q= {-0.422882, -2.13038, 0., 0.},\q\= 2.17195

n= 6,q= {-3.95971, 2.5018, 0., 0.},\q\= 4.68383

n= 7,q= {9.82026, -19.1128, 0., 0.},\q\= 21.4881

n= 8,q= {-268.462, -374.685, 0., 0.},\q\= 460.935

n= 9,q= {-68317., 201178., 0., 0.},\q\= 212462.

n= 10,q= {-3.58055×10^10, -2.74878×10^10, 0., 0.},\q\= 4.51399×10^10

n= 11,q= {5.26453×10^20, 1.96843×10^21, 0., 0.},\q\= 2.03761×10^21

n= 12,q= {-3.59755×10^42, 2.07257×10^42, 0., 0.},\q\= 4.15186×10^42

n= 13,q= {8.64685×10^84, -1.49124×10^85, 0., 0.},\q\= 1.72379×10^85

n= 14,q= {-1.4761×10^170, -2.5789×10^170, 0., 0.},\q\= 2.97146×10^170

n= 15,q= {-4.471842015190418×10^340, 7.613437991289128×10^340, 0., 0.}
 ,\q\= 8.829598465164026×10^340

n= 16,q= {-3.796706703838234×10^681, -6.809218377898732×10^681, 0., 0.}
 ,\q\= 7.796180905602693×10^681

n= 17,q= {-3.195047312294365×10^1363, 5.170521012653324×10^1363, 0., 0.}
 ,\q\= 6.078043671288403×10^1363

n= 18,q= {-1.652596021449011×10^2727, -3.304011852927908×10^2727, 0., 0.}
 ,\q\= 3.694261487008900×10^2727

n= 19,q= {-8.185420714179011×10^5454, 1.092039368593807×10^5455, 0., 0.}
 ,\q\= 1.364756793439721×10^5455

n= 20,q= {-5.225388598776531×10^10909, -1.787760333677344×10^10910, 0., 0.}
 ,\q\= 1.862561105239870×10^10910
```

In[•]:=

```
P = {0.4, 0.5, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {0.4, 0.5, 0, 0}

```
n= 1,q= {0.4, 0.5, 0, 0},\q\= 0.640312

n= 2,q= {0.31, 0.9, 0., 0.},\q\= 0.951893

n= 3,q= {-0.3139, 1.058, 0., 0.},\q\= 1.10358

n= 4,q= {-0.620831, -0.164212, 0., 0.},\q\= 0.642181

n= 5,q= {0.758465, 0.703896, 0., 0.},\q\= 1.03477

n= 6,q= {0.479799, 1.56776, 0., 0.},\q\= 1.63954

n= 7,q= {-1.82767, 2.00442, 0., 0.},\q\= 2.71258

n= 8,q= {-0.277336, -6.82684, 0., 0.},\q\= 6.83247

n= 9,q= {-46.1288, 4.28666, 0., 0.},\q\= 46.3276

n= 10,q= {2109.89, -394.977, 0., 0.},\q\= 2146.55

n= 11,q= {4.29564×10^6, -1.66672×10^6, 0., 0.},\q\= 4.60766×10^6

n= 12,q= {1.56746×10^13, -1.43193×10^13, 0., 0.},\q\= 2.12305×10^13

n= 13,q= {4.06515×10^25, -4.48897×10^26, 0., 0.},\q\= 4.50734×10^26

n= 14,q= {-1.99856×10^53, -3.64967×10^52, 0., 0.},\q\= 2.03161×10^53

n= 15,q= {3.86105×10^106, 1.45882×10^106, 0., 0.},\q\= 4.12745×10^106

n= 16,q= {1.27796×10^213, 1.12651×10^213, 0., 0.},\q\= 1.70359×10^213

n= 17,q= {3.641396820235645×10^425, 2.879269401595104×10^426, 0., 0.}
 ,\q\= 2.902204333775631×10^426

n= 18,q= {-8.157594578937608×10^852, 2.096912488714040×10^852, 0., 0.}
 ,\q\= 8.422789994986053×10^852

n= 19,q= {6.214930732898733×10^1705, -3.421152390088045×10^1705, 0., 0.}
 ,\q\= 7.094339129963715×10^1705

n= 20,q= {2.692108033852405×10^3411, -4.252445026217629×10^3411, 0., 0.}
 ,\q\= 5.032964769093433×10^3411
```

In[•]:=

```
P = {0.4, 0.4, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
    Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
    n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {0.4, 0.4, 0, 0}

```
n= 1,q= {0.4, 0.4, 0, 0},\q\= 0.565685

n= 2,q= {0.4, 0.72, 0., 0.},\q\= 0.82365

n= 3,q= {0.0416, 0.976, 0., 0.},\q\= 0.976886

n= 4,q= {-0.550845, 0.481203, 0., 0.},\q\= 0.731428

n= 5,q= {0.471874, -0.130137, 0., 0.},\q\= 0.48949

n= 6,q= {0.60573, 0.277183, 0., 0.},\q\= 0.666137

n= 7,q= {0.690078, 0.735796, 0., 0.},\q\= 1.00876

n= 8,q= {0.334811, 1.41551, 0., 0.},\q\= 1.45457

n= 9,q= {-1.49158, 1.34786, 0., 0.},\q\= 2.01036

n= 10,q= {0.808082, -3.62088, 0., 0.},\q\= 3.70995

n= 11,q= {-12.0578, -5.45193, 0., 0.},\q\= 13.233

n= 12,q= {116.066, 131.876, 0., 0.},\q\= 175.678

n= 13,q= {-3919.62, 30613.1, 0., 0.},\q\= 30863.

n= 14,q= {-9.21795×10^8, -2.39983×10^8, 0., 0.},\q\= 9.52522×10^8

n= 15,q= {7.92115×10^17, 4.42431×10^17, 0., 0.},\q\= 9.07299×10^17

n= 16,q= {4.31701×10^35, 7.00912×10^35, 0., 0.},\q\= 8.23191×10^35

n= 17,q= {-3.04912×10^71, 6.05169×10^71, 0., 0.},\q\= 6.77644×10^71

n= 18,q= {-2.73258×10^143, -3.69047×10^143, 0., 0.},\q\= 4.59201×10^143

n= 19,q= {-6.15259×10^286, 2.0169×10^287, 0., 0.},\q\= 2.10866×10^287

n= 20,q= {-3.689346603113686×10^574, -2.481832496743607×10^574, 0., 0.}
 ,\q\= 4.446433503359642×10^574
```

In[ ]:=
```
P = {0.4, 0.2, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[ ]= {0.4, 0.2, 0, 0}

```
n= 1,q= {0.4, 0.2, 0, 0},\q\= 0.447214
n= 2,q= {0.52, 0.36, 0., 0.},\q\= 0.632456
n= 3,q= {0.5408, 0.5744, 0., 0.},\q\= 0.788923
n= 4,q= {0.362529, 0.821271, 0., 0.},\q\= 0.897727
n= 5,q= {-0.143059, 0.79547, 0., 0.},\q\= 0.808231
n= 6,q= {-0.212306, -0.0275976, 0., 0.},\q\= 0.214092
n= 7,q= {0.444312, 0.211718, 0., 0.},\q\= 0.492177
n= 8,q= {0.552589, 0.388138, 0., 0.},\q\= 0.675282
n= 9,q= {0.554703, 0.628961, 0., 0.},\q\= 0.838623
n= 10,q= {0.312103, 0.897774, 0., 0.},\q\= 0.950477
n= 11,q= {-0.308589, 0.760396, 0., 0.},\q\= 0.820628
n= 12,q= {-0.0829747, -0.2693, 0., 0.},\q\= 0.281793
n= 13,q= {0.334362, 0.24469, 0., 0.},\q\= 0.414332
n= 14,q= {0.451925, 0.36363, 0., 0.},\q\= 0.580054
n= 15,q= {0.472009, 0.528667, 0., 0.},\q\= 0.708718
n= 16,q= {0.343304, 0.699071, 0., 0.},\q\= 0.778818
n= 17,q= {0.029157, 0.679987, 0., 0.},\q\= 0.680612
n= 18,q= {-0.0615327, 0.239653, 0., 0.},\q\= 0.247426
n= 19,q= {0.346353, 0.170507, 0., 0.},\q\= 0.386048
n= 20,q= {0.490888, 0.318111, 0., 0.},\q\= 0.584949
```

In[ ]:=
```
P = {0.4, -0.2, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[ ]=
```
{0.4, -0.2, 0, 0}
```

```
n= 1,q= {0.4, -0.2, 0, 0},\q\= 0.447214
n= 2,q= {0.52, -0.36, 0., 0.},\q\= 0.632456
n= 3,q= {0.5408, -0.5744, 0., 0.},\q\= 0.788923
n= 4,q= {0.362529, -0.821271, 0., 0.},\q\= 0.897727
n= 5,q= {-0.143059, -0.79547, 0., 0.},\q\= 0.808231
n= 6,q= {-0.212306, 0.0275976, 0., 0.},\q\= 0.214092
n= 7,q= {0.444312, -0.211718, 0., 0.},\q\= 0.492177
n= 8,q= {0.552589, -0.388138, 0., 0.},\q\= 0.675282
n= 9,q= {0.554703, -0.628961, 0., 0.},\q\= 0.838623
n= 10,q= {0.312103, -0.897774, 0., 0.},\q\= 0.950477
n= 11,q= {-0.308589, -0.760396, 0., 0.},\q\= 0.820628
n= 12,q= {-0.0829747, 0.2693, 0., 0.},\q\= 0.281793
n= 13,q= {0.334362, -0.24469, 0., 0.},\q\= 0.414332
n= 14,q= {0.451925, -0.36363, 0., 0.},\q\= 0.580054
n= 15,q= {0.472009, -0.528667, 0., 0.},\q\= 0.708718
n= 16,q= {0.343304, -0.699071, 0., 0.},\q\= 0.778818
n= 17,q= {0.029157, -0.679987, 0., 0.},\q\= 0.680612
n= 18,q= {-0.0615327, -0.239653, 0., 0.},\q\= 0.247426
n= 19,q= {0.346353, -0.170507, 0., 0.},\q\= 0.386048
n= 20,q= {0.490888, -0.318111, 0., 0.},\q\= 0.584949
```

In[•]:=
```
P = {0.4, -0.4, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {0.4, -0.4, 0, 0}

```
n= 1,q= {0.4, -0.4, 0, 0},\q\= 0.565685

n= 2,q= {0.4, -0.72, 0., 0.},\q\= 0.82365

n= 3,q= {0.0416, -0.976, 0., 0.},\q\= 0.976886

n= 4,q= {-0.550845, -0.481203, 0., 0.},\q\= 0.731428

n= 5,q= {0.471874, 0.130137, 0., 0.},\q\= 0.48949

n= 6,q= {0.60573, -0.277183, 0., 0.},\q\= 0.666137

n= 7,q= {0.690078, -0.735796, 0., 0.},\q\= 1.00876

n= 8,q= {0.334811, -1.41551, 0., 0.},\q\= 1.45457

n= 9,q= {-1.49158, -1.34786, 0., 0.},\q\= 2.01036

n= 10,q= {0.808082, 3.62088, 0., 0.},\q\= 3.70995

n= 11,q= {-12.0578, 5.45193, 0., 0.},\q\= 13.233

n= 12,q= {116.066, -131.876, 0., 0.},\q\= 175.678

n= 13,q= {-3919.62, -30613.1, 0., 0.},\q\= 30863.

n= 14,q= {-9.21795×10^8, 2.39983×10^8, 0., 0.},\q\= 9.52522×10^8

n= 15,q= {7.92115×10^17, -4.42431×10^17, 0., 0.},\q\= 9.07299×10^17

n= 16,q= {4.31701×10^35, -7.00912×10^35, 0., 0.},\q\= 8.23191×10^35

n= 17,q= {-3.04912×10^71, -6.05169×10^71, 0., 0.},\q\= 6.77644×10^71

n= 18,q= {-2.73258×10^143, 3.69047×10^143, 0., 0.},\q\= 4.59201×10^143

n= 19,q= {-6.15259×10^286, -2.0169×10^287, 0., 0.},\q\= 2.10866×10^287

n= 20,q= {-3.689346603113686×10^574, 2.481832496743607×10^574, 0., 0.}
 ,\q\= 4.446433503359642×10^574
```

In[•]:=
```
P = {0.4, -1.2, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {0.4, -1.2, 0, 0}

```
n= 1,q= {0.4, -1.2, 0, 0},\q\= 1.26491

n= 2,q= {-0.88, -2.16, 0., 0.},\q\= 2.33238

n= 3,q= {-3.4912, 2.6016, 0., 0.},\q\= 4.35394

n= 4,q= {5.82015, -19.3654, 0., 0.},\q\= 20.2211

n= 5,q= {-340.745, -226.619, 0., 0.},\q\= 409.223

n= 6,q= {64 751.2, 154 438., 0., 0.},\q\= 167 463.

n= 7,q= {-1.96583×10^10, 2.×10^10, 0., 0.},\q\= 2.80437×10^10

n= 8,q= {-1.35541×10^19, -7.86332×10^20, 0., 0.},\q\= 7.86449×10^20

n= 9,q= {-6.18135×10^41, 2.13161×10^40, 0., 0.},\q\= 6.18502×10^41

n= 10,q= {3.81636×10^83, -2.63525×10^82, 0., 0.},\q\= 3.82545×10^83

n= 11,q= {1.44952×10^167, -2.01141×10^166, 0., 0.},\q\= 1.46341×10^167

n= 12,q= {2.060643558121792×10^334, -5.831156125852581×10^333, 0., 0.}
 ,\q\= 2.141559172955424×10^334

n= 13,q= {3.906228055988158×10^668, -2.403186861428109×10^668, 0., 0.}
 ,\q\= 4.586275691269520×10^668

n= 14,q= {9.48331053444834×10^1336, -1.877479188378521×10^1337, 0., 0.}
 ,\q\= 2.103392471632971×10^1337

n= 15,q= {-2.625596315866682×10^2674, -3.560943633071510×10^2674, 0., 0.}
 ,\q\= 4.424259889722260×10^2674

n= 16,q= {-5.786563544019832×10^5348, 1.869920096800295×10^5349, 0., 0.}
 ,\q\= 1.957407557180522×10^5349

n= 17,q= {-3.161757991927832×10^10 698, -2.164082292474925×10^10 698, 0., 0.}
 ,\q\= 3.831444344907420×10^10 698

n= 18,q= {5.313461430915991×10^21 396, 1.368460896684420×10^21 397, 0., 0.}
 ,\q\= 1.467996576812304×10^21 397

n= 19,q= {-1.590356501976008×10^42 794, 1.454252838849876×10^42 794, 0., 0.}
 ,\q\= 2.155013949532644×10^42 794

n= 20,q= {4.143824840744420×10^85 587, -4.625560915563934×10^85 588, 0., 0.}
 ,\q\= 4.644085122680286×10^85 588
```

In[•]:=
```
P = {0.4, -0.5, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {0.4, -0.5, 0, 0}

```
n= 1,q= {0.4, -0.5, 0, 0},\q\= 0.640312

n= 2,q= {0.31, -0.9, 0., 0.},\q\= 0.951893

n= 3,q= {-0.3139, -1.058, 0., 0.},\q\= 1.10358

n= 4,q= {-0.620831, 0.164212, 0., 0.},\q\= 0.642181

n= 5,q= {0.758465, -0.703896, 0., 0.},\q\= 1.03477

n= 6,q= {0.479799, -1.56776, 0., 0.},\q\= 1.63954

n= 7,q= {-1.82767, -2.00442, 0., 0.},\q\= 2.71258

n= 8,q= {-0.277336, 6.82684, 0., 0.},\q\= 6.83247

n= 9,q= {-46.1288, -4.28666, 0., 0.},\q\= 46.3276

n= 10,q= {2109.89, 394.977, 0., 0.},\q\= 2146.55

n= 11,q= {4.29564×10^6, 1.66672×10^6, 0., 0.},\q\= 4.60766×10^6

n= 12,q= {1.56746×10^13, 1.43193×10^13, 0., 0.},\q\= 2.12305×10^13

n= 13,q= {4.06515×10^25, 4.48897×10^26, 0., 0.},\q\= 4.50734×10^26

n= 14,q= {-1.99856×10^53, 3.64967×10^52, 0., 0.},\q\= 2.03161×10^53

n= 15,q= {3.86105×10^106, -1.45882×10^106, 0., 0.},\q\= 4.12745×10^106

n= 16,q= {1.27796×10^213, -1.12651×10^213, 0., 0.},\q\= 1.70359×10^213

n= 17,q= {3.641396820235645×10^425, -2.879269401595104×10^426, 0., 0.}
 ,\q\= 2.902204333775631×10^426

n= 18,q= {-8.157594578937608×10^852, -2.096912488714040×10^852, 0., 0.}
 ,\q\= 8.422789994986053×10^852

n= 19,q= {6.214930732898733×10^1705, 3.421152390088045×10^1705, 0., 0.}
 ,\q\= 7.094339129963715×10^1705

n= 20,q= {2.692108033852405×10^3411, 4.252445026217629×10^3411, 0., 0.}
 ,\q\= 5.032964769093433×10^3411
```

In[•]:=

```
P = {0.4, -0.7, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
    Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
    n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {0.4, -0.7, 0, 0}

```
n= 1,q= {0.4, -0.7, 0, 0},\q\= 0.806226

n= 2,q= {0.07, -1.26, 0., 0.},\q\= 1.26194

n= 3,q= {-1.1827, -0.8764, 0., 0.},\q\= 1.47202

n= 4,q= {1.0307, 1.37304, 0., 0.},\q\= 1.71685

n= 5,q= {-0.422882, 2.13038, 0., 0.},\q\= 2.17195

n= 6,q= {-3.95971, -2.5018, 0., 0.},\q\= 4.68383

n= 7,q= {9.82026, 19.1128, 0., 0.},\q\= 21.4881

n= 8,q= {-268.462, 374.685, 0., 0.},\q\= 460.935

n= 9,q= {-68 317., -201 178., 0., 0.},\q\= 212 462.

n= 10,q= {-3.58055×10^10, 2.74878×10^10, 0., 0.},\q\= 4.51399×10^10

n= 11,q= {5.26453×10^20, -1.96843×10^21, 0., 0.},\q\= 2.03761×10^21

n= 12,q= {-3.59755×10^42, -2.07257×10^42, 0., 0.},\q\= 4.15186×10^42

n= 13,q= {8.64685×10^84, 1.49124×10^85, 0., 0.},\q\= 1.72379×10^85

n= 14,q= {-1.4761×10^170, 2.5789×10^170, 0., 0.},\q\= 2.97146×10^170

n= 15,q= {-4.471842015190418×10^340, -7.613437991289128×10^340, 0., 0.}
 ,\q\= 8.829598465164026×10^340

n= 16,q= {-3.796706703838234×10^681, 6.809218377898732×10^681, 0., 0.}
 ,\q\= 7.796180905602693×10^681

n= 17,q= {-3.195047312294365×10^1363, -5.170521012653324×10^1363, 0., 0.}
 ,\q\= 6.078043671288403×10^1363

n= 18,q= {-1.652596021449011×10^2727, 3.304011852927908×10^2727, 0., 0.}
 ,\q\= 3.694261487008900×10^2727

n= 19,q= {-8.185420714179011×10^5454, -1.092039368593807×10^5455, 0., 0.}
 ,\q\= 1.364756793439721×10^5455

n= 20,q= {-5.225388598776531×10^10 909, 1.787760333677344×10^10 910, 0., 0.}
 ,\q\= 1.862561105239870×10^10 910
```

In[•]:=

```
P = {0.4, -1.4, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {0.4, -1.4, 0, 0}

```
n= 1,q= {0.4, -1.4, 0, 0},\q\= 1.45602

n= 2,q= {-1.4, -2.52, 0., 0.},\q\= 2.88278

n= 3,q= {-3.9904, 5.656, 0., 0.},\q\= 6.92197

n= 4,q= {-15.667, -46.5394, 0., 0.},\q\= 49.1057

n= 5,q= {-1920.06, 1456.87, 0., 0.},\q\= 2410.21

n= 6,q= {1.56416×10^6, -5.59456×10^6, 0., 0.},\q\= 5.8091×10^6

n= 7,q= {-2.88525×10^13, -1.75016×10^13, 0., 0.},\q\= 3.37457×10^13

n= 8,q= {5.26159×10^26, 1.00993×10^27, 0., 0.},\q\= 1.13877×10^27

n= 9,q= {-7.43108×10^53, 1.06276×10^54, 0., 0.},\q\= 1.2968×10^54

n= 10,q= {-5.77259×10^107, -1.5795×10^108, 0., 0.},\q\= 1.68168×10^108

n= 11,q= {-2.16159×10^216, 1.82356×10^216, 0., 0.},\q\= 2.82804×10^216

n= 12,q= {1.347102556624021×10^432, -7.883568009646126×10^432, 0., 0.}
 ,\q\= 7.997832822757598×10^432

n= 13,q= {-6.033595926465281×10^865, -2.123994924222728×10^865, 0., 0.}
 ,\q\= 6.396532986077876×10^865

n= 14,q= {3.189292536573453×10^1731, 2.563065424524637×10^1731, 0., 0.}
 ,\q\= 4.091563424198235×10^1731

n= 15,q= {3.602282513449470×10^3462, 1.634873085837179×10^3463, 0., 0.}
 ,\q\= 1.674089125423679×10^3463

n= 16,q= {-2.543045613727740×10^6926, 1.177854945764089×10^6926, 0., 0.}
 ,\q\= 2.802574399861817×10^6926

n= 17,q= {5.079738720238976×10^13852, -5.990677706865782×10^13852, 0., 0.}
 ,\q\= 7.854423266760824×10^13852

n= 18,q= {-1.008447392164355×10^27705, -6.086215501607711×10^27705, 0., 0.}
 ,\q\= 6.169196485343378×10^27705

n= 19,q= {-3.602505298924691×10^55411, 1.227525630149313×10^55411, 0., 0.}
 ,\q\= 3.805898527477308×10^55411

n= 20,q= {1.147122525610701×10^110823, -8.844335174357543×10^110822, 0., 0.}
 ,\q\= 1.448486360145394×10^110823
```

In[•]:=

```
P = {0.7, 1.4, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {0.7, 1.4, 0, 0}

```
n= 1,q= {0.7, 1.4, 0, 0},\q\= 1.56525

n= 2,q= {-0.77, 3.36, 0., 0.},\q\= 3.4471

n= 3,q= {-9.9967, -3.7744, 0., 0.},\q\= 10.6855

n= 4,q= {86.3879, 76.8631, 0., 0.},\q\= 115.632

n= 5,q= {1555.64, 13 281.5, 0., 0.},\q\= 13 372.3

n= 6,q= {-1.73978×10^8, 4.13224×10^7, 0., 0.},\q\= 1.78818×10^8

n= 7,q= {2.85607×10^16, -1.43783×10^16, 0., 0.},\q\= 3.19758×10^16

n= 8,q= {6.08979×10^32, -8.21312×10^32, 0., 0.},\q\= 1.02245×10^33

n= 9,q= {-3.03698×10^65, -1.00032×10^66, 0., 0.},\q\= 1.04541×10^66

n= 10,q= {-9.08416×10^131, 6.07594×10^131, 0., 0.},\q\= 1.09288×10^132

n= 11,q= {4.5605×10^263, -1.1039×10^264, 0., 0.},\q\= 1.19439×10^264

n= 12,q= {-1.010604083742845×10^528, -1.006862097503111×10^528, 0., 0.}
 ,\q\= 1.426566471450272×10^528

n= 13,q= {7.549330689352586×10^1053, 2.035077895005061×10^1056, 0., 0.}
 ,\q\= 2.035091897466079×10^1056

n= 14,q= {-4.141485046344373×10^2112, 3.072695201596953×10^2110, 0., 0.}
 ,\q\= 4.141599031132087×10^2112

n= 15,q= {1.715095424351386×10^4225, -2.545104245877578×10^4223, 0., 0.}
 ,\q\= 1.715284253467424×10^4225

n= 16,q= {2.940904559068822×10^8450, -8.730193293203838×10^8448, 0., 0.}
 ,\q\= 2.942200070193299×10^8450

n= 17,q= {8.641297998058115×10^16 900, -5.134933051507045×10^16 899, 0., 0.}
 ,\q\= 8.656541253045455×10^16 900

n= 18,q= {7.440835571680859×10^33 801, -8.874497339630054×10^33 800, 0., 0.}
 ,\q\= 7.493570646567778×10^33 801

n= 19,q= {5.457846697448020×10^67 603, -1.320673509710129×10^67 603, 0., 0.}
 ,\q\= 5.615360103510222×10^67 603

n= 20,q= {2.804391205359419×10^135 207, -1.441606710675703×10^135 207, 0., 0.}
 ,\q\= 3.153226909209433×10^135 207
```

In[ ]:=
```
P = {0.7, 1.2, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[ ]= {0.7, 1.2, 0, 0}

```
n= 1,q= {0.7, 1.2, 0, 0},\q\= 1.38924

n= 2,q= {-0.25, 2.88, 0., 0.},\q\= 2.89083

n= 3,q= {-7.5319, -0.24, 0., 0.},\q\= 7.53572

n= 4,q= {57.3719, 4.81531, 0., 0.},\q\= 57.5736

n= 5,q= {3269.05, 553.727, 0., 0.},\q\= 3315.61

n= 6,q= {1.03801×10^7, 3.62033×10^6, 0., 0.},\q\= 1.09933×10^7

n= 7,q= {9.46391×10^13, 7.51585×10^13, 0., 0.},\q\= 1.20853×10^14

n= 8,q= {3.30777×10^27, 1.42259×10^28, 0., 0.},\q\= 1.46054×10^28

n= 9,q= {-1.91434×10^56, 9.41118×10^55, 0., 0.},\q\= 2.13317×10^56

n= 10,q= {2.779×10^112, -3.60324×10^112, 0., 0.},\q\= 4.5504×10^112

n= 11,q= {-5.26053×10^224, -2.00268×10^225, 0., 0.},\q\= 2.07062×10^225

n= 12,q= {-3.733992082336978×10^450, 2.107030575602885×10^450, 0., 0.}
 ,\q\= 4.287455506180871×10^450

n= 13,q= {9.50311902442982×10^900, -1.573527097308619×10^901, 0., 0.}
 ,\q\= 1.838227471748066×10^901

n= 14,q= {-1.572894814039690×10^1802, -2.990683058777874×10^1802, 0., 0.}
 ,\q\= 3.379080237889289×10^1802

n= 15,q= {-6.470187062028030×10^3604, 9.40805974717615×10^3604, 0., 0.}
 ,\q\= 1.141818325409393×10^3605

n= 16,q= {-4.664826758880124×10^7209, -1.217438129099317×10^7210, 0., 0.}
 ,\q\= 1.303749088240711×10^7210

n= 17,q= {-1.264549511281204×10^14420, 1.135827592380689×10^14420, 0., 0.}
 ,\q\= 1.699761685088485×10^14420

n= 18,q= {3.089811468682173×10^28839, -2.872620453689414×10^28840, 0., 0.}
 ,\q\= 2.889189786094845×10^28840

n= 19,q= {-8.156478921834776×10^57680, -1.775171124596108×10^57680, 0., 0.}
 ,\q\= 8.347417620074774×10^57680

n= 20,q= {6.337691588073519×10^115361, 2.895829172083578×10^115361, 0., 0.}
 ,\q\= 6.967938092393481×10^115361
```

In[•]:=
```
P = {0.7, 0.7, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {0.7, 0.7, 0, 0}

```
n= 1,q= {0.7, 0.7, 0, 0},\q\= 0.989949

n= 2,q= {0.7, 1.68, 0., 0.},\q\= 1.82

n= 3,q= {-1.6324, 3.052, 0., 0.},\q\= 3.46113

n= 4,q= {-5.94997, -9.26417, 0., 0.},\q\= 11.0103

n= 5,q= {-49.7226, 110.943, 0., 0.},\q\= 121.576

n= 6,q= {-9835.34, -11032.1, 0., 0.},\q\= 14779.7

n= 7,q= {-2.49727×10^7, 2.17008×10^8, 0., 0.},\q\= 2.18441×10^8

n= 8,q= {-4.6469×10^16, -1.08386×10^16, 0., 0.},\q\= 4.77163×10^16

n= 9,q= {2.04189×10^33, 1.00732×10^33, 0., 0.},\q\= 2.27684×10^33

n= 10,q= {3.15464×10^66, 4.11366×10^66, 0., 0.},\q\= 5.18401×10^66

n= 11,q= {-6.97047×10^132, 2.59542×10^133, 0., 0.},\q\= 2.68739×10^133

n= 12,q= {-6.25034×10^266, -3.61826×10^266, 0., 0.},\q\= 7.22209×10^266

n= 13,q= {2.597491455811477×10^533, 4.523075060020172×10^533, 0., 0.}
 ,\q\= 5.215857538467678×10^533

n= 14,q= {-1.371124613556286×10^1067, 2.349729764479276×10^1067, 0., 0.}
 ,\q\= 2.720516986159010×10^1067

n= 15,q= {-3.641247260179959×10^2134, -6.443544630566697×10^2134, 0., 0.}
 ,\q\= 7.401212671979705×10^2134

n= 16,q= {-2.826058579633686×10^4269, 4.692507846379654×10^4269, 0., 0.}
 ,\q\= 5.477794901587297×10^4269

n= 17,q= {-1.403302279281345×10^8539, -2.652260411851922×10^8539, 0., 0.}
 ,\q\= 3.000623698385578×10^8539

n= 18,q= {-5.065228005240709×10^17078, 7.443846162398963×10^17078, 0., 0.}
 ,\q\= 9.003742579313146×10^17078

n= 19,q= {-2.975431094438700×10^34157, -7.540955609697362×10^34157, 0., 0.}
 ,\q\= 8.106738043453655×10^34157

n= 20,q= {-4.801282130967343×10^68315, 4.487518760575095×10^68315, 0., 0.}
 ,\q\= 6.571920170517879×10^68315
```

In[•]:=

```
P = {0.7, 0.5, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {0.7, 0.5, 0, 0}

```
n= 1,q= {0.7, 0.5, 0, 0},\q\= 0.860233

n= 2,q= {0.94, 1.2, 0., 0.},\q\= 1.52434

n= 3,q= {0.1436, 2.756, 0., 0.},\q\= 2.75974

n= 4,q= {-6.87492, 1.29152, 0., 0.},\q\= 6.99518

n= 5,q= {46.2964, -17.2582, 0., 0.},\q\= 49.4086

n= 6,q= {1846.21, -1597.49, 0., 0.},\q\= 2441.41

n= 7,q= {856 533., -5.89861×10^6, 0., 0.},\q\= 5.96047×10^6

n= 8,q= {-3.40599×10^13, -1.01047×10^13, 0., 0.},\q\= 3.55272×10^13

n= 9,q= {1.05797×10^27, 6.8833×10^26, 0., 0.},\q\= 1.26218×10^27

n= 10,q= {6.45505×10^53, 1.45647×10^54, 0., 0.},\q\= 1.5931×10^54

n= 11,q= {-1.70462×10^108, 1.88031×10^108, 0., 0.},\q\= 2.53797×10^108

n= 12,q= {-6.29849×10^215, -6.41044×10^216, 0., 0.},\q\= 6.44131×10^216

n= 13,q= {-4.069705546952813×10^433, 8.075214753160699×10^432, 0., 0.}
 ,\q\= 4.149047381266589×10^433

n= 14,q= {1.591041230580186×10^867, -6.572749254754658×10^866, 0., 0.}
 ,\q\= 1.721459417199514×10^867

n= 15,q= {2.099401869747332×10^1734, -2.091503012515970×10^1734, 0., 0.}
 ,\q\= 2.963422525064890×10^1734

n= 16,q= {3.310335933521645×10^3466, -8.781810670116408×10^3468, 0., 0.}
 ,\q\= 8.781873062061970×10^3468

n= 17,q= {-7.711910281337113×10^6937, -5.814148684534029×10^6935, 0., 0.}
 ,\q\= 7.712129447816968×10^6937

n= 18,q= {5.947017975490048×10^13 875, 8.967638603496125×10^13 873, 0., 0.}
 ,\q\= 5.947694061988565×10^13 875

n= 19,q= {3.535898094658945×10^27 751, 1.066614159453798×10^27 750, 0., 0.}
 ,\q\= 3.537506465501404×10^27 751

n= 20,q= {1.249119867816129×10^55 503, 7.542877948297877×10^55 501, 0., 0.}
 ,\q\= 1.251395199346423×10^55 503
```

In[•]:=
```
P = {0.7, 0.4, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {0.7, 0.4, 0, 0}

```
n= 1,q= {0.7, 0.4, 0, 0},\q\= 0.806226

n= 2,q= {1.03, 0.96, 0., 0.},\q\= 1.40801

n= 3,q= {0.8393, 2.3776, 0., 0.},\q\= 2.52139

n= 4,q= {-4.24856, 4.39104, 0., 0.},\q\= 6.10995

n= 5,q= {-0.530988, -36.9112, 0., 0.},\q\= 36.915

n= 6,q= {-1361.45, 39.5988, 0., 0.},\q\= 1362.03

n= 7,q= {1.85198×10^6, -107823., 0., 0.},\q\= 1.85512×10^6

n= 8,q= {3.41822×10^12, -3.99374×10^11, 0., 0.},\q\= 3.44147×10^12

n= 9,q= {1.15247×10^25, -2.7303×10^24, 0., 0.},\q\= 1.18437×10^25

n= 10,q= {1.25365×10^50, -6.29319×10^49, 0., 0.},\q\= 1.40274×10^50

n= 11,q= {1.1756×10^100, -1.57789×10^100, 0., 0.},\q\= 1.96768×10^100

n= 12,q= {-1.10771×10^200, -3.70992×10^200, 0., 0.},\q\= 3.87176×10^200

n= 13,q= {-1.253648225199897×10^401, 8.219051945099823×10^400, 0., 0.}
 ,\q\= 1.499053708613986×10^401

n= 14,q= {8.961057237843609×10^801, -2.060759976760032×10^802, 0., 0.}
 ,\q\= 2.247162021309345×10^802

n= 15,q= {-3.443726213616913×10^1604, -3.693317621040782×10^1604, 0., 0.}
 ,\q\= 5.049737150015099×10^1604

n= 16,q= {-1.781344815538059×10^3208, 2.543754941358279×10^3209, 0., 0.}
 ,\q\= 2.549984528424262×10^3209

n= 17,q= {-6.438957308166219×10^6418, -9.06260935357578×10^6417, 0., 0.}
 ,\q\= 6.502421095203105×10^6418

n= 18,q= {4.063886233343197×10^12837, 1.167075094565246×10^12837, 0., 0.}
 ,\q\= 4.228148009934235×10^12837

n= 19,q= {1.515310704120188×10^25675, 9.48572082016282×10^25674, 0., 0.}
 ,\q\= 1.787723559391083×10^25675

n= 20,q= {1.396377535240515×10^51350, 2.874762859017690×10^51350, 0., 0.}
 ,\q\= 3.195955524801924×10^51350
```

In[•]:=

```
P = {0.7, 0.2, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {0.7, 0.2, 0, 0}

```
n= 1,q= {0.7, 0.2, 0, 0},\q\= 0.728011

n= 2,q= {1.15, 0.48, 0., 0.},\q\= 1.24615

n= 3,q= {1.7921, 1.304, 0., 0.},\q\= 2.21631

n= 4,q= {2.21121, 4.8738, 0., 0.},\q\= 5.35195

n= 5,q= {-18.1645, 21.7539, 0., 0.},\q\= 28.3405

n= 6,q= {-142.586, -790.097, 0., 0.},\q\= 802.86

n= 7,q= {-603922., 225314., 0., 0.},\q\= 644584.

n= 8,q= {3.13955×10^11, -2.72145×10^11, 0., 0.},\q\= 4.15488×10^11

n= 9,q= {2.45053×10^22, -1.70883×10^23, 0., 0.},\q\= 1.72631×10^23

n= 10,q= {-2.86003×10^46, -8.37506×10^45, 0., 0.},\q\= 2.98013×10^46

n= 11,q= {7.47837×10^92, 4.79059×10^92, 0., 0.},\q\= 8.8812×10^92

n= 12,q= {3.29763×10^185, 7.16516×10^185, 0., 0.},\q\= 7.88758×10^185

n= 13,q= {-4.046518720106294×10^371, 4.725607152058041×10^371, 0., 0.}
 ,\q\= 6.221388647862532×10^371

n= 14,q= {-5.957049203411436×10^742, -3.824451560934211×10^743, 0., 0.}
 ,\q\= 3.870567670775279×10^743

n= 15,q= {-1.427156538981347×10^1487, 4.556489224909752×10^1486, 0., 0.}
 ,\q\= 1.498129409405077×10^1487

n= 16,q= {1.829159846190031×10^2974, -1.300564678425601×10^2974, 0., 0.}
 ,\q\= 2.244391727324404×10^2974

n= 17,q= {1.654357260145651×10^5948, -4.757881374298317×10^5948, 0., 0.}
 ,\q\= 5.037294225682223×10^5948

n= 18,q= {-1.990053722769822×10^11897, -1.574247118896438×10^11897, 0., 0.}
 ,\q\= 2.537433311609147×10^11897

n= 19,q= {1.482059828156293×10^23794, 6.265672679039045×10^23794, 0., 0.}
 ,\q\= 6.438567810863763×10^23794

n= 20,q= {-3.706215278662166×10^47589, 1.857220354796037×10^47589, 0., 0.}
 ,\q\= 4.145515545509098×10^47589
```

In[•]:=
```
P = {0.7, -0.2, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {0.7, -0.2, 0, 0}

```
n= 1,q= {0.7, -0.2, 0, 0},\q\= 0.728011

n= 2,q= {1.15, -0.48, 0., 0.},\q\= 1.24615

n= 3,q= {1.7921, -1.304, 0., 0.},\q\= 2.21631

n= 4,q= {2.21121, -4.8738, 0., 0.},\q\= 5.35195

n= 5,q= {-18.1645, -21.7539, 0., 0.},\q\= 28.3405

n= 6,q= {-142.586, 790.097, 0., 0.},\q\= 802.86

n= 7,q= {-603922., -225314., 0., 0.},\q\= 644584.

n= 8,q= {3.13955×10^11, 2.72145×10^11, 0., 0.},\q\= 4.15488×10^11

n= 9,q= {2.45053×10^22, 1.70883×10^23, 0., 0.},\q\= 1.72631×10^23

n= 10,q= {-2.86003×10^46, 8.37506×10^45, 0., 0.},\q\= 2.98013×10^46

n= 11,q= {7.47837×10^92, -4.79059×10^92, 0., 0.},\q\= 8.8812×10^92

n= 12,q= {3.29763×10^185, -7.16516×10^185, 0., 0.},\q\= 7.88758×10^185

n= 13,q= {-4.046518720106294×10^371, -4.725607152058041×10^371, 0., 0.}
 ,\q\= 6.221388647862532×10^371

n= 14,q= {-5.957049203411436×10^742, 3.824451560934211×10^743, 0., 0.}
 ,\q\= 3.870567670775279×10^743

n= 15,q= {-1.427156538981347×10^1487, -4.556489224909752×10^1486, 0., 0.}
 ,\q\= 1.498129409405077×10^1487

n= 16,q= {1.829159846190031×10^2974, 1.300564678425601×10^2974, 0., 0.}
 ,\q\= 2.244391727324404×10^2974

n= 17,q= {1.654357260145651×10^5948, 4.757881374298317×10^5948, 0., 0.}
 ,\q\= 5.037294225682223×10^5948

n= 18,q= {-1.990053722769822×10^11897, 1.574247118896438×10^11897, 0., 0.}
 ,\q\= 2.537433311609147×10^11897

n= 19,q= {1.482059828156293×10^23794, -6.265672679039045×10^23794, 0., 0.}
 ,\q\= 6.438567810863763×10^23794

n= 20,q= {-3.706215278662166×10^47589, -1.857220354796037×10^47589, 0., 0.}
 ,\q\= 4.145515545509098×10^47589
```

In[•]:=

```
P = {0.7, -0.4, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {0.7, -0.4, 0, 0}

```
n= 1,q= {0.7, -0.4, 0, 0},\q\= 0.806226

n= 2,q= {1.03, -0.96, 0., 0.},\q\= 1.40801

n= 3,q= {0.8393, -2.3776, 0., 0.},\q\= 2.52139

n= 4,q= {-4.24856, -4.39104, 0., 0.},\q\= 6.10995

n= 5,q= {-0.530988, 36.9112, 0., 0.},\q\= 36.915

n= 6,q= {-1361.45, -39.5988, 0., 0.},\q\= 1362.03

n= 7,q= {1.85198×10^6, 107823., 0., 0.},\q\= 1.85512×10^6

n= 8,q= {3.41822×10^12, 3.99374×10^11, 0., 0.},\q\= 3.44147×10^12

n= 9,q= {1.15247×10^25, 2.7303×10^24, 0., 0.},\q\= 1.18437×10^25

n= 10,q= {1.25365×10^50, 6.29319×10^49, 0., 0.},\q\= 1.40274×10^50

n= 11,q= {1.1756×10^100, 1.57789×10^100, 0., 0.},\q\= 1.96768×10^100

n= 12,q= {-1.10771×10^200, 3.70992×10^200, 0., 0.},\q\= 3.87176×10^200

n= 13,q= {-1.253648225199897×10^401, -8.219051945099823×10^400, 0., 0.}
 ,\q\= 1.499053708613986×10^401

n= 14,q= {8.961057237843609×10^801, 2.060759976760032×10^802, 0., 0.}
 ,\q\= 2.247162021309345×10^802

n= 15,q= {-3.443726213616913×10^1604, 3.693317621040782×10^1604, 0., 0.}
 ,\q\= 5.049737150015099×10^1604

n= 16,q= {-1.781344815538059×10^3208, -2.543754941358279×10^3209, 0., 0.}
 ,\q\= 2.549984528424262×10^3209

n= 17,q= {-6.438957308166219×10^6418, 9.06260935357578×10^6417, 0., 0.}
 ,\q\= 6.502421095203105×10^6418

n= 18,q= {4.063886233343197×10^12837, -1.167075094565246×10^12837, 0., 0.}
 ,\q\= 4.228148009934235×10^12837

n= 19,q= {1.515310704120188×10^25675, -9.48572082016282×10^25674, 0., 0.}
 ,\q\= 1.787723559391083×10^25675

n= 20,q= {1.396377535240515×10^51350, -2.874762859017690×10^51350, 0., 0.}
 ,\q\= 3.195955524801924×10^51350
```

In[•]:=

```
P = {0.7, -0.5, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {0.7, -0.5, 0, 0}

```
n= 1,q= {0.7, -0.5, 0, 0},\q\= 0.860233

n= 2,q= {0.94, -1.2, 0., 0.},\q\= 1.52434

n= 3,q= {0.1436, -2.756, 0., 0.},\q\= 2.75974

n= 4,q= {-6.87492, -1.29152, 0., 0.},\q\= 6.99518

n= 5,q= {46.2964, 17.2582, 0., 0.},\q\= 49.4086

n= 6,q= {1846.21, 1597.49, 0., 0.},\q\= 2441.41

n= 7,q= {856 533., 5.89861×10^6, 0., 0.},\q\= 5.96047×10^6

n= 8,q= {-3.40599×10^13, 1.01047×10^13, 0., 0.},\q\= 3.55272×10^13

n= 9,q= {1.05797×10^27, -6.8833×10^26, 0., 0.},\q\= 1.26218×10^27

n= 10,q= {6.45505×10^53, -1.45647×10^54, 0., 0.},\q\= 1.5931×10^54

n= 11,q= {-1.70462×10^108, -1.88031×10^108, 0., 0.},\q\= 2.53797×10^108

n= 12,q= {-6.29849×10^215, 6.41044×10^216, 0., 0.},\q\= 6.44131×10^216

n= 13,q= {-4.069705546952813×10^433, -8.075214753160699×10^432, 0., 0.}
 ,\q\= 4.149047381266589×10^433

n= 14,q= {1.591041230580186×10^867, 6.572749254754658×10^866, 0., 0.}
 ,\q\= 1.721459417199514×10^867

n= 15,q= {2.099401869747332×10^1734, 2.091503012515970×10^1734, 0., 0.}
 ,\q\= 2.963422525064890×10^1734

n= 16,q= {3.310335933521645×10^3466, 8.781810670116408×10^3468, 0., 0.}
 ,\q\= 8.781873062061970×10^3468

n= 17,q= {-7.711910281337113×10^6937, 5.814148684534029×10^6935, 0., 0.}
 ,\q\= 7.712129447816968×10^6937

n= 18,q= {5.947017975490048×10^13 875, -8.967638603496125×10^13 873, 0., 0.}
 ,\q\= 5.947694061988565×10^13 875

n= 19,q= {3.535898094658945×10^27 751, -1.066614159453798×10^27 750, 0., 0.}
 ,\q\= 3.537506465501404×10^27 751

n= 20,q= {1.249119867816129×10^55 503, -7.542877948297877×10^55 501, 0., 0.}
 ,\q\= 1.251395199346423×10^55 503
```

In[ ]:=
```
P = {0.7, -0.7, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[ ]= {0.7, -0.7, 0, 0}

```
n= 1,q= {0.7, -0.7, 0, 0},\q\= 0.989949

n= 2,q= {0.7, -1.68, 0., 0.},\q\= 1.82

n= 3,q= {-1.6324, -3.052, 0., 0.},\q\= 3.46113

n= 4,q= {-5.94997, 9.26417, 0., 0.},\q\= 11.0103

n= 5,q= {-49.7226, -110.943, 0., 0.},\q\= 121.576

n= 6,q= {-9835.34, 11032.1, 0., 0.},\q\= 14779.7

n= 7,q= {-2.49727×10^7, -2.17008×10^8, 0., 0.},\q\= 2.18441×10^8

n= 8,q= {-4.6469×10^16, 1.08386×10^16, 0., 0.},\q\= 4.77163×10^16

n= 9,q= {2.04189×10^33, -1.00732×10^33, 0., 0.},\q\= 2.27684×10^33

n= 10,q= {3.15464×10^66, -4.11366×10^66, 0., 0.},\q\= 5.18401×10^66

n= 11,q= {-6.97047×10^132, -2.59542×10^133, 0., 0.},\q\= 2.68739×10^133

n= 12,q= {-6.25034×10^266, 3.61826×10^266, 0., 0.},\q\= 7.22209×10^266

n= 13,q= {2.597491455811477×10^533, -4.523075060020172×10^533, 0., 0.}
 ,\q\= 5.215857538467678×10^533

n= 14,q= {-1.371124613556286×10^1067, -2.349729764479276×10^1067, 0., 0.}
 ,\q\= 2.720516986159010×10^1067

n= 15,q= {-3.641247260179959×10^2134, 6.443544630566697×10^2134, 0., 0.}
 ,\q\= 7.401212671979705×10^2134

n= 16,q= {-2.826058579633686×10^4269, -4.692507846379654×10^4269, 0., 0.}
 ,\q\= 5.477794901587297×10^4269

n= 17,q= {-1.403302279281345×10^8539, 2.652260411851922×10^8539, 0., 0.}
 ,\q\= 3.000623698385578×10^8539

n= 18,q= {-5.065228005240709×10^17078, -7.443846162398963×10^17078, 0., 0.}
 ,\q\= 9.003742579313146×10^17078

n= 19,q= {-2.975431094438700×10^34157, 7.540955609697362×10^34157, 0., 0.}
 ,\q\= 8.106738043453655×10^34157

n= 20,q= {-4.801282130967343×10^68315, -4.487518760575095×10^68315, 0., 0.}
 ,\q\= 6.571920170517879×10^68315
```

In[•]:=
```
P = {0.7, -1.2, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {0.7, -1.2, 0, 0}

```
n= 1,q= {0.7, -1.2, 0, 0},\q\= 1.38924

n= 2,q= {-0.25, -2.88, 0., 0.},\q\= 2.89083

n= 3,q= {-7.5319, 0.24, 0., 0.},\q\= 7.53572

n= 4,q= {57.3719, -4.81531, 0., 0.},\q\= 57.5736

n= 5,q= {3269.05, -553.727, 0., 0.},\q\= 3315.61

n= 6,q= {1.03801×10^7, -3.62033×10^6, 0., 0.},\q\= 1.09933×10^7

n= 7,q= {9.46391×10^13, -7.51585×10^13, 0., 0.},\q\= 1.20853×10^14

n= 8,q= {3.30777×10^27, -1.42259×10^28, 0., 0.},\q\= 1.46054×10^28

n= 9,q= {-1.91434×10^56, -9.41118×10^55, 0., 0.},\q\= 2.13317×10^56

n= 10,q= {2.779×10^112, 3.60324×10^112, 0., 0.},\q\= 4.5504×10^112

n= 11,q= {-5.26053×10^224, 2.00268×10^225, 0., 0.},\q\= 2.07062×10^225

n= 12,q= {-3.733992082336978×10^450, -2.107030575602885×10^450, 0., 0.}
 ,\q\= 4.287455506180871×10^450

n= 13,q= {9.50311902442982×10^900, 1.573527097308619×10^901, 0., 0.}
 ,\q\= 1.838227471748066×10^901

n= 14,q= {-1.572894814039690×10^1802, 2.990683058777874×10^1802, 0., 0.}
 ,\q\= 3.379080237889289×10^1802

n= 15,q= {-6.470187062028030×10^3604, -9.40805974717615×10^3604, 0., 0.}
 ,\q\= 1.141818325409393×10^3605

n= 16,q= {-4.664826758880124×10^7209, 1.217438129099317×10^7210, 0., 0.}
 ,\q\= 1.303749088240711×10^7210

n= 17,q= {-1.264549511281204×10^14420, -1.135827592380689×10^14420, 0., 0.}
 ,\q\= 1.699761685088485×10^14420

n= 18,q= {3.089811468682173×10^28839, 2.872620453689414×10^28840, 0., 0.}
 ,\q\= 2.889189786094845×10^28840

n= 19,q= {-8.156478921834776×10^57680, 1.775171124596108×10^57680, 0., 0.}
 ,\q\= 8.347417620074774×10^57680

n= 20,q= {6.337691588073519×10^115361, -2.895829172083578×10^115361, 0., 0.}
 ,\q\= 6.967938092393481×10^115361
```

In[•]:=
```
P = {0.7, -1.4, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[•]= {0.7, -1.4, 0, 0}

```
n= 1,q= {0.7, -1.4, 0, 0},\q\= 1.56525

n= 2,q= {-0.77, -3.36, 0., 0.},\q\= 3.4471

n= 3,q= {-9.9967, 3.7744, 0., 0.},\q\= 10.6855

n= 4,q= {86.3879, -76.8631, 0., 0.},\q\= 115.632

n= 5,q= {1555.64, -13 281.5, 0., 0.},\q\= 13 372.3

n= 6,q= {-1.73978×10^8, -4.13224×10^7, 0., 0.},\q\= 1.78818×10^8

n= 7,q= {2.85607×10^16, 1.43783×10^16, 0., 0.},\q\= 3.19758×10^16

n= 8,q= {6.08979×10^32, 8.21312×10^32, 0., 0.},\q\= 1.02245×10^33

n= 9,q= {-3.03698×10^65, 1.00032×10^66, 0., 0.},\q\= 1.04541×10^66

n= 10,q= {-9.08416×10^131, -6.07594×10^131, 0., 0.},\q\= 1.09288×10^132

n= 11,q= {4.5605×10^263, 1.1039×10^264, 0., 0.},\q\= 1.19439×10^264

n= 12,q= {-1.010604083742845×10^528, 1.006862097503111×10^528, 0., 0.}
 ,\q\= 1.426566471450272×10^528

n= 13,q= {7.549330689352586×10^1053, -2.035077895005061×10^1056, 0., 0.}
 ,\q\= 2.035091897466079×10^1056

n= 14,q= {-4.141485046344373×10^2112, -3.072695201596953×10^2110, 0., 0.}
 ,\q\= 4.141599031132087×10^2112

n= 15,q= {1.715095424351386×10^4225, 2.545104245877578×10^4223, 0., 0.}
 ,\q\= 1.715284253467424×10^4225

n= 16,q= {2.940904559068822×10^8450, 8.730193293203838×10^8448, 0., 0.}
 ,\q\= 2.942200070193299×10^8450

n= 17,q= {8.641297998058115×10^16 900, 5.134933051507045×10^16 899, 0., 0.}
 ,\q\= 8.656541253045455×10^16 900

n= 18,q= {7.440835571680859×10^33 801, 8.874497339630054×10^33 800, 0., 0.}
 ,\q\= 7.493570646567778×10^33 801

n= 19,q= {5.457846697448020×10^67 603, 1.320673509710129×10^67 603, 0., 0.}
 ,\q\= 5.615360103510222×10^67 603

n= 20,q= {2.804391205359419×10^135 207, 1.441606710675703×10^135 207, 0., 0.}
 ,\q\= 3.153226909209433×10^135 207
```

In[1]:=
```
P = {0.9, 1.4, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[1]= {0.9, 1.4, 0, 0}

```
n= 1,q= {0.9, 1.4, 0, 0},\q\= 1.66433

n= 2,q= {-0.25, 3.92, 0., 0.},\q\= 3.92796

n= 3,q= {-14.4039, -0.56, 0., 0.},\q\= 14.4148

n= 4,q= {208.059, 17.5324, 0., 0.},\q\= 208.796

n= 5,q= {42 982., 7296.92, 0., 0.},\q\= 43 596.9

n= 6,q= {1.7942×10^9, 6.27272×10^8, 0., 0.},\q\= 1.90069×10^9

n= 7,q= {2.82569×10^18, 2.25091×10^18, 0., 0.},\q\= 3.61264×10^18

n= 8,q= {2.91797×10^36, 1.27208×10^37, 0., 0.},\q\= 1.30511×10^37

n= 9,q= {-1.53303×10^74, 7.42375×10^73, 0., 0.},\q\= 1.70332×10^74

n= 10,q= {1.79906×10^148, -2.27617×10^148, 0., 0.},\q\= 2.9013×10^148

n= 11,q= {-1.94431×10^296, -8.18993×10^296, 0., 0.},\q\= 8.41756×10^296

n= 12,q= {-6.329467547249228×10^593, 3.184752059507657×10^593, 0., 0.}
 ,\q\= 7.085534920683082×10^593

n= 13,q= {2.991951375114289×10^1187, -4.031556961337771×10^1187, 0., 0.}
 ,\q\= 5.020480511221941×10^1187

n= 14,q= {-7.301678501462757×10^2374, -2.412444478865226×10^2375, 0., 0.}
 ,\q\= 2.520522456355933×10^2375

n= 15,q= {-5.286743274220077×10^4750, 3.522978797460548×10^4750, 0., 0.}
 ,\q\= 6.353033452994545×10^4750

n= 16,q= {1.553827484015464×10^9501, -3.725016892538898×10^9501, 0., 0.}
 ,\q\= 4.036103405486779×10^9501

n= 17,q= {-1.146137099961832×10^19 003, -1.157606725209764×10^19 003, 0., 0.}
 ,\q\= 1.629013069978197×10^19 003

n= 18,q= {-2.642307834195556×10^38 004, 2.653552029856463×10^38 006, 0., 0.}
 ,\q\= 2.653683582159791×10^38 006

n= 19,q= {-7.040640196086290×10^76 012, -1.402300263387050×10^76 011, 0., 0.}
 ,\q\= 7.042036554224420×10^76 012

n= 20,q= {4.955094991045904×10^152 025, 1.974618320277052×10^152 024, 0., 0.}
 ,\q\= 4.959027883103295×10^152 025
```

In[5]:=

```
P = {0.9, 1.2, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[5]= {0.9, 1.2, 0, 0}

```
n= 1,q= {0.9, 1.2, 0, 0},\q\= 1.5
n= 2,q= {0.27, 3.36, 0., 0.},\q\= 3.37083
n= 3,q= {-10.3167, 3.0144, 0., 0.},\q\= 10.7481
n= 4,q= {98.2477, -60.9973, 0., 0.},\q\= 115.643
n= 5,q= {5932.84, -11984.5, 0., 0.},\q\= 13372.6
n= 6,q= {-1.0843×10^8, -1.42204×10^8, 0., 0.},\q\= 1.78827×10^8
n= 7,q= {-8.46503×10^15, 3.08382×10^16, 0., 0.},\q\= 3.19789×10^16
n= 8,q= {-8.7934×10^32, -5.22093×10^32, 0., 0.},\q\= 1.02265×10^33
n= 9,q= {5.00657×10^65, 9.18194×10^65, 0., 0.},\q\= 1.04582×10^66
n= 10,q= {-5.92424×10^131, 9.194×10^131, 0., 0.},\q\= 1.09374×10^132
n= 11,q= {-4.94331×10^263, -1.08935×10^264, 0., 0.},\q\= 1.19626×10^264
n= 12,q= {-9.42318178220839×10^527, 1.076999165134003×10^528, 0., 0.}
 ,\q\= 1.431045334957904×10^528
n= 13,q= {-2.719636526938977×10^1055, -2.029751782468877×10^1056, 0., 0.}
 ,\q\= 2.047890750704780×10^1056
n= 14,q= {-4.045928070048975×10^2112, 1.104037417644371×10^2112, 0., 0.}
 ,\q\= 4.193856526822189×10^2112
n= 15,q= {1.515063532845137×10^4225, -8.933711956863486×10^4224, 0., 0.}
 ,\q\= 1.758843256756907×10^4225
n= 16,q= {1.497305415275132×10^8450, -2.707028239757287×10^8450, 0., 0.}
 ,\q\= 3.093529601839244×10^8450
n= 17,q= {-5.086078384231203×10^16900, -8.106496085382589×10^16900, 0., 0.}
 ,\q\= 9.56992539745567×10^16900
n= 18,q= {-3.984708545177935×10^33801, 8.246054902343849×10^33801, 0., 0.}
 ,\q\= 9.15834721128671×10^33801
n= 19,q= {-5.211951926245497×10^67603, -6.571625086675188×10^67603, 0., 0.}
 ,\q\= 8.387532364248308×10^67603
n= 20,q= {-1.602181339832452×10^135207, 6.850198805811995×10^135207, 0., 0.}
 ,\q\= 7.035069916131281×10^135207
```

In[9]:=
```
P = {0.9, 0.7, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[9]= {0.9, 0.7, 0, 0}

```
n= 1,q= {0.9, 0.7, 0, 0},\q\= 1.14018

n= 2,q= {1.22, 1.96, 0., 0.},\q\= 2.30868

n= 3,q= {-1.4532, 5.4824, 0., 0.},\q\= 5.67173

n= 4,q= {-27.0449, -15.234, 0., 0.},\q\= 31.0404

n= 5,q= {500.251, 824.707, 0., 0.},\q\= 964.569

n= 6,q= {-429889., 825123., 0., 0.},\q\= 930394.

n= 7,q= {-4.96022×10^11, -7.09423×10^11, 0., 0.},\q\= 8.65632×10^11

n= 8,q= {-2.57243×10^23, 7.0378×10^23, 0., 0.},\q\= 7.49319×10^23

n= 9,q= {-4.29132×10^47, -3.62085×10^47, 0., 0.},\q\= 5.6148×10^47

n= 10,q= {5.30488×10^94, 3.10764×10^95, 0., 0.},\q\= 3.15259×10^95

n= 11,q= {-9.376×10^190, 3.29713×10^190, 0., 0.},\q\= 9.93884×10^190

n= 12,q= {7.703838218690188×10^381, -6.182785256280149×10^381, 0., 0.}
 ,\q\= 9.87805430360791×10^381

n= 13,q= {2.112228977447643×10^763, -9.52623547105704×10^763, 0., 0.}
 ,\q\= 9.75759568250268×10^763

n= 14,q= {-8.628765099685591×10^1527, -4.024318121591257×10^1527, 0., 0.}
 ,\q\= 9.52106735031949×10^1527

n= 15,q= {5.826045080178430×10^3055, 6.944979151523782×10^3055, 0., 0.}
 ,\q\= 9.06507234893199×10^3055

n= 16,q= {-1.428993413882870×10^6111, 8.092352323535379×10^6111, 0., 0.}
 ,\q\= 8.217553669137128×10^6111

n= 17,q= {-6.344414395130783×10^12223, -2.312783634630360×10^12223, 0., 0.}
 ,\q\= 6.752818830514907×10^12223

n= 18,q= {3.490262587652868×10^24447, 2.934651556874350×10^24447, 0., 0.}
 ,\q\= 4.560056215775671×10^24447

n= 19,q= {3.569753170504246×10^48894, 2.048540907351157×10^48895, 0., 0.}
 ,\q\= 2.079411269103434×10^48895

n= 20,q= {-4.069088472107850×10^97790, 1.462557079784887×10^97790, 0., 0.}
 ,\q\= 4.323951226074352×10^97790
```

In[13]:=
```
P = {0.9, 0.5, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[13]= {0.9, 0.5, 0, 0}

```
n= 1,q= {0.9, 0.5, 0, 0},\q\= 1.02956

n= 2,q= {1.46, 1.4, 0., 0.},\q\= 2.02277

n= 3,q= {1.0716, 4.588, 0., 0.},\q\= 4.71148

n= 4,q= {-19.0014, 10.333, 0., 0.},\q\= 21.6293

n= 5,q= {255.183, -392.183, 0., 0.},\q\= 467.895

n= 6,q= {-88 688.5, -200 157., 0., 0.},\q\= 218 925.

n= 7,q= {-3.2197×10^10, 3.55032×10^10, 0., 0.},\q\= 4.79283×10^10

n= 8,q= {-2.23831×10^20, -2.28619×10^21, 0., 0.},\q\= 2.29712×10^21

n= 9,q= {-5.17656×10^42, 1.02344×10^42, 0., 0.},\q\= 5.27676×10^42

n= 10,q= {2.57494×10^85, -1.05958×10^85, 0., 0.},\q\= 2.78442×10^85

n= 11,q= {5.50759×10^170, -5.4567×10^170, 0., 0.},\q\= 7.75301×10^170

n= 12,q= {5.578808944410104×10^339, -6.010653992644118×10^341, 0., 0.}
 ,\q\= 6.010912886593225×10^341

n= 13,q= {-3.612484910836485×10^683, -6.706458051183462×10^681, 0., 0.}
 ,\q\= 3.613107373021250×10^683

n= 14,q= {1.304554957306206×10^1367, 4.845395703011623×10^1365, 0., 0.}
 ,\q\= 1.305454488898052×10^1367

n= 15,q= {1.699515850680320×10^2734, 1.264216996894800×10^2733, 0., 0.}
 ,\q\= 1.704211422584073×10^2734

n= 16,q= {2.872371680561276×10^5468, 4.297113649844373×10^5467, 0., 0.}
 ,\q\= 2.904336572866030×10^5468

n= 17,q= {8.065867214093620×10^10 936, 2.468581511193256×10^10 936, 0., 0.}
 ,\q\= 8.435170928487197×10^10 936

n= 18,q= {5.896431923798520×10^21 873, 3.982250135290274×10^21 873, 0., 0.}
 ,\q\= 7.115210859279556×10^21 873

n= 19,q= {1.890959329197092×10^43 747, 4.696213365255309×10^43 747, 0., 0.}
 ,\q\= 5.062622557200972×10^43 747

n= 20,q= {-1.847869278732508×10^87 495, 1.776069694985919×10^87 495, 0., 0.}
 ,\q\= 2.563014715668011×10^87 495
```

In[17]:=
```
P = {0.9, 0.4, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[17]= {0.9, 0.4, 0, 0}

```
n= 1,q= {0.9, 0.4, 0, 0},\q\= 0.984886

n= 2,q= {1.55, 1.12, 0., 0.},\q\= 1.9123

n= 3,q= {2.0481, 3.872, 0., 0.},\q\= 4.38031

n= 4,q= {-9.89767, 16.2605, 0., 0.},\q\= 19.0359

n= 5,q= {-165.54, -321.482, 0., 0.},\q\= 361.599

n= 6,q= {-75946.4, 106436., 0., 0.},\q\= 130754.

n= 7,q= {-5.56084×10^9, -1.61669×10^10, 0., 0.},\q\= 1.70965×10^10

n= 8,q= {-2.30446×10^20, 1.79803×10^20, 0., 0.},\q\= 2.92292×10^20

n= 9,q= {2.07761×10^40, -8.28697×10^40, 0., 0.},\q\= 8.54344×10^40

n= 10,q= {-6.43575×10^81, -3.44341×10^81, 0., 0.},\q\= 7.29904×10^81

n= 11,q= {2.95618×10^163, 4.43219×10^163, 0., 0.},\q\= 5.3276×10^163

n= 12,q= {-1.090530531291127×10^327, 2.620466381232606×10^327, 0., 0.}
 ,\q\= 2.838327129639643×10^327

n= 13,q= {-5.677587215492202×10^654, -5.715397189912260×10^654, 0., 0.}
 ,\q\= 8.056100894848416×10^654

n= 14,q= {-4.307684489364568×10^1307, 6.489933203381180×10^1309, 0., 0.}
 ,\q\= 6.490076162797745×10^1309

n= 15,q= {-4.211737736978352×10^2619, -5.591316919443444×10^2617, 0., 0.}
 ,\q\= 4.212108859891550×10^2619

n= 16,q= {1.773560848259816×10^5239, 4.709832093805100×10^5237, 0., 0.}
 ,\q\= 1.774186104757689×10^5239

n= 17,q= {3.143299830644895×10^10478, 1.670634760690056×10^10477, 0., 0.}
 ,\q\= 3.147736334315263×10^10478

n= 18,q= {9.85242362029597×10^20956, 1.050261192069306×10^20956, 0., 0.}
 ,\q\= 9.90824403036849×10^20956

n= 19,q= {9.59672026221991×10^41913, 2.069523635244766×10^41913, 0., 0.}
 ,\q\= 9.81732997653328×10^41913

n= 20,q= {8.781411171446546×10^83827, 3.972127880699289×10^83827, 0., 0.}
 ,\q\= 9.63799678681389×10^83827
```

In[21]:=
```
P = {0.9, 0.2, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[21]= {0.9, 0.2, 0, 0}

```
n= 1,q= {0.9, 0.2, 0, 0},\q\= 0.921954

n= 2,q= {1.67, 0.56, 0., 0.},\q\= 1.76139

n= 3,q= {3.3753, 2.0704, 0., 0.},\q\= 3.9597

n= 4,q= {8.00609, 14.1764, 0., 0.},\q\= 16.2809

n= 5,q= {-135.974, 227.196, 0., 0.},\q\= 264.777

n= 6,q= {-33128.1, -61785.2, 0., 0.},\q\= 70106.3

n= 7,q= {-2.71994×10^9, 4.09366×10^9, 0., 0.},\q\= 4.91489×10^9

n= 8,q= {-9.35996×10^18, -2.2269×10^19, 0., 0.},\q\= 2.41561×10^19

n= 9,q= {-4.08302×10^38, 4.16875×10^38, 0., 0.},\q\= 5.83519×10^38

n= 10,q= {-7.0744×10^75, -3.40421×10^77, 0., 0.},\q\= 3.40495×10^77

n= 11,q= {-1.15837×10^155, 4.81655×10^153, 0., 0.},\q\= 1.15937×10^155

n= 12,q= {1.339492474009539×10^310, -1.115866656092269×10^309, 0., 0.}
 ,\q\= 1.344132311891199×10^310

n= 13,q= {1.781788503986410×10^620, -2.989389975667570×10^619, 0., 0.}
 ,\q\= 1.806691671869981×10^620

n= 14,q= {3.085405748671911×10^1240, -1.065292138515338×10^1240, 0., 0.}
 ,\q\= 3.264134797204346×10^1240

n= 15,q= {8.384881293555095×10^2480, -6.573716976380435×10^2480, 0., 0.}
 ,\q\= 1.065457597432026×10^2481

n= 16,q= {2.709247942145783×10^4961, -1.102396730087557×10^4962, 0., 0.}
 ,\q\= 1.135199891925625×10^4962

n= 17,q= {-1.141878306387527×10^9924, -5.973332144835911×10^9923, 0., 0.}
 ,\q\= 1.288678794627951×10^9924

n= 18,q= {9.47079097473148×10^19847, 1.364163678607081×10^19848, 0., 0.}
 ,\q\= 1.660693035723748×10^19848

n= 19,q= {-9.63983725160251×10^39695, 2.583941811081688×10^39696, 0., 0.}
 ,\q\= 2.757901358901356×10^39696

n= 20,q= {-5.747490660682278×10^79392, -4.981755705287704×10^79392, 0., 0.}
 ,\q\= 7.606019905429948×10^79392
```

In[25]:=
```
P = {0.9, -0.2, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[25]= {0.9, -0.2, 0, 0}

```
n= 1,q= {0.9, -0.2, 0, 0},\q\= 0.921954

n= 2,q= {1.67, -0.56, 0., 0.},\q\= 1.76139

n= 3,q= {3.3753, -2.0704, 0., 0.},\q\= 3.9597

n= 4,q= {8.00609, -14.1764, 0., 0.},\q\= 16.2809

n= 5,q= {-135.974, -227.196, 0., 0.},\q\= 264.777

n= 6,q= {-33128.1, 61785.2, 0., 0.},\q\= 70106.3

n= 7,q= {-2.71994×10^9, -4.09366×10^9, 0., 0.},\q\= 4.91489×10^9

n= 8,q= {-9.35996×10^18, 2.2269×10^19, 0., 0.},\q\= 2.41561×10^19

n= 9,q= {-4.08302×10^38, -4.16875×10^38, 0., 0.},\q\= 5.83519×10^38

n= 10,q= {-7.0744×10^75, 3.40421×10^77, 0., 0.},\q\= 3.40495×10^77

n= 11,q= {-1.15837×10^155, -4.81655×10^153, 0., 0.},\q\= 1.15937×10^155

n= 12,q= {1.339492474009539×10^310, 1.115866656092269×10^309, 0., 0.}
 ,\q\= 1.344132311891199×10^310

n= 13,q= {1.781788503986410×10^620, 2.989389975667570×10^619, 0., 0.}
 ,\q\= 1.806691671869981×10^620

n= 14,q= {3.085405748671911×10^1240, 1.065292138515338×10^1240, 0., 0.}
 ,\q\= 3.264134797204346×10^1240

n= 15,q= {8.384881293555095×10^2480, 6.573716976380435×10^2480, 0., 0.}
 ,\q\= 1.065457597432026×10^2481

n= 16,q= {2.709247942145783×10^4961, 1.102396730087557×10^4962, 0., 0.}
 ,\q\= 1.135199891925625×10^4962

n= 17,q= {-1.141878306387527×10^9924, 5.973332144835911×10^9923, 0., 0.}
 ,\q\= 1.288678794627951×10^9924

n= 18,q= {9.47079097473148×10^19847, -1.364163678607081×10^19848, 0., 0.}
 ,\q\= 1.660693035723748×10^19848

n= 19,q= {-9.63983725160251×10^39695, -2.583941811081688×10^39696, 0., 0.}
 ,\q\= 2.757901358901356×10^39696

n= 20,q= {-5.747490660682278×10^79392, 4.981755705287704×10^79392, 0., 0.}
 ,\q\= 7.606019905429948×10^79392
```

In[29]:=
```
P = {0.9, -0.4, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[29]= {0.9, -0.4, 0, 0}

```
n= 1,q= {0.9, -0.4, 0, 0},\q\= 0.984886

n= 2,q= {1.55, -1.12, 0., 0.},\q\= 1.9123

n= 3,q= {2.0481, -3.872, 0., 0.},\q\= 4.38031

n= 4,q= {-9.89767, -16.2605, 0., 0.},\q\= 19.0359

n= 5,q= {-165.54, 321.482, 0., 0.},\q\= 361.599

n= 6,q= {-75946.4, -106436., 0., 0.},\q\= 130754.

n= 7,q= {-5.56084×10^9, 1.61669×10^10, 0., 0.},\q\= 1.70965×10^10

n= 8,q= {-2.30446×10^20, -1.79803×10^20, 0., 0.},\q\= 2.92292×10^20

n= 9,q= {2.07761×10^40, 8.28697×10^40, 0., 0.},\q\= 8.54344×10^40

n= 10,q= {-6.43575×10^81, 3.44341×10^81, 0., 0.},\q\= 7.29904×10^81

n= 11,q= {2.95618×10^163, -4.43219×10^163, 0., 0.},\q\= 5.3276×10^163

n= 12,q= {-1.090530531291127×10^327, -2.620466381232606×10^327, 0., 0.}
 ,\q\= 2.838327129639643×10^327

n= 13,q= {-5.677587215492202×10^654, 5.715397189912260×10^654, 0., 0.}
 ,\q\= 8.056100894848416×10^654

n= 14,q= {-4.307684489364568×10^1307, -6.489933203381180×10^1309, 0., 0.}
 ,\q\= 6.490076162797745×10^1309

n= 15,q= {-4.211737736978352×10^2619, 5.591316919443444×10^2617, 0., 0.}
 ,\q\= 4.212108859891550×10^2619

n= 16,q= {1.773560848259816×10^5239, -4.709832093805100×10^5237, 0., 0.}
 ,\q\= 1.774186104757689×10^5239

n= 17,q= {3.143299830644895×10^10478, -1.670634760690056×10^10477, 0., 0.}
 ,\q\= 3.147736334315263×10^10478

n= 18,q= {9.85242362029597×10^20956, -1.050261192069306×10^20956, 0., 0.}
 ,\q\= 9.90824403036849×10^20956

n= 19,q= {9.596720262219991×10^41913, -2.069523635244766×10^41913, 0., 0.}
 ,\q\= 9.81732997653328×10^41913

n= 20,q= {8.781411171446546×10^83827, -3.972127880699289×10^83827, 0., 0.}
 ,\q\= 9.63799678681389×10^83827
```

In[33]:=
```
P = {0.9, -0.5, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[33]= {0.9, -0.5, 0, 0}

```
n= 1,q= {0.9, -0.5, 0, 0},\q\= 1.02956

n= 2,q= {1.46, -1.4, 0., 0.},\q\= 2.02277

n= 3,q= {1.0716, -4.588, 0., 0.},\q\= 4.71148

n= 4,q= {-19.0014, -10.333, 0., 0.},\q\= 21.6293

n= 5,q= {255.183, 392.183, 0., 0.},\q\= 467.895

n= 6,q= {-88688.5, 200157., 0., 0.},\q\= 218925.

n= 7,q= {-3.2197×10^10, -3.55032×10^10, 0., 0.},\q\= 4.79283×10^10

n= 8,q= {-2.23831×10^20, 2.28619×10^21, 0., 0.},\q\= 2.29712×10^21

n= 9,q= {-5.17656×10^42, -1.02344×10^42, 0., 0.},\q\= 5.27676×10^42

n= 10,q= {2.57494×10^85, 1.05958×10^85, 0., 0.},\q\= 2.78442×10^85

n= 11,q= {5.50759×10^170, 5.4567×10^170, 0., 0.},\q\= 7.75301×10^170

n= 12,q= {5.578808944410104×10^339, 6.010653992644118×10^341, 0., 0.}
 ,\q\= 6.010912886593225×10^341

n= 13,q= {-3.612484910836485×10^683, 6.706458051183462×10^681, 0., 0.}
 ,\q\= 3.613107373021250×10^683

n= 14,q= {1.304554957306206×10^1367, -4.845395703011623×10^1365, 0., 0.}
 ,\q\= 1.305454488898052×10^1367

n= 15,q= {1.699515850680320×10^2734, -1.264216996894800×10^2733, 0., 0.}
 ,\q\= 1.704211422584073×10^2734

n= 16,q= {2.872371680561276×10^5468, -4.297113649844373×10^5467, 0., 0.}
 ,\q\= 2.904336572866030×10^5468

n= 17,q= {8.065867214093620×10^10936, -2.468581511193256×10^10936, 0., 0.}
 ,\q\= 8.435170928487197×10^10936

n= 18,q= {5.896431923798520×10^21873, -3.982250135290274×10^21873, 0., 0.}
 ,\q\= 7.115210859279556×10^21873

n= 19,q= {1.890959329197092×10^43747, -4.696213365255309×10^43747, 0., 0.}
 ,\q\= 5.062622557200972×10^43747

n= 20,q= {-1.847869278732508×10^87495, -1.776069694985919×10^87495, 0., 0.}
 ,\q\= 2.563014715668011×10^87495
```

In[37]:=
```
P = {0.9, -0.7, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[37]= {0.9, -0.7, 0, 0}

n= 1,q= {0.9, −0.7, 0, 0},\q\= 1.14018

n= 2,q= {1.22, −1.96, 0., 0.},\q\= 2.30868

n= 3,q= {−1.4532, −5.4824, 0., 0.},\q\= 5.67173

n= 4,q= {−27.0449, 15.234, 0., 0.},\q\= 31.0404

n= 5,q= {500.251, −824.707, 0., 0.},\q\= 964.569

n= 6,q= {−429 889., −825 123., 0., 0.},\q\= 930 394.

n= 7,q= $\{-4.96022\times10^{11}, 7.09423\times10^{11}, 0., 0.\}$,\q\= 8.65632×10^{11}

n= 8,q= $\{-2.57243\times10^{23}, -7.0378\times10^{23}, 0., 0.\}$,\q\= 7.49319×10^{23}

n= 9,q= $\{-4.29132\times10^{47}, 3.62085\times10^{47}, 0., 0.\}$,\q\= 5.6148×10^{47}

n= 10,q= $\{5.30488\times10^{94}, -3.10764\times10^{95}, 0., 0.\}$,\q\= 3.15259×10^{95}

n= 11,q= $\{-9.376\times10^{190}, -3.29713\times10^{190}, 0., 0.\}$,\q\= 9.93884×10^{190}

n= 12,q= $\{7.703838218690188\times10^{381}, 6.182785256280149\times10^{381}, 0., 0.\}$
,\q\= $9.87805430360791\times10^{381}$

n= 13,q= $\{2.112228977447643\times10^{763}, 9.52623547105704\times10^{763}, 0., 0.\}$,\q\= $9.75759568250268\times10^{763}$

n= 14,q= $\{-8.628765099685591\times10^{1527}, 4.024318121591257\times10^{1527}, 0., 0.\}$
,\q\= $9.52106735031949\times10^{1527}$

n= 15,q= $\{5.826045080178430\times10^{3055}, -6.944979151523782\times10^{3055}, 0., 0.\}$
,\q\= $9.06507234893199\times10^{3055}$

n= 16,q= $\{-1.428993413882870\times10^{6111}, -8.092352323535379\times10^{6111}, 0., 0.\}$
,\q\= $8.217553669137128\times10^{6111}$

n= 17,q= $\{-6.344414395130783\times10^{12\,223}, 2.312783634630360\times10^{12\,223}, 0., 0.\}$
,\q\= $6.752818830514907\times10^{12\,223}$

n= 18,q= $\{3.490262587652868\times10^{24\,447}, -2.934651556874350\times10^{24\,447}, 0., 0.\}$
,\q\= $4.560056215775671\times10^{24\,447}$

n= 19,q= $\{3.569753170504246\times10^{48\,894}, -2.048540907351157\times10^{48\,895}, 0., 0.\}$
,\q\= $2.079411269103434\times10^{48\,895}$

n= 20,q= $\{-4.069088472107850\times10^{97\,790}, -1.462557079784887\times10^{97\,790}, 0., 0.\}$
,\q\= $4.323951226074352\times10^{97\,790}$

In[41]:=
```
P = {0.9, -1.2, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[41]= {0.9, −1.2, 0, 0}

```
n= 1,q= {0.9, -1.2, 0, 0},\q\= 1.5

n= 2,q= {0.27, -3.36, 0., 0.},\q\= 3.37083

n= 3,q= {-10.3167, -3.0144, 0., 0.},\q\= 10.7481

n= 4,q= {98.2477, 60.9973, 0., 0.},\q\= 115.643

n= 5,q= {5932.84, 11984.5, 0., 0.},\q\= 13372.6

n= 6,q= {-1.0843×10^8, 1.42204×10^8, 0., 0.},\q\= 1.78827×10^8

n= 7,q= {-8.46503×10^15, -3.08382×10^16, 0., 0.},\q\= 3.19789×10^16

n= 8,q= {-8.7934×10^32, 5.22093×10^32, 0., 0.},\q\= 1.02265×10^33

n= 9,q= {5.00657×10^65, -9.18194×10^65, 0., 0.},\q\= 1.04582×10^66

n= 10,q= {-5.92424×10^131, -9.194×10^131, 0., 0.},\q\= 1.09374×10^132

n= 11,q= {-4.94331×10^263, 1.08935×10^264, 0., 0.},\q\= 1.19626×10^264

n= 12,q= {-9.42318178220839×10^527, -1.076999165134003×10^528, 0., 0.}
 ,\q\= 1.431045334957904×10^528

n= 13,q= {-2.719636526938977×10^1055, 2.029751782468877×10^1056, 0., 0.}
 ,\q\= 2.047890750704780×10^1056

n= 14,q= {-4.045928070048975×10^2112, -1.104037417644371×10^2112, 0., 0.}
 ,\q\= 4.193856526822189×10^2112

n= 15,q= {1.515063532845137×10^4225, 8.933711956863486×10^4224, 0., 0.}
 ,\q\= 1.758843256756907×10^4225

n= 16,q= {1.497305415275132×10^8450, 2.707028239757287×10^8450, 0., 0.}
 ,\q\= 3.093529601839244×10^8450

n= 17,q= {-5.086078384231203×10^16900, 8.106496085382589×10^16900, 0., 0.}
 ,\q\= 9.56992539745567×10^16900

n= 18,q= {-3.984708545177935×10^33801, -8.246054902343849×10^33801, 0., 0.}
 ,\q\= 9.15834721128671×10^33801

n= 19,q= {-5.211951926245497×10^67603, 6.571625086675188×10^67603, 0., 0.}
 ,\q\= 8.387532364248308×10^67603

n= 20,q= {-1.602181339832452×10^135207, -6.850198805811995×10^135207, 0., 0.}
 ,\q\= 7.035069916131281×10^135207
```

In[45]:=
```
P = {0.9, -1.4, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[45]= {0.9, -1.4, 0, 0}

```
n= 1,q= {0.9, -1.4, 0, 0},\q\= 1.66433

n= 2,q= {-0.25, -3.92, 0., 0.},\q\= 3.92796

n= 3,q= {-14.4039, 0.56, 0., 0.},\q\= 14.4148

n= 4,q= {208.059, -17.5324, 0., 0.},\q\= 208.796

n= 5,q= {42982., -7296.92, 0., 0.},\q\= 43596.9

n= 6,q= {1.7942×10^9, -6.27272×10^8, 0., 0.},\q\= 1.90069×10^9

n= 7,q= {2.82569×10^18, -2.25091×10^18, 0., 0.},\q\= 3.61264×10^18

n= 8,q= {2.91797×10^36, -1.27208×10^37, 0., 0.},\q\= 1.30511×10^37

n= 9,q= {-1.53303×10^74, -7.42375×10^73, 0., 0.},\q\= 1.70332×10^74

n= 10,q= {1.79906×10^148, 2.27617×10^148, 0., 0.},\q\= 2.9013×10^148

n= 11,q= {-1.94431×10^296, 8.18993×10^296, 0., 0.},\q\= 8.41756×10^296

n= 12,q= {-6.329467547249228×10^593, -3.184752059507657×10^593, 0., 0.}
 ,\q\= 7.085534920683082×10^593

n= 13,q= {2.991951375114289×10^1187, 4.031556961337771×10^1187, 0., 0.}
 ,\q\= 5.020480511221941×10^1187

n= 14,q= {-7.301678501462757×10^2374, 2.412444478865226×10^2375, 0., 0.}
 ,\q\= 2.520522456355933×10^2375

n= 15,q= {-5.286743274220077×10^4750, -3.522978797460548×10^4750, 0., 0.}
 ,\q\= 6.353033452994545×10^4750

n= 16,q= {1.553827484015464×10^9501, 3.725016892538898×10^9501, 0., 0.}
 ,\q\= 4.036103405486779×10^9501

n= 17,q= {-1.146137099961832×10^19003, 1.157606725209764×10^19003, 0., 0.}
 ,\q\= 1.629013069978197×10^19003

n= 18,q= {-2.642307834195556×10^38004, -2.653552029856463×10^38006, 0., 0.}
 ,\q\= 2.653683582159791×10^38006

n= 19,q= {-7.040640196086290×10^76012, 1.402300263387050×10^76011, 0., 0.}
 ,\q\= 7.042036554224420×10^76012

n= 20,q= {4.955094991045904×10^152025, -1.974618320277052×10^152024, 0., 0.}
 ,\q\= 4.959027883103295×10^152025
```

In[49]:=
```
P = {1.2, 1.4, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[49]= {1.2, 1.4, 0, 0}

```
n= 1,q= {1.2, 1.4, 0, 0},\q\= 1.84391

n= 2,q= {0.68, 4.76, 0., 0.},\q\= 4.80833

n= 3,q= {-20.9952, 7.8736, 0., 0.},\q\= 22.423

n= 4,q= {380.005, -329.216, 0., 0.},\q\= 502.779

n= 5,q= {36022., -250206., 0., 0.},\q\= 252785.

n= 6,q= {-6.13053×10^10, -1.80258×10^10, 0., 0.},\q\= 6.39005×10^10

n= 7,q= {3.43341×10^21, 2.21015×10^21, 0., 0.},\q\= 4.08327×10^21

n= 8,q= {6.90352×10^42, 1.51767×10^43, 0., 0.},\q\= 1.66731×10^43

n= 9,q= {-1.82674×10^86, 2.09546×10^86, 0., 0.},\q\= 2.77991×10^86

n= 10,q= {-1.05395×10^172, -7.65572×10^172, 0., 0.},\q\= 7.72793×10^172

n= 11,q= {-5.749923850784894×10^345, 1.613741499892428×10^345, 0., 0.}
 ,\q\= 5.972083884064259×10^345

n= 12,q= {3.045746266134992×10^691, -1.855778147846572×10^691, 0., 0.}
 ,\q\= 3.566578591830005×10^691

n= 13,q= {5.832657783650395×10^1382, -1.130445872915722×10^1383, 0., 0.}
 ,\q\= 1.272048285170010×10^1383

n= 14,q= {-9.37708903380412×10^2765, -1.318700783931470×10^2766, 0., 0.}
 ,\q\= 1.618106839803963×10^2766

n= 15,q= {-8.596737700625773×10^5531, 2.473114931974537×10^5532, 0., 0.}
 ,\q\= 2.618269745020368×10^5532

n= 16,q= {-5.377258475821815×10^11064, -4.252144074737210×10^11064, 0., 0.}
 ,\q\= 6.855336457689025×10^11064

n= 17,q= {1.083417948347479×10^22129, 4.572975553259234×10^22129, 0., 0.}
 ,\q\= 4.699563794812031×10^22129

n= 18,q= {-1.973831095990514×10^44259, 9.90888758351059×10^44258, 0., 0.}
 ,\q\= 2.208589986150806×10^44259

n= 19,q= {2.914148664072610×10^88518, -3.911694087801502×10^88518, 0., 0.}
 ,\q\= 4.877869726925617×10^88518

n= 20,q= {-6.809088200225046×10^177036, -2.279851620045494×10^177037, 0., 0.}
 ,\q\= 2.379361307285740×10^177037
```

In[53]:=
```
P = {1.2, 1.2, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[53]= {1.2, 1.2, 0, 0}

```
n= 1,q= {1.2, 1.2, 0, 0},\q\= 1.69706
n= 2,q= {1.2, 4.08, 0., 0.},\q\= 4.25281
n= 3,q= {-14.0064, 10.992, 0., 0.},\q\= 17.8046
n= 4,q= {76.5552, -306.717, 0., 0.},\q\= 316.126
n= 5,q= {-88 213.2, -46 960.3, 0., 0.},\q\= 99 934.2
n= 6,q= {5.57631×10^9, 8.28504×10^9, 0., 0.},\q\= 9.98685×10^9
n= 7,q= {-3.75467×10^19, 9.23998×10^19, 0., 0.},\q\= 9.97371×10^19
n= 8,q= {-7.12797×10^39, -6.93862×10^39, 0., 0.},\q\= 9.94748×10^39
n= 9,q= {2.66354×10^78, 9.89166×10^79, 0., 0.},\q\= 9.89525×10^79
n= 10,q= {-9.7774×10^159, 5.26937×10^158, 0., 0.},\q\= 9.79159×10^159
n= 11,q= {9.53198651360759×10^319, -1.030414830696073×10^319, 0., 0.}
 ,\q\= 9.58751905442254×10^319
n= 12,q= {8.979701217227850×10^639, -1.964380053923242×10^639, 0., 0.}
 ,\q\= 9.19205216189153×10^639
n= 13,q= {7.677624495443186×10^1279, -3.527909192262530×10^1279, 0., 0.}
 ,\q\= 8.449382294693482×10^1279
n= 14,q= {4.649977462417878×10^2559, -5.417192406442796×10^2559, 0., 0.}
 ,\q\= 7.139206116187969×10^2559
n= 15,q= {-7.723683167427284×10^5118, -5.037964519908054×10^5119, 0., 0.}
 ,\q\= 5.096826396941570×10^5119
n= 16,q= {-2.478453368714440×10^10 239, 7.782328352101944×10^10 238, 0., 0.}
 ,\q\= 2.597763932056039×10^10 239
n= 17,q= {5.537084755092657×10^20 478, -3.857627584141791×10^20 478, 0., 0.}
 ,\q\= 6.748377446691252×10^20 478
n= 18,q= {1.577801700714788×10^40 957, -4.272002177395286×10^40 957, 0., 0.}
 ,\q\= 4.554059816301114×10^40 957
n= 19,q= {-1.576054439689159×10^81 915, -1.348074460190312×10^81 915, 0., 0.}
 ,\q\= 2.073946081044854×10^81 915
n= 20,q= {6.666428466465081×10^163 829, 4.249277476029013×10^163 830, 0., 0.}
 ,\q\= 4.301252347081308×10^163 830
```

In[57]:=
```
P = {1.2, 0.7, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[57]= {1.2, 0.7, 0, 0}

```
n= 1,q= {1.2, 0.7, 0, 0},\q\= 1.38924

n= 2,q= {2.15, 2.38, 0., 0.},\q\= 3.20732

n= 3,q= {0.1581, 10.934, 0., 0.},\q\= 10.9351

n= 4,q= {-118.327, 4.15733, 0., 0.},\q\= 118.4

n= 5,q= {13985.3, -983.152, 0., 0.},\q\= 14019.8

n= 6,q= {1.94621×10^8, -2.74993×10^7, 0., 0.},\q\= 1.96555×10^8

n= 7,q= {3.71213×10^16, -1.07039×10^16, 0., 0.},\q\= 3.86337×10^16

n= 8,q= {1.26342×10^33, -7.94687×10^32, 0., 0.},\q\= 1.49257×10^33

n= 9,q= {9.64698×10^65, -2.00804×10^66, 0., 0.},\q\= 2.22775×10^66

n= 10,q= {-3.10159×10^132, -3.87431×10^132, 0., 0.},\q\= 4.96288×10^132

n= 11,q= {-5.39041×10^264, 2.40331×10^265, 0., 0.},\q\= 2.46302×10^265

n= 12,q= {-5.485329218685683×10^530, -2.590962267205347×10^530, 0., 0.}
 ,\q\= 6.066458778187548×10^530

n= 13,q= {2.337575116728501×10^1061, 2.842456205762718×10^1061, 0., 0.}
 ,\q\= 3.680192210744875×10^1061

n= 14,q= {-2.615299855330720×10^2122, 1.328890979396288×10^2123, 0., 0.}
 ,\q\= 1.354381470802725×10^2123

n= 15,q= {-1.697553301787895×10^4246, -6.950896772330818×10^4245, 0., 0.}
 ,\q\= 1.834349168453753×10^4246

n= 16,q= {2.398537553014996×10^8492, 2.359903553251401×10^8492, 0., 0.}
 ,\q\= 3.364836871806975×10^8492

n= 17,q= {1.838376125745748×10^16983, 1.132063458793402×10^16985, 0., 0.}
 ,\q\= 1.132212717387175×10^16985

n= 18,q= {-1.281229712057309×10^33970, 4.162316870949891×10^33968, 0., 0.}
 ,\q\= 1.281905637413252×10^33970

n= 19,q= {1.639817086885036×10^67940, -1.066576809211682×10^67939, 0., 0.}
 ,\q\= 1.643282063231875×10^67940

n= 20,q= {2.677624217540644×10^135880, -3.497981752441274×10^135879, 0., 0.}
 ,\q\= 2.700375939339607×10^135880
```

In[61]:=
```
P = {1.2, 0.5, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[61]= {1.2, 0.5, 0, 0}

```
n= 1,q= {1.2, 0.5, 0, 0},\q\= 1.3

n= 2,q= {2.39, 1.7, 0., 0.},\q\= 2.93293

n= 3,q= {4.0221, 8.626, 0., 0.},\q\= 9.51762

n= 4,q= {-57.0306, 69.8893, 0., 0.},\q\= 90.2053

n= 5,q= {-1630.82, -7971.15, 0., 0.},\q\= 8136.27

n= 6,q= {-6.08797×10^7, 2.59991×10^7, 0., 0.},\q\= 6.61988×10^7

n= 7,q= {3.03038×10^15, -3.16563×10^15, 0., 0.},\q\= 4.38229×10^15

n= 8,q= {-8.37977×10^29, -1.91862×10^31, 0., 0.},\q\= 1.92044×10^31

n= 9,q= {-3.67406×10^62, 3.21551×10^61, 0., 0.},\q\= 3.68811×10^62

n= 10,q= {1.33953×10^125, -2.3628×10^124, 0., 0.},\q\= 1.36021×10^125

n= 11,q= {1.73852×10^250, -6.33009×10^249, 0., 0.},\q\= 1.85018×10^250

n= 12,q= {2.621758059145861×10^500, -2.201000113042697×10^500, 0., 0.}
 ,\q\= 3.423158894692187×10^500

n= 13,q= {2.029213823082307×10^1000, -1.154097956910128×10^1001, 0., 0.}
 ,\q\= 1.171801681831023×10^1001

n= 14,q= {-1.290765006746249×10^2002, -4.683823054706161×10^2001, 0., 0.}
 ,\q\= 1.373119181542015×10^2002

n= 15,q= {1.446692318562675×10^4004, 1.209142979361207×10^4004, 0., 0.}
 ,\q\= 1.885456286718614×10^4004

n= 16,q= {6.308919200497515×10^8007, 3.498515720571689×10^8008, 0., 0.}
 ,\q\= 3.554945409126743×10^8008

n= 17,q= {-1.184158763230318×10^16017, 4.414370600551425×10^16016, 0., 0.}
 ,\q\= 1.263763686187130×10^16017

n= 18,q= {1.207365298545029×10^32034, -1.045463126157850×10^32034, 0., 0.}
 ,\q\= 1.597098654525284×10^32034

n= 19,q= {3.647378159749816×10^64067, -2.524511798862785×10^64068, 0., 0.}
 ,\q\= 2.550724112286472×10^64068

n= 20,q= {-6.240126148195213×10^128136, -1.841569839840568×10^128136, 0., 0.}
 ,\q\= 6.506193496999612×10^128136
```

In[65]:=
```
P = {1.2, 0.4, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[65]= {1.2, 0.4, 0, 0}

```
n= 1,q= {1.2, 0.4, 0, 0},\q\= 1.26491

n= 2,q= {2.48, 1.36, 0., 0.},\q\= 2.82843

n= 3,q= {5.5008, 7.1456, 0., 0.},\q\= 9.01767

n= 4,q= {-19.6008, 79.013, 0., 0.},\q\= 81.4079

n= 5,q= {-5857.67, -3097.04, 0., 0.},\q\= 6626.

n= 6,q= {2.47206×10^7, 3.62828×10^7, 0., 0.},\q\= 4.39039×10^7

n= 7,q= {-7.05334×10^14, 1.79387×10^15, 0., 0.},\q\= 1.92755×10^15

n= 8,q= {-2.72047×10^30, -2.53055×10^30, 0., 0.},\q\= 3.71546×10^30

n= 9,q= {9.97263×10^59, 1.37686×10^61, 0., 0.},\q\= 1.38047×10^61

n= 10,q= {-1.8858×10^122, 2.74618×10^121, 0., 0.},\q\= 1.90569×10^122

n= 11,q= {3.48082×10^244, -1.03575×10^244, 0., 0.},\q\= 3.63165×10^244

n= 12,q= {1.104332903387162×10^489, -7.210511519241572×10^488, 0., 0.}
 ,\q\= 1.318888139758134×10^489

n= 13,q= {6.996363978123637×10^977, -1.592561024190124×10^978, 0., 0.}
 ,\q\= 1.739465925194672×10^978

n= 14,q= {-2.046759526625636×10^1956, -2.228427316521494×10^1956, 0., 0.}
 ,\q\= 3.025741704913356×10^1956

n= 15,q= {-7.766637451863888×10^3911, 9.12210967896633×10^3912, 0., 0.}
 ,\q\= 9.15511286485198×10^3912

n= 16,q= {-8.260967842200434×10^7825, -1.416962373453400×10^7825, 0., 0.}
 ,\q\= 8.381609156817824×10^7825

n= 17,q= {6.623580732208701×10^15651, 2.341096120141308×10^15651, 0., 0.}
 ,\q\= 7.025137205765239×10^15651

n= 18,q= {3.839109067234566×10^31303, 3.101287830723303×10^31303, 0., 0.}
 ,\q\= 4.935255275982703×10^31303

n= 19,q= {5.120772221130212×10^62606, 2.381236446206810×10^62607, 0., 0.}
 ,\q\= 2.435674463911511×10^62607

n= 20,q= {-5.408063931336649×10^125214, 2.438753889135731×10^125214, 0., 0.}
 ,\q\= 5.932510094150626×10^125214
```

In[69]:=
```
P = {1.2, 0.2, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[69]= {1.2, 0.2, 0, 0}

```
n= 1,q= {1.2, 0.2, 0, 0},\q\= 1.21655

n= 2,q= {2.6, 0.68, 0., 0.},\q\= 2.68745

n= 3,q= {7.4976, 3.736, 0., 0.},\q\= 8.37686

n= 4,q= {43.4563, 56.2221, 0., 0.},\q\= 71.0589

n= 5,q= {-1271.27, 4886.61, 0., 0.},\q\= 5049.26

n= 6,q= {-2.22628×10^7, -1.24244×10^7, 0., 0.},\q\= 2.54951×10^7

n= 7,q= {3.41267×10^14, 5.53204×10^14, 0., 0.},\q\= 6.49998×10^14

n= 8,q= {-1.89571×10^29, 3.7758×10^29, 0., 0.},\q\= 4.22497×10^29

n= 9,q= {-1.06629×10^59, -1.43157×10^59, 0., 0.},\q\= 1.78504×10^59

n= 10,q= {-9.12399×10^117, 3.05294×10^118, 0., 0.},\q\= 3.18636×10^118

n= 11,q= {-8.48797×10^236, -5.571×10^236, 0., 0.},\q\= 1.01529×10^237

n= 12,q= {4.100964033503680×10^473, 9.45729667623086×10^473, 0., 0.}
 ,\q\= 1.030816988734363×10^474

n= 13,q= {-7.262255441815651×10^947, 7.756806704679331×10^947, 0., 0.}
 ,\q\= 1.062583664263381×10^948

n= 14,q= {-7.427696151577181×10^1894, -1.126638234043392×10^1896, 0., 0.}
 ,\q\= 1.129084043559393×10^1896

n= 15,q= {-1.263796643396398×10^3792, 1.673665295044763×10^3791, 0., 0.}
 ,\q\= 1.274830777420429×10^3792

n= 16,q= {1.569170400661629×10^7584, -4.230345164093226×10^7583, 0., 0.}
 ,\q\= 1.625193511058374×10^7584

n= 17,q= {2.283337544238907×10^15168, -1.327626483215430×10^15168, 0., 0.}
 ,\q\= 2.641253948386246×10^15168

n= 18,q= {3.451038261995992×10^30336, -6.062838787703313×10^30336, 0., 0.}
 ,\q\= 6.976222419865932×10^30336

n= 19,q= {-2.484834907991946×10^60673, -4.184617726535505×10^60673, 0., 0.}
 ,\q\= 4.866767925144009×10^60673

n= 20,q= {-1.133662099725984×10^121347, 2.079616840699463×10^121347, 0., 0.}
 ,\q\= 2.368543003721052×10^121347
```

In[73]:=
```
P = {1.2, -0.2, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[73]= {1.2, -0.2, 0, 0}

```
n= 1,q= {1.2, -0.2, 0, 0},\q\= 1.21655

n= 2,q= {2.6, -0.68, 0., 0.},\q\= 2.68745

n= 3,q= {7.4976, -3.736, 0., 0.},\q\= 8.37686

n= 4,q= {43.4563, -56.2221, 0., 0.},\q\= 71.0589

n= 5,q= {-1271.27, -4886.61, 0., 0.},\q\= 5049.26

n= 6,q= {-2.22628×10^7, 1.24244×10^7, 0., 0.},\q\= 2.54951×10^7

n= 7,q= {3.41267×10^14, -5.53204×10^14, 0., 0.},\q\= 6.49998×10^14

n= 8,q= {-1.89571×10^29, -3.7758×10^29, 0., 0.},\q\= 4.22497×10^29

n= 9,q= {-1.06629×10^59, 1.43157×10^59, 0., 0.},\q\= 1.78504×10^59

n= 10,q= {-9.12399×10^117, -3.05294×10^118, 0., 0.},\q\= 3.18636×10^118

n= 11,q= {-8.48797×10^236, 5.571×10^236, 0., 0.},\q\= 1.01529×10^237

n= 12,q= {4.100964033503680×10^473, -9.45729667623086×10^473, 0., 0.}
 ,\q\= 1.030816988734363×10^474

n= 13,q= {-7.262255441815651×10^947, -7.756806704679331×10^947, 0., 0.}
 ,\q\= 1.062583664263381×10^948

n= 14,q= {-7.427696151577181×10^1894, 1.126638234043392×10^1896, 0., 0.}
 ,\q\= 1.129084043559393×10^1896

n= 15,q= {-1.263796643396398×10^3792, -1.673665295044763×10^3791, 0., 0.}
 ,\q\= 1.274830777420429×10^3792

n= 16,q= {1.569170400661629×10^7584, 4.230345164093226×10^7583, 0., 0.}
 ,\q\= 1.625193511058374×10^7584

n= 17,q= {2.283337544238907×10^15168, 1.327626483215430×10^15168, 0., 0.}
 ,\q\= 2.641253948386246×10^15168

n= 18,q= {3.451038261995992×10^30336, 6.062838787703313×10^30336, 0., 0.}
 ,\q\= 6.976222419865932×10^30336

n= 19,q= {-2.484834907991946×10^60673, 4.184617726535505×10^60673, 0., 0.}
 ,\q\= 4.866767925144009×10^60673

n= 20,q= {-1.133662099725984×10^121347, -2.079616840699463×10^121347, 0., 0.}
 ,\q\= 2.368543003721052×10^121347
```

In[77]:=
```
P = {1.2, -0.4, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[77]= {1.2, -0.4, 0, 0}

```
n= 1,q= {1.2, -0.4, 0, 0},\q\= 1.26491

n= 2,q= {2.48, -1.36, 0., 0.},\q\= 2.82843

n= 3,q= {5.5008, -7.1456, 0., 0.},\q\= 9.01767

n= 4,q= {-19.6008, -79.013, 0., 0.},\q\= 81.4079

n= 5,q= {-5857.67, 3097.04, 0., 0.},\q\= 6626.

n= 6,q= {2.47206×10^7, -3.62828×10^7, 0., 0.},\q\= 4.39039×10^7

n= 7,q= {-7.05334×10^14, -1.79387×10^15, 0., 0.},\q\= 1.92755×10^15

n= 8,q= {-2.72047×10^30, 2.53055×10^30, 0., 0.},\q\= 3.71546×10^30

n= 9,q= {9.97263×10^59, -1.37686×10^61, 0., 0.},\q\= 1.38047×10^61

n= 10,q= {-1.8858×10^122, -2.74618×10^121, 0., 0.},\q\= 1.90569×10^122

n= 11,q= {3.48082×10^244, 1.03575×10^244, 0., 0.},\q\= 3.63165×10^244

n= 12,q= {1.104332903387162×10^489, 7.210511519241572×10^488, 0., 0.}
 ,\q\= 1.318888139758134×10^489

n= 13,q= {6.996363978123637×10^977, 1.592561024190124×10^978, 0., 0.}
 ,\q\= 1.739465925194672×10^978

n= 14,q= {-2.046759526625636×10^1956, 2.228427316521494×10^1956, 0., 0.}
 ,\q\= 3.025741704913356×10^1956

n= 15,q= {-7.766637451863888×10^3911, -9.12210967896633×10^3912, 0., 0.}
 ,\q\= 9.15511286485198×10^3912

n= 16,q= {-8.260967842200434×10^7825, 1.416962373453400×10^7825, 0., 0.}
 ,\q\= 8.381609156817824×10^7825

n= 17,q= {6.623580732208701×10^15651, -2.341096120141308×10^15651, 0., 0.}
 ,\q\= 7.025137205765239×10^15651

n= 18,q= {3.839109067234566×10^31303, -3.101287830723303×10^31303, 0., 0.}
 ,\q\= 4.935255275982703×10^31303

n= 19,q= {5.120772221130212×10^62606, -2.381236446206810×10^62607, 0., 0.}
 ,\q\= 2.435674463911511×10^62607

n= 20,q= {-5.408063931336649×10^125214, -2.438753889135731×10^125214, 0., 0.}
 ,\q\= 5.932510094150626×10^125214
```

In[81]:=
```
P = {1.2, -0.5, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[81]= {1.2, -0.5, 0, 0}

```
n= 1,q= {1.2, -0.5, 0, 0},\q\= 1.3
n= 2,q= {2.39, -1.7, 0., 0.},\q\= 2.93293
n= 3,q= {4.0221, -8.626, 0., 0.},\q\= 9.51762
n= 4,q= {-57.0306, -69.8893, 0., 0.},\q\= 90.2053
n= 5,q= {-1630.82, 7971.15, 0., 0.},\q\= 8136.27
n= 6,q= {-6.08797×10^7, -2.59991×10^7, 0., 0.},\q\= 6.61988×10^7
n= 7,q= {3.03038×10^15, 3.16563×10^15, 0., 0.},\q\= 4.38229×10^15
n= 8,q= {-8.37977×10^29, 1.91862×10^31, 0., 0.},\q\= 1.92044×10^31
n= 9,q= {-3.67406×10^62, -3.21551×10^61, 0., 0.},\q\= 3.68811×10^62
n= 10,q= {1.33953×10^125, 2.3628×10^124, 0., 0.},\q\= 1.36021×10^125
n= 11,q= {1.73852×10^250, 6.33009×10^249, 0., 0.},\q\= 1.85018×10^250
n= 12,q= {2.621758059145861×10^500, 2.201000113042697×10^500, 0., 0.}
 ,\q\= 3.423158894692187×10^500
n= 13,q= {2.029213823082307×10^1000, 1.154097956910128×10^1001, 0., 0.}
 ,\q\= 1.171801681831023×10^1001
n= 14,q= {-1.290765006746249×10^2002, 4.683823054706161×10^2001, 0., 0.}
 ,\q\= 1.373119181542015×10^2002
n= 15,q= {1.446692318562675×10^4004, -1.209142979361207×10^4004, 0., 0.}
 ,\q\= 1.885456286718614×10^4004
n= 16,q= {6.308919200497515×10^8007, -3.498515720571689×10^8008, 0., 0.}
 ,\q\= 3.554945409126743×10^8008
n= 17,q= {-1.184158763230318×10^16017, -4.414370600551425×10^16016, 0., 0.}
 ,\q\= 1.263763686187130×10^16017
n= 18,q= {1.207365298545029×10^32034, 1.045463126157850×10^32034, 0., 0.}
 ,\q\= 1.597098654525284×10^32034
n= 19,q= {3.647378159749816×10^64067, 2.524511798862785×10^64068, 0., 0.}
 ,\q\= 2.550724112286472×10^64068
n= 20,q= {-6.240126148195213×10^128136, 1.841569839840568×10^128136, 0., 0.}
 ,\q\= 6.506193496999612×10^128136
```

In[85]:=

```
P = {1.2, -0.5, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[85]= {1.2, -0.5, 0, 0}

```
n= 1,q= {1.2, -0.5, 0, 0},\q\= 1.3

n= 2,q= {2.39, -1.7, 0., 0.},\q\= 2.93293

n= 3,q= {4.0221, -8.626, 0., 0.},\q\= 9.51762

n= 4,q= {-57.0306, -69.8893, 0., 0.},\q\= 90.2053

n= 5,q= {-1630.82, 7971.15, 0., 0.},\q\= 8136.27

n= 6,q= {-6.08797×10^7, -2.59991×10^7, 0., 0.},\q\= 6.61988×10^7

n= 7,q= {3.03038×10^15, 3.16563×10^15, 0., 0.},\q\= 4.38229×10^15

n= 8,q= {-8.37977×10^29, 1.91862×10^31, 0., 0.},\q\= 1.92044×10^31

n= 9,q= {-3.67406×10^62, -3.21551×10^61, 0., 0.},\q\= 3.68811×10^62

n= 10,q= {1.33953×10^125, 2.3628×10^124, 0., 0.},\q\= 1.36021×10^125

n= 11,q= {1.73852×10^250, 6.33009×10^249, 0., 0.},\q\= 1.85018×10^250

n= 12,q= {2.621758059145861×10^500, 2.201000113042697×10^500, 0., 0.}
 ,\q\= 3.423158894692187×10^500

n= 13,q= {2.029213823082307×10^1000, 1.154097956910128×10^1001, 0., 0.}
 ,\q\= 1.171801681831023×10^1001

n= 14,q= {-1.290765006746249×10^2002, 4.683823054706161×10^2001, 0., 0.}
 ,\q\= 1.373119181542015×10^2002

n= 15,q= {1.446692318562675×10^4004, -1.209142979361207×10^4004, 0., 0.}
 ,\q\= 1.885456286718614×10^4004

n= 16,q= {6.308919200497515×10^8007, -3.498515720571689×10^8008, 0., 0.}
 ,\q\= 3.554945409126743×10^8008

n= 17,q= {-1.184158763230318×10^16017, -4.414370600551425×10^16016, 0., 0.}
 ,\q\= 1.263763686187130×10^16017

n= 18,q= {1.207365298545029×10^32034, 1.045463126157850×10^32034, 0., 0.}
 ,\q\= 1.597098654525284×10^32034

n= 19,q= {3.647378159749816×10^64067, 2.524511798862785×10^64068, 0., 0.}
 ,\q\= 2.550724112286472×10^64068

n= 20,q= {-6.240126148195213×10^128136, 1.841569839840568×10^128136, 0., 0.}
 ,\q\= 6.506193496999612×10^128136
```

In[89]:=
```
P = {1.2, -0.7, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[89]= {1.2, -0.7, 0, 0}

```
n= 1,q= {1.2, -0.7, 0, 0},\q\= 1.38924

n= 2,q= {2.15, -2.38, 0., 0.},\q\= 3.20732

n= 3,q= {0.1581, -10.934, 0., 0.},\q\= 10.9351

n= 4,q= {-118.327, -4.15733, 0., 0.},\q\= 118.4

n= 5,q= {13985.3, 983.152, 0., 0.},\q\= 14019.8

n= 6,q= {1.94621×10^8, 2.74993×10^7, 0., 0.},\q\= 1.96555×10^8

n= 7,q= {3.71213×10^16, 1.07039×10^16, 0., 0.},\q\= 3.86337×10^16

n= 8,q= {1.26342×10^33, 7.94687×10^32, 0., 0.},\q\= 1.49257×10^33

n= 9,q= {9.64698×10^65, 2.00804×10^66, 0., 0.},\q\= 2.22775×10^66

n= 10,q= {-3.10159×10^132, 3.87431×10^132, 0., 0.},\q\= 4.96288×10^132

n= 11,q= {-5.39041×10^264, -2.40331×10^265, 0., 0.},\q\= 2.46302×10^265

n= 12,q= {-5.485329218685683×10^530, 2.590962267205347×10^530, 0., 0.}
 ,\q\= 6.066458778187548×10^530

n= 13,q= {2.337575116728501×10^1061, -2.842456205762718×10^1061, 0., 0.}
 ,\q\= 3.680192210744875×10^1061

n= 14,q= {-2.615299855330720×10^2122, -1.328890979396288×10^2123, 0., 0.}
 ,\q\= 1.354381470802725×10^2123

n= 15,q= {-1.697553301787895×10^4246, 6.950896772330818×10^4245, 0., 0.}
 ,\q\= 1.834349168453753×10^4246

n= 16,q= {2.398537553014996×10^8492, -2.359903553251401×10^8492, 0., 0.}
 ,\q\= 3.364836871806975×10^8492

n= 17,q= {1.838376125745748×10^16983, -1.132063458793402×10^16985, 0., 0.}
 ,\q\= 1.132212717387175×10^16985

n= 18,q= {-1.281229712057309×10^33970, -4.162316870949891×10^33968, 0., 0.}
 ,\q\= 1.281905637413252×10^33970

n= 19,q= {1.639817086885036×10^67940, 1.066576809211682×10^67939, 0., 0.}
 ,\q\= 1.643282063231875×10^67940

n= 20,q= {2.677624217540644×10^135880, 3.497981752441274×10^135879, 0., 0.}
 ,\q\= 2.700375939339607×10^135880
```

In[93]:=
```
P = {1.2, -1.2, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[93]= {1.2, -1.2, 0, 0}

```
n= 1,q= {1.2, -1.2, 0, 0},\q\= 1.69706
n= 2,q= {1.2, -4.08, 0., 0.},\q\= 4.25281
n= 3,q= {-14.0064, -10.992, 0., 0.},\q\= 17.8046
n= 4,q= {76.5552, 306.717, 0., 0.},\q\= 316.126
n= 5,q= {-88213.2, 46960.3, 0., 0.},\q\= 99934.2
n= 6,q= {5.57631×10^9, -8.28504×10^9, 0., 0.},\q\= 9.98685×10^9
n= 7,q= {-3.75467×10^19, -9.23998×10^19, 0., 0.},\q\= 9.97371×10^19
n= 8,q= {-7.12797×10^39, 6.93862×10^39, 0., 0.},\q\= 9.94748×10^39
n= 9,q= {2.66354×10^78, -9.89166×10^79, 0., 0.},\q\= 9.89525×10^79
n= 10,q= {-9.7774×10^159, -5.26937×10^158, 0., 0.},\q\= 9.79159×10^159
n= 11,q= {9.53198651360759×10^319, 1.030414830696073×10^319, 0., 0.},\q\= 9.58751905442254×10^319
n= 12,q= {8.979701217227850×10^639, 1.964380053923242×10^639, 0., 0.}
 ,\q\= 9.19205216189153×10^639
n= 13,q= {7.677624495443186×10^1279, 3.527909192262530×10^1279, 0., 0.}
 ,\q\= 8.449382294693482×10^1279
n= 14,q= {4.649977462417878×10^2559, 5.417192406442796×10^2559, 0., 0.}
 ,\q\= 7.139206116187969×10^2559
n= 15,q= {-7.723683167427284×10^5118, 5.037964519908054×10^5119, 0., 0.}
 ,\q\= 5.096826396941570×10^5119
n= 16,q= {-2.478453368714440×10^10239, -7.782328352101944×10^10238, 0., 0.}
 ,\q\= 2.597763932056039×10^10239
n= 17,q= {5.537084755092657×10^20478, 3.857627584141791×10^20478, 0., 0.}
 ,\q\= 6.748377446691252×10^20478
n= 18,q= {1.577801700714788×10^40957, 4.272002177395286×10^40957, 0., 0.}
 ,\q\= 4.554059816301114×10^40957
n= 19,q= {-1.576054439689159×10^81915, 1.348074460190312×10^81915, 0., 0.}
 ,\q\= 2.073946081044854×10^81915
n= 20,q= {6.666428466465081×10^163829, -4.249277476029013×10^163830, 0., 0.}
 ,\q\= 4.301252347081308×10^163830
```

In[97]:=
```
P = {1.2, -1.4, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[97]= {1.2, -1.4, 0, 0}

```
n= 1,q= {1.2, -1.4, 0, 0},\q\= 1.84391

n= 2,q= {0.68, -4.76, 0., 0.},\q\= 4.80833

n= 3,q= {-20.9952, -7.8736, 0., 0.},\q\= 22.423

n= 4,q= {380.005, 329.216, 0., 0.},\q\= 502.779

n= 5,q= {36 022., 250 206., 0., 0.},\q\= 252 785.

n= 6,q= {-6.13053×10^10, 1.80258×10^10, 0., 0.},\q\= 6.39005×10^10

n= 7,q= {3.43341×10^21, -2.21015×10^21, 0., 0.},\q\= 4.08327×10^21

n= 8,q= {6.90352×10^42, -1.51767×10^43, 0., 0.},\q\= 1.66731×10^43

n= 9,q= {-1.82674×10^86, -2.09546×10^86, 0., 0.},\q\= 2.77991×10^86

n= 10,q= {-1.05395×10^172, 7.65572×10^172, 0., 0.},\q\= 7.72793×10^172

n= 11,q= {-5.749923850784894×10^345, -1.613741499892428×10^345, 0., 0.}
 ,\q\= 5.972083884064259×10^345

n= 12,q= {3.045746266134992×10^691, 1.855778147846572×10^691, 0., 0.}
 ,\q\= 3.566578591830005×10^691

n= 13,q= {5.832657783650395×10^1382, 1.130445872915722×10^1383, 0., 0.}
 ,\q\= 1.272048285170010×10^1383

n= 14,q= {-9.37708903380412×10^2765, 1.318700783931470×10^2766, 0., 0.}
 ,\q\= 1.618106839803963×10^2766

n= 15,q= {-8.596737700625773×10^5531, -2.473114931974537×10^5532, 0., 0.}
 ,\q\= 2.618269745020368×10^5532

n= 16,q= {-5.377258475821815×10^11 064, 4.252144074737210×10^11 064, 0., 0.}
 ,\q\= 6.855336457689025×10^11 064

n= 17,q= {1.083417948347479×10^22 129, -4.572975553259234×10^22 129, 0., 0.}
 ,\q\= 4.699563794812031×10^22 129

n= 18,q= {-1.973831095990514×10^44 259, -9.90888758351059×10^44 258, 0., 0.}
 ,\q\= 2.208589986150806×10^44 259

n= 19,q= {2.914148664072610×10^88 518, 3.911694087801502×10^88 518, 0., 0.}
 ,\q\= 4.877869726925617×10^88 518

n= 20,q= {-6.809088200225046×10^177 036, 2.279851620045494×10^177 037, 0., 0.}
 ,\q\= 2.379361307285740×10^177 037
```

In[101]:=
```
P = {1.5, 1.4, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[101]= {1.5, 1.4, 0, 0}

```
n= 1,q= {1.5, 1.4, 0, 0},\q\= 2.05183

n= 2,q= {1.79, 5.6, 0., 0.},\q\= 5.87912

n= 3,q= {-26.6559, 21.448, 0., 0.},\q\= 34.2134

n= 4,q= {252.02, -1142.03, 0., 0.},\q\= 1169.51

n= 5,q= {-1.24072×10^6, -575629., 0., 0.},\q\= 1.36775×10^6

n= 6,q= {1.20804×10^12, 1.42839×10^12, 0., 0.},\q\= 1.87074×10^12

n= 7,q= {-5.80938×10^23, 3.4511×10^24, 0., 0.},\q\= 3.49965×10^24

n= 8,q= {-1.15726×10^49, -4.00975×10^48, 0., 0.},\q\= 1.22475×10^49

n= 9,q= {1.17846×10^98, 9.28062×10^97, 0., 0.},\q\= 1.50002×10^98

n= 10,q= {5.27478×10^195, 2.18737×10^196, 0., 0.},\q\= 2.25007×10^196

n= 11,q= {-4.506368803642956×10^392, 2.307580477805702×10^392, 0., 0.}
 ,\q\= 5.062833935257648×10^392

n= 12,q= {1.498243213289646×10^785, -2.079761735415824×10^785, 0., 0.}
 ,\q\= 2.563228745599644×10^785

n= 13,q= {-2.080676149931359×10^1570, -6.231977810692509×10^1570, 0., 0.}
 ,\q\= 6.570141602268325×10^1570

n= 14,q= {-3.450833419207062×10^3141, 2.593345519521870×10^3141, 0., 0.}
 ,\q\= 4.316676067385699×10^3141

n= 15,q= {5.182810303492141×10^6282, -1.789840677263394×10^6283, 0., 0.}
 ,\q\= 1.863369227074046×10^6283

n= 16,q= {-2.934914423566842×10^12566, -1.855280940746014×10^12566, 0., 0.}
 ,\q\= 3.472144876406528×10^12566

n= 17,q= {5.171655304565275×10^25132, 1.089018158552827×10^25133, 0., 0.}
 ,\q\= 1.205579004275611×10^25133

n= 18,q= {-9.18500363765410×10^50265, 1.126405307289527×10^50266, 0., 0.}
 ,\q\= 1.453420735550172×10^50266

n= 19,q= {-4.251459980528252×10^100531, -2.069207368985438×10^100532, 0., 0.}
 ,\q\= 2.112431834527204×10^100532

n= 20,q= {-4.100870016203305×10^201064, 1.759430464131149×10^201064, 0., 0.}
 ,\q\= 4.462368255523970×10^201064
```

In[105]:=
```
P = {1.5, 1.2, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[105]= {1.5, 1.2, 0, 0}

```
n= 1,q= {1.5, 1.2, 0, 0},\q\= 1.92094

n= 2,q= {2.31, 4.8, 0., 0.},\q\= 5.32692

n= 3,q= {-16.2039, 23.376, 0., 0.},\q\= 28.443

n= 4,q= {-282.371, -756.365, 0., 0.},\q\= 807.354

n= 5,q= {-492 353., 427 152., 0., 0.},\q\= 651 821.

n= 6,q= {5.99523×10^10, -4.20619×10^11, 0., 0.},\q\= 4.2487×10^11

n= 7,q= {-1.73326×10^23, -5.04341×10^22, 0., 0.},\q\= 1.80515×10^23

n= 8,q= {2.74983×10^46, 1.74831×10^46, 0., 0.},\q\= 3.25855×10^46

n= 9,q= {4.505×10^92, 9.61512×10^92, 0., 0.},\q\= 1.06182×10^93

n= 10,q= {-7.21556×10^185, 8.66322×10^185, 0., 0.},\q\= 1.12746×10^186

n= 11,q= {-2.298705891478494×10^371, -1.250199632295119×10^372, 0., 0.}
 ,\q\= 1.271156799276167×10^372

n= 12,q= {-1.510158632835671×10^744, 5.747682520562074×10^743, 0., 0.}
 ,\q\= 1.615839608346030×10^744

n= 13,q= {1.950220552756356×10^1488, -1.735982475445102×10^1488, 0., 0.}
 ,\q\= 2.610937639899852×10^1488

n= 14,q= {7.897250493408041×10^2975, -6.771097405675786×10^2976, 0., 0.}
 ,\q\= 6.816995359445809×10^2976

n= 15,q= {-4.522409442359303×10^5953, -1.069461046557740×10^5953, 0., 0.}
 ,\q\= 4.647142573070570×10^5953

n= 16,q= {1.930844023423620×10^11 907, 9.67308147037637×10^11 906, 0., 0.}
 ,\q\= 2.159593409444496×10^11 907

n= 17,q= {2.792473591465327×10^23 814, 3.735442309033197×10^23 814, 0., 0.}
 ,\q\= 4.663843694116102×10^23 814

n= 18,q= {-6.155620485084001×10^47 628, 2.086224800083493×10^47 629, 0., 0.}
 ,\q\= 2.175143800314653×10^47 629

n= 19,q= {-3.973417280919554×10^95 258, -2.568401623176845×10^95 258, 0., 0.}
 ,\q\= 4.731250552047270×10^95 258

n= 20,q= {9.19135799037269×10^190 516, 2.041066278774542×10^190 517, 0., 0.}
 ,\q\= 2.238473178624759×10^190 517
```

In[109]:=

```
P = {1.5, 0.7, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[109]= {1.5, 0.7, 0, 0}

```
n= 1,q= {1.5, 0.7, 0, 0},\q\= 1.65529

n= 2,q= {3.26, 2.8, 0., 0.},\q\= 4.29739

n= 3,q= {4.2876, 18.956, 0., 0.},\q\= 19.4349

n= 4,q= {-339.446, 163.251, 0., 0.},\q\= 376.663

n= 5,q= {88574.3, -110830., 0., 0.},\q\= 141875.

n= 6,q= {-4.43778×10^9, -1.96333×10^10, 0., 0.},\q\= 2.01286×10^10

n= 7,q= {-3.65773×10^20, 1.74257×10^20, 0., 0.},\q\= 4.05161×10^20

n= 8,q= {1.03424×10^41, -1.27477×10^41, 0., 0.},\q\= 1.64155×10^41

n= 9,q= {-5.55372×10^81, -2.63684×10^82, 0., 0.},\q\= 2.69469×10^82

n= 10,q= {-6.6445×10^164, 2.92885×10^164, 0., 0.},\q\= 7.26137×10^164

n= 11,q= {3.557113583294676×10^329, -3.892150961232142×10^329, 0., 0.}
 ,\q\= 5.272750340143156×10^329

n= 12,q= {-2.495782060560797×10^658, -2.768964610486456×10^659, 0., 0.}
 ,\q\= 2.780189614947977×10^659

n= 13,q= {-7.604875733188239×10^1318, 1.382146440235962×10^1318, 0., 0.}
 ,\q\= 7.729454295064580×10^1318

n= 14,q= {5.592380613497841×10^2637, -2.102210384612595×10^2637, 0., 0.}
 ,\q\= 5.974446369949229×10^2637

n= 15,q= {2.685543242505345×10^5275, -2.351272120080263×10^5275, 0., 0.}
 ,\q\= 3.569400942739952×10^5275

n= 16,q= {1.683661924699387×10^10550, -1.262888590674553×10^10551, 0., 0.}
 ,\q\= 1.274062309003286×10^10551

n= 17,q= {-1.566540417689135×10^21102, -4.252554870512029×10^21101, 0., 0.}
 ,\q\= 1.623234767222784×10^21102

n= 18,q= {2.273206650986495×10^42204, 1.332359816619576×10^42204, 0., 0.}
 ,\q\= 2.634891109520807×10^42204

n= 19,q= {3.392285797146686×10^84408, 6.057458393293535×10^84408, 0., 0.}
 ,\q\= 6.942651159031788×10^84408

n= 20,q= {-2.518519925695918×10^168817, 4.109726014875328×10^168817, 0., 0.}
 ,\q\= 4.820040511600542×10^168817
```

In[113]:=
```
P = {1.5, 0.5, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[113]= {1.5, 0.5, 0, 0}

```
n= 1,q= {1.5, 0.5, 0, 0},\q\= 1.58114

n= 2,q= {3.5, 2., 0., 0.},\q\= 4.03113

n= 3,q= {9.75, 14.5, 0., 0.},\q\= 17.4732

n= 4,q= {-113.688, 283.25, 0., 0.},\q\= 305.214

n= 5,q= {-67 304.2, -64 403.5, 0., 0.},\q\= 93 154.

n= 6,q= {3.82051×10^8, 8.66925×10^9, 0., 0.},\q\= 8.67766×10^9

n= 7,q= {-7.50099×10^19, 6.62418×10^18, 0., 0.},\q\= 7.53019×10^19

n= 8,q= {5.58261×10^39, -9.93759×10^38, 0., 0.},\q\= 5.67037×10^39

n= 9,q= {3.0178×10^79, -1.10955×10^79, 0., 0.},\q\= 3.21531×10^79

n= 10,q= {7.87599×10^158, -6.69682×10^158, 0., 0.},\q\= 1.03382×10^159

n= 11,q= {1.718388547301242×10^317, -1.054881491231032×10^318, 0., 0.}
 ,\q\= 1.068786018123724×10^318

n= 12,q= {-1.083246368546844×10^636, -3.625392546582919×10^635, 0., 0.}
 ,\q\= 1.142303552536766×10^636

n= 13,q= {1.041987983801735×10^1272, 7.854386621285486×10^1271, 0., 0.}
 ,\q\= 1.304857406138115×10^1272

n= 14,q= {4.688250664209213×10^2543, 1.636835295902518×10^2544, 0., 0.}
 ,\q\= 1.702652850353490×10^2544

n= 15,q= {-2.459432843007701×10^5088, 1.534778832643212×10^5088, 0., 0.}
 ,\q\= 2.899026728816863×10^5088

n= 16,q= {3.693263844135281×10^10 176, -7.549370935511472×10^10 176, 0., 0.}
 ,\q\= 8.404355974394604×10^10 176

n= 17,q= {-4.335280369954845×10^20 353, -5.576363744418052×10^20 353, 0., 0.}
 ,\q\= 7.063319934434227×10^20 353

n= 18,q= {-1.230117672394431×10^40 707, 4.835020055380695×10^40 707, 0., 0.}
 ,\q\= 4.989048849617594×10^40 707

n= 19,q= {-2.186422944799645×10^81 415, -1.189528723301058×10^81 415, 0., 0.}
 ,\q\= 2.489060842387063×10^81 415

n= 20,q= {3.365466709988106×10^162 830, 5.201625788247325×10^162 830, 0., 0.}
 ,\q\= 6.195423877104598×10^162 830
```

In[117]:=
```
P = {1.5, 0.4, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[117]= {1.5, 0.4, 0, 0}

```
n= 1,q= {1.5, 0.4, 0, 0},\q\= 1.55242

n= 2,q= {3.59, 1.6, 0., 0.},\q\= 3.93041

n= 3,q= {11.8281, 11.888, 0., 0.},\q\= 16.7699

n= 4,q= {0.0794056, 281.625, 0., 0.},\q\= 281.625

n= 5,q= {-79 311.1, 45.1252, 0., 0.},\q\= 79 311.1

n= 6,q= {6.29025×10^9, -7.15786×10^6, 0., 0.},\q\= 6.29025×10^9

n= 7,q= {3.95671×10^19, -9.00493×10^16, 0., 0.},\q\= 3.95672×10^19

n= 8,q= {1.56555×10^39, -7.12599×10^36, 0., 0.},\q\= 1.56557×10^39

n= 9,q= {2.4509×10^78, -2.23122×10^76, 0., 0.},\q\= 2.451×10^78

n= 10,q= {6.0064×10^156, -1.0937×10^155, 0., 0.},\q\= 6.00739×10^156

n= 11,q= {3.606485557065646×10^313, -1.313836526660478×10^312, 0., 0.}
 ,\q\= 3.608877905597663×10^313

n= 12,q= {1.298947640913523×10^627, -9.47666491549261×10^625, 0., 0.}
 ,\q\= 1.302399973751098×10^627

n= 13,q= {1.678284256042754×10^1254, -2.461938307141416×10^1253, 0., 0.}
 ,\q\= 1.696245691626860×10^1254

n= 14,q= {2.756026641799277×10^2508, -8.263664600447978×10^2507, 0., 0.}
 ,\q\= 2.877249446362684×10^2508

n= 15,q= {6.912801324020428×10^5016, -4.554975959545641×10^5016, 0., 0.}
 ,\q\= 8.278564376594369×10^5016

n= 16,q= {2.703901615333985×10^10 033, -6.297528768805665×10^10 033, 0., 0.}
 ,\q\= 6.853462813741731×10^10 033

n= 17,q= {-3.234778464852926×10^20 067, -3.405579642117176×10^20 067, 0., 0.}
 ,\q\= 4.696995253934073×10^20 067

n= 18,q= {-1.134180982126702×10^40 134, 2.203259137332435×10^40 135, 0., 0.}
 ,\q\= 2.206176441547921×10^40 135

n= 19,q= {-4.841487161236687×10^80 270, -4.997789224518663×10^80 269, 0., 0.}
 ,\q\= 4.867214491241045×10^80 270

n= 20,q= {2.319021896109253×10^160 541, 4.839346473014833×10^160 540, 0., 0.}
 ,\q\= 2.368977690374683×10^160 541
```

In[121]:=
```
P = {1.5, 0.2, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[121]= {1.5, 0.2, 0, 0}

```
n= 1,q= {1.5, 0.2, 0, 0},\q\= 1.51327

n= 2,q= {3.71, 0.8, 0., 0.},\q\= 3.79527

n= 3,q= {14.6241, 6.136, 0., 0.},\q\= 15.8592

n= 4,q= {177.714, 179.667, 0., 0.},\q\= 252.71

n= 5,q= {-696.518, 63858.8, 0., 0.},\q\= 63862.6

n= 6,q= {-4.07746×10^9, -8.89576×10^7, 0., 0.},\q\= 4.07843×10^9

n= 7,q= {1.66178×10^19, 7.25443×10^17, 0., 0.},\q\= 1.66336×10^19

n= 8,q= {2.75624×10^38, 2.41105×10^37, 0., 0.},\q\= 2.76677×10^38

n= 9,q= {7.53873×10^76, 1.32909×10^76, 0., 0.},\q\= 7.655×10^76

n= 10,q= {5.5066×10^153, 2.00392×10^153, 0., 0.},\q\= 5.8599×10^153

n= 11,q= {2.6307×10^307, 2.20696×10^307, 0., 0.},\q\= 3.43384×10^307

n= 12,q= {2.049871379662801×10^614, 1.161169809912458×10^615, 0., 0.}
 ,\q\= 1.179124698318096×10^615

n= 13,q= {-1.306295600720527×10^1230, 4.760497520536086×10^1229, 0., 0.}
 ,\q\= 1.390335054183741×10^1230

n= 14,q= {1.479784830031501×10^2460, -1.243723393663454×10^2460, 0., 0.}
 ,\q\= 1.933031562892106×10^2460

n= 15,q= {6.429152632456209×10^4919, -3.680886021396951×10^4920, 0., 0.}
 ,\q\= 3.736611023137097×10^4920

n= 16,q= {-1.313558186680129×10^9841, -4.732995610847094×10^9840, 0., 0.}
 ,\q\= 1.396226193822966×10^9841

n= 17,q= {1.501422635271410×10^19682, 1.243413026429863×10^19682, 0., 0.}
 ,\q\= 1.949447584317367×10^19682

n= 18,q= {7.081939754098726×10^39363, 3.733776925746249×10^39364, 0., 0.}
 ,\q\= 3.800345884000817×10^39364

n= 19,q= {-1.343955142442827×10^78729, 5.288476648675778×10^78728, 0., 0.}
 ,\q\= 1.444262883804195×10^78729

n= 20,q= {1.526535572262631×10^157458, -1.421495077535325×10^157458, 0., 0.}
 ,\q\= 2.085895277534411×10^157458
```

In[125]:=
```
P = {1.5, -0.2, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[125]= {1.5, -0.2, 0, 0}

```
n= 1,q= {1.5, -0.2, 0, 0},\q\= 1.51327
n= 2,q= {3.71, -0.8, 0., 0.},\q\= 3.79527
n= 3,q= {14.6241, -6.136, 0., 0.},\q\= 15.8592
n= 4,q= {177.714, -179.667, 0., 0.},\q\= 252.71
n= 5,q= {-696.518, -63858.8, 0., 0.},\q\= 63862.6
n= 6,q= {-4.07746×10^9, 8.89576×10^7, 0., 0.},\q\= 4.07843×10^9
n= 7,q= {1.66178×10^19, -7.25443×10^17, 0., 0.},\q\= 1.66336×10^19
n= 8,q= {2.75624×10^38, -2.41105×10^37, 0., 0.},\q\= 2.76677×10^38
n= 9,q= {7.53873×10^76, -1.32909×10^76, 0., 0.},\q\= 7.655×10^76
n= 10,q= {5.5066×10^153, -2.00392×10^153, 0., 0.},\q\= 5.8599×10^153
n= 11,q= {2.6307×10^307, -2.20696×10^307, 0., 0.},\q\= 3.43384×10^307
n= 12,q= {2.049871379662801×10^614, -1.161169809912458×10^615, 0., 0.}
 ,\q\= 1.179124698318096×10^615
n= 13,q= {-1.306295600720527×10^1230, -4.760497520536086×10^1229, 0., 0.}
 ,\q\= 1.390335054183741×10^1230
n= 14,q= {1.479784830031501×10^2460, 1.243723393663454×10^2460, 0., 0.}
 ,\q\= 1.933031562892106×10^2460
n= 15,q= {6.429152632456209×10^4919, 3.680886021396951×10^4920, 0., 0.}
 ,\q\= 3.736611023137097×10^4920
n= 16,q= {-1.313558186680129×10^9841, 4.732995610847094×10^9840, 0., 0.}
 ,\q\= 1.396226193822966×10^9841
n= 17,q= {1.501422635271410×10^19682, -1.243413026429863×10^19682, 0., 0.}
 ,\q\= 1.949447584317367×10^19682
n= 18,q= {7.081939754098726×10^39363, -3.733776925746249×10^39364, 0., 0.}
 ,\q\= 3.800345884000817×10^39364
n= 19,q= {-1.343955142442827×10^78729, -5.288476648675778×10^78728, 0., 0.}
 ,\q\= 1.444262883804195×10^78729
n= 20,q= {1.526535572262631×10^157458, 1.421495077535325×10^157458, 0., 0.}
 ,\q\= 2.085895277534411×10^157458
```

In[129]:=
```
P = {1.5, -0.4, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[129]= {1.5, -0.4, 0, 0}

```
n= 1,q= {1.5, -0.4, 0, 0},\q\= 1.55242

n= 2,q= {3.59, -1.6, 0., 0.},\q\= 3.93041

n= 3,q= {11.8281, -11.888, 0., 0.},\q\= 16.7699

n= 4,q= {0.0794056, -281.625, 0., 0.},\q\= 281.625

n= 5,q= {-79311.1, -45.1252, 0., 0.},\q\= 79311.1

n= 6,q= {6.29025×10^9, 7.15786×10^6, 0., 0.},\q\= 6.29025×10^9

n= 7,q= {3.95671×10^19, 9.00493×10^16, 0., 0.},\q\= 3.95672×10^19

n= 8,q= {1.56555×10^39, 7.12599×10^36, 0., 0.},\q\= 1.56557×10^39

n= 9,q= {2.4509×10^78, 2.23122×10^76, 0., 0.},\q\= 2.451×10^78

n= 10,q= {6.0064×10^156, 1.0937×10^155, 0., 0.},\q\= 6.00739×10^156

n= 11,q= {3.606485557065646×10^313, 1.313836526660478×10^312, 0., 0.}
 ,\q\= 3.608877905597663×10^313

n= 12,q= {1.298947640913523×10^627, 9.47666491549261×10^625, 0., 0.}
 ,\q\= 1.302399973751098×10^627

n= 13,q= {1.678284256042754×10^1254, 2.461938307141416×10^1253, 0., 0.}
 ,\q\= 1.696245691626860×10^1254

n= 14,q= {2.756026641799277×10^2508, 8.263664600447978×10^2507, 0., 0.}
 ,\q\= 2.877249446362684×10^2508

n= 15,q= {6.912801324020428×10^5016, 4.554975959545641×10^5016, 0., 0.}
 ,\q\= 8.278564376594369×10^5016

n= 16,q= {2.703901615333985×10^10033, 6.297528768805665×10^10033, 0., 0.}
 ,\q\= 6.853462813741731×10^10033

n= 17,q= {-3.234778464852926×10^20067, 3.405579642117176×10^20067, 0., 0.}
 ,\q\= 4.696995253934073×10^20067

n= 18,q= {-1.134180982126702×10^40134, -2.203259137332435×10^40135, 0., 0.}
 ,\q\= 2.206176441547921×10^40135

n= 19,q= {-4.841487161236687×10^80270, 4.997789224518663×10^80269, 0., 0.}
 ,\q\= 4.867214491241045×10^80270

n= 20,q= {2.319021896109253×10^160541, -4.839346473014833×10^160540, 0., 0.}
 ,\q\= 2.368977690374683×10^160541
```

In[133]:=
```
P = {1.5, -0.5, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[133]= {1.5, -0.5, 0, 0}

```
n= 1,q= {1.5, -0.5, 0, 0},\q\= 1.58114

n= 2,q= {3.5, -2., 0., 0.},\q\= 4.03113

n= 3,q= {9.75, -14.5, 0., 0.},\q\= 17.4732

n= 4,q= {-113.688, -283.25, 0., 0.},\q\= 305.214

n= 5,q= {-67 304.2, 64 403.5, 0., 0.},\q\= 93 154.

n= 6,q= {3.82051×10^8, -8.66925×10^9, 0., 0.},\q\= 8.67766×10^9

n= 7,q= {-7.50099×10^19, -6.62418×10^18, 0., 0.},\q\= 7.53019×10^19

n= 8,q= {5.58261×10^39, 9.93759×10^38, 0., 0.},\q\= 5.67037×10^39

n= 9,q= {3.0178×10^79, 1.10955×10^79, 0., 0.},\q\= 3.21531×10^79

n= 10,q= {7.87599×10^158, 6.69682×10^158, 0., 0.},\q\= 1.03382×10^159

n= 11,q= {1.718388547301242×10^317, 1.054881491231032×10^318, 0., 0.}
 ,\q\= 1.068786018123724×10^318

n= 12,q= {-1.083246368546844×10^636, 3.625392546582919×10^635, 0., 0.}
 ,\q\= 1.142303552536766×10^636

n= 13,q= {1.041987983801735×10^1272, -7.854386621285486×10^1271, 0., 0.}
 ,\q\= 1.304857406138115×10^1272

n= 14,q= {4.688250664209213×10^2543, -1.636835295902518×10^2544, 0., 0.}
 ,\q\= 1.702652850353490×10^2544

n= 15,q= {-2.459432843007701×10^5088, -1.534778832643212×10^5088, 0., 0.}
 ,\q\= 2.899026728816863×10^5088

n= 16,q= {3.693263844135281×10^10 176, 7.549370935511472×10^10 176, 0., 0.}
 ,\q\= 8.404355974394604×10^10 176

n= 17,q= {-4.335280369954845×10^20 353, 5.576363744418052×10^20 353, 0., 0.}
 ,\q\= 7.063319934434227×10^20 353

n= 18,q= {-1.230117672394431×10^40 707, -4.835020055380695×10^40 707, 0., 0.}
 ,\q\= 4.989048849617594×10^40 707

n= 19,q= {-2.186422944799645×10^81 415, 1.189528723301058×10^81 415, 0., 0.}
 ,\q\= 2.489060842387063×10^81 415

n= 20,q= {3.365466709988106×10^162 830, -5.201625788247325×10^162 830, 0., 0.}
 ,\q\= 6.195423877104598×10^162 830
```

In[137]:=
```
P = {1.5, -0.7, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[137]= {1.5, -0.7, 0, 0}

n= 1,q= {1.5, -0.7, 0, 0},\q\= 1.65529

n= 2,q= {3.26, -2.8, 0., 0.},\q\= 4.29739

n= 3,q= {4.2876, -18.956, 0., 0.},\q\= 19.4349

n= 4,q= {-339.446, -163.251, 0., 0.},\q\= 376.663

n= 5,q= {88 574.3, 110 830., 0., 0.},\q\= 141 875.

n= 6,q= $\{-4.43778\times10^{9}, 1.96333\times10^{10}, 0., 0.\}$,\q\= 2.01286×10^{10}

n= 7,q= $\{-3.65773\times10^{20}, -1.74257\times10^{20}, 0., 0.\}$,\q\= 4.05161×10^{20}

n= 8,q= $\{1.03424\times10^{41}, 1.27477\times10^{41}, 0., 0.\}$,\q\= 1.64155×10^{41}

n= 9,q= $\{-5.55372\times10^{81}, 2.63684\times10^{82}, 0., 0.\}$,\q\= 2.69469×10^{82}

n= 10,q= $\{-6.6445\times10^{164}, -2.92885\times10^{164}, 0., 0.\}$,\q\= 7.26137×10^{164}

n= 11,q= $\{3.557113583294676\times10^{329}, 3.892150961232142\times10^{329}, 0., 0.\}$
,\q\= $5.272750340143156\times10^{329}$

n= 12,q= $\{-2.495782060560797\times10^{658}, 2.768964610486456\times10^{659}, 0., 0.\}$
,\q\= $2.780189614947977\times10^{659}$

n= 13,q= $\{-7.604875733188239\times10^{1318}, -1.382146440235962\times10^{1318}, 0., 0.\}$
,\q\= $7.729454295064580\times10^{1318}$

n= 14,q= $\{5.592380613497841\times10^{2637}, 2.102210384612595\times10^{2637}, 0., 0.\}$
,\q\= $5.974446369949229\times10^{2637}$

n= 15,q= $\{2.685543242505345\times10^{5275}, 2.351272120080263\times10^{5275}, 0., 0.\}$
,\q\= $3.569400942739952\times10^{5275}$

n= 16,q= $\{1.683661924699387\times10^{10\,550}, 1.262888590674553\times10^{10\,551}, 0., 0.\}$
,\q\= $1.274062309003286\times10^{10\,551}$

n= 17,q= $\{-1.566540417689135\times10^{21\,102}, 4.252554870512029\times10^{21\,101}, 0., 0.\}$
,\q\= $1.623234767222784\times10^{21\,102}$

n= 18,q= $\{2.273206650986495\times10^{42\,204}, -1.332359816619576\times10^{42\,204}, 0., 0.\}$
,\q\= $2.634891109520807\times10^{42\,204}$

n= 19,q= $\{3.392285797146686\times10^{84\,408}, -6.057458393293535\times10^{84\,408}, 0., 0.\}$
,\q\= $6.942651159031788\times10^{84\,408}$

n= 20,q= $\{-2.518519925695918\times10^{168\,817}, -4.109726014875328\times10^{168\,817}, 0., 0.\}$
,\q\= $4.820040511600542\times10^{168\,817}$

In[141]:=
```
P = {1.5, -1.2, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[141]= {1.5, -1.2, 0, 0}

```
n= 1,q= {1.5, -1.2, 0, 0},\q\= 1.92094

n= 2,q= {2.31, -4.8, 0., 0.},\q\= 5.32692

n= 3,q= {-16.2039, -23.376, 0., 0.},\q\= 28.443

n= 4,q= {-282.371, 756.365, 0., 0.},\q\= 807.354

n= 5,q= {-492 353., -427 152., 0., 0.},\q\= 651 821.

n= 6,q= {5.99523×10^10, 4.20619×10^11, 0., 0.},\q\= 4.2487×10^11

n= 7,q= {-1.73326×10^23, 5.04341×10^22, 0., 0.},\q\= 1.80515×10^23

n= 8,q= {2.74983×10^46, -1.74831×10^46, 0., 0.},\q\= 3.25855×10^46

n= 9,q= {4.505×10^92, -9.61512×10^92, 0., 0.},\q\= 1.06182×10^93

n= 10,q= {-7.21556×10^185, -8.66322×10^185, 0., 0.},\q\= 1.12746×10^186

n= 11,q= {-2.298705891478494×10^371, 1.250199632295119×10^372, 0., 0.}
 ,\q\= 1.271156799276167×10^372

n= 12,q= {-1.510158632835671×10^744, -5.747682520562074×10^743, 0., 0.}
 ,\q\= 1.615839608346030×10^744

n= 13,q= {1.950220552756356×10^1488, 1.735982475445102×10^1488, 0., 0.}
 ,\q\= 2.610937639899852×10^1488

n= 14,q= {7.897250493408041×10^2975, 6.771097405675786×10^2976, 0., 0.}
 ,\q\= 6.816995359445809×10^2976

n= 15,q= {-4.522409442359303×10^5953, 1.069461046557740×10^5953, 0., 0.}
 ,\q\= 4.647142573070570×10^5953

n= 16,q= {1.930844023423620×10^11 907, -9.67308147037637×10^11 906, 0., 0.}
 ,\q\= 2.159593409444496×10^11 907

n= 17,q= {2.792473591465327×10^23 814, -3.735442309033197×10^23 814, 0., 0.}
 ,\q\= 4.663843694116102×10^23 814

n= 18,q= {-6.155620485084001×10^47 628, -2.086224800083493×10^47 629, 0., 0.}
 ,\q\= 2.175143800314653×10^47 629

n= 19,q= {-3.973417280919554×10^95 258, 2.568401623176845×10^95 258, 0., 0.}
 ,\q\= 4.731250552047270×10^95 258

n= 20,q= {9.19135799037269×10^190 516, -2.041066278774542×10^190 517, 0., 0.}
 ,\q\= 2.238473178624759×10^190 517
```

In[145]:=

```
P = {1.5, -1.4, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[145]= {1.5, -1.4, 0, 0}

```
n= 1,q= {1.5, -1.4, 0, 0},\q\= 2.05183

n= 2,q= {1.79, -5.6, 0., 0.},\q\= 5.87912

n= 3,q= {-26.6559, -21.448, 0., 0.},\q\= 34.2134

n= 4,q= {252.02, 1142.03, 0., 0.},\q\= 1169.51

n= 5,q= {-1.24072×10^6, 575629., 0., 0.},\q\= 1.36775×10^6

n= 6,q= {1.20804×10^12, -1.42839×10^12, 0., 0.},\q\= 1.87074×10^12

n= 7,q= {-5.80938×10^23, -3.4511×10^24, 0., 0.},\q\= 3.49965×10^24

n= 8,q= {-1.15726×10^49, 4.00975×10^48, 0., 0.},\q\= 1.22475×10^49

n= 9,q= {1.17846×10^98, -9.28062×10^97, 0., 0.},\q\= 1.50002×10^98

n= 10,q= {5.27478×10^195, -2.18737×10^196, 0., 0.},\q\= 2.25007×10^196

n= 11,q= {-4.506368803642956×10^392, -2.307580477805702×10^392, 0., 0.}
 ,\q\= 5.062833935257648×10^392

n= 12,q= {1.498243213289646×10^785, 2.079761735415824×10^785, 0., 0.}
 ,\q\= 2.563228745599644×10^785

n= 13,q= {-2.080676149931359×10^1570, 6.231977810692509×10^1570, 0., 0.}
 ,\q\= 6.570141602268325×10^1570

n= 14,q= {-3.450833419207062×10^3141, -2.593345519521870×10^3141, 0., 0.}
 ,\q\= 4.316676067385699×10^3141

n= 15,q= {5.182810303492141×10^6282, 1.789840677263394×10^6283, 0., 0.}
 ,\q\= 1.863369227074046×10^6283

n= 16,q= {-2.934914423566842×10^12566, 1.855280940746014×10^12566, 0., 0.}
 ,\q\= 3.472144876406528×10^12566

n= 17,q= {5.171655304565275×10^25132, -1.089018158552827×10^25133, 0., 0.}
 ,\q\= 1.205579004275611×10^25133

n= 18,q= {-9.18500363765410×10^50265, -1.126405307289527×10^50266, 0., 0.}
 ,\q\= 1.453420735550172×10^50266

n= 19,q= {-4.251459980528252×10^100531, 2.069207368985438×10^100532, 0., 0.}
 ,\q\= 2.112431834527204×10^100532

n= 20,q= {-4.100870016203305×10^201064, -1.759430464131149×10^201064, 0., 0.}
 ,\q\= 4.462368255523970×10^201064
```

In[149]:=
```
P = {0.124, 0.624, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[149]= {0.124, 0.624, 0, 0}

```
n= 1,q= {0.124, 0.624, 0, 0},\q\= 0.636201
n= 2,q= {-0.25, 0.778752, 0., 0.},\q\= 0.817896
n= 3,q= {-0.419955, 0.234624, 0., 0.},\q\= 0.481051
n= 4,q= {0.245314, 0.426937, 0., 0.},\q\= 0.492396
n= 5,q= {0.00190342, 0.833467, 0., 0.},\q\= 0.833469
n= 6,q= {-0.570663, 0.627173, 0., 0.},\q\= 0.84794
n= 7,q= {0.0563109, -0.0918092, 0., 0.},\q\= 0.107703
n= 8,q= {0.118742, 0.61366, 0., 0.},\q\= 0.625043
n= 9,q= {-0.238479, 0.769734, 0., 0.},\q\= 0.805831
n= 10,q= {-0.411619, 0.256869, 0., 0.},\q\= 0.485192
n= 11,q= {0.227449, 0.412536, 0., 0.},\q\= 0.471083
n= 12,q= {0.00554678, 0.811662, 0., 0.},\q\= 0.81168
n= 13,q= {-0.534764, 0.633004, 0., 0.},\q\= 0.828653
n= 14,q= {0.00927782, -0.0530153, 0., 0.},\q\= 0.053821
n= 15,q= {0.121275, 0.623016, 0., 0.},\q\= 0.63471
n= 16,q= {-0.249442, 0.775113, 0., 0.},\q\= 0.814261
n= 17,q= {-0.414579, 0.237309, 0., 0.},\q\= 0.477694
n= 18,q= {0.23956, 0.427233, 0., 0.},\q\= 0.489813
n= 19,q= {-0.0011389, 0.828696, 0., 0.},\q\= 0.828697
n= 20,q= {-0.562736, 0.622112, 0., 0.},\q\= 0.838866
```

In[157]:=
```
P = {0.124, 0.67, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[157]= {0.124, 0.67, 0, 0}

```
n= 1,q= {0.124, 0.67, 0, 0},\q\= 0.681378
n= 2,q= {-0.309524, 0.83616, 0., 0.},\q\= 0.89161
n= 3,q= {-0.479358, 0.152377, 0., 0.},\q\= 0.502994
n= 4,q= {0.330566, 0.523914, 0., 0.},\q\= 0.619483
n= 5,q= {-0.0412119, 1.01638, 0., 0.},\q\= 1.01721
n= 6,q= {-0.907322, 0.586226, 0., 0.},\q\= 1.08023
n= 7,q= {0.603571, -0.393792, 0., 0.},\q\= 0.720673
n= 8,q= {0.333226, 0.194637, 0., 0.},\q\= 0.385906
n= 9,q= {0.197156, 0.799716, 0., 0.},\q\= 0.82366
n= 10,q= {-0.476676, 0.985338, 0., 0.},\q\= 1.09458
n= 11,q= {-0.619671, -0.269373, 0., 0.},\q\= 0.675687
n= 12,q= {0.43543, 1.00384, 0., 0.},\q\= 1.09421
n= 13,q= {-0.694105, 1.54421, 0., 0.},\q\= 1.69303
n= 14,q= {-1.7788, -1.47369, 0., 0.},\q\= 2.30995
n= 15,q= {1.11637, 5.91278, 0., 0.},\q\= 6.01725
n= 16,q= {-33.5907, 13.8717, 0., 0.},\q\= 36.3423
n= 17,q= {936.036, -931.252, 0., 0.},\q\= 1320.38
n= 18,q= {8932.64, -1.74337×10^6, 0., 0.},\q\= 1.74339×10^6
n= 19,q= {-3.03926×10^12, -3.11458×10^10, 0., 0.},\q\= 3.03942×10^12
n= 20,q= {9.23613×10^24, 1.8932×10^23, 0., 0.},\q\= 9.23807×10^24
```

In[161]:=
```
P = {0.14, 0.624, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[161]= {0.14, 0.624, 0, 0}

```
n= 1,q= {0.14, 0.624, 0, 0},\q\= 0.639512
n= 2,q= {-0.229776, 0.79872, 0., 0.},\q\= 0.831114
n= 3,q= {-0.445157, 0.256947, 0., 0.},\q\= 0.51399
n= 4,q= {0.272143, 0.395237, 0., 0.},\q\= 0.479869
n= 5,q= {0.0578494, 0.839122, 0., 0.},\q\= 0.841114
n= 6,q= {-0.560779, 0.721085, 0., 0.},\q\= 0.913475
n= 7,q= {-0.0654912, -0.184739, 0., 0.},\q\= 0.196004
n= 8,q= {0.110161, 0.648198, 0., 0.},\q\= 0.657492
n= 9,q= {-0.268025, 0.766812, 0., 0.},\q\= 0.812304
n= 10,q= {-0.376163, 0.212951, 0., 0.},\q\= 0.432258
n= 11,q= {0.23615, 0.463791, 0., 0.},\q\= 0.520451
n= 12,q= {-0.0193356, 0.843049, 0., 0.},\q\= 0.843271
n= 13,q= {-0.570358, 0.591398, 0., 0.},\q\= 0.82162
n= 14,q= {0.115556, -0.0506173, 0., 0.},\q\= 0.126156
n= 15,q= {0.150791, 0.612302, 0., 0.},\q\= 0.630596
n= 16,q= {-0.212175, 0.808659, 0., 0.},\q\= 0.836031
n= 17,q= {-0.468911, 0.280845, 0., 0.},\q\= 0.546582
n= 18,q= {0.281004, 0.360617, 0., 0.},\q\= 0.457174
n= 19,q= {0.0889184, 0.82667, 0., 0.},\q\= 0.831438
n= 20,q= {-0.535477, 0.771012, 0., 0.},\q\= 0.93872
```

In[165]:=
```
P = {0.14, 0.67, 0, 0}
quaternion[{x_, y_, z_, w_}] := {x^2 - y^2 - z^2 - w^2, 2 x y, 2 x z, 2 x w}
iteration[t_] := Module[{q = t, n = 1}, While[n ≤ 20, q = quaternion[q] + P;
   Print["n= ", n, ",", "q= ", q, ",", "\q\= ", N[Sqrt[Plus @@ (q^2)]]];
   n++]]
iteration[
 {0,
  0,
  0,
  0}]
```

Out[165]= {0.14, 0.67, 0, 0}

```
n= 1,q= {0.14, 0.67, 0, 0},\q\= 0.684471
n= 2,q= {-0.2893, 0.8576, 0., 0.},\q\= 0.905081
n= 3,q= {-0.511783, 0.173793, 0., 0.},\q\= 0.540487
n= 4,q= {0.371718, 0.492112, 0., 0.},\q\= 0.616724
n= 5,q= {0.0360006, 1.03585, 0., 0.},\q\= 1.03648
n= 6,q= {-0.931697, 0.744583, 0., 0.},\q\= 1.19267
n= 7,q= {0.453656, -0.717451, 0., 0.},\q\= 0.848846
n= 8,q= {-0.168932, 0.0190484, 0., 0.},\q\= 0.170002
n= 9,q= {0.168175, 0.663564, 0., 0.},\q\= 0.684544
n= 10,q= {-0.272035, 0.89319, 0., 0.},\q\= 0.933698
n= 11,q= {-0.583786, 0.184043, 0., 0.},\q\= 0.612109
n= 12,q= {0.446934, 0.455117, 0., 0.},\q\= 0.637872
n= 13,q= {0.132618, 1.07681, 0., 0.},\q\= 1.08495
n= 14,q= {-1.00194, 0.955611, 0., 0.},\q\= 1.38459
n= 15,q= {0.230695, -1.24493, 0., 0.},\q\= 1.26613
n= 16,q= {-1.35663, 0.0956004, 0., 0.},\q\= 1.36
n= 17,q= {1.97132, 0.41061, 0., 0.},\q\= 2.01363
n= 18,q= {3.8575, 2.28889, 0., 0.},\q\= 4.48545
n= 19,q= {9.78128, 18.3287, 0., 0.},\q\= 20.7754
n= 20,q= {-240.13, 359.227, 0., 0.},\q\= 432.095
```