Least-Squares Pareto Approximation
Objective function:

$$f(\alpha) = \left(\frac{\alpha 2^{\alpha}}{2^{\alpha+1}} - 1.25\right)^2 + \left(\frac{\alpha 2^{\alpha}}{3^{\alpha+1}} - 0.3\right)^2 + \left(\frac{\alpha 2^{\alpha}}{4^{\alpha+1}} - 0.1\right)^2 + \left(\frac{\alpha 2^{\alpha}}{5^{\alpha+1}} - 0.05\right)^2$$

Record of calculations:

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dig = 5 // The number of the digits after the decimal point in the answer.
N = 10

Step 1:
alpha = 2.5;
Initial segment for alpha: [2, 3].
The length of the segments = 1.
The length of the subsegments = 0.1.
f(2.1) = 0.040634099282236
f(2.2) = 0.022962570229
f(2.3) = 0.010318818999464
f(2.4) = 0.002702959280226
f(2.5) = 0.00011608959656875
f(2.6) = 0.0025599542544206
f(2.7) = 0.010036683627336
f(2.8) = 0.02254859671627
f(2.9) = 0.040098052557335
f(3) = 0.062687339921125
Output:
Minimal value of the objective function: f = 0.00011608959656875
alpha = 2.5

Step 2:
Segment: [2.45, 2.55].
The length of the segment = 0.1.
The length of the subsegment = 0.01.
f(2.45) = 0.00078080341542181
f(2.46) = 0.00054725814590802
f(2.47) = 0.00036401225958599
f(2.48) = 0.00023106760408469
f(2.49) = 0.00014842607161364
f(2.5) = 0.00011608959656875
f(2.51) = 0.00013406015320243
f(2.52) = 0.00020233975335676
f(2.53) = 0.00032093044425793
f(2.54) = 0.0004898343063706
f(2.55) = 0.00070905345131078
Output:

Minimal value of the objective function: f = 0.00011608959656875
alpha = 2.5

Step 3:
Segment: [2.495, 2.505].
The length of the segment = 0.01.
The length of the subsegment = 0.001.
f(2.495) = 0.00012596957942942
f(2.496) = 0.0001229874542095
f(2.497) = 0.00012050839133126
f(2.498) = 0.00011853239277499
f(2.499) = 0.00011705946052484
f(2.5) = 0.00011608959656875
f(2.501) = 0.00011562280289844
f(2.502) = 0.00011565908150939
f(2.503) = 0.00011619843440081
f(2.504) = 0.00011724086357564
f(2.505) = 0.0001187863710405
Output:
Minimal value of the objective function: f = 0.00011562280289844
alpha = 2.501

Step 4:
Segment: [2.5005, 2.5015].
The length of the segment = 0.001.
The length of the subsegment = 0.0001.
f(2.5005) = 0.00011579331582324
f(2.5006) = 0.00011574915180464
f(2.5007) = 0.00011571001850086
f(2.5008) = 0.00011567591591391
f(2.5009) = 0.00011564684404577
f(2.501) = 0.00011562280289844
f(2.5011) = 0.00011560379247392
f(2.5012) = 0.0001155898127742
f(2.5013) = 0.0001155808638013
f(2.5014) = 0.00011557694555719
f(2.5015) = 0.00011557805804389
Output:
Minimal value of the objective function: f = 0.00011557694555719
alpha = 2.5014

Step 5:
Segment: [2.50135, 2.50145].
The length of the segment = 0.0001.
The length of the subsegment = 1.0E-5.
f(2.50135) = 0.00011557827583802

f(2.50136) = 0.00011557790916725
f(2.50137) = 0.00011557759280378
f(2.50138) = 0.00011557732674761
f(2.50139) = 0.00011557711099875
f(2.5014) = 0.00011557694555719
f(2.50141) = 0.00011557683042294
f(2.50142) = 0.000115576765596
f(2.50143) = 0.00011557675107638
f(2.50144) = 0.00011557678686406
f(2.50145) = 0.00011557687295907
Output:
Minimal value of the objective function: f = 0.00011557675107638
alpha = 2.50143

meanP = 3.33206
medianP = 2.6386
varianceP = 8.85172
standard_deviationP = 2.97518

Answer:
alpha = 2.50143