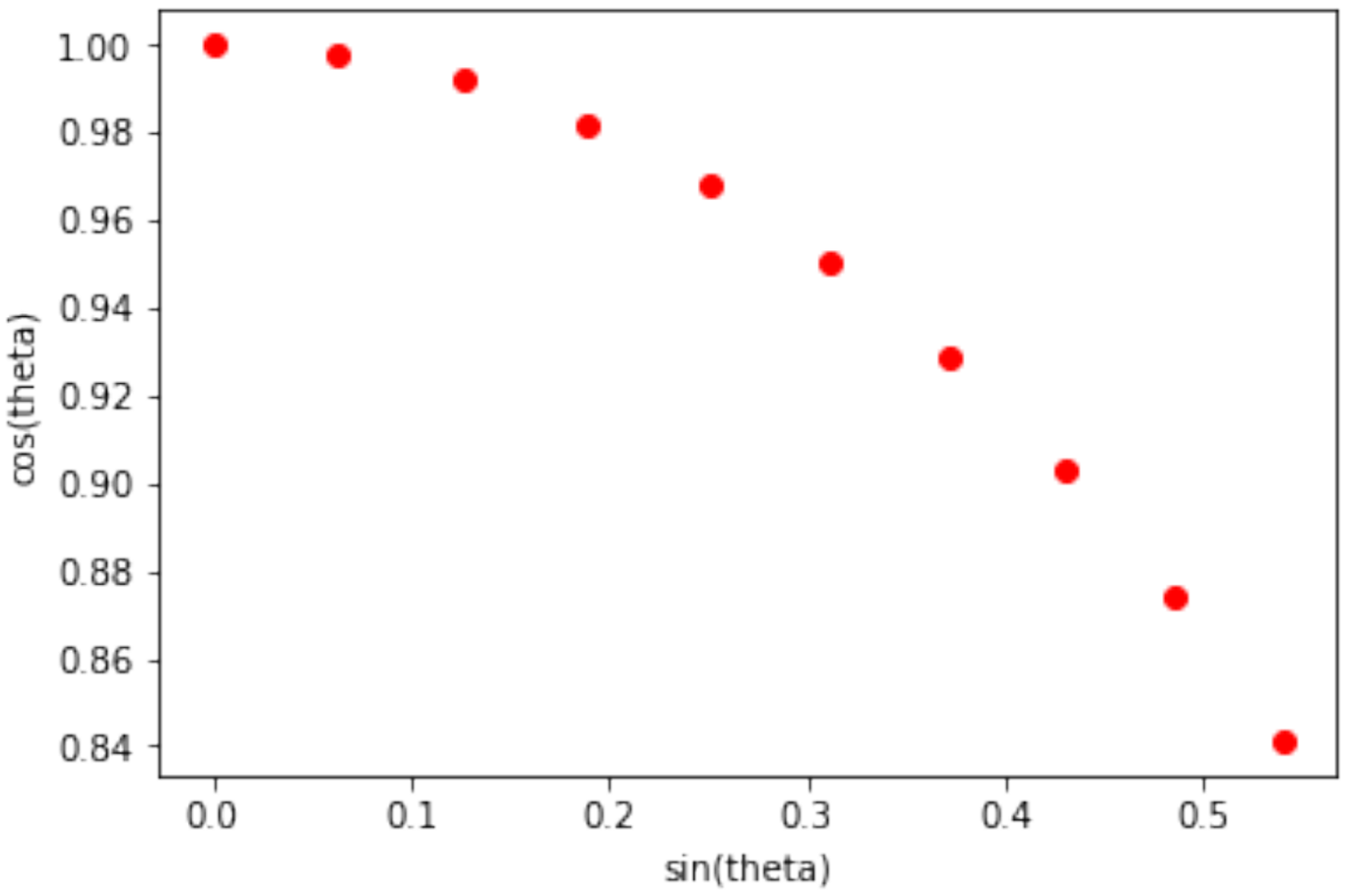
# PHYS 391 - Day 4

- Lab 1 plot examples
- Counting Statistics
- Start discussing Chap. 5

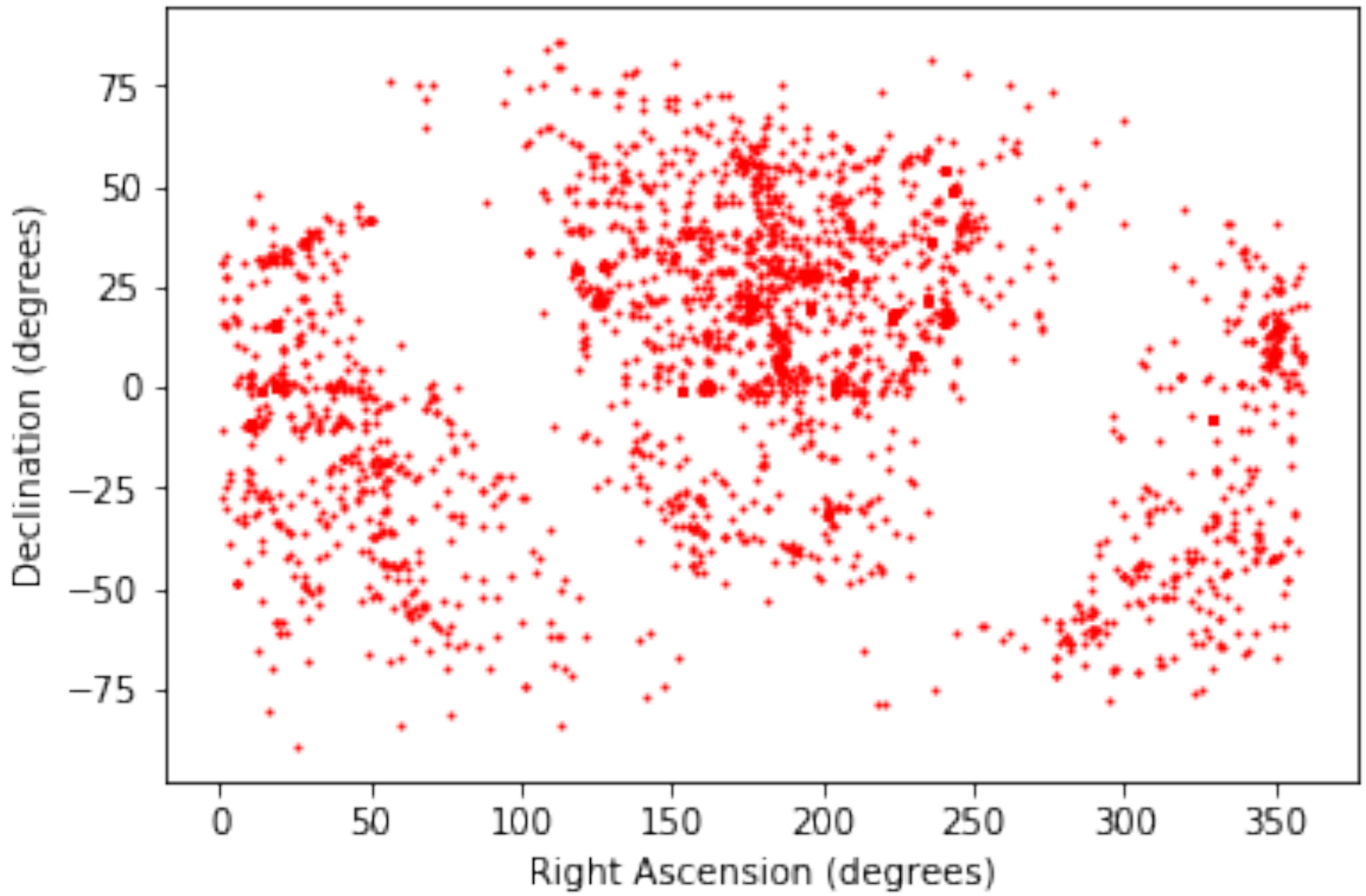
# Lab 1 plot examples




- First 10 points in sin/cos array

- Change plot type from line to points

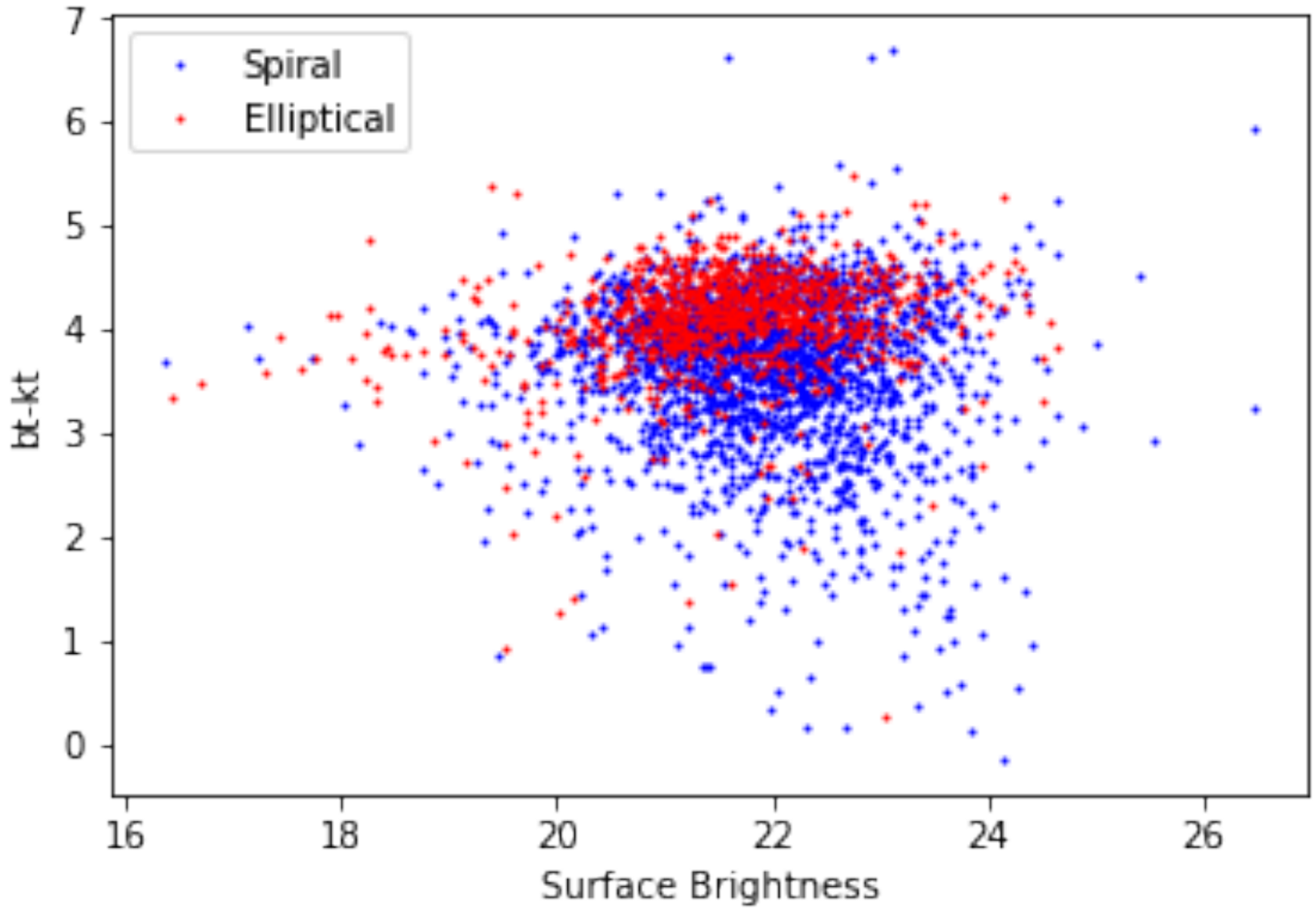
# Lab 1 galaxy plots




- Declination vs. RA, 24 hours = 360 degrees

- Use circles unless you have a good reason not to, size should be appropriate

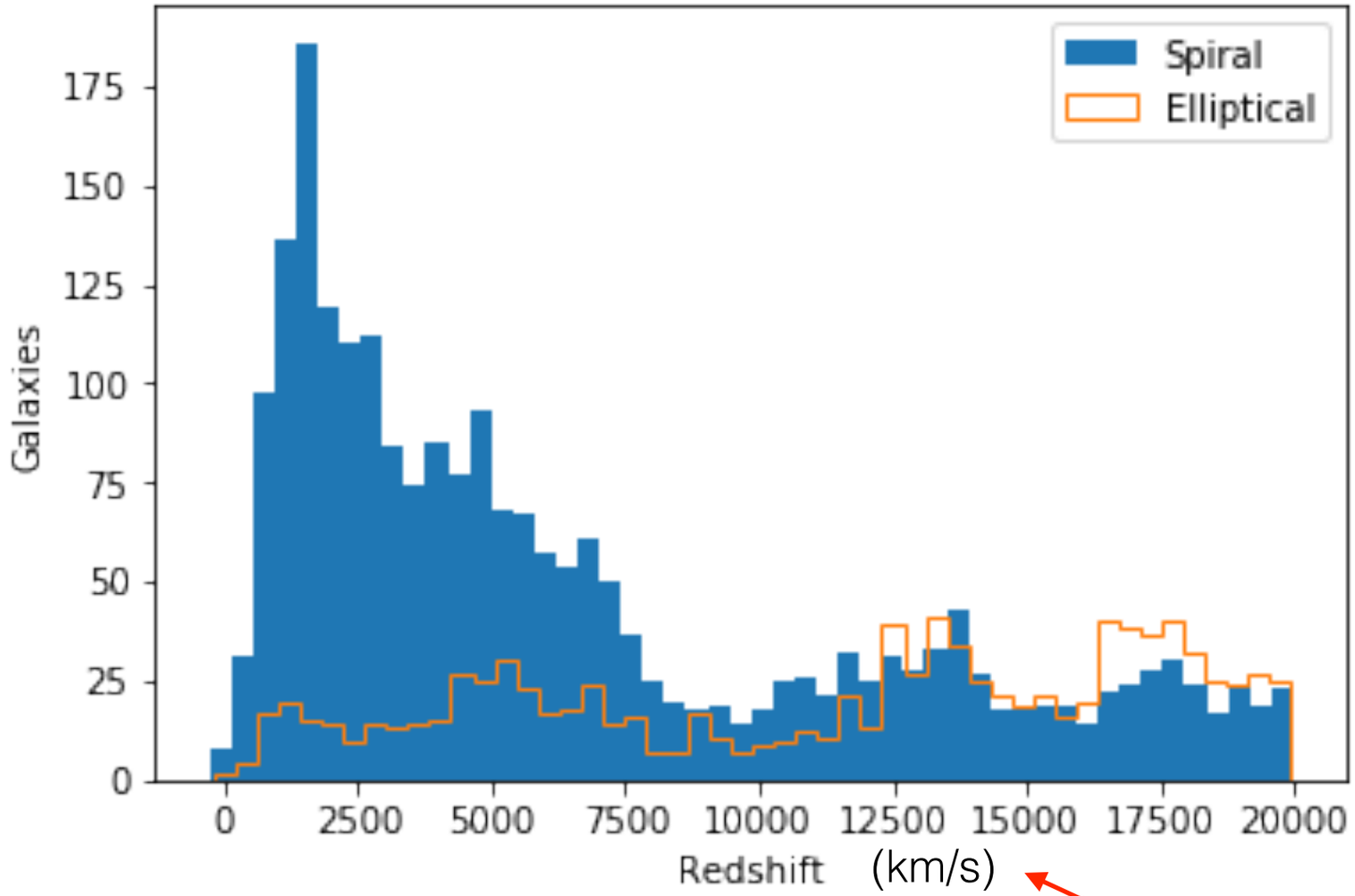
# Lab 1 galaxy plots




- Use different colors, could in principle use different symbols, but here probably too many points to make sense

- Add a legend to identify each population

# Lab 1 galaxy plots




**Don’t forget units!**

- Different ways to do this, must be able to identify different distributions.
- Could also ‘stack’ histograms so Spiral is added on top of Elliptical

# Counting Bacteria

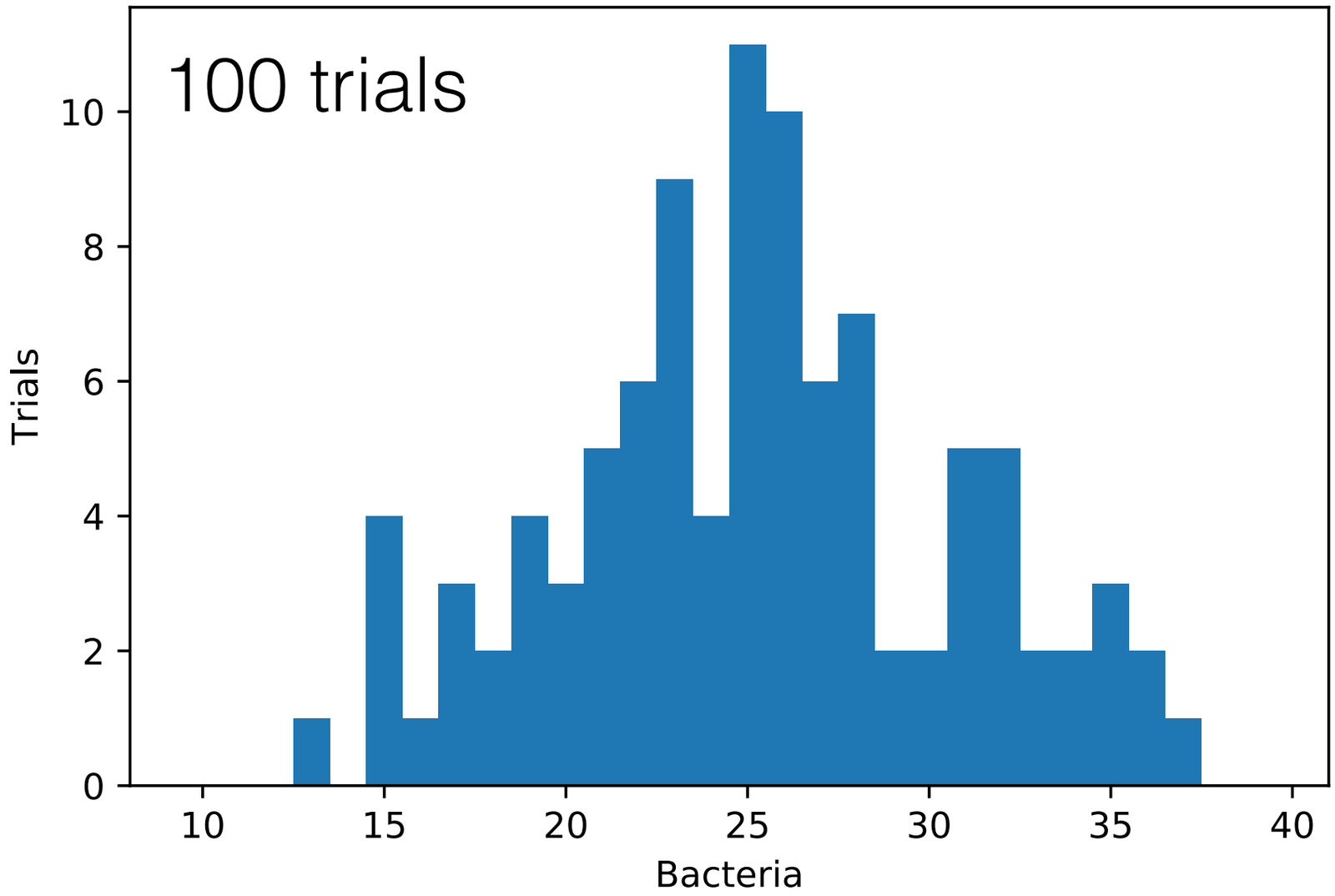
- Your friend works in a biology lab counting bacteria under a microscope

- For a given sample, there are usually around 25 bacteria per sample

- If they want to know the mean number to 1%, how many samples do they need?

Example of a counting problem…

# Counting Bacteria




$$\nu \approx 25 \qquad \sigma_\nu = \sqrt{\nu} \approx 5$$

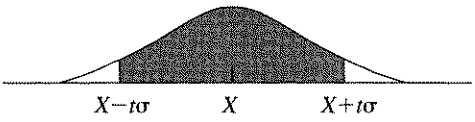
# Counting Bacteria II

- Counting their 101st sample, your friend finds 40 bacteria

- They are convinced there must be something wrong with the sample: “I have never seen a number this high”

- Do you agree with your friend’s assessment?

**Table A.** The percentage probability, $Prob(\text{within } t\sigma) = \int_{X-t\sigma}^{X+t\sigma} G_{X,\sigma}(x)\,dx$, as a function of $t$.




| $t$ | 0.00 | 0.01 | 0.02 | 0.03 | 0.04 | 0.05 | 0.06 | 0.07 | 0.08 | 0.09 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.0 | 0.00 | 0.80 | 1.60 | 2.39 | 3.19 | 3.99 | 4.78 | 5.58 | 6.38 | 7.17 |
| 0.1 | 7.97 | 8.76 | 9.55 | 10.34 | 11.13 | 11.92 | 12.71 | 13.50 | 14.28 | 15.07 |
| 0.2 | 15.85 | 16.63 | 17.41 | 18.19 | 18.97 | 19.74 | 20.51 | 21.28 | 22.05 | 22.82 |
| 0.3 | 23.58 | 24.34 | 25.10 | 25.86 | 26.61 | 27.37 | 28.12 | 28.86 | 29.61 | 30.35 |
| 0.4 | 31.08 | 31.82 | 32.55 | 33.28 | 34.01 | 34.73 | 35.45 | 36.16 | 36.88 | 37.59 |
| 0.5 | 38.29 | 38.99 | 39.69 | 40.39 | 41.08 | 41.77 | 42.45 | 43.13 | 43.81 | 44.48 |
| 0.6 | 45.15 | 45.81 | 46.47 | 47.13 | 47.78 | 48.43 | 49.07 | 49.71 | 50.35 | 50.98 |
| 0.7 | 51.61 | 52.23 | 52.85 | 53.46 | 54.07 | 54.67 | 55.27 | 55.87 | 56.46 | 57.05 |
| 0.8 | 57.63 | 58.21 | 58.78 | 59.35 | 59.91 | 60.47 | 61.02 | 61.57 | 62.11 | 62.65 |
| 0.9 | 63.19 | 63.72 | 64.24 | 64.76 | 65.28 | 65.79 | 66.29 | 66.80 | 67.29 | 67.78 |
| 1.0 | 68.27 | 68.75 | 69.23 | 69.70 | 70.17 | 70.63 | 71.09 | 71.54 | 71.99 | 72.43 |
| 1.1 | 72.87 | 73.30 | 73.73 | 74.15 | 74.57 | 74.99 | 75.40 | 75.80 | 76.20 | 76.60 |
| 1.2 | 76.99 | 77.37 | 77.75 | 78.13 | 78.50 | 78.87 | 79.23 | 79.59 | 79.95 | 80.29 |
| 1.3 | 80.64 | 80.98 | 81.32 | 81.65 | 81.98 | 82.30 | 82.62 | 82.93 | 83.24 | 83.55 |
| 1.4 | 83.85 | 84.15 | 84.44 | 84.73 | 85.01 | 85.29 | 85.57 | 85.84 | 86.11 | 86.38 |
| 1.5 | 86.64 | 86.90 | 87.15 | 87.40 | 87.64 | 87.89 | 88.12 | 88.36 | 88.59 | 88.82 |
| 1.6 | 89.04 | 89.26 | 89.48 | 89.69 | 89.90 | 90.11 | 90.31 | 90.51 | 90.70 | 90.90 |
| 1.7 | 91.09 | 91.27 | 91.46 | 91.64 | 91.81 | 91.99 | 92.16 | 92.33 | 92.49 | 92.65 |
| 1.8 | 92.81 | 92.97 | 93.12 | 93.28 | 93.42 | 93.57 | 93.71 | 93.85 | 93.99 | 94.12 |
| 1.9 | 94.26 | 94.39 | 94.51 | 94.64 | 94.76 | 94.88 | 95.00 | 95.12 | 95.23 | 95.34 |
| 2.0 | 95.45 | 95.56 | 95.66 | 95.76 | 95.86 | 95.96 | 96.06 | 96.15 | 96.25 | 96.34 |
| 2.1 | 96.43 | 96.51 | 96.60 | 96.68 | 96.76 | 96.84 | 96.92 | 97.00 | 97.07 | 97.15 |
| 2.2 | 97.22 | 97.29 | 97.36 | 97.43 | 97.49 | 97.56 | 97.62 | 97.68 | 97.74 | 97.80 |
| 2.3 | 97.86 | 97.91 | 97.97 | 98.02 | 98.07 | 98.12 | 98.17 | 98.22 | 98.27 | 98.32 |
| 2.4 | 98.36 | 98.40 | 98.45 | 98.49 | 98.53 | 98.57 | 98.61 | 98.65 | 98.69 | 98.72 |
| 2.5 | 98.76 | 98.79 | 98.83 | 98.86 | 98.89 | 98.92 | 98.95 | 98.98 | 99.01 | 99.04 |
| 2.6 | 99.07 | 99.09 | 99.12 | 99.15 | 99.17 | 99.20 | 99.22 | 99.24 | 99.26 | 99.29 |
| 2.7 | 99.31 | 99.33 | 99.35 | 99.37 | 99.39 | 99.40 | 99.42 | 99.44 | 99.46 | 99.47 |
| 2.8 | 99.49 | 99.50 | 99.52 | 99.53 | 99.55 | 99.56 | 99.58 | 99.59 | 99.60 | 99.61 |
| 2.9 | 99.63 | 99.64 | 99.65 | 99.66 | 99.67 | 99.68 | 99.69 | 99.70 | 99.71 | 99.72 |
| 3.0 | 99.73 | | | | | | | | | |
| 3.5 | 99.95 | | | | | | | | | |
| 4.0 | 99.994 | | | | | | | | | |
| 4.5 | 99.9993 | | | | | | | | | |
| 5.0 | 99.99994 | | | | | | | | | |