

Olasılık Biliniyorsa Z değerinin Bulunması

$P(Z > a) = 0,063$ ise $a = ?$,

Tablonun içinden 0.063 bulunarak buna karşılık gelen sol kenardaki ve üstteki değer okunur. $a = 1,53$ olur.

- $X \sim N(5,9)$ ise $P(X > a) = 0,1587$ $a = ?$, önce standart Normal'e dönüşüm yapılır. Sonra tablo kullanılır.

| | | |
|-----|---|-------|
| Z | | 0.03 |
| | | ↑ |
| 1.5 | ← | 0.063 |

$$P\left(\frac{X-\mu}{\sigma} < \frac{a-\mu}{\sigma}\right) = P\left(Z > \frac{a-5}{3}\right) = 0,1587$$

olasılığı 0.1587 olan Z tablo değeri 1' dir . Bu nedenle $\frac{a-5}{3} = 1$ çözümlerse, $a = 3 + 5 = 8$ olur

Örnek 6.2. Klinik semptomlara göre felcin sebebini ortaya koymak zordur. Bunun için anjio (angiogram) yapmak gerekir. Bunun da belirli riskleri vardır. Bu test yerine beyindeki CBF (cerabralbloodflow) değerini ölçmek teşhise yardımcı olmaktadır. Toplumda CBF in ortalamasının 75 ve standart sapmasının 17 olduğu bilinmektedir. CBF değeri 40 altına düşerse tehlikeli bölgeye girilmiş demektir. Bu toplumdaki tesadüfen çekilen bir şahsın 40' in altında CBF değerine sahip olma olasılığı nedir?

$X \sim N(75, 17^2)$ olduğuna göre, $P(X < 40) = ?$

$$P(X < 40) = P[Z < (40-75)/17] = P(Z < -2.06) = P[Z > 2.06]$$

$$= 0,0197$$

yani tesadüfen çekilen şahsın CBF inin 40 in altında bulunması olasılığı % 1,97 dir.

Örnek 6.3. Bir şahsın DBP (Diastolic(küçük) kan basıncı) 90 ile 100 mm Hg civarında ise bu kişi yüksek tansiyon sınırındadır denir. 35-44 yaş grubundaki erkeklerde DBP değerleri Normal dağılışı gösterir, ortalaması 80 ve varyansı 144 dür. Bu toplumdaki tesadüfen seçilen bir şahsın yüksek tansiyon sınırında olma olasılığı nedir?

X : (DBP değerleri) $\sim N(80, 144)$, $P(90 < X < 100) = ?$

$$P(90 < X < 100) = P\left(\frac{90-80}{\sqrt{144}} < \frac{X-\mu}{\sigma} < \frac{100-80}{\sqrt{144}}\right)$$

$$P\left(\frac{10}{12} < Z < \frac{20}{12}\right) = P(0.83 < Z < 1.67)$$

$$P(Z > 0.83) - P(Z > 1.67) = 0.2033 - 0.0475 \\ = 0.1555, \text{ yani } \%15.55 \text{ dir.}$$

Örnek 6.4. “Glaucoma” göz içi basınçla ilgili bir hastalıktır. Toplumda göz içi basıncın değerinin 16 mm Hg ortalama ve 3 mm Hg standart sapma ile Normal dağılış gösterdiği bilinmektedir. Eğer basınç değerleri 12 mm Hg ile 20 mm Hg arasında ise sağlıklı kabul edilmektedir. Buna göre Toplumun % kaç bu değerler arasında bulunmaktadır?

$X \sim$ Normal dağılış, $\mu=16$, $\sigma=3$, $X \sim N(16,9)$

$$P(12 \leq X \leq 20) = P\left[\frac{(12-16)}{3} \leq \frac{(X-\mu)}{\sigma} \leq \frac{(20-16)}{3}\right]$$

$$P\left[-\frac{4}{3} \leq Z \leq \frac{4}{3}\right] = P(-1,33 \leq Z \leq 1,33)$$

$$= 1 - 2 \cdot P(Z > 1,33) = 1 - 2 \cdot 0,0918 = 0,8164$$

yani %81,64 sağlıklıdır.

Örnek 6.5. İstatistik final sınavında aritmetik ortalama 72, standart sapmada 15 bulunmuştur. a) 60 b) 93

puan alan öğrencilerin standart puan derecelerini bulunuz?

$$Z = \frac{X-\mu}{\sigma} = \frac{60-72}{15} = -0,8 \quad Z = \frac{93-72}{15} = 1,4$$

Örnek 6.6. Bir fabrikada üretilen akülerin dayanma süreleri normal bölünmekte olup, ortalama dayanma süresi 800 saat ve standart sapma 72 saat olarak hesaplanmıştır. Üretimden alınacak herhangi bir akünün 764-872 saat arasında dayanma olasılığını bulunuz?

$$Z = \frac{X-\mu}{\sigma} = \frac{764-800}{72} = -0,50 \quad P(-0,50 < Z < 0) = 0,1915$$

$$Z = \frac{872-800}{72} = 1,00 \quad P(0 < Z < 1) = 0,3413$$

$$P(-0,50 < Z < 1) = P(-0,50 < Z < 0) + P(0 < Z < 1) \\ = 0,1915 + 0,3413 = 0,5328$$

Örnek 6.7. 300 öğrenciye uygulanan zeka testi sonuçları normal dağılım göstermektedir. Puanların ortalaması 100 ve varyansı 144 ise;

a) 105 puandan aşağı olan öğrenci sayısını,

b) 90 ile 110 puan arasında not alan öğrenci sayılarını bulunuz?

$$\text{a)} \quad Z = \frac{X - \mu}{\sigma} = \frac{105 - 100}{12} = 0.42$$

$$P(Z < 0.42) = 0.6628 \quad 0,6628 \times 300 = 199 \text{kişi}$$

$$\text{b)} \quad Z_{alt} = \frac{X - \mu}{\sigma} = \frac{90 - 100}{12} = -0,83 \quad Z_{ust} = \frac{110 - 100}{12} = 0,83$$

$$P(-0,83 < Z < 0,83) = 0,5934 \quad 0,5934 \times 300 = 178 \text{kişi}$$

Örnek 6.8. 300 öğrenciye uygulanan zeka testi sonuçları normal dağılım göstermektedir. Puanların ortalaması 100 ve varyansı 144 ise;

a) 105 puandan aşağı olan öğrenci sayısını,

b) 90 ile 110 puan arasında not alan öğrenci sayılarını bulunuz?

$$\text{a)} \quad Z = \frac{X - \mu}{\sigma} = \frac{105 - 100}{12} = 0.42$$

$$P(Z < 0.42) = 0.6628 \quad 0,6628 \times 300 = 199 \text{kişi}$$

$$\text{b)} \quad Z_{alt} = \frac{X - \mu}{\sigma} = \frac{90 - 100}{12} = -0,83 \quad Z_{ust} = \frac{110 - 100}{12} = 0,83$$

$$P(-0,83 < Z < 0,83) = 0,5934 \quad 0,5934 \times 300 = 178 \text{kişi}$$

Örnek 6.9. Bir gazetecinin her gün dağıttığı gazeteler için sarf etmiş olduğu zaman (dk) normal dağılım göstermekte olup, günlük ortalama zaman sarfiyatı 12 dk ve standart sapması ise 2 dk'dır. Buna göre 1 yıl boyunca gazete dağıtımının;

- a) 17 dk. dan fazla sürdüğü gün sayısını,
 - b) 10 dk. dan az sürdüğü gün sayısını,
 - c) 9 ile 13 dk. arasında gerçekleşen gün sayısını
- bulunuz?

$$\text{a)} \quad Z = \frac{X - \mu}{\sigma} = \frac{17 - 12}{2} = 2,5$$

$$P(X > 17) = P(Z > 2,5) = 0,0062 \quad 0,0062 \times 365 \sim 2 \text{ gün}$$

$$\text{b)} \quad Z = \frac{10 - 12}{2} = -1$$

$$P(X < 10) = P(Z < -1) = P(Z > 1) = 0,1587 \quad 0,1587 \times 365 \sim 58 \text{ gün}$$

$$Z_{alt} = \frac{9 - 12}{2} = -1,5 \quad Z_{ust} = \frac{13 - 12}{2} = 0,5$$

$$P(9 < X < 13) = P(-1,5 < Z < 0,5) = 0,6247 \quad 0,6247 \times 365 = 228 \text{ gün}$$

Örnek 6.10. Bir tarlada yetiştirilen buğday bitkisinin uzunlukları normal dağılım göstermekte olup, ortalaması μ ve standart sapması 6 cm dir. Aynı zamanda ürünlerin %4,78'inin 82 cm den büyük olduğu bilinmektedir. Buna göre yığın ortalamasının kaç cm olduğunu tahmin ediniz?

$$X \sim N(\mu, 36) \quad \text{ve} \quad P(X > 82) = 0,0478$$

$$P(X > 82) = P\left(\frac{X - \mu}{\sigma} > \frac{82 - \mu}{6}\right) = 1 - P(Z < \frac{82 - \mu}{6}) = 0,0478$$

$$P(Z < \frac{82 - \mu}{6}) = 0,9522 \quad P(1,67) = 0,9522$$

$$\frac{82 - \mu}{6} = 1,67 \Rightarrow \mu = 72 \text{ cm}$$

Z TABLOSU

Areas Under the Normal Curve

| Z | Cum p | Tail p | Z | Cum p | Tail p | Z | Cum p | Tail p | Z | Cum p | Tail p | Z | Cum p | Tail p |
|------|--------|--------|------|--------|--------|------|--------|--------|------|--------|--------|------|--------|--------|
| 0.00 | 0.5000 | 0.5000 | 0.40 | 0.6554 | 0.3446 | 0.80 | 0.7881 | 0.2119 | 1.20 | 0.8849 | 0.1151 | 1.60 | 0.9452 | 0.0548 |
| 0.01 | 0.5040 | 0.4960 | 0.41 | 0.6591 | 0.3409 | 0.81 | 0.7910 | 0.2090 | 1.21 | 0.8869 | 0.1131 | 1.61 | 0.9463 | 0.0537 |
| 0.02 | 0.5080 | 0.4920 | 0.42 | 0.6628 | 0.3372 | 0.82 | 0.7939 | 0.2061 | 1.22 | 0.8888 | 0.1112 | 1.62 | 0.9474 | 0.0526 |
| 0.03 | 0.5120 | 0.4880 | 0.43 | 0.6664 | 0.3336 | 0.83 | 0.7967 | 0.2033 | 1.23 | 0.8907 | 0.1093 | 1.63 | 0.9484 | 0.0516 |
| 0.04 | 0.5160 | 0.4840 | 0.44 | 0.6700 | 0.3300 | 0.84 | 0.7995 | 0.2005 | 1.24 | 0.8925 | 0.1075 | 1.64 | 0.9495 | 0.0505 |
| 0.05 | 0.5199 | 0.4801 | 0.45 | 0.6736 | 0.3264 | 0.85 | 0.8023 | 0.1977 | 1.25 | 0.8944 | 0.1056 | 1.65 | 0.9505 | 0.0495 |
| 0.06 | 0.5239 | 0.4761 | 0.46 | 0.6772 | 0.3228 | 0.86 | 0.8051 | 0.1949 | 1.26 | 0.8962 | 0.1038 | 1.66 | 0.9515 | 0.0485 |
| 0.07 | 0.5279 | 0.4721 | 0.47 | 0.6808 | 0.3192 | 0.87 | 0.8078 | 0.1922 | 1.27 | 0.8980 | 0.1020 | 1.67 | 0.9525 | 0.0475 |
| 0.08 | 0.5319 | 0.4681 | 0.48 | 0.6844 | 0.3156 | 0.88 | 0.8106 | 0.1894 | 1.28 | 0.8997 | 0.1003 | 1.68 | 0.9535 | 0.0465 |
| 0.09 | 0.5359 | 0.4641 | 0.49 | 0.6879 | 0.3121 | 0.89 | 0.8133 | 0.1867 | 1.29 | 0.9015 | 0.0985 | 1.69 | 0.9545 | 0.0455 |
| 0.10 | 0.5398 | 0.4602 | 0.50 | 0.6915 | 0.3085 | 0.90 | 0.8159 | 0.1841 | 1.30 | 0.9032 | 0.0968 | 1.70 | 0.9554 | 0.0446 |
| 0.11 | 0.5438 | 0.4562 | 0.51 | 0.6950 | 0.3050 | 0.91 | 0.8186 | 0.1814 | 1.31 | 0.9049 | 0.0951 | 1.71 | 0.9564 | 0.0436 |
| 0.12 | 0.5478 | 0.4522 | 0.52 | 0.6985 | 0.3015 | 0.92 | 0.8212 | 0.1788 | 1.32 | 0.9066 | 0.0934 | 1.72 | 0.9573 | 0.0427 |
| 0.13 | 0.5517 | 0.4483 | 0.53 | 0.7019 | 0.2981 | 0.93 | 0.8238 | 0.1762 | 1.33 | 0.9082 | 0.0918 | 1.73 | 0.9582 | 0.0418 |
| 0.14 | 0.5557 | 0.4443 | 0.54 | 0.7054 | 0.2946 | 0.94 | 0.8264 | 0.1736 | 1.34 | 0.9099 | 0.0901 | 1.74 | 0.9591 | 0.0409 |
| 0.15 | 0.5596 | 0.4404 | 0.55 | 0.7088 | 0.2912 | 0.95 | 0.8289 | 0.1711 | 1.35 | 0.9115 | 0.0885 | 1.75 | 0.9599 | 0.0401 |
| 0.16 | 0.5636 | 0.4364 | 0.56 | 0.7123 | 0.2877 | 0.96 | 0.8315 | 0.1685 | 1.36 | 0.9131 | 0.0869 | 1.76 | 0.9608 | 0.0392 |
| 0.17 | 0.5675 | 0.4325 | 0.57 | 0.7157 | 0.2843 | 0.97 | 0.8340 | 0.1660 | 1.37 | 0.9147 | 0.0853 | 1.77 | 0.9616 | 0.0384 |
| 0.18 | 0.5714 | 0.4286 | 0.58 | 0.7190 | 0.2810 | 0.98 | 0.8365 | 0.1635 | 1.38 | 0.9162 | 0.0838 | 1.78 | 0.9625 | 0.0375 |
| 0.19 | 0.5753 | 0.4247 | 0.59 | 0.7224 | 0.2776 | 0.99 | 0.8389 | 0.1611 | 1.39 | 0.9177 | 0.0823 | 1.79 | 0.9633 | 0.0367 |
| 0.20 | 0.5793 | 0.4207 | 0.60 | 0.7257 | 0.2743 | 1.00 | 0.8413 | 0.1587 | 1.40 | 0.9192 | 0.0808 | 1.80 | 0.9641 | 0.0359 |
| 0.21 | 0.5832 | 0.4168 | 0.61 | 0.7291 | 0.2709 | 1.01 | 0.8438 | 0.1562 | 1.41 | 0.9207 | 0.0793 | 1.81 | 0.9649 | 0.0351 |
| 0.22 | 0.5871 | 0.4129 | 0.62 | 0.7324 | 0.2676 | 1.02 | 0.8461 | 0.1539 | 1.42 | 0.9222 | 0.0778 | 1.82 | 0.9656 | 0.0344 |
| 0.23 | 0.5910 | 0.4090 | 0.63 | 0.7357 | 0.2643 | 1.03 | 0.8485 | 0.1515 | 1.43 | 0.9236 | 0.0764 | 1.83 | 0.9664 | 0.0336 |
| 0.24 | 0.5948 | 0.4052 | 0.64 | 0.7389 | 0.2611 | 1.04 | 0.8508 | 0.1492 | 1.44 | 0.9251 | 0.0749 | 1.84 | 0.9671 | 0.0329 |
| 0.25 | 0.5987 | 0.4013 | 0.65 | 0.7422 | 0.2578 | 1.05 | 0.8531 | 0.1469 | 1.45 | 0.9265 | 0.0735 | 1.85 | 0.9678 | 0.0322 |
| 0.26 | 0.6026 | 0.3974 | 0.66 | 0.7454 | 0.2546 | 1.06 | 0.8554 | 0.1446 | 1.46 | 0.9279 | 0.0721 | 1.86 | 0.9686 | 0.0314 |
| 0.27 | 0.6064 | 0.3936 | 0.67 | 0.7486 | 0.2514 | 1.07 | 0.8577 | 0.1423 | 1.47 | 0.9292 | 0.0708 | 1.87 | 0.9693 | 0.0307 |
| 0.28 | 0.6103 | 0.3897 | 0.68 | 0.7517 | 0.2483 | 1.08 | 0.8599 | 0.1401 | 1.48 | 0.9306 | 0.0694 | 1.88 | 0.9699 | 0.0301 |
| 0.29 | 0.6141 | 0.3859 | 0.69 | 0.7549 | 0.2451 | 1.09 | 0.8621 | 0.1379 | 1.49 | 0.9319 | 0.0681 | 1.89 | 0.9706 | 0.0294 |
| 0.30 | 0.6179 | 0.3821 | 0.70 | 0.7580 | 0.2420 | 1.10 | 0.8643 | 0.1357 | 1.50 | 0.9332 | 0.0668 | 1.90 | 0.9713 | 0.0287 |
| 0.31 | 0.6217 | 0.3783 | 0.71 | 0.7611 | 0.2389 | 1.11 | 0.8665 | 0.1335 | 1.51 | 0.9345 | 0.0655 | 1.91 | 0.9719 | 0.0281 |
| 0.32 | 0.6255 | 0.3745 | 0.72 | 0.7642 | 0.2358 | 1.12 | 0.8686 | 0.1314 | 1.52 | 0.9357 | 0.0643 | 1.92 | 0.9726 | 0.0274 |
| 0.33 | 0.6293 | 0.3707 | 0.73 | 0.7673 | 0.2327 | 1.13 | 0.8708 | 0.1292 | 1.53 | 0.9370 | 0.0630 | 1.93 | 0.9732 | 0.0268 |
| 0.34 | 0.6331 | 0.3669 | 0.74 | 0.7704 | 0.2296 | 1.14 | 0.8729 | 0.1271 | 1.54 | 0.9382 | 0.0618 | 1.94 | 0.9738 | 0.0262 |
| 0.35 | 0.6368 | 0.3632 | 0.75 | 0.7734 | 0.2266 | 1.15 | 0.8749 | 0.1251 | 1.55 | 0.9394 | 0.0606 | 1.95 | 0.9744 | 0.0256 |
| 0.36 | 0.6406 | 0.3594 | 0.76 | 0.7764 | 0.2236 | 1.16 | 0.8770 | 0.1230 | 1.56 | 0.9406 | 0.0594 | 1.96 | 0.9750 | 0.0250 |
| 0.37 | 0.6443 | 0.3557 | 0.77 | 0.7794 | 0.2206 | 1.17 | 0.8790 | 0.1210 | 1.57 | 0.9418 | 0.0582 | 1.97 | 0.9756 | 0.0244 |
| 0.38 | 0.6480 | 0.3520 | 0.78 | 0.7823 | 0.2177 | 1.18 | 0.8810 | 0.1190 | 1.58 | 0.9429 | 0.0571 | 1.98 | 0.9761 | 0.0239 |
| 0.39 | 0.6517 | 0.3483 | 0.79 | 0.7852 | 0.2148 | 1.19 | 0.8830 | 0.1170 | 1.59 | 0.9441 | 0.0559 | 1.99 | 0.9767 | 0.0233 |

| Z | Cum p | Tail p | Z | Cum p | Tail p | Z | Cum p | Tail p | Z | Cum p | Tail p |
|------|--------|--------|------|--------|--------|------|--------|--------|------|--------|--------|
| 2.00 | 0.9772 | 0.0228 | 2.40 | 0.9918 | 0.0082 | 2.80 | 0.9974 | 0.0026 | 3.20 | 0.9993 | 0.0007 |
| 2.01 | 0.9778 | 0.0222 | 2.41 | 0.9920 | 0.0080 | 2.81 | 0.9975 | 0.0025 | 3.21 | 0.9993 | 0.0007 |
| 2.02 | 0.9783 | 0.0217 | 2.42 | 0.9922 | 0.0078 | 2.82 | 0.9976 | 0.0024 | 3.22 | 0.9994 | 0.0006 |
| 2.03 | 0.9788 | 0.0212 | 2.43 | 0.9925 | 0.0075 | 2.83 | 0.9977 | 0.0023 | 3.23 | 0.9994 | 0.0006 |
| 2.04 | 0.9793 | 0.0207 | 2.44 | 0.9927 | 0.0073 | 2.84 | 0.9977 | 0.0023 | 3.24 | 0.9994 | 0.0006 |
| 2.05 | 0.9798 | 0.0202 | 2.45 | 0.9929 | 0.0071 | 2.85 | 0.9978 | 0.0022 | 3.25 | 0.9994 | 0.0006 |
| 2.06 | 0.9803 | 0.0197 | 2.46 | 0.9931 | 0.0069 | 2.86 | 0.9979 | 0.0021 | 3.26 | 0.9994 | 0.0006 |
| 2.07 | 0.9808 | 0.0192 | 2.47 | 0.9932 | 0.0068 | 2.87 | 0.9979 | 0.0021 | 3.27 | 0.9995 | 0.0005 |
| 2.08 | 0.9812 | 0.0188 | 2.48 | 0.9934 | 0.0066 | 2.88 | 0.9980 | 0.0020 | 3.28 | 0.9995 | 0.0005 |
| 2.09 | 0.9817 | 0.0183 | 2.49 | 0.9936 | 0.0064 | 2.89 | 0.9981 | 0.0019 | 3.29 | 0.9995 | 0.0005 |
| 2.10 | 0.9821 | 0.0179 | 2.50 | 0.9938 | 0.0062 | 2.90 | 0.9981 | 0.0019 | 3.30 | 0.9995 | 0.0005 |
| 2.11 | 0.9826 | 0.0174 | 2.51 | 0.9940 | 0.0060 | 2.91 | 0.9982 | 0.0018 | 3.31 | 0.9995 | 0.0005 |
| 2.12 | 0.9830 | 0.0170 | 2.52 | 0.9941 | 0.0059 | 2.92 | 0.9982 | 0.0018 | 3.32 | 0.9995 | 0.0005 |
| 2.13 | 0.9834 | 0.0166 | 2.53 | 0.9943 | 0.0057 | 2.93 | 0.9983 | 0.0017 | 3.33 | 0.9996 | 0.0004 |
| 2.14 | 0.9838 | 0.0162 | 2.54 | 0.9945 | 0.0055 | 2.94 | 0.9984 | 0.0016 | 3.34 | 0.9996 | 0.0004 |
| 2.15 | 0.9842 | 0.0158 | 2.55 | 0.9946 | 0.0054 | 2.95 | 0.9984 | 0.0016 | 3.35 | 0.9996 | 0.0004 |
| 2.16 | 0.9846 | 0.0154 | 2.56 | 0.9948 | 0.0052 | 2.96 | 0.9985 | 0.0015 | 3.36 | 0.9996 | 0.0004 |
| 2.17 | 0.9850 | 0.0150 | 2.57 | 0.9949 | 0.0051 | 2.97 | 0.9985 | 0.0015 | 3.37 | 0.9996 | 0.0004 |
| 2.18 | 0.9854 | 0.0146 | 2.58 | 0.9951 | 0.0049 | 2.98 | 0.9986 | 0.0014 | 3.38 | 0.9996 | 0.0004 |
| 2.19 | 0.9857 | 0.0143 | 2.59 | 0.9952 | 0.0048 | 2.99 | 0.9986 | 0.0014 | 3.39 | 0.9997 | 0.0003 |
| 2.20 | 0.9861 | 0.0139 | 2.60 | 0.9953 | 0.0047 | 3.00 | 0.9987 | 0.0013 | 3.40 | 0.9997 | 0.0003 |
| 2.21 | 0.9864 | 0.0136 | 2.61 | 0.9955 | 0.0045 | 3.01 | 0.9987 | 0.0013 | 3.41 | 0.9997 | 0.0003 |
| 2.22 | 0.9868 | 0.0132 | 2.62 | 0.9956 | 0.0044 | 3.02 | 0.9987 | 0.0013 | 3.42 | 0.9997 | 0.0003 |
| 2.23 | 0.9871 | 0.0129 | 2.63 | 0.9957 | 0.0043 | 3.03 | 0.9988 | 0.0012 | 3.43 | 0.9997 | 0.0003 |
| 2.24 | 0.9875 | 0.0125 | 2.64 | 0.9959 | 0.0041 | 3.04 | 0.9988 | 0.0012 | 3.44 | 0.9997 | 0.0003 |
| 2.25 | 0.9878 | 0.0122 | 2.65 | 0.9960 | 0.0040 | 3.05 | 0.9989 | 0.0011 | 3.45 | 0.9997 | 0.0003 |
| 2.26 | 0.9881 | 0.0119 | 2.66 | 0.9961 | 0.0039 | 3.06 | 0.9989 | 0.0011 | 3.46 | 0.9997 | 0.0003 |
| 2.27 | 0.9884 | 0.0116 | 2.67 | 0.9962 | 0.0038 | 3.07 | 0.9989 | 0.0011 | 3.47 | 0.9997 | 0.0003 |
| 2.28 | 0.9887 | 0.0113 | 2.68 | 0.9963 | 0.0037 | 3.08 | 0.9990 | 0.0010 | 3.48 | 0.9997 | 0.0003 |
| 2.29 | 0.9890 | 0.0110 | 2.69 | 0.9964 | 0.0036 | 3.09 | 0.9990 | 0.0010 | 3.49 | 0.9998 | 0.0002 |
| 2.30 | 0.9893 | 0.0107 | 2.70 | 0.9965 | 0.0035 | 3.10 | 0.9990 | 0.0010 | 3.50 | 0.9998 | 0.0002 |
| 2.31 | 0.9896 | 0.0104 | 2.71 | 0.9966 | 0.0034 | 3.11 | 0.9991 | 0.0009 | | | |
| 2.32 | 0.9898 | 0.0102 | 2.72 | 0.9967 | 0.0033 | 3.12 | 0.9991 | 0.0009 | 3.60 | 0.9998 | 0.0002 |
| 2.33 | 0.9901 | 0.0099 | 2.73 | 0.9968 | 0.0032 | 3.13 | 0.9991 | 0.0009 | 3.70 | 0.9999 | 0.0001 |
| 2.34 | 0.9904 | 0.0096 | 2.74 | 0.9969 | 0.0031 | 3.14 | 0.9992 | 0.0008 | 3.80 | 0.9999 | 0.0001 |
| 2.35 | 0.9906 | 0.0094 | 2.75 | 0.9970 | 0.0030 | 3.15 | 0.9992 | 0.0008 | 3.90 | 1.0000 | 0.0000 |
| 2.36 | 0.9909 | 0.0091 | 2.76 | 0.9971 | 0.0029 | 3.16 | 0.9992 | 0.0008 | | | |
| 2.37 | 0.9911 | 0.0089 | 2.77 | 0.9972 | 0.0028 | 3.17 | 0.9992 | 0.0008 | | | |
| 2.38 | 0.9913 | 0.0087 | 2.78 | 0.9973 | 0.0027 | 3.18 | 0.9993 | 0.0007 | | | |
| 2.39 | 0.9916 | 0.0084 | 2.79 | 0.9974 | 0.0026 | 3.19 | 0.9993 | 0.0007 | | | |

Z Tablosu

| z | 0 | 0.01 | 0.02 | 0.03 | 0.04 | 0.05 | 0.06 | 0.07 | 0.08 | 0.09 |
|-----|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| 0.0 | 0.5000 | 0.4960 | 0.4920 | 0.4880 | 0.4840 | 0.4801 | 0.4761 | 0.4721 | 0.4681 | 0.4641 |
| 0.1 | 0.4602 | 0.4562 | 0.4522 | 0.4483 | 0.4443 | 0.4404 | 0.4364 | 0.4325 | 0.4286 | 0.4247 |
| 0.2 | 0.4207 | 0.4168 | 0.4129 | 0.4090 | 0.4052 | 0.4013 | 0.3974 | 0.3936 | 0.3897 | 0.3859 |
| 0.3 | 0.3821 | 0.3783 | 0.3745 | 0.3707 | 0.3669 | 0.3632 | 0.3594 | 0.3557 | 0.3520 | 0.3483 |
| 0.4 | 0.3446 | 0.3409 | 0.3372 | 0.3336 | 0.3300 | 0.3264 | 0.3228 | 0.3192 | 0.3156 | 0.3121 |
| 0.5 | 0.3085 | 0.3050 | 0.3015 | 0.2981 | 0.2946 | 0.2912 | 0.2877 | 0.2843 | 0.2810 | 0.2776 |
| 0.6 | 0.2743 | 0.2709 | 0.2676 | 0.2643 | 0.2611 | 0.2578 | 0.2546 | 0.2514 | 0.2483 | 0.2451 |
| 0.7 | 0.2420 | 0.2389 | 0.2358 | 0.2327 | 0.2297 | 0.2266 | 0.2236 | 0.2207 | 0.2177 | 0.2148 |
| 0.8 | 0.2119 | 0.2090 | 0.2061 | 0.2033 | 0.2005 | 0.1977 | 0.1949 | 0.1922 | 0.1894 | 0.1867 |
| 0.9 | 0.1841 | 0.1814 | 0.1788 | 0.1762 | 0.1736 | 0.1711 | 0.1685 | 0.1660 | 0.1635 | 0.1611 |
| 1.0 | 0.1587 | 0.1563 | 0.1539 | 0.1515 | 0.1492 | 0.1469 | 0.1446 | 0.1423 | 0.1401 | 0.1379 |
| 1.1 | 0.1357 | 0.1335 | 0.1314 | 0.1292 | 0.1271 | 0.1251 | 0.1230 | 0.1210 | 0.1190 | 0.1170 |
| 1.2 | 0.1151 | 0.1131 | 0.1112 | 0.1094 | 0.1075 | 0.1057 | 0.1038 | 0.1020 | 0.1003 | 0.0985 |
| 1.3 | 0.0968 | 0.0951 | 0.0934 | 0.0918 | 0.0901 | 0.0885 | 0.0869 | 0.0853 | 0.0838 | 0.0823 |
| 1.4 | 0.0808 | 0.0793 | 0.0778 | 0.0764 | 0.0749 | 0.0735 | 0.0721 | 0.0708 | 0.0694 | 0.0681 |
| 1.5 | 0.0668 | 0.0655 | 0.0643 | 0.0630 | 0.0618 | 0.0606 | 0.0594 | 0.0582 | 0.0571 | 0.0559 |
| 1.6 | 0.0548 | 0.0537 | 0.0526 | 0.0516 | 0.0505 | 0.0495 | 0.0485 | 0.0475 | 0.0465 | 0.0455 |
| 1.7 | 0.0446 | 0.0436 | 0.0427 | 0.0418 | 0.0409 | 0.0401 | 0.0392 | 0.0384 | 0.0375 | 0.0367 |
| 1.8 | 0.0359 | 0.0352 | 0.0344 | 0.0336 | 0.0329 | 0.0322 | 0.0314 | 0.0307 | 0.0301 | 0.0294 |
| 1.9 | 0.0287 | 0.0281 | 0.0274 | 0.0268 | 0.0262 | 0.0256 | 0.0250 | 0.0244 | 0.0239 | 0.0233 |
| 2.0 | 0.0228 | 0.0222 | 0.0217 | 0.0212 | 0.0207 | 0.0202 | 0.0197 | 0.0192 | 0.0188 | 0.0183 |
| 2.1 | 0.0179 | 0.0174 | 0.0170 | 0.0166 | 0.0162 | 0.0158 | 0.0154 | 0.0150 | 0.0146 | 0.0143 |
| 2.2 | 0.0139 | 0.0136 | 0.0132 | 0.0129 | 0.0126 | 0.0122 | 0.0119 | 0.0116 | 0.0113 | 0.0110 |
| 2.3 | 0.0107 | 0.0104 | 0.0102 | 0.0099 | 0.0096 | 0.0094 | 0.0091 | 0.0089 | 0.0087 | 0.0084 |
| 2.4 | 0.0082 | 0.0080 | 0.0078 | 0.0076 | 0.0073 | 0.0071 | 0.0070 | 0.0068 | 0.0066 | 0.0064 |
| 2.5 | 0.0062 | 0.0060 | 0.0059 | 0.0057 | 0.0055 | 0.0054 | 0.0052 | 0.0051 | 0.0049 | 0.0048 |
| 2.6 | 0.0047 | 0.0045 | 0.0044 | 0.0043 | 0.0042 | 0.0040 | 0.0039 | 0.0038 | 0.0037 | 0.0036 |
| 2.7 | 0.0035 | 0.0034 | 0.0033 | 0.0032 | 0.0031 | 0.0030 | 0.0029 | 0.0028 | 0.0027 | 0.0026 |
| 2.8 | 0.0026 | 0.0025 | 0.0024 | 0.0023 | 0.0023 | 0.0022 | 0.0021 | 0.0021 | 0.0020 | 0.0019 |
| 2.9 | 0.0019 | 0.0018 | 0.0018 | 0.0017 | 0.0016 | 0.0016 | 0.0015 | 0.0015 | 0.0014 | 0.0014 |
| 3.0 | 0.0014 | 0.0013 | 0.0013 | 0.0012 | 0.0012 | 0.0011 | 0.0011 | 0.0011 | 0.0010 | 0.0010 |
| 3.1 | 0.0010 | 0.0009 | 0.0009 | 0.0009 | 0.0008 | 0.0008 | 0.0008 | 0.0008 | 0.0007 | 0.0007 |
| 3.2 | 0.0007 | 0.0007 | 0.0006 | 0.0006 | 0.0006 | 0.0006 | 0.0006 | 0.0005 | 0.0005 | 0.0005 |
| 3.3 | 0.0005 | 0.0005 | 0.0005 | 0.0004 | 0.0004 | 0.0004 | 0.0004 | 0.0004 | 0.0004 | 0.0004 |
| 3.4 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0003 | 0.0002 |
| 3.5 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.0002 |
| 3.6 | 0.0002 | 0.0002 | 0.0002 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 |
| 3.7 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 |

| Z | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|-----|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| 0.0 | 0.0000 | 0.0040 | 0.0080 | 0.0120 | 0.0160 | 0.0199 | 0.0239 | 0.0279 | 0.0319 | 0.0359 |
| 0.1 | 0.0398 | 0.0438 | 0.0478 | 0.0517 | 0.0557 | 0.0596 | 0.0636 | 0.0675 | 0.0714 | 0.0753 |
| 0.2 | 0.0793 | 0.0832 | 0.0871 | 0.0910 | 0.0948 | 0.0987 | 0.1026 | 0.1064 | 0.1103 | 0.1141 |
| 0.3 | 0.1179 | 0.1217 | 0.1255 | 0.1293 | 0.1331 | 0.1368 | 0.1406 | 0.1443 | 0.1480 | 0.1517 |
| 0.4 | 0.1554 | 0.1591 | 0.1628 | 0.1664 | 0.1700 | 0.1736 | 0.1772 | 0.1808 | 0.1844 | 0.1879 |
| 0.5 | 0.1915 | 0.1950 | 0.1985 | 0.2019 | 0.2054 | 0.2088 | 0.2123 | 0.2157 | 0.2190 | 0.2224 |
| 0.6 | 0.2257 | 0.2291 | 0.2324 | 0.2357 | 0.2389 | 0.2422 | 0.2454 | 0.2486 | 0.2517 | 0.2549 |
| 0.7 | 0.2580 | 0.2611 | 0.2642 | 0.2673 | 0.2704 | 0.2734 | 0.2764 | 0.2794 | 0.2823 | 0.2852 |
| 0.8 | 0.2881 | 0.2910 | 0.2939 | 0.2967 | 0.2995 | 0.3023 | 0.3051 | 0.3078 | 0.3106 | 0.3133 |
| 0.9 | 0.3159 | 0.3186 | 0.3212 | 0.3238 | 0.3264 | 0.3289 | 0.3315 | 0.3340 | 0.3365 | 0.3389 |
| 1.0 | 0.3413 | 0.3438 | 0.3461 | 0.3485 | 0.3508 | 0.3531 | 0.3554 | 0.3577 | 0.3599 | 0.3621 |
| 1.1 | 0.3643 | 0.3665 | 0.3686 | 0.3708 | 0.3729 | 0.3749 | 0.3770 | 0.3790 | 0.3810 | 0.3830 |
| 1.2 | 0.3849 | 0.3869 | 0.3888 | 0.3907 | 0.3925 | 0.3944 | 0.3962 | 0.3980 | 0.3997 | 0.4015 |
| 1.3 | 0.4032 | 0.4049 | 0.4066 | 0.4082 | 0.4099 | 0.4115 | 0.4131 | 0.4147 | 0.4162 | 0.4177 |
| 1.4 | 0.4192 | 0.4207 | 0.4222 | 0.4236 | 0.4251 | 0.4265 | 0.4279 | 0.4292 | 0.4306 | 0.4319 |
| 1.5 | 0.4332 | 0.4345 | 0.4357 | 0.4370 | 0.4382 | 0.4394 | 0.4406 | 0.4418 | 0.4429 | 0.4441 |
| 1.6 | 0.4452 | 0.4463 | 0.4474 | 0.4484 | 0.4495 | 0.4505 | 0.4515 | 0.4525 | 0.4535 | 0.4545 |
| 1.7 | 0.4554 | 0.4564 | 0.4573 | 0.4582 | 0.4591 | 0.4599 | 0.4608 | 0.4616 | 0.4625 | 0.4633 |
| 1.8 | 0.4641 | 0.4649 | 0.4656 | 0.4664 | 0.4671 | 0.4678 | 0.4686 | 0.4693 | 0.4699 | 0.4706 |
| 1.9 | 0.4713 | 0.4719 | 0.4726 | 0.4732 | 0.4738 | 0.4744 | 0.4750 | 0.4756 | 0.4761 | 0.4767 |
| 2.0 | 0.4772 | 0.4778 | 0.4783 | 0.4788 | 0.4793 | 0.4798 | 0.4803 | 0.4808 | 0.4812 | 0.4817 |
| 2.1 | 0.4821 | 0.4826 | 0.4830 | 0.4834 | 0.4838 | 0.4842 | 0.4846 | 0.4850 | 0.4854 | 0.4857 |
| 2.2 | 0.4861 | 0.4864 | 0.4868 | 0.4871 | 0.4875 | 0.4878 | 0.4881 | 0.4884 | 0.4887 | 0.4890 |
| 2.3 | 0.4893 | 0.4896 | 0.4898 | 0.4901 | 0.4904 | 0.4906 | 0.4909 | 0.4911 | 0.4913 | 0.4916 |
| 2.4 | 0.4918 | 0.4920 | 0.4922 | 0.4925 | 0.4927 | 0.4929 | 0.4931 | 0.4932 | 0.4934 | 0.4936 |
| 2.5 | 0.4938 | 0.4940 | 0.4941 | 0.4943 | 0.4945 | 0.4946 | 0.4948 | 0.4949 | 0.4951 | 0.4952 |
| 2.6 | 0.4953 | 0.4955 | 0.4956 | 0.4957 | 0.4959 | 0.4960 | 0.4961 | 0.4962 | 0.4963 | 0.4964 |
| 2.7 | 0.4965 | 0.4966 | 0.4967 | 0.4968 | 0.4969 | 0.4970 | 0.4971 | 0.4972 | 0.4973 | 0.4974 |
| 2.8 | 0.4974 | 0.4975 | 0.4976 | 0.4977 | 0.4977 | 0.4978 | 0.4979 | 0.4979 | 0.4980 | 0.4981 |
| 2.9 | 0.4981 | 0.4982 | 0.4982 | 0.4983 | 0.4984 | 0.4984 | 0.4985 | 0.4985 | 0.4986 | 0.4986 |
| 3.0 | 0.4987 | 0.4987 | 0.4987 | 0.4988 | 0.4988 | 0.4989 | 0.4989 | 0.4989 | 0.4990 | 0.4990 |
| 3.1 | 0.4990 | 0.4991 | 0.4991 | 0.4991 | 0.4992 | 0.4992 | 0.4992 | 0.4992 | 0.4993 | 0.4993 |
| 3.2 | 0.4993 | 0.4993 | 0.4994 | 0.4994 | 0.4994 | 0.4994 | 0.4994 | 0.4995 | 0.4995 | 0.4995 |
| 3.3 | 0.4995 | 0.4995 | 0.4995 | 0.4996 | 0.4996 | 0.4996 | 0.4996 | 0.4996 | 0.4996 | 0.4997 |
| 3.4 | 0.4997 | 0.4997 | 0.4997 | 0.4997 | 0.4997 | 0.4997 | 0.4997 | 0.4997 | 0.4997 | 0.4998 |
| 3.5 | 0.4998 | 0.4998 | 0.4998 | 0.4998 | 0.4998 | 0.4998 | 0.4998 | 0.4998 | 0.4998 | 0.4998 |