# Statistics for Social Sciences I

## Test 2 (B)

**Name:** _____

**Group:** _____ **Date:** _____

**PROBLEM 1.** The following tables come from a 2010 YouGov survey carried out for the Daily Telegraph about opinions on euthanasia and assisted suicide in the UK.

**Sample Size: 2053 GB Adults**
**Fieldwork: 26th - 28th January 2010**

| | | Gender | | Age | | | Social grade | | Region | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total | Male | Female | 18-34 | 35-54 | 55+ | ABC1 | C2DE | London | Rest of South | Midlands / Wales | North | Scotland |
| Weighted Sample | 2053 | 985 | 1068 | 604 | 731 | 718 | 1128 | 925 | 263 | 668 | 439 | 506 | 178 |

**Assisting a suicide is a criminal offence punishable by 14 years in prison. Do you believe the law on assisted suicide should...?**

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Remain as it is - to change it would be to start down a dangerously slippery slope | 13 | 15 | 11 | 13 | 11 | 15 | 14 | 11 | 15 | 14 | 10 | 11 | 17 |
| Be amended to allow some people, such as doctors and/or close relatives to assist a suicide in particular circumstances | 75 | 72 | 78 | 72 | 78 | 75 | 76 | 74 | 68 | 75 | 79 | 76 | 72 |
| Be abolished altogether | 7 | 8 | 6 | 6 | 7 | 8 | 6 | 8 | 7 | 7 | 6 | 9 | 6 |
| Don't know | 5 | 5 | 5 | 9 | 4 | 3 | 4 | 7 | 10 | 4 | 5 | 4 | 5 |

Note that in the second table, all of the columns are percentages and sum to 100%

**a)** Classify the type of the variable "belief on the law of assisted suicide" discussed in this table as Qualitative or Quantitative and nominal, ordinal, discrete, continuous or mixed.

(To do this you should ignore the possible response "Don't know".)

(0.5 points)

**b)** If one of the people in the study is chosen at random, calculate the probability that they come from London.

(0.5 points)

**c)** Given that they are from London, what is the chance they believe that the law on assisted suicide should be abolished altogether?

(0.5 points)

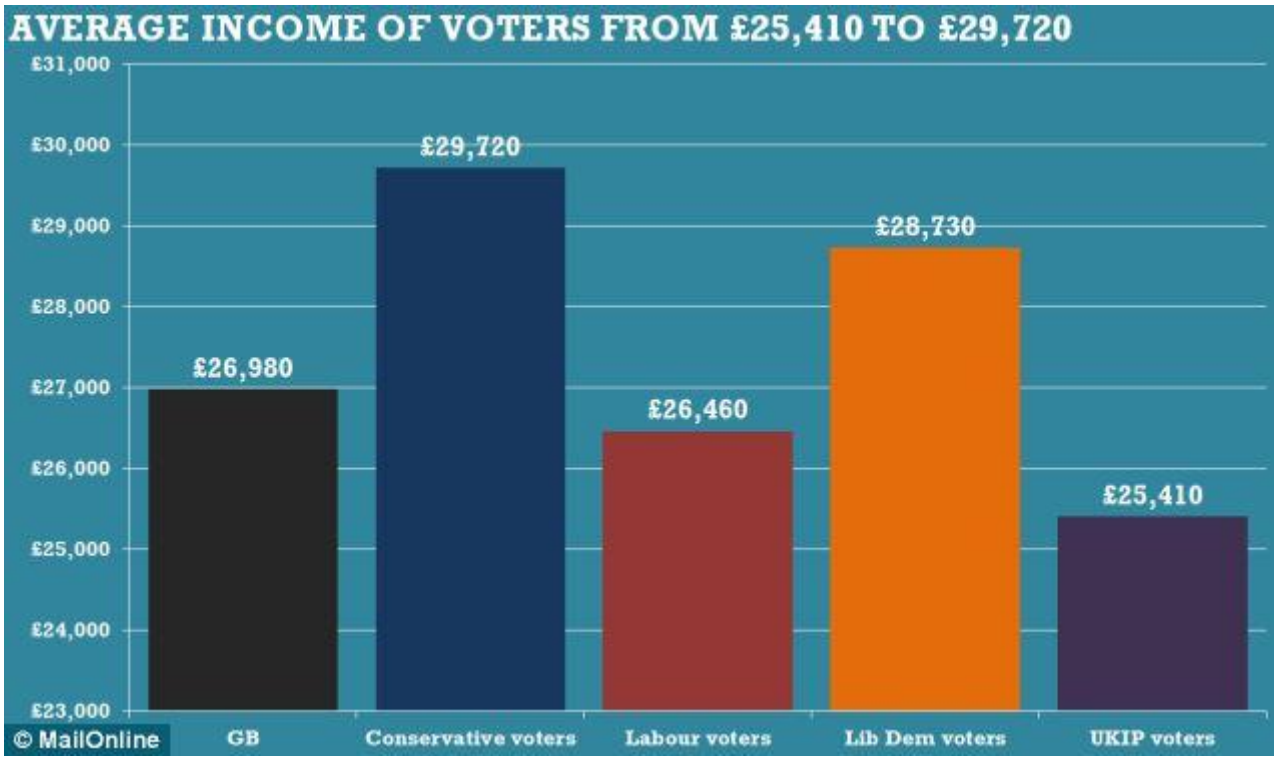
**d)** Assuming they believe that the law on assisted suicide should be abolished altogether, calculate the probability they come from London.

(0.5 points)

**e)** Is there any relation between the region in which people come from and their beliefs about whether the law on assisted suicide should be abolished? Comment with respect to the table.

(1 point)

**PROBLEM 2.** The following graphic comes from the 3rd March 2014 edition of The Mail.




Assuming that income of voters in the different parties follows a normal distribution with mean as given in the chart and standard deviation £2000:

**a)** What is the probability that a Liberal Democrat voter earns more than the average wage of a Labour voter and less than the median wage of a Conservative voter?

(1 point)

**b)** Calculate the probability that a Liberal Democrat voter earns exactly £28,730 per year.

(0.5 points)

**c)** In a sample of four UKIP voters, what is the probability that they all earn more than £25,410?

(0.75 points)

**d)** What are the expected total yearly earnings of two Conservative voters, three Labour voters, two Liberal Democrat voters and three UKIP voters?

(0.75 points)

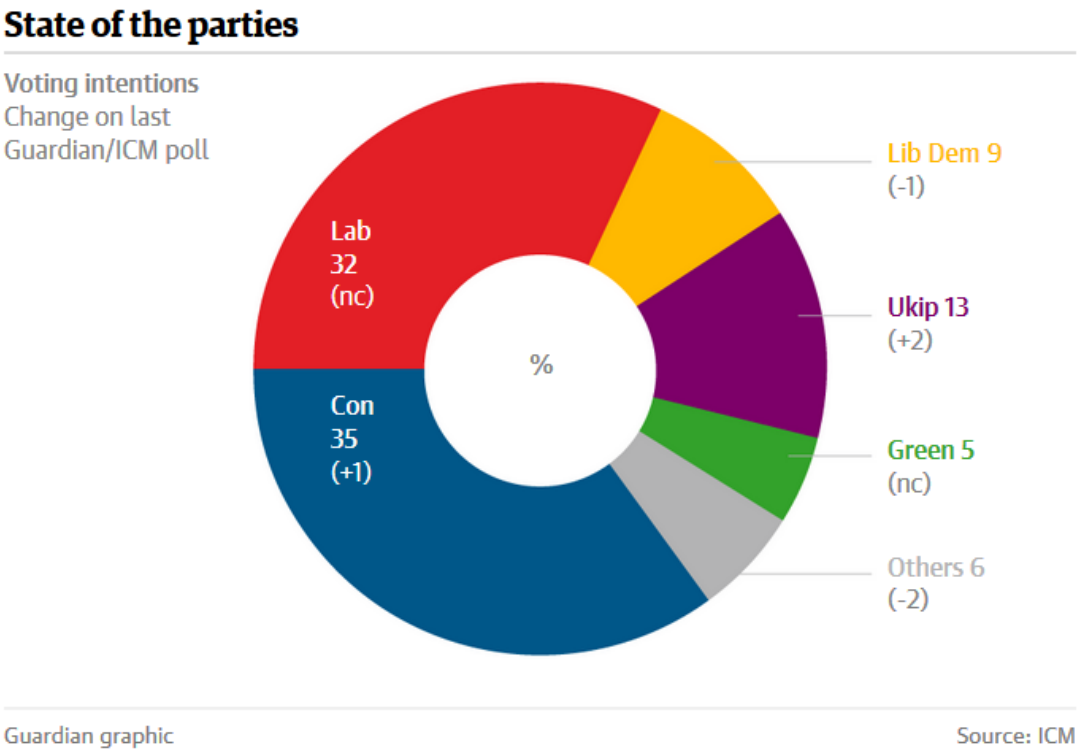
**PROBLEM 3.** The following headline and article come from the Guardian Newspaper of 27th April 2015.

# Conservatives take three-point lead over Labour in Guardian/ICM poll

Conservative support has edged up in the latest Guardian/ICM campaign poll, with David Cameron's party registering a three-point lead over Labour.

The Tories have advanced by one percentage point on the previous ICM survey a week ago, to 35%. Labour stands still on 32%.

Ukip is up by two, on 13 points, which is its highest with ICM since last December, while the Liberal Democrats drop back one, to 9%. The Greens are unchanged on 5%.




The telephone fieldwork took place from Friday to Sunday, a weekend in which the Tories have continued to focus their campaign on warnings against "the coalition of chaos", which they say would result if Labour ended up being propped up in government by the Scottish National party.

To test how far such fears are cutting through, ICM added "fears of a smaller party holding the next government to ransom" to a regular question it asks in which respondents are asked about "the single issue" that will "concern you most when it comes to casting your vote".

The NHS remains the top priority for voters, with 30% citing that as the most important election issue. That is followed by "jobs, prices and wages" at 16% and immigration at 14%. However, for a non-trivial 5% of all voters, fears about the price that smaller parties could extract in a hung parliament is now the election's defining question.

ICM Unlimited interviewed a random sample of 1,004 adults aged 18+ by telephone on 24-26 April 2015.

a) Calculate a 95% confidence interval for the true proportion of voters who think that the NHS is the most important election issue.

The sample proportion is 0.3 and the value from the normal distribution for a 95% interval is 1.96.

From the Excel output, the interval is 0.30 ± 0.028 = (0.272 0.328).

You can also do this from the formula. Use the formula for an interval for a proportion and not a mean here.

(1 point)

b) Is there any evidence (at a 5% significance level) that this proportion is different to 25%? Explain briefly your response.

Here you could do a formal., two tailed hypothesis test:

p = true proportion of voters who think the NHS is the most important issue.

$H_0$: p = 0.25
$H_1$: p ≠ 0.25

…

However, you have already done a 95% confidence interval and the value 0.25 is outside this interval. Therefore, you can conclude that because of the relation between confidence intervals and two sided hypothesis tests (where confidence and significance sum to 100%), you will reject $H_0$, because 0.25 lies outside the 95% interval and therefore there is evidence that the proportion of voters who think the NHS is the most important issue is not equal to 25%.

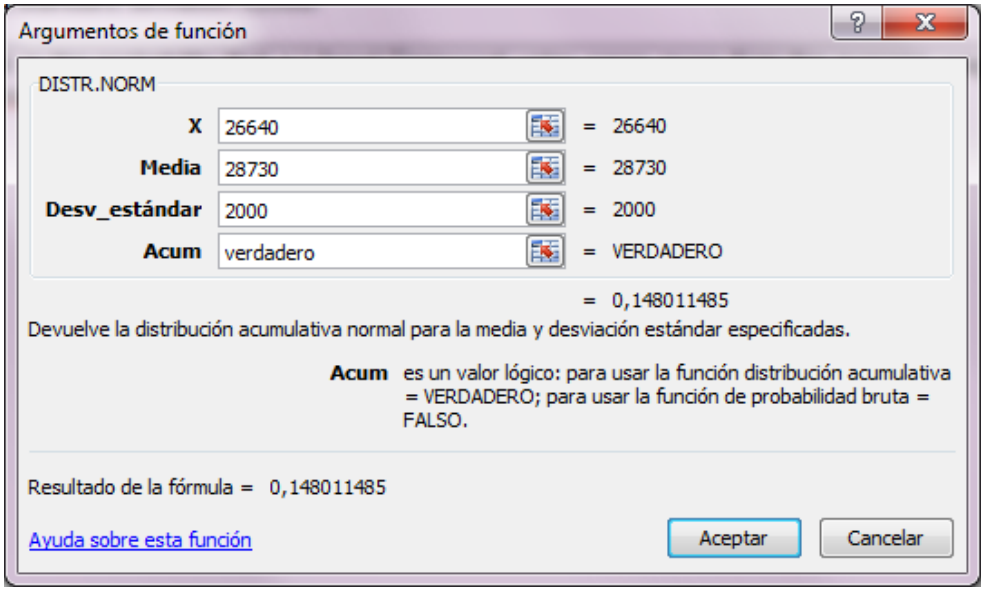
(1 point)

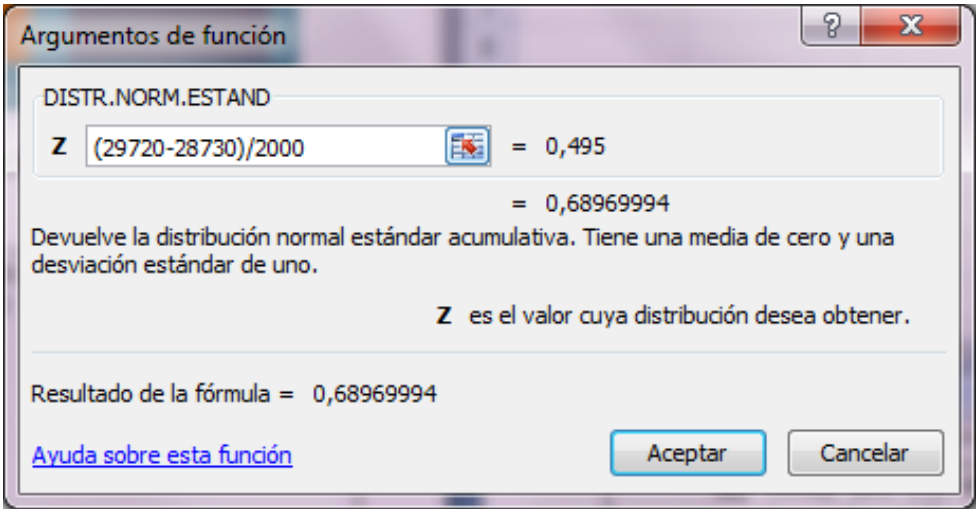
c) In the previous elections, the Labour party received 29% of the vote. Is there any evidence (at a 5% significance level) that their vote percentage this time will be higher?

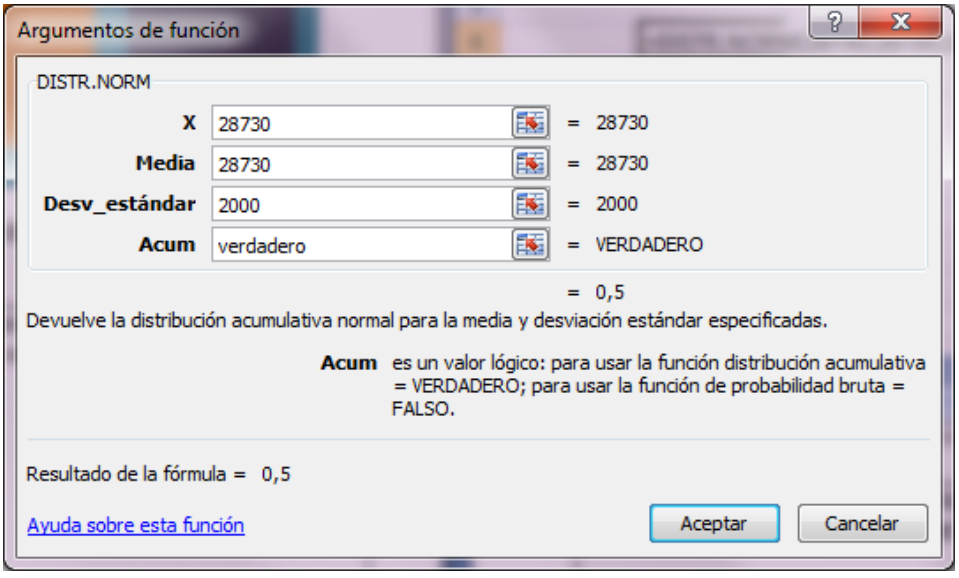
(2 points)

# Excel output

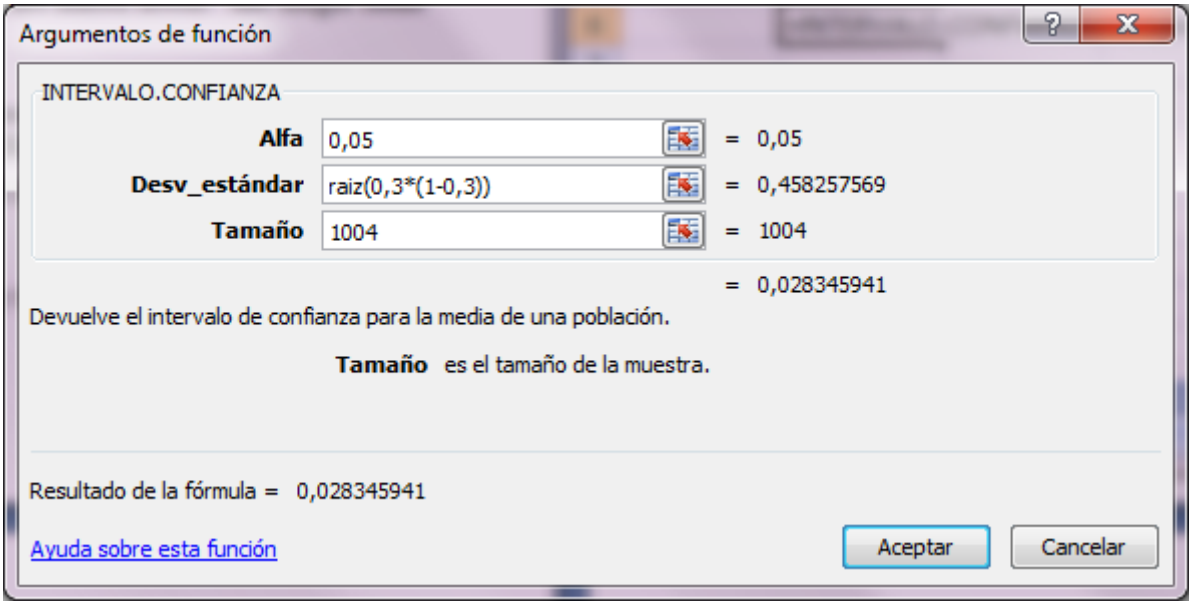
Outputs for problem 2

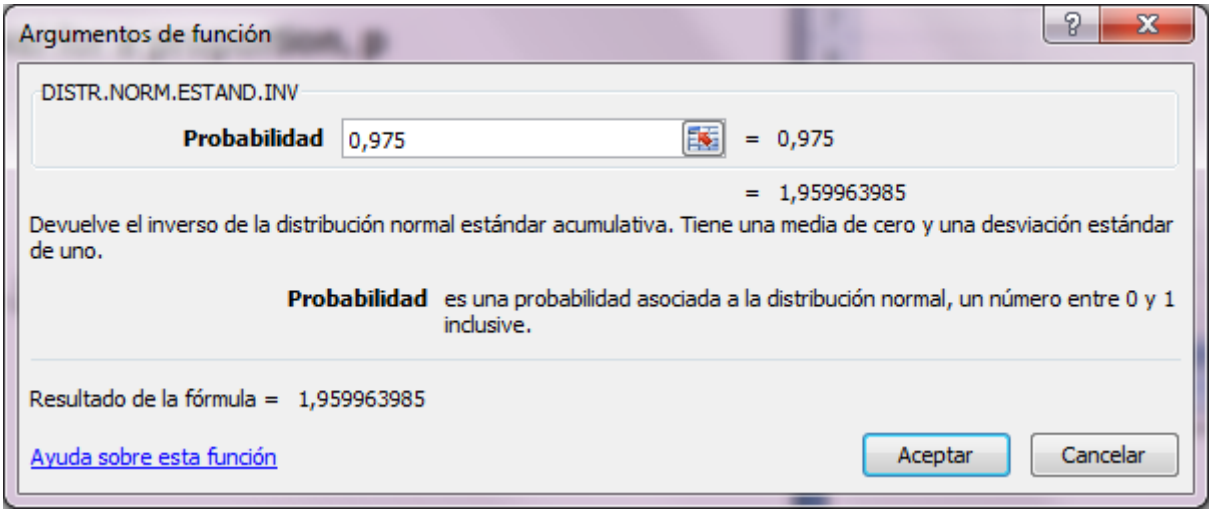


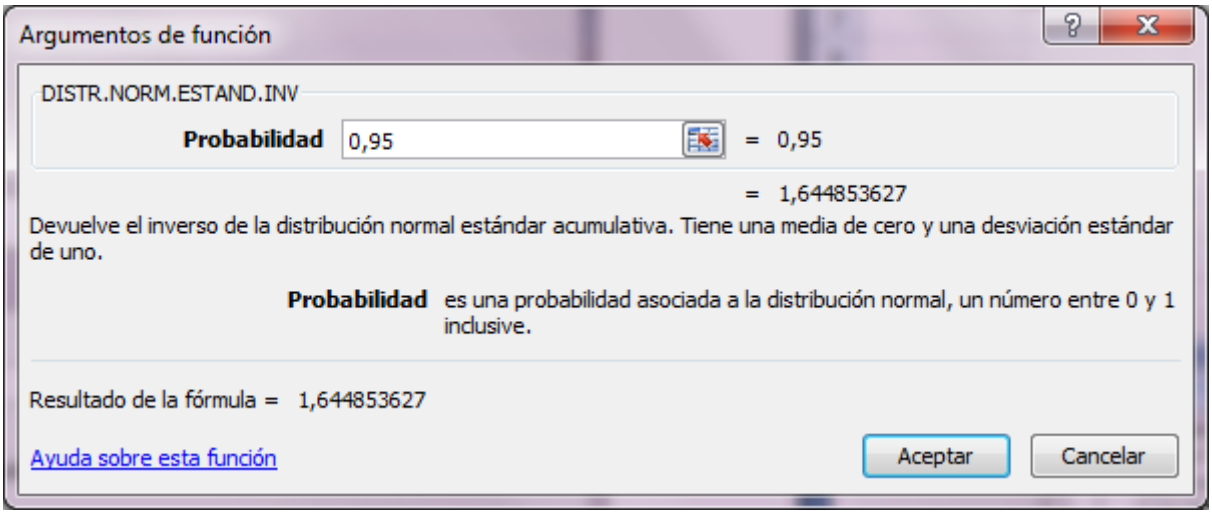



Outputs for problem 3



# Normal distribution tables

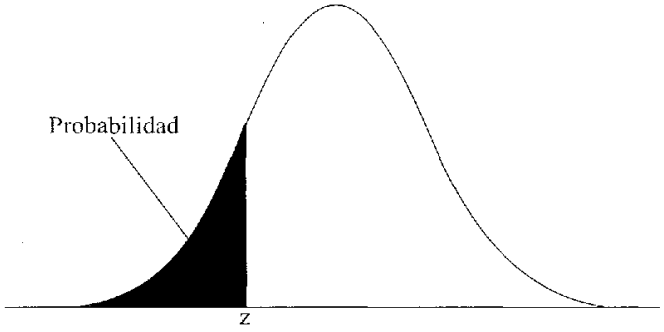



**Tabla 3.** *Probabilidad de que una variable normal de media cero y desviación típica uno tome un valor menor que z*

| z | 0,00 | 0,01 | 0,02 | 0,03 | 0,04 | 0,05 | 0,06 | 0,07 | 0,08 | 0,09 |
|---|---|---|---|---|---|---|---|---|---|---|
| −3,4 | 0,0003 | 0,0003 | 0,0003 | 0,0003 | 0,0003 | 0,0003 | 0,0003 | 0,0003 | 0,0003 | 0,0002 |
| −3,3 | 0,0005 | 0,0005 | 0,0005 | 0,0004 | 0,0004 | 0,0004 | 0,0004 | 0,0004 | 0,0004 | 0,0003 |
| −3,2 | 0,0007 | 0,0006 | 0,0006 | 0,0006 | 0,0006 | 0,0006 | 0,0006 | 0,0005 | 0,0005 | 0,0005 |
| −3,1 | 0,0010 | 0,0009 | 0,0009 | 0,0009 | 0,0008 | 0,0008 | 0,0008 | 0,0008 | 0,0007 | 0,0007 |
| −3,0 | 0,0013 | 0,0013 | 0,0013 | 0,0012 | 0,0012 | 0,0011 | 0,0011 | 0,0011 | 0,0010 | 0,0010 |
| −2,9 | 0,0019 | 0,0018 | 0,0018 | 0,0017 | 0,0016 | 0,0016 | 0,0015 | 0,0015 | 0,0014 | 0,0014 |
| −2,8 | 0,0026 | 0,0025 | 0,0024 | 0,0023 | 0,0023 | 0,0022 | 0,0021 | 0,0021 | 0,0020 | 0,0019 |
| −2,7 | 0,0035 | 0,0034 | 0,0033 | 0,0032 | 0,0031 | 0,0030 | 0,0029 | 0,0028 | 0,0027 | 0,0026 |
| −2,6 | 0,0047 | 0,0045 | 0,0044 | 0,0043 | 0,0041 | 0,0040 | 0,0039 | 0,0038 | 0,0037 | 0,0036 |
| −2,5 | 0,0062 | 0,0060 | 0,0059 | 0,0057 | 0,0055 | 0,0054 | 0,0052 | 0,0051 | 0,0049 | 0,0048 |
| −2,4 | 0,0082 | 0,0080 | 0,0078 | 0,0075 | 0,0073 | 0,0071 | 0,0069 | 0,0068 | 0,0066 | 0,0064 |
| −2,3 | 0,0107 | 0,0104 | 0,0102 | 0,0099 | 0,0096 | 0,0094 | 0,0091 | 0,0089 | 0,0087 | 0,0084 |
| −2,2 | 0,0139 | 0,0136 | 0,0132 | 0,0129 | 0,0125 | 0,0122 | 0,0119 | 0,0116 | 0,0113 | 0,0110 |
| −2,1 | 0,0179 | 0,0174 | 0,0170 | 0,0166 | 0,016 | 0,0158 | 0,0154 | 0,0150 | 0,0146 | 0,0143 |
| −2,0 | 0,0228 | 0,0222 | 0,0217 | 0,0212 | 0,0207 | 0,0202 | 0,0197 | 0,0192 | 0,0188 | 0,0183 |
| −1,9 | 0,0287 | 0,0281 | 0,0274 | 0,0268 | 0,0262 | 0,0256 | 0,0250 | 0,0244 | 0,0239 | 0,0233 |
| −1,8 | 0,0359 | 0,0351 | 0,0344 | 0,0336 | 0,0329 | 0,0322 | 0,0314 | 0,0307 | 0,0301 | 0,0294 |
| −1,7 | 0,0446 | 0,0436 | 0,0427 | 0,0418 | 0,0409 | 0,0401 | 0,0392 | 0,0384 | 0,0375 | 0,0367 |
| −1,6 | 0,0548 | 0,0537 | 0,0526 | 0,0516 | 0,0505 | 0,0495 | 0,0485 | 0,0475 | 0,0465 | 0,0455 |
| −1,5 | 0,0668 | 0,0655 | 0,0643 | 0,0630 | 0,0618 | 0,0606 | 0,0594 | 0,0582 | 0,0571 | 0,0559 |
| −1,4 | 0,0808 | 0,0793 | 0,0778 | 0,0764 | 0,0749 | 0,0735 | 0,0721 | 0,0708 | 0,0694 | 0,0681 |
| −1,3 | 0,0968 | 0,0951 | 0,0934 | 0,0918 | 0,0901 | 0,0855 | 0,0869 | 0,0853 | 0,0838 | 0,0823 |
| −1,2 | 0,1151 | 0,1131 | 0,1112 | 0,1093 | 0,1075 | 0,1056 | 0,1038 | 0,1020 | 0,1003 | 0,0985 |
| −1,1 | 0,1357 | 0,1335 | 0,1314 | 0,1292 | 0,1271 | 0,1251 | 0,1230 | 0,1210 | 0,1190 | 0,1170 |
| −1,0 | 0,1587 | 0,1562 | 0,1539 | 0,1515 | 0,1492 | 0,1469 | 0,1446 | 0,1423 | 0,1401 | 0,1379 |
| −0,9 | 0,1841 | 0,1814 | 0,1788 | 0,1762 | 0,1736 | 0,1711 | 0,1685 | 0,1660 | 0,1635 | 0,1611 |
| −0,8 | 0,2119 | 0,2090 | 0,2061 | 0,2033 | 0,2005 | 0,1977 | 0,1949 | 0,1922 | 0,1894 | 0,1867 |
| −0,7 | 0,2420 | 0,2389 | 0,2358 | 0,2327 | 0,2296 | 0,2266 | 0,2236 | 0,2206 | 0,2177 | 0,2148 |
| −0,6 | 0,2743 | 0,2709 | 0,2676 | 0,2643 | 0,2611 | 0,2578 | 0,2546 | 0,2514 | 0,2483 | 0,2451 |
| −0,5 | 0,3085 | 0,3050 | 0,3015 | 0,2981 | 0,2946 | 0,2912 | 0,2877 | 0,2843 | 0,2810 | 0,2776 |
| −0,4 | 0,3446 | 0,3409 | 0,3372 | 0,3336 | 0,3300 | 0,3264 | 0,3228 | 0,3192 | 0,3156 | 0,3121 |
| −0,3 | 0,3821 | 0,3783 | 0,3745 | 0,3707 | 0,3669 | 0,3632 | 0,3594 | 0,3557 | 0,3520 | 0,3483 |
| −0,2 | 0,4207 | 0,4168 | 0,4129 | 0,4090 | 0,4052 | 0,4013 | 0,3974 | 0,3936 | 0,3897 | 0,3859 |
| −0,1 | 0,4602 | 0,4562 | 0,4522 | 0,4483 | 0,4443 | 0,4404 | 0,4364 | 0,4325 | 0,4286 | 0,4247 |
| −0,0 | 0,5000 | 0,4960 | 0,4920 | 0,4880 | 0,4840 | 0,4801 | 0,4761 | 0,721 | 0,4681 | 0,4641 |

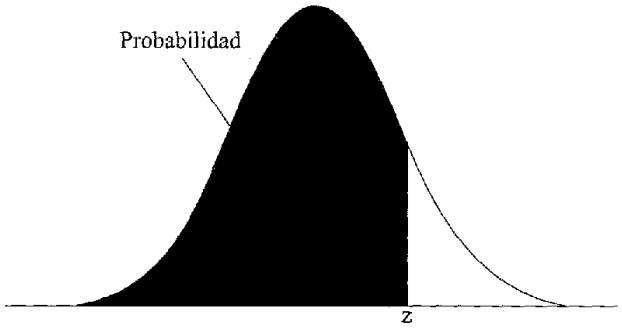



**Tabla 3.** (*continuación*) *Probabilidad de que una variable normal de media cero y desviación típica uno tome un valor menor que z*

| *z* | **0,00** | **0,01** | **0,02** | **0,03** | **0,04** | **0,05** | **0,06** | **0,07** | **0,08** | **0,09** |
|---|---|---|---|---|---|---|---|---|---|---|
| 0,0 | 0,5000 | 0,5040 | 0,5080 | 0,5120 | 0,5160 | 0,5199 | 0,5239 | 0,5279 | 0,5319 | 0,5359 |
| 0,1 | 0,5398 | 0,5438 | 0,5478 | 0,5517 | 0,5557 | 0,5596 | 0,5636 | 0,5675 | 0,5714 | 0,5753 |
| 0,2 | 0,5793 | 0,5832 | 0,5871 | 0,5910 | 0,5948 | 0,5987 | 0,6026 | 0,6064 | 0,6103 | 0,6141 |
| 0,3 | 0,6179 | 0,6217 | 0,6255 | 0,6293 | 0,6331 | 0,6368 | 0,6406 | 0,6443 | 0,6480 | 0,6517 |
| 0,4 | 0,6554 | 0,6591 | 0,6628 | 0,6664 | 0,6700 | 0,6736 | 0,6772 | 0,6808 | 0,6844 | 0,6879 |
| 0,5 | 0,6915 | 0,6950 | 0,6985 | 0,7019 | 0,7054 | 0,7088 | 0,7123 | 0,7157 | 0,7190 | 0,7224 |
| 0,6 | 0,7257 | 0,7291 | 0,7324 | 0,7357 | 0,7389 | 0,7422 | 0,7454 | 0,7486 | 0,7517 | 0,7549 |
| 0,7 | 0,7580 | 0,7611 | 0,7642 | 0,7673 | 0,7704 | 0,7734 | 0,7764 | 0,7794 | 0,7823 | 0,7852 |
| 0,8 | 0,7881 | 0,7910 | 0,7939 | 0,7967 | 0,7995 | 0,8023 | 0,8051 | 0,8078 | 0,8106 | 0,8133 |
| 0,9 | 0,8159 | 0,8186 | 0,8212 | 0,8238 | 0,8264 | 0,8289 | 0,8315 | 0,8340 | 0,8365 | 0,8389 |
| 1,0 | 0,8413 | 0,8438 | 0,8461 | 0,8485 | 0,8508 | 0,8531 | 0,8554 | 0,8577 | 0,8599 | 0,8621 |
| 1,1 | 0,8643 | 0,8665 | 0,8686 | 0,8708 | 0,8729 | 0,8749 | 0,8770 | 0,8790 | 0,8810 | 0,8830 |
| 1,2 | 0,8849 | 0,8869 | 0,8888 | 0,8907 | 0,8925 | 0,8944 | 0,8962 | 0,8980 | 0,8997 | 0,9015 |
| 1,3 | 0,9032 | 0,9049 | 0,9066 | 0,9082 | 0,9099 | 0,9115 | 0,9131 | 0,9147 | 0,9162 | 0,9177 |
| 1,4 | 0,9192 | 0,9207 | 0,9222 | 0,9236 | 0,9251 | 0,9265 | 0,9279 | 0,9292 | 0,9306 | 0,9319 |
| 1,5 | 0,9332 | 0,9345 | 0,9357 | 0,9370 | 0,9382 | 0,9394 | 0,9406 | 0,9418 | 0,9429 | 0,9441 |
| 1,6 | 0,9452 | 0,9463 | 0,9474 | 0,9484 | 0,9495 | 0,9505 | 0,9515 | 0,9525 | 0,9535 | 0,9545 |
| 1,7 | 0,9554 | 0,9564 | 0,9573 | 0,9582 | 0,9591 | 0,9599 | 0,9608 | 0,9616 | 0,9625 | 0,9633 |
| 1,8 | 0,9641 | 0,9649 | 0,9656 | 0,9664 | 0,9671 | 0,9678 | 0,9686 | 0,9693 | 0,9699 | 0,9706 |
| 1,9 | 0,9713 | 0,9719 | 0,9726 | 0,9732 | 0,9738 | 0,9744 | 0,9750 | 0,9756 | 0,9761 | 0,9767 |
| 2,0 | 0,9772 | 0,9778 | 0,9783 | 0,9788 | 0,9793 | 0,9798 | 0,9803 | 0,9808 | 0,9812 | 0,9817 |
| 2,1 | 0,9821 | 0,9826 | 0,9830 | 0,9834 | 0,9838 | 0,9842 | 0,9846 | 0,9850 | 0,9854 | 0,9857 |
| 2,2 | 0,9861 | 0,9864 | 0,9868 | 0,9871 | 0,9875 | 0,9878 | 0,9881 | 0,9884 | 0,9887 | 0,9890 |
| 2,3 | 0,9893 | 0,9896 | 0,9898 | 0,9901 | 0,9904 | 0,9906 | 0,9909 | 0,9911 | 0,9913 | 0,9916 |
| 2,4 | 0,9918 | 0,9920 | 0,9922 | 0,9925 | 0,9927 | 0,9929 | 0,9931 | 0,9932 | 0,9934 | 0,9936 |
| 2,5 | 0,9938 | 0,9940 | 0,9941 | 0,9943 | 0,9945 | 0,9946 | 0,9948 | 0,9949 | 0,9951 | 0,9952 |
| 2,6 | 0,9953 | 0,9955 | 0,9956 | 0,9957 | 0,9959 | 0,9960 | 0,9961 | 0,9962 | 0,9963 | 0,9964 |
| 2,7 | 0,9965 | 0,9966 | 0,9967 | 0,9968 | 0,9969 | 0,9970 | 0,9971 | 0,9972 | 0,9973 | 0,9974 |
| 2,8 | 0,9974 | 0,9975 | 0,9976 | 0,9977 | 0,9977 | 0,9978 | 0,9979 | 0,9979 | 0,9980 | 0,9981 |
| 2,9 | 09981, | 0,9982 | 0,9982 | 0,9983 | 0,9984 | 0,9984 | 0,9985 | 0,9985 | 0,9986 | 0,9986 |
| 3,0 | 0,9987 | 0,9987 | 0,9987 | 0,9988 | 0,9988 | 0,9989 | 0,9989 | 0,9989 | 0,9990 | 0,9990 |
| 3,1 | 0,9990 | 0,9991 | 0,9991 | 0,9991 | 0,9992 | 0,9992 | 0,9992 | 0,9992 | 0,9993 | 0,9993 |
| 3,2 | 0,9993 | 0,9993 | 0,9994 | 0,9994 | 0,9994 | 0,9994 | 0,9994 | 0,9995 | 0,9995 | 0,9995 |
| 3,3 | 0,9995 | 0,9995 | 0,9995 | 0,9996 | 0,9996 | 0,9996 | 0,9996 | 0,9996 | 0,9996 | 0,9997 |
| 3,4 | 0,9997 | 0,9997 | 0,9997 | 0,9997 | 0,9997 | 0,9997 | 0,9997 | 0,9997 | 0,9997 | 0,9998 |

# Chuletario

**Tests for the mean, $\mu$, of a normal distribution with standard deviation $\sigma$ and significance level $\alpha$.**

| $H_0$ | $H_1$ | Rejection region |
|---|---|---|
| $\mu = \mu_0$ | $\mu < \mu_0$ | $\frac{\bar{x} - \mu_0}{\sigma/\sqrt{N}} < -Z_\alpha$ |
| $\mu = \mu_0$ | $\mu > \mu_0$ | $\frac{\bar{x} - \mu_0}{\sigma/\sqrt{N}} > Z_\alpha$ |
| $\mu = \mu_0$ | $\mu \neq \mu_0$ | $\frac{\lvert\bar{x} - \mu_0\rvert}{\sigma/\sqrt{N}} > Z_{\alpha/2}$ |

**95% confidence interval for the mean, $\mu$, of a normal distribution with standard deviation $\sigma$.**

$$(\bar{x} - 1.96\sigma/\sqrt{N}, \bar{x} + 1.96\sigma/\sqrt{N})$$

## Tests for a proportion, p, with significance level $\alpha$.

| $H_0$ | $H_1$ | Rejection region |
|---|---|---|
| $p = p_0$ | $p < p_0$ | $\frac{\hat{p} - p_0}{\sqrt{\frac{p_0(1-p_0)}{N}}} < -Z_\alpha$ |
| $p = p_0$ | $p > p_0$ | $\frac{\hat{p} - p_0}{\sqrt{\frac{p_0(1-p_0)}{N}}} > Z_\alpha$ |
| $p = p_0$ | $p \neq p_0$ | $\frac{\lvert\hat{p} - p_0\rvert}{\sqrt{\frac{p_0(1-p_0)}{N}}} > Z_{\alpha/2}$ |

## 95% confidence interval for a proportion, p

$$\left(\hat{p} - 1.96\sqrt{\frac{\hat{p}(1-\hat{p})}{N}}, \hat{p} + 1.96\sqrt{\frac{\hat{p}(1-\hat{p})}{N}}\right)$$

## Space for calculations