1) A normal population has a mean $\mu = 31$ and standard deviation $\sigma = 8$. What proportion of the population is less than 29?

In order to use tables, we need to find the z score:

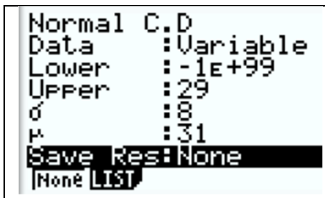
$$z = \frac{x - \mu}{\sigma} = \frac{29 - 31}{8} = -0.25$$

Therefore, $P(x < 29) = P(z < -0.25)$. By the table:

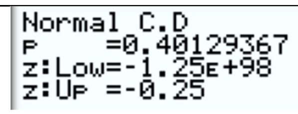
−0.5	.3085	.3050	.3015	.2981	.2946	.2912	.2877	.2843	.2810	.2776
−0.4	.3446	.3409	.3372	.3336	.3300	.3264	.3228	.3192	.3156	.3121
−0.3	.3821	.3783	.3745	.3707	.3669	.3632	.3594	.3557	.3520	.3483
−0.2	.4207	.4168	.4129	.4090	.4052	.4013	.3974	.3936	.3897	.3859
−0.1	.4602	.4562	.4522	.4483	.4443	.4404	.4364	.4325	.4286	.4247
−0.0	.5000	.4960	.4920	.4880	.4840	.4801	.4761	.4721	.4681	.4641

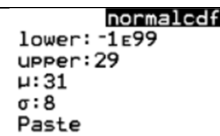
Answer: 0.4013

On Calculators:

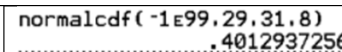


CASIO 9750





TI84



2) A normal population has a mean $\mu = 33$ and standard deviation $\sigma = 8$. What is the probability that a randomly chosen value will be greater than 30?

Finding the z score:

$z = \frac{x-\mu}{\sigma} = \frac{30-33}{8} = -0.375 \approx -0.38$ Therefore, $P(x < 30) \Rightarrow P(z < -0.38)$:

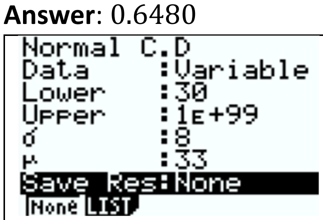
−0.5	.3085	.3050	.3015	.2981	.2946	.2912	.2877	.2843	.2810	.2776
−0.4	.3446	.3409	.3372	.3336	.3300	.3264	.3228	.3192	.3156	.3121
−0.3	.3821	.3783	.3745	.3707	.3669	.3632	.3594	.3557	.3520	.3483
−0.2	.4207	.4168	.4129	.4090	.4052	.4013	.3974	.3936	.3897	.3859

$P(z < -0.38) = 0.3520$

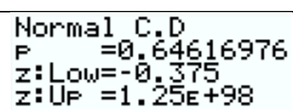
And

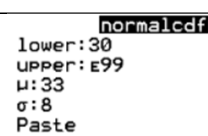
$P(z > -0.38) = 1 - 0.3520 = 0.6480$

Answer: 0.6480

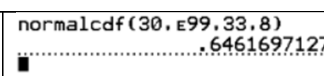


CASIO 9750





TI84



Notice that the output on the calculators correct to four decimal places is 0.6462

3) The average length of crocodiles in a swamp is 12.5 feet. If the lengths are normally distributed with a standard deviation of 2.1 feet, find the probability that a crocodile is more than 12 feet long.

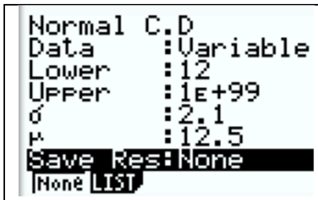
$$z = \frac{x - \mu}{\sigma} = \frac{12 - 12.5}{2.1} = -0.238 \approx -0.24$$

On the table, $P(z < -0.24)$:

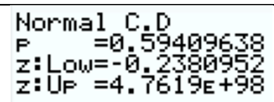
−0.4	.3446	.3409	.3372	.3336	.3300	.3264	.3228	.3192	.3156	.3121
−0.3	.3821	.3783	.3745	.3707	.3669	.3632	.3594	.3557	.3520	.3483
−0.2	.4207	.4168	.4129	.4090	.4052	.4013	.3974	.3936	.3897	.3859
−0.1	.4602	.4562	.4522	.4483	.4443	.4404	.4364	.4325	.4286	.4247

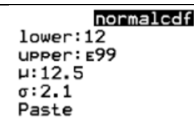
Therefore, $P(z > -0.24) = 1 - 0.4052 = 0.5948$

On Calculators:

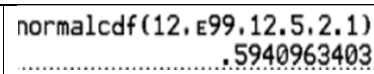


CASIO 9750





*TI*84



4) The average gas mileage of a certain model car is 30.0 miles per gallon. If the gas mileages are normally distributed with a standard deviation of 0.75 miles per gallon, find the probability that a car has a gas mileage of between 29.8 and 30.2 miles per gallon.

Finding both z scores, for $x = 29.8$ and 30.2:

$z = \frac{x-\mu}{\sigma} = \frac{30.2-30.0}{0.75} = 0.26666\ldots \approx 0.27$ Therefore, $P(x < 30.2) \Rightarrow P(z < 0.27) = 0.6064$

TABLE A-2 (*continued*) Cumulative Area from the LEFT

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.5000	.5040	.5080	.5120	.5160	.5199	.5239	.5279	.5319	.5359
0.1	.5398	.5438	.5478	.5517	.5557	.5596	.5636	.5675	.5714	.5753
0.2	.5793	.5832	.5871	.5910	.5948	.5987	.6026	.6064	.6103	.6141
0.3	.6179	.6217	.6255	.6293	.6331	.6368	.6406	.6443	.6480	.6517
0.4	.6554	.6591	.6628	.6664	.6700	.6736	.6772	.6808	.6844	.6879

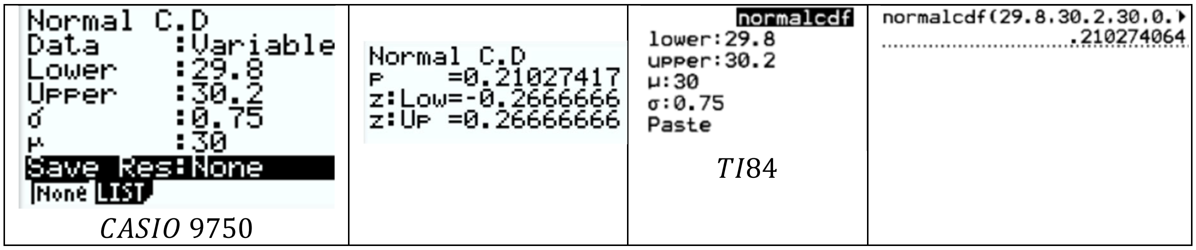
$$z = \frac{x - \mu}{\sigma} = \frac{29.8 - 30.0}{0.75} = -0.26666\ldots \approx -0.27$$

$P(x < 29.8) \Rightarrow P(z < -0.27) = 0.3936$

−0.4	.3446	.3409	.3372	.3336	.3300	.3264	.3228	.3192	.3156	.3121
−0.3	.3821	.3783	.3745	.3707	.3669	.3632	.3594	.3557	.3520	.3483
−0.2	.4207	.4168	.4129	.4090	.4052	.4013	.3974	.3936	.3897	.3859
−0.1	.4602	.4562	.4522	.4483	.4443	.4404	.4364	.4325	.4286	.4247
−0.0	.5000	.4960	.4920	.4880	.4840	.4801	.4761	.4721	.4681	.4641

$P(29.8 < x < 30.2) \Rightarrow P(-0.27 < z < 0.27) = 0.6064 - 0.3936 = 0.2128 \approx 0.213$ to three decimal places.

On Calculators:



5) The average height of flowering cherry trees in a certain nursery is 9.5 feet. If the heights are normally distributed with a standard deviation of 1.3 feet, find the probability that a tree is less than 11.5 feet tall.

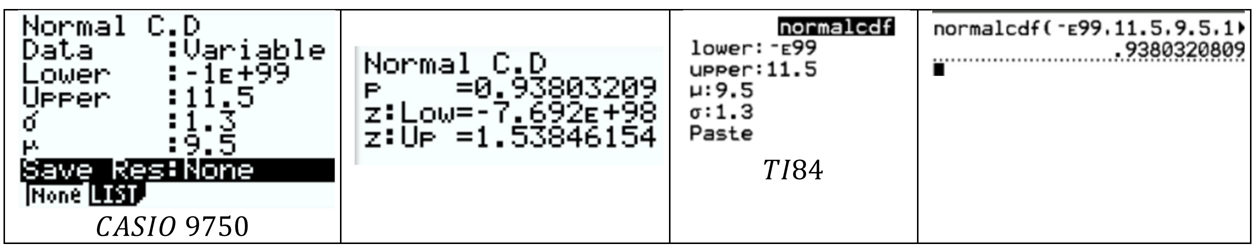
$$z = \frac{x - \mu}{\sigma} = \frac{11.5 - 9.5}{1.3} = 1.53846 \ldots \approx 1.54$$

$P(x < 11.5) \;=>\; P(z < \;1.54)$, by table:

1.0	.8413	.8438	.8461	.8485	.8508	.8531	.8554	.8577	.8599	.8621
1.1	.8643	.8665	.8686	.8708	.8729	.8749	.8770	.8790	.8810	.8830
1.2	.8849	.8869	.8888	.8907	.8925	.8944	.8962	.8980	.8997	.9015
1.3	.9032	.9049	.9066	.9082	.9099	.9115	.9131	.9147	.9162	.9177
1.4	.9192	.9207	.9222	.9236	.9251	.9265	.9279	.9292	.9306	.9319
1.5	.9332	.9345	.9357	.9370	.9382	.9394	.9406	.9418	.9429	.9441

Answer: 0.9382

On Calculators:



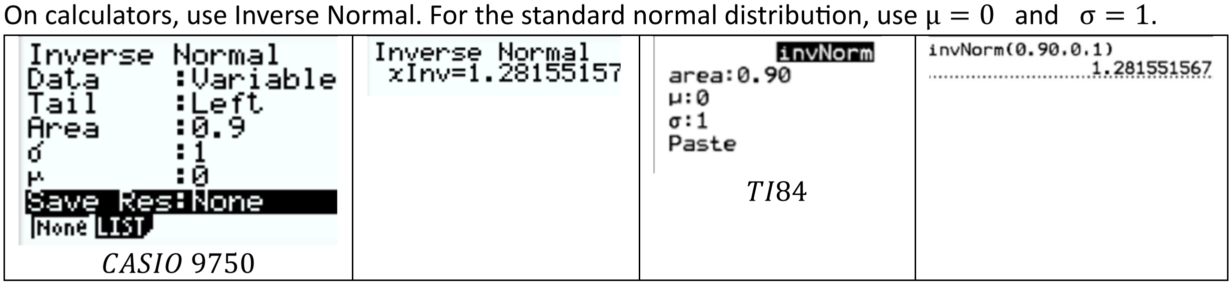
6) For the standard normal curve, find the z-score that corresponds to the 90th percentile.

Look up on the table for the z score that corresponds to 90% or 0.9000

0.8	.7881	.7910	.7939	.7967	.7995	.8023	.8051	.8078	.8106	.8133
0.9	.8159	.8186	.8212	.8238	.8264	.8289	.8315	.8340	.8365	.8389
1.0	.8413	.8438	.8461	.8485	.8508	.8531	.8554	.8577	.8599	.8621
1.1	.8643	.8665	.8686	.8708	.8729	.8749	.8770	.8790	.8810	.8830
1.2	.8849	.8869	.8888	.8907	.8925	.8944	.8962	.8980	.8997	.9015
1.3	.9032	.9049	.9066	.9082	.9099	.9115	.9131	.9147	.9162	.9177
1.4	.9192	.9207	.9222	.9236	.9251	.9265	.9279	.9292	.9306	.9319

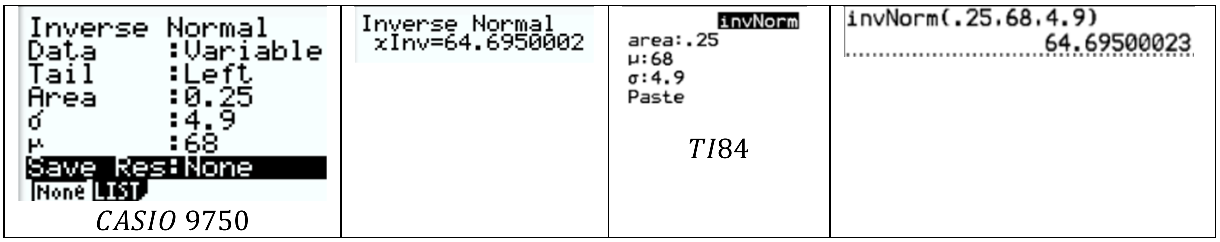
0.8997 is the closest number to 0.9000. The corresponding z score is 1.28

On calculators, use Inverse Normal. For the standard normal distribution, use $\mu = 0$ and $\sigma = 1$.



7) The times for completing one circuit of a bicycle course are normally distributed with a mean of 68.0 minutes and a standard deviation of 4.9 minutes. An association wants to sponsor a race but will cut the bottom 25% of riders. In a trial run, what should be the cutoff time?

Answer: To find the cutoff time, you need to find the $25th$ percentile of the normal distribution. Locate 0.2500 in the body of the table. The corresponding z-score value in this case is -0.67, since 0.2514 is the closest value to 0.2500.
Solving for x in the formula for the z-score: $x = \mu + z \cdot \sigma = 68 + (-0.67)(4.9) = 64.7$ minutes.
On Calculators, Inv Normal:

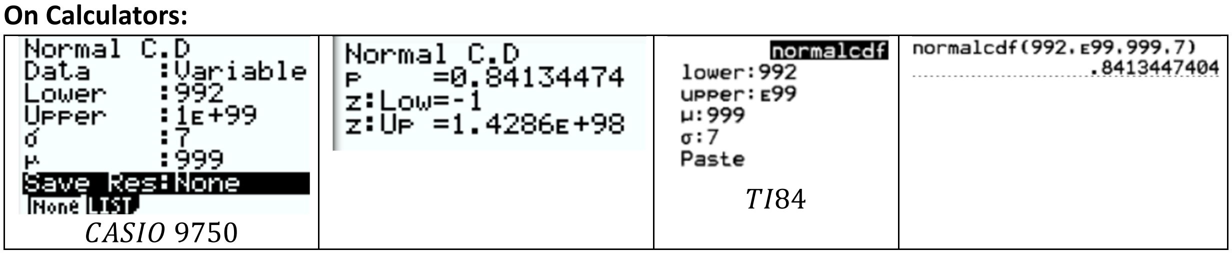


8) A bottler of drinking water fills plastic bottles with a mean volume of 999 milliliters (mL) and standard deviation 7 mL. The fill volumes are normally distributed. What is the probability that a bottle has a volume greater than 992 mL?

$$z = \frac{x - \mu}{\sigma} = \frac{992 - 999}{7} = -1 \quad \therefore \quad P(x > 992) \Rightarrow 1 - P(z < -1) = 1 - 0.1587 = 0.8413$$

−1.2	.1151	.1131	.1112	.1093	.1075	.1056	.1038	.1020	.1003	.0985
−1.1	.1357	.1335	.1314	.1292	.1271	.1251	.1230	.1210	.1190	.1170
−1.0	.1587	.1562	.1539	.1515	.1492	.1469	.1446	.1423	.1401	.1379
−0.9	.1841	.1814	.1788	.1762	.1736	.1711	.1685	.1660	.1635	.1611
−0.8	.2119	.2090	.2061	.2033	.2005	.1977	.1949	.1922	.1894	.1867

On Calculators:



9) In order to be accepted into a certain top university, applicants must score within the top 5% on the SAT exam. Given that the exam has a mean of 1000 and a standard deviation of 200, what is the lowest possible score a student needs to qualify for acceptance into the university?

To the left of the top 5% we have the bottom 95%. Since tables includes areas to the left, we need to locate 0.9500 in the table's body. It corresponds to a z-score of 1.64.
Therefore, $x = \mu + z \cdot \sigma = 1000 + 1.64\,(200) = 1328$

1.3	.9032	.9049	.9066	.9082	.9099	.9115	.9131	.9147	.9162	.9177
1.4	.9192	.9207	.9222	.9236	.9251	.9265	.9279	.9292	.9306	.9319
1.5	.9332	.9345	.9357	.9370	.9382	.9394	.9406	.9418	.9429	.9441
1.6	.9452	.9463	.9474	.9484	.9495	* .9505	.9515	.9525	.9535	.9545
1.7	.9554	.9564	.9573	.9582	.9591	.9599	.9608	.9616	.9625	.9633