Central Limit Theorem Solutions

Race Based Life Expectancy

https://www.thebalance.com/the-racial-life-expectancy-gap-in-the-u-s-4588898

The life Expectancy in the United States is 78.9 years according to the CDC in 2014. However, different ethnicities have different Life Expectancy rates. They even differ by States in the Union. The causes of Death also vary from ethnicity to ethnicity and by State.

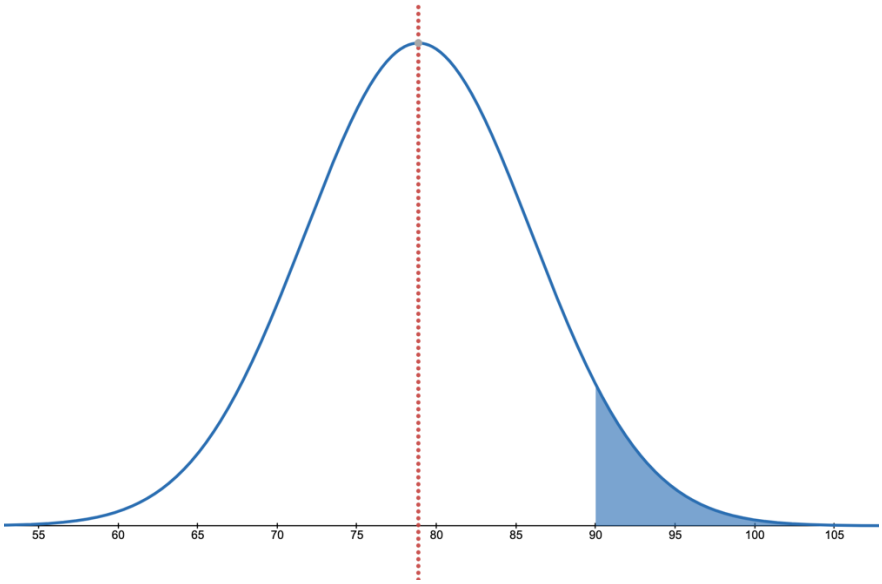
Native Americans live on average of 75.06 years
African Americans live on average of 75.54 years
White Americans live on average of 79.12 years
Hispanic Americans live on Average of 82.89 years
Asian Americans live on Average of 86.67 years

We will use the Central Limit Theorem to determine probabilities for a group of individuals from the same population using information from https://www.worldlifeexpectancy.com/usa-cause-of-death-by-age-and-gender

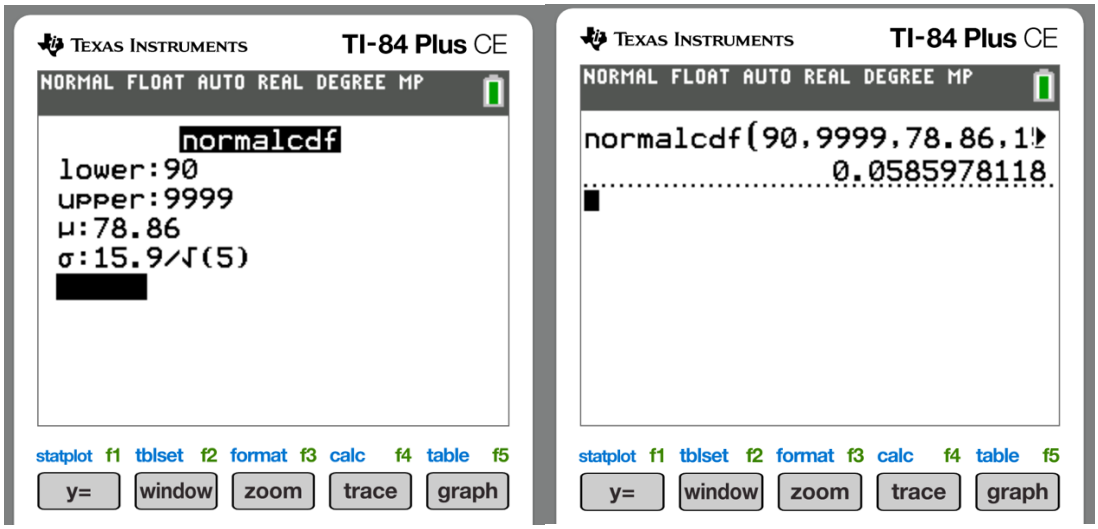
If the Life Expectancy of all races in the United States is Normally distributed with a mean of 78.86 years and a standard deviation of 15.9 years (this is an assumption):
https://www.thinkingaheadinstitute.org/en/News/Public/News/2018/12/A-basic-question-about-life-expectancy-that-even-actuaries-struggle-to-answer

Approximate Answers to the Nearest Thousandths

1. What's the probability 5 randomly selected people living at least 90 years of age?

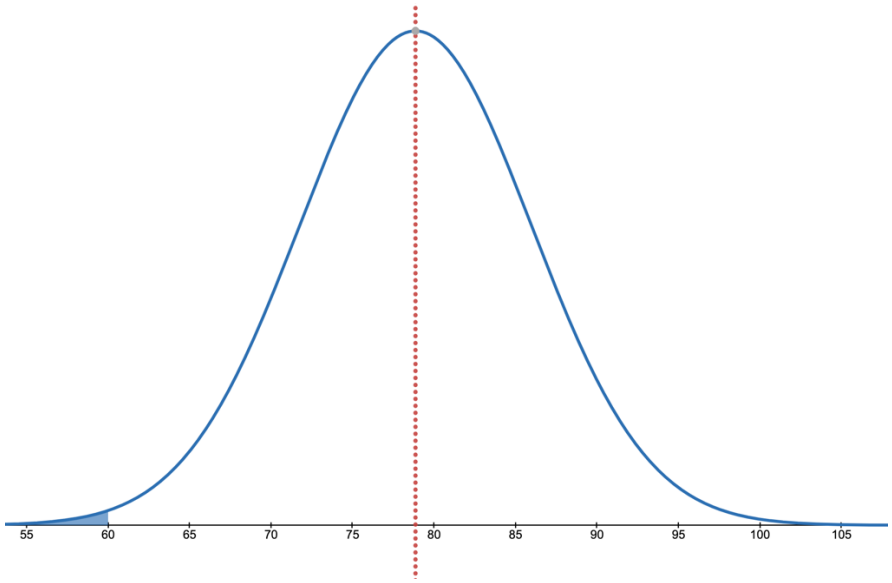


78.86

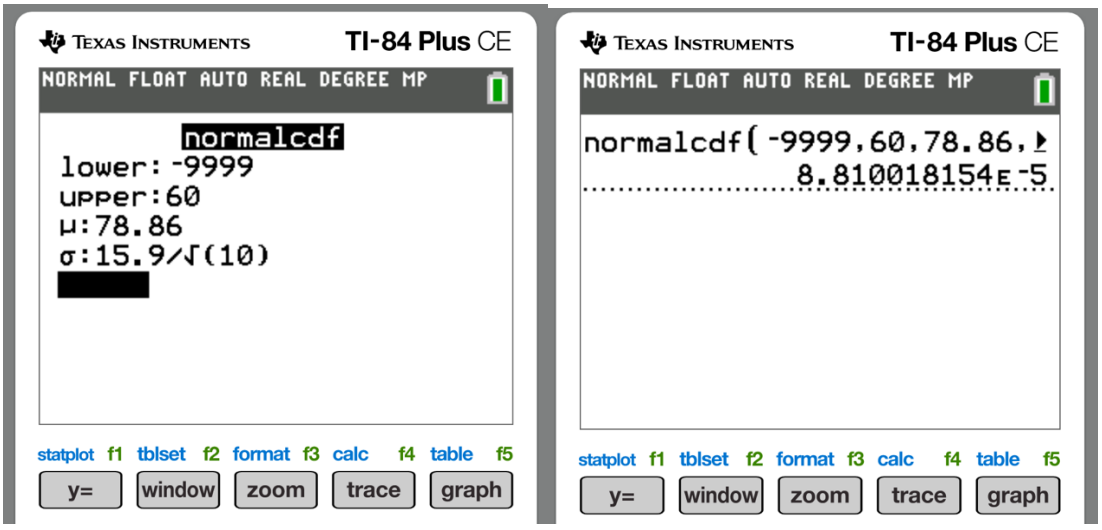


$$p(x \geq 90) \approx 0.059$$

2. What's the probability 10 randomly selected people living less than 60 years of age?



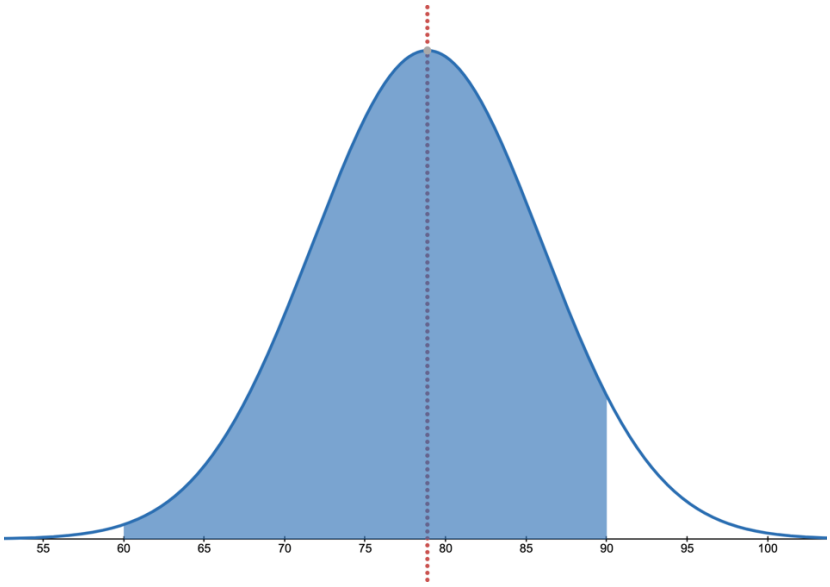
78.86



$$p(x < 60) \approx 0.00009 \approx 0.000$$

Not Likely

3. What's the probability 20 randomly selected people living between 60 years and 90 years of age?



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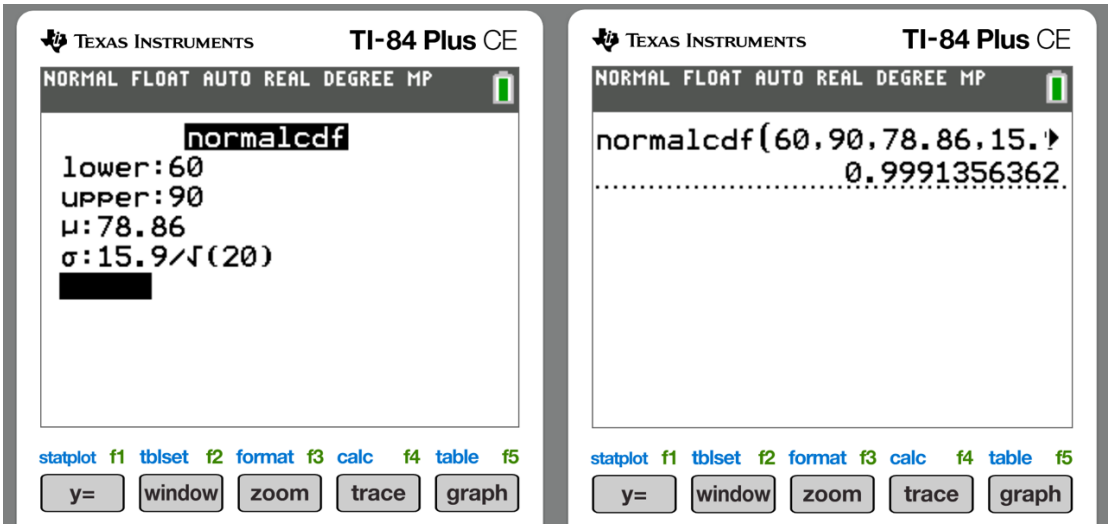
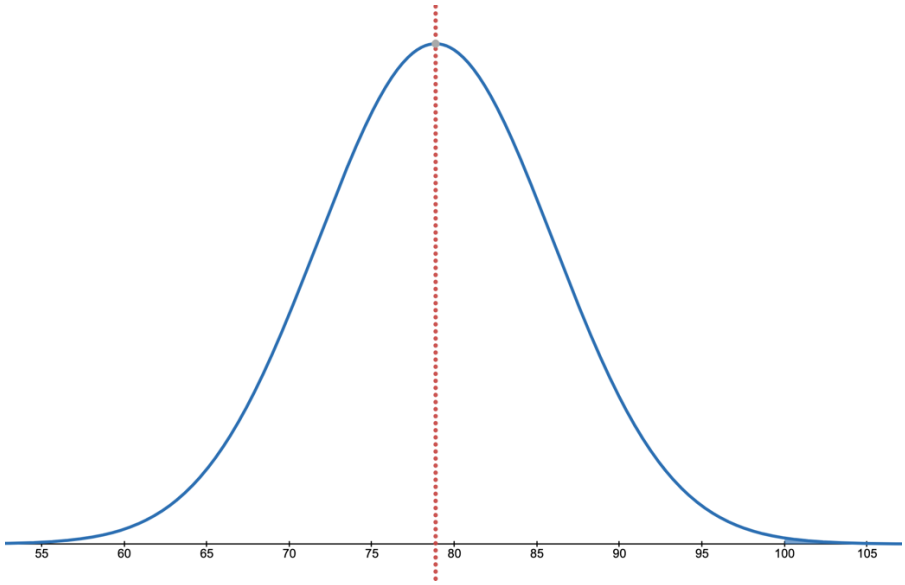


$$p(60 \leq x \leq 90) \approx 0.999$$

Almost Certain

4. What's the probability 35 randomly selected people living more than 100 years of age?



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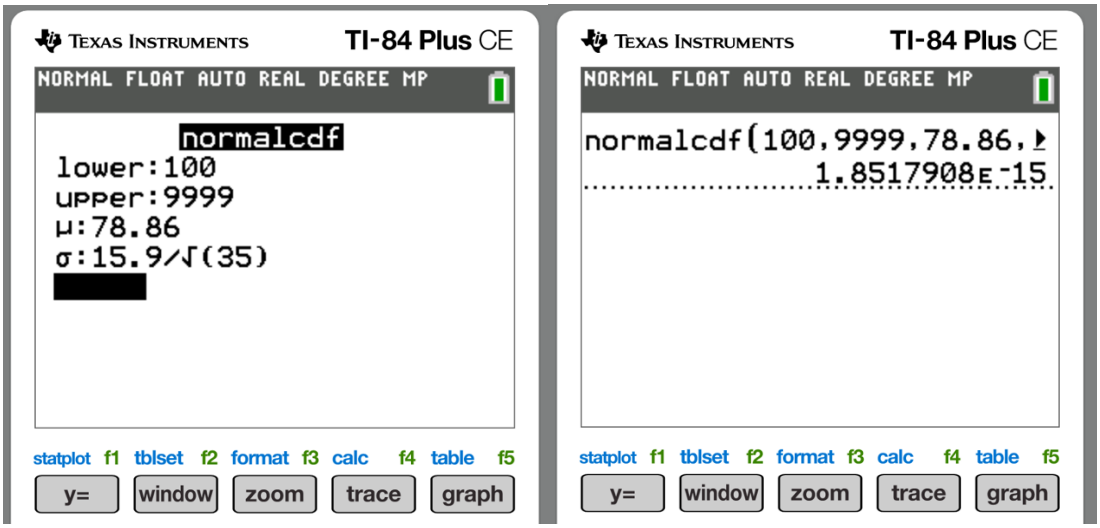
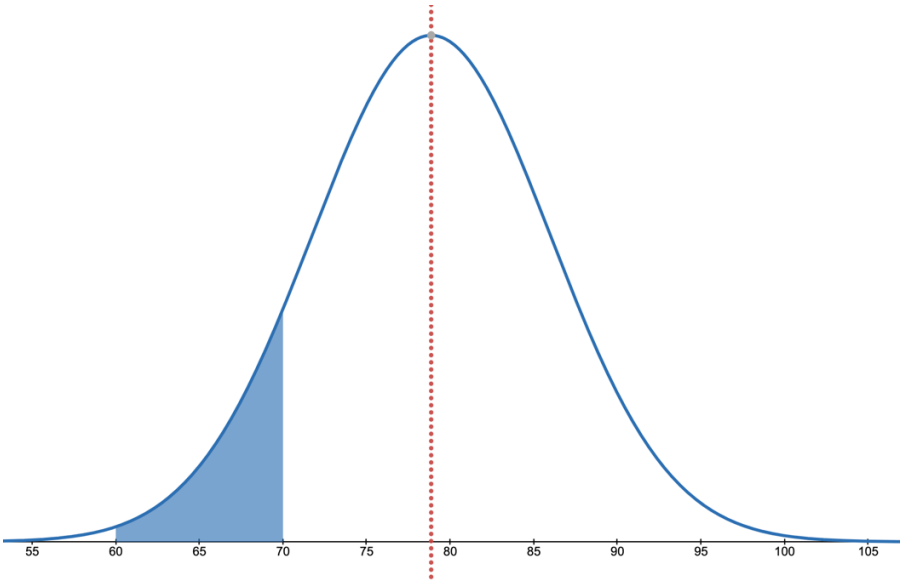


$$p(x > 100) \approx 0.000000000000002$$

Not Likely

5. What's the probability 50 randomly selected people living between 60 and 70 years of age?



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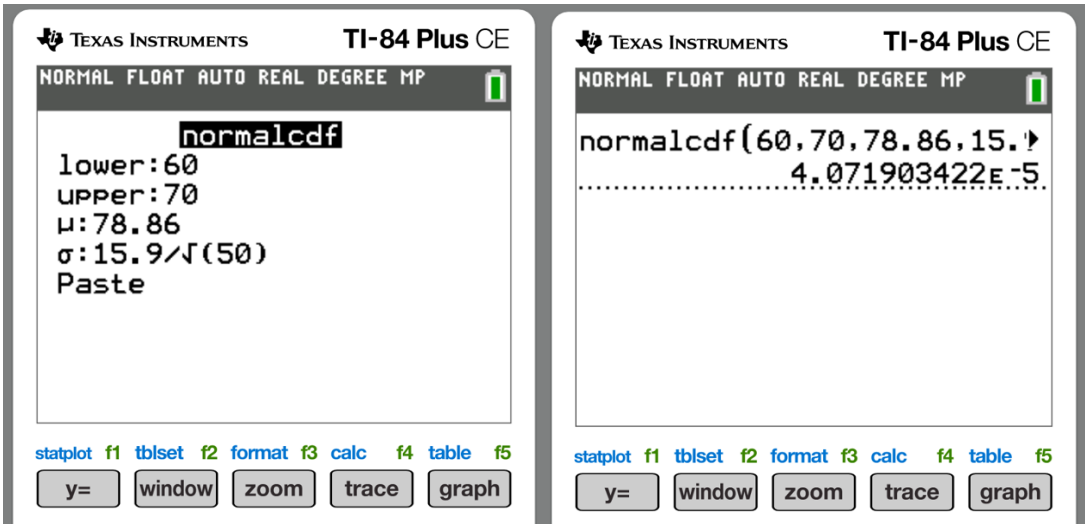


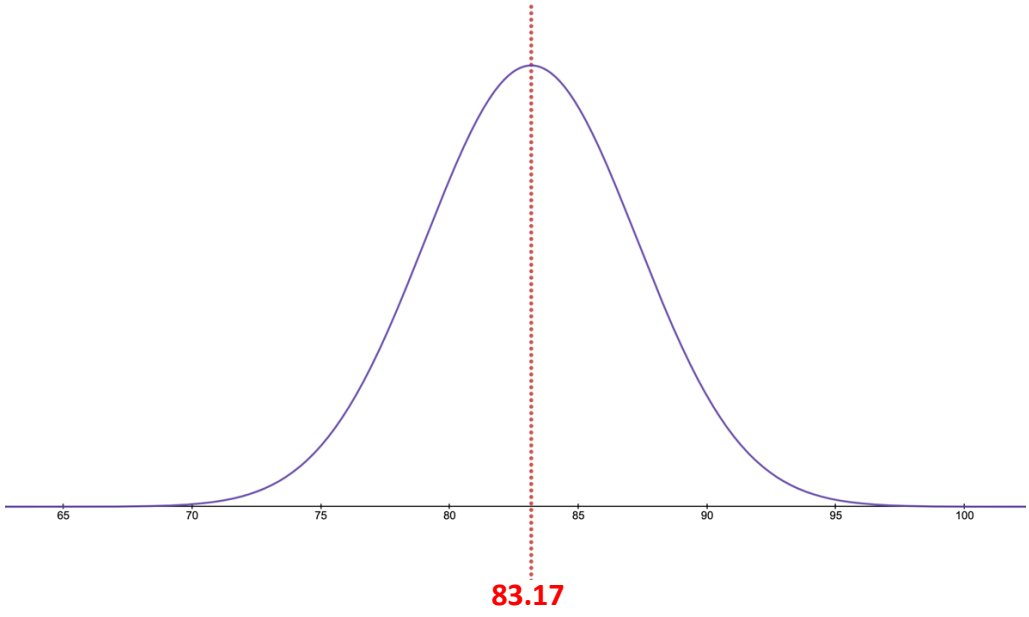
$$p(60 \leq x \leq 70) \approx 0.00004$$

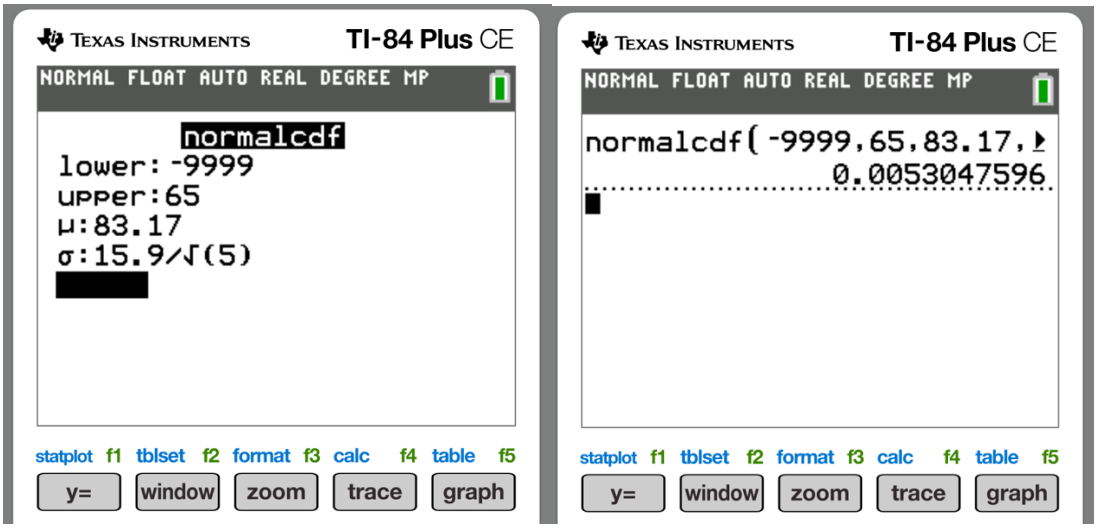
Not Likely

If the Life Expectancy of Hispanic Americans in California is 83.17 years with a standard deviation of 15.9 years (this is an assumption): https://www.worldlifeexpectancy.com/usa/life-expectancy-hispanic

Approximate Answers to the Nearest Thousandths

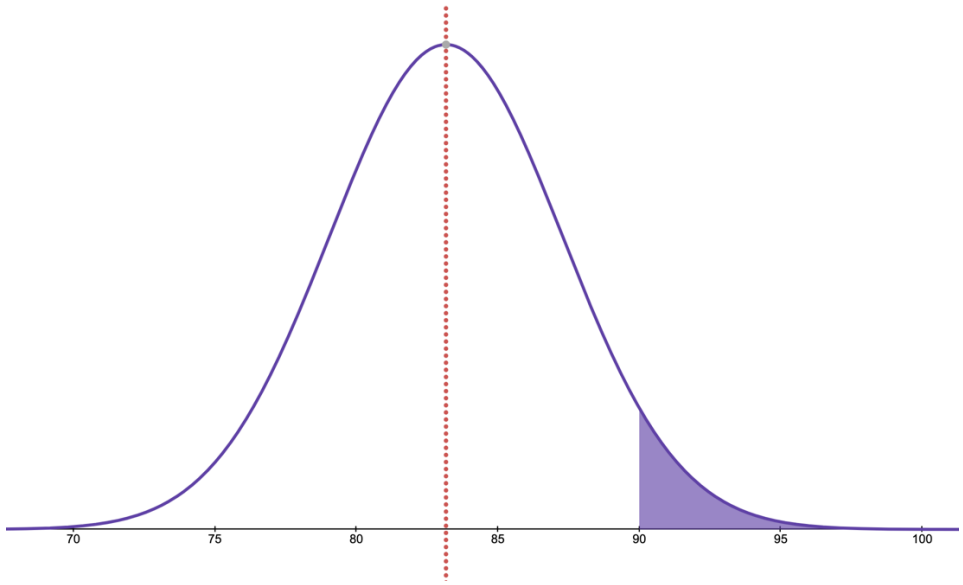
6. What's the probability of 5 randomly selected Hispanic Americans in California living no more than 65 years?



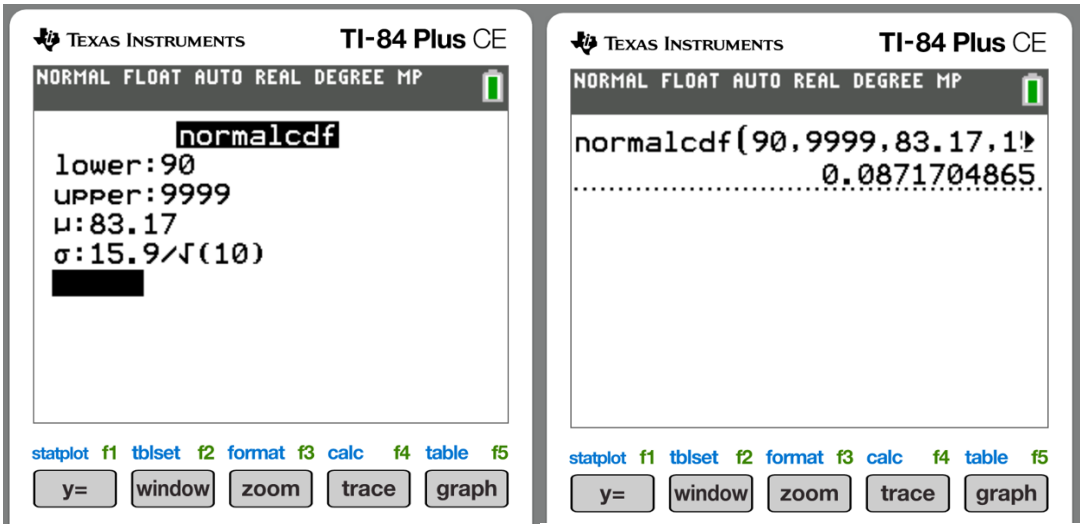


$$p(x \leq 65) \approx 0.005$$

7. What's the probability of 10 randomly selected Hispanic Americans in California living more than 90 years?

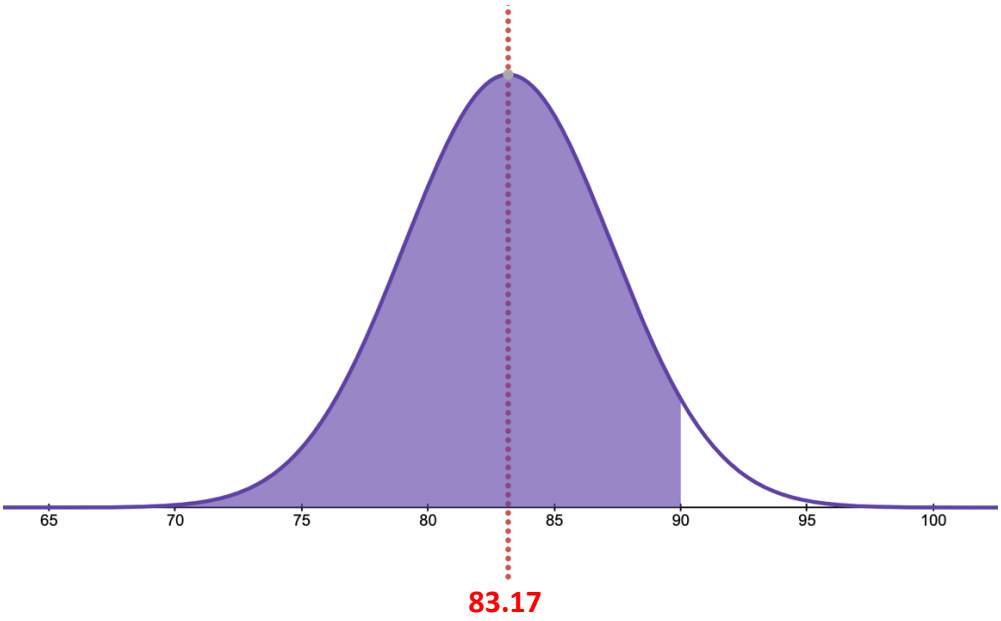


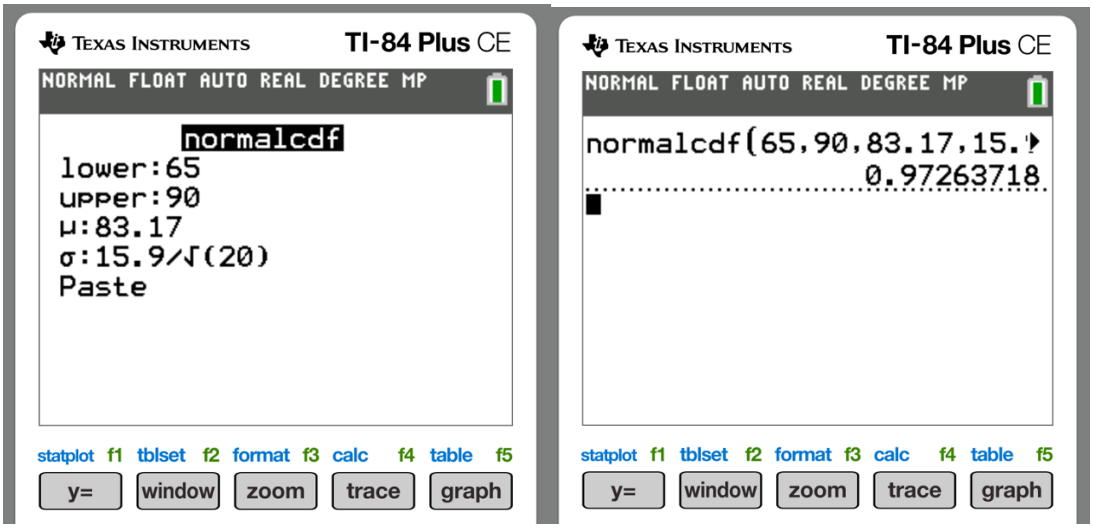
83.17



$$p(x > 90) \approx 0.087$$

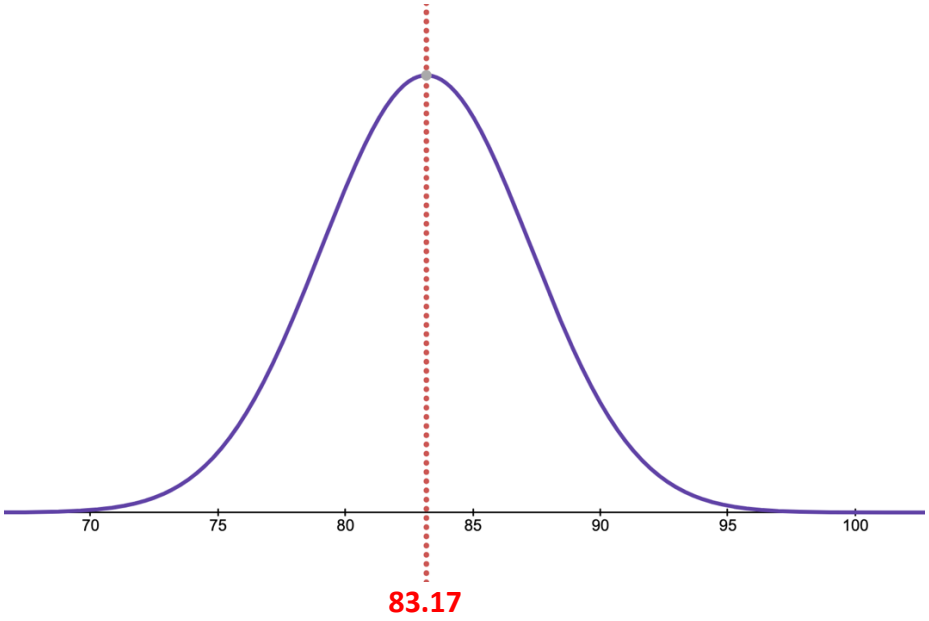
8. What's the probability of 20 randomly selected Hispanic Americans in California living between 65 and 90 years of age?

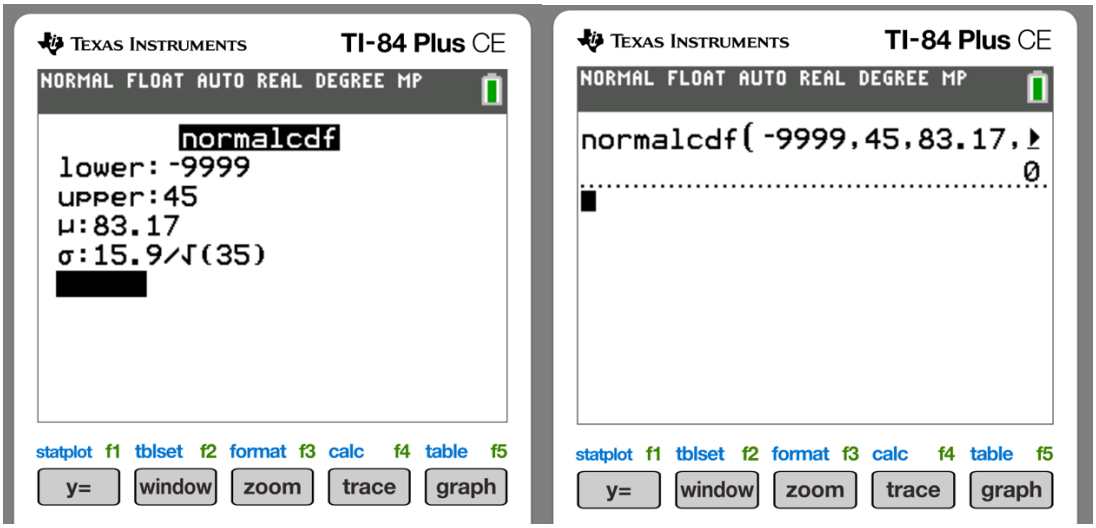




$$p(65 \leq x \leq 90) \approx 0.973$$

9. What's the probability of 35 randomly selected Hispanic Americans in California living less than 45 years?

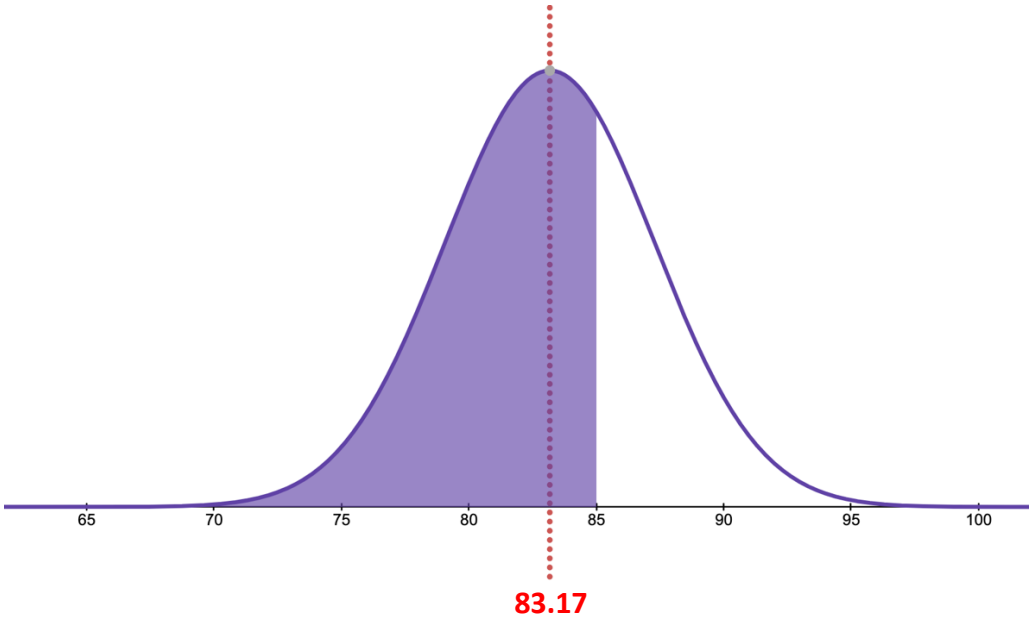


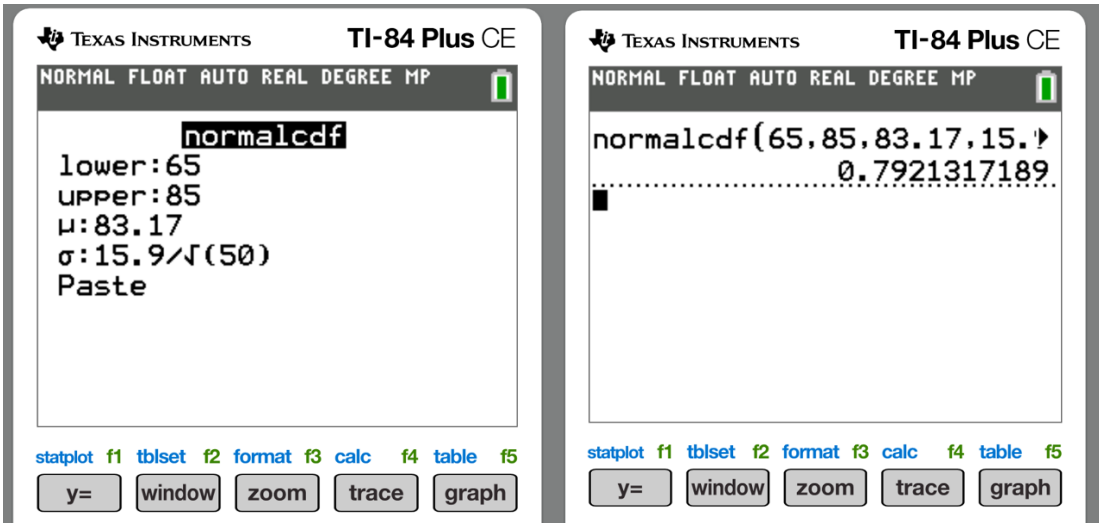


$$p(x < 45) \approx 0.000$$

Not Likely

10. What's the probability of 50 randomly selected Hispanic Americans in California living between 65 and 85 years of age?



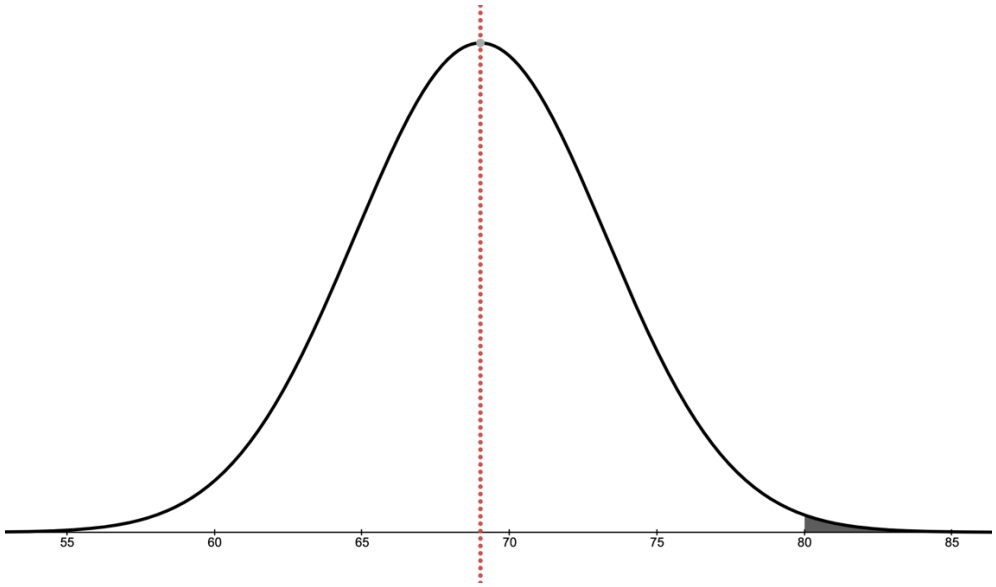


$$p(65 \leq x \leq 85) \approx 0.792$$

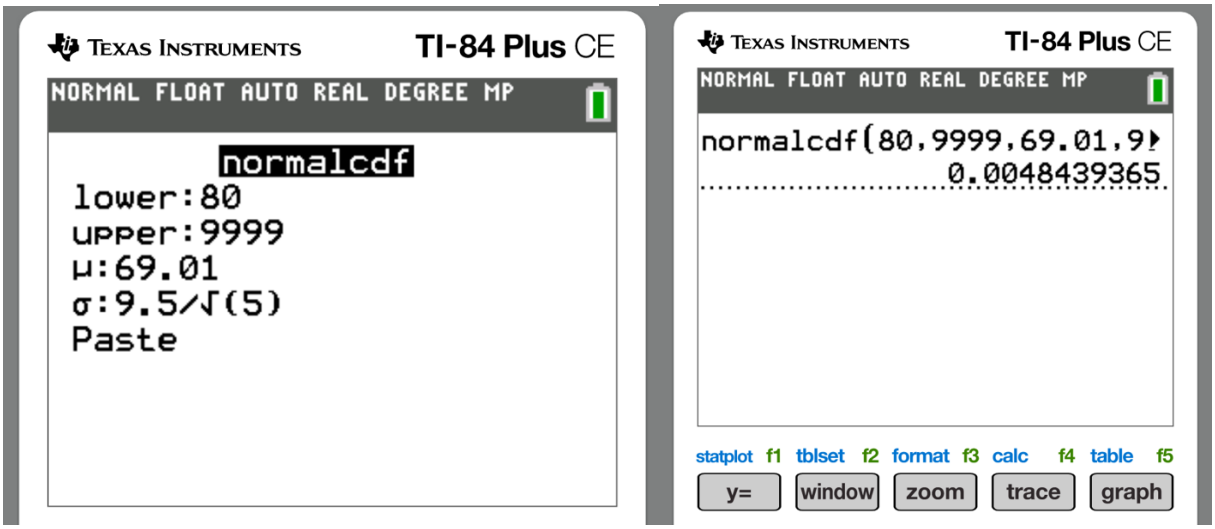
If the Life Expectancy of African America Male from Alabama is 69.01 years with a standard deviation of 9.5 years (this is an assumption): https://www.worldlifeexpectancy.com/usa/life-expectancy-hispanic

Approximate Answers to the Nearest Thousandths

11. What's the probability of 5 randomly selected African America males living at least 80 years of age?

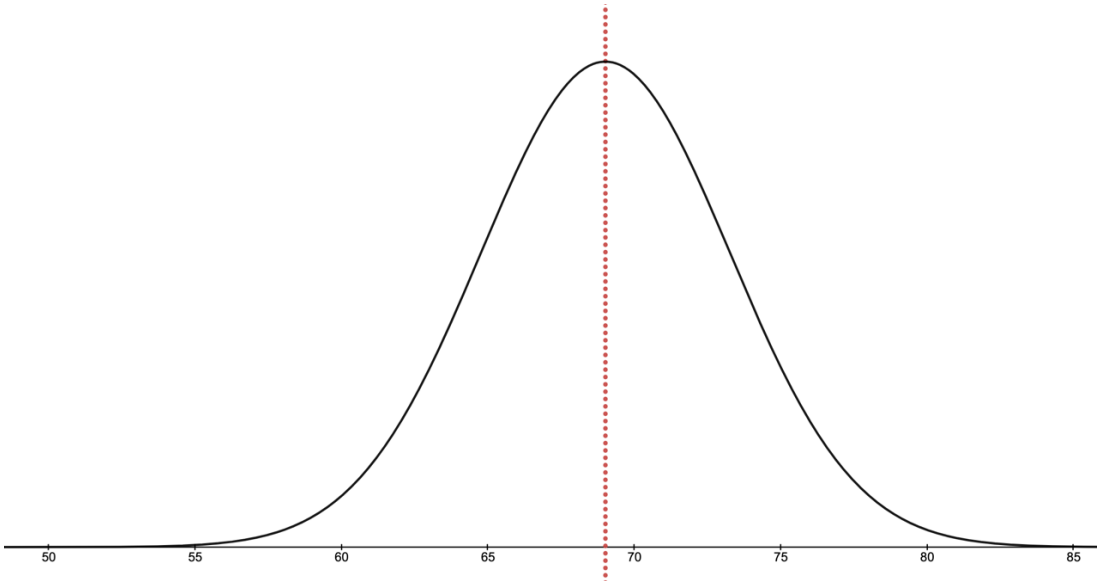


69.01

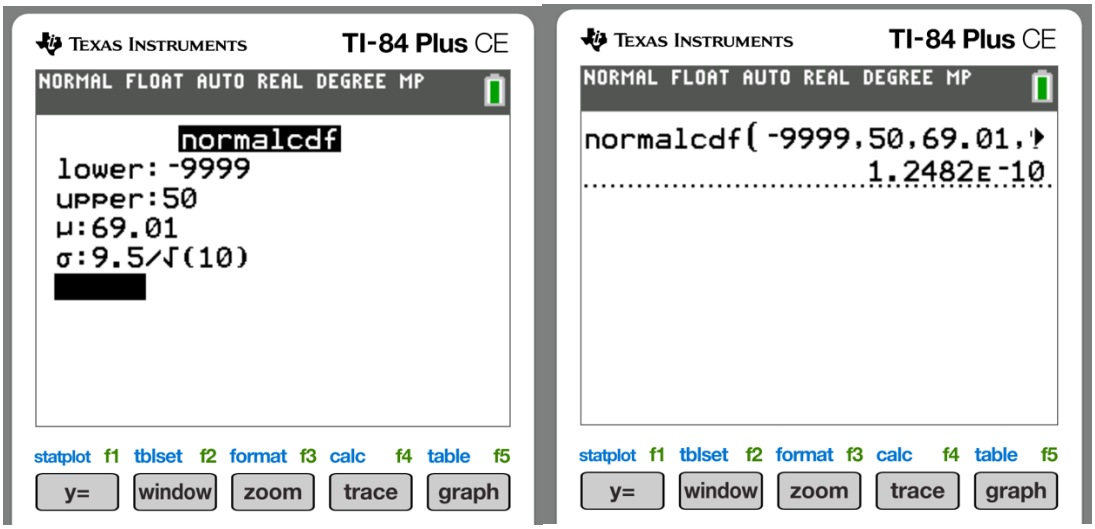


$$p(x \geq 80) \approx 0.005$$

12. What's the probability of 10 randomly selected African America males living less than 50 years of age?



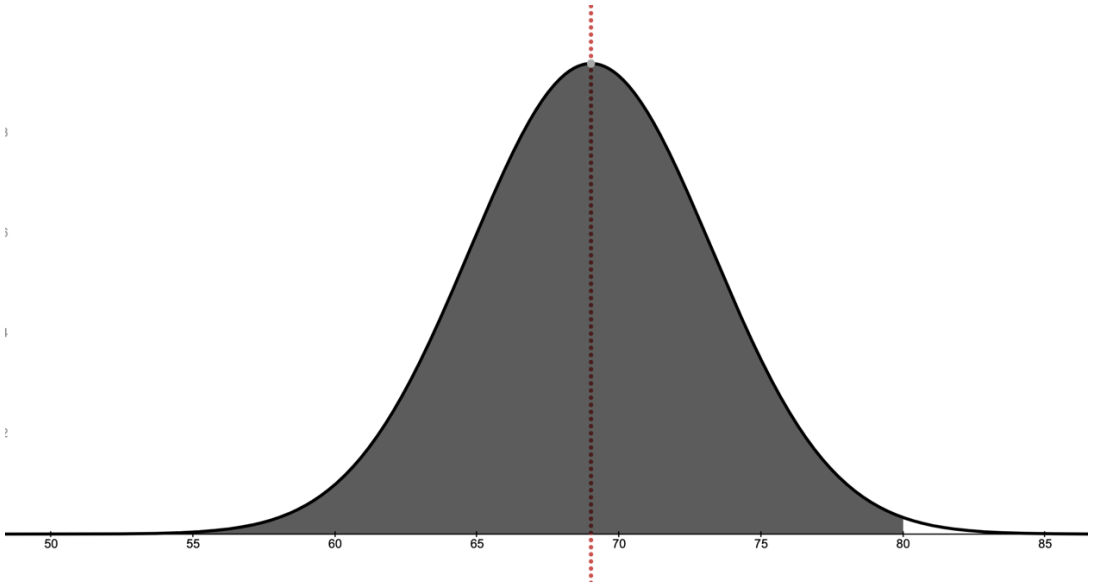
69.01



$$p(x \geq 80) \approx 0.0000000001 \approx 0.000$$

Not Likely

13. What's the probability of 20 randomly selected African America Females living between 50 and 80 years of age?



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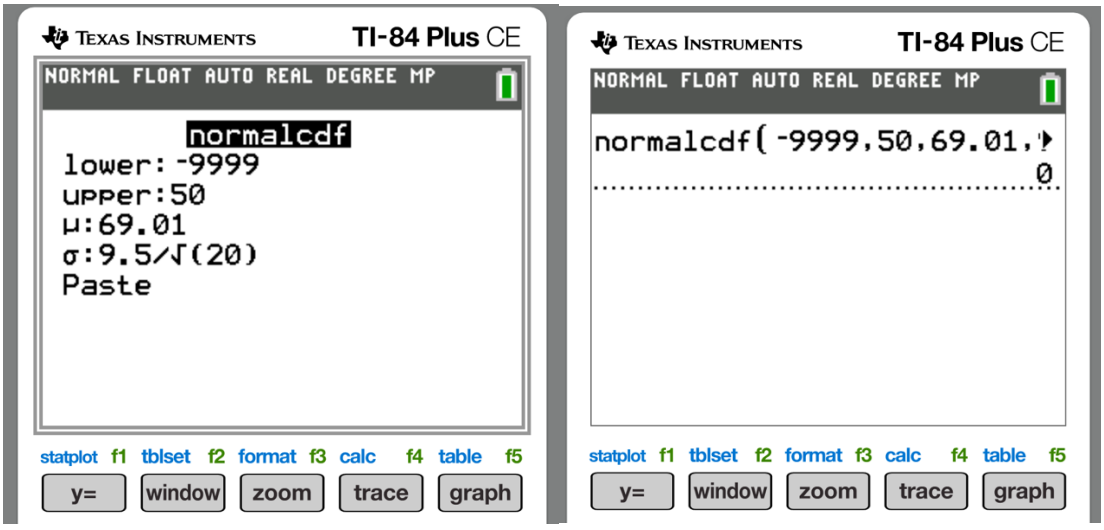
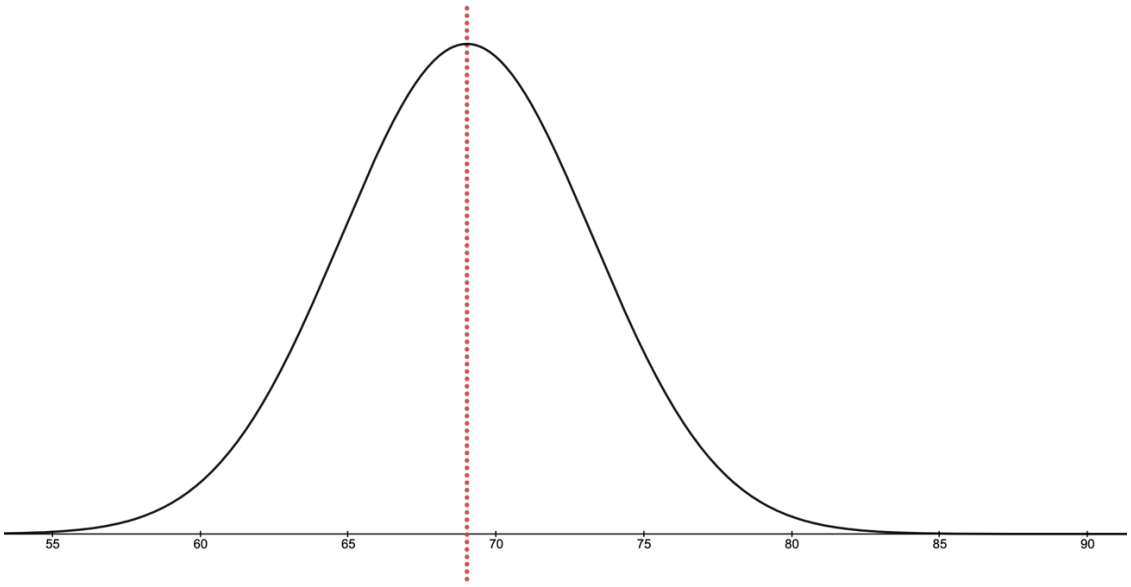


$$p(50 \leq x \leq 80) \approx 0.000$$

Not Likely

14. What's the probability of 35 randomly selected African America males living more than 95 years?



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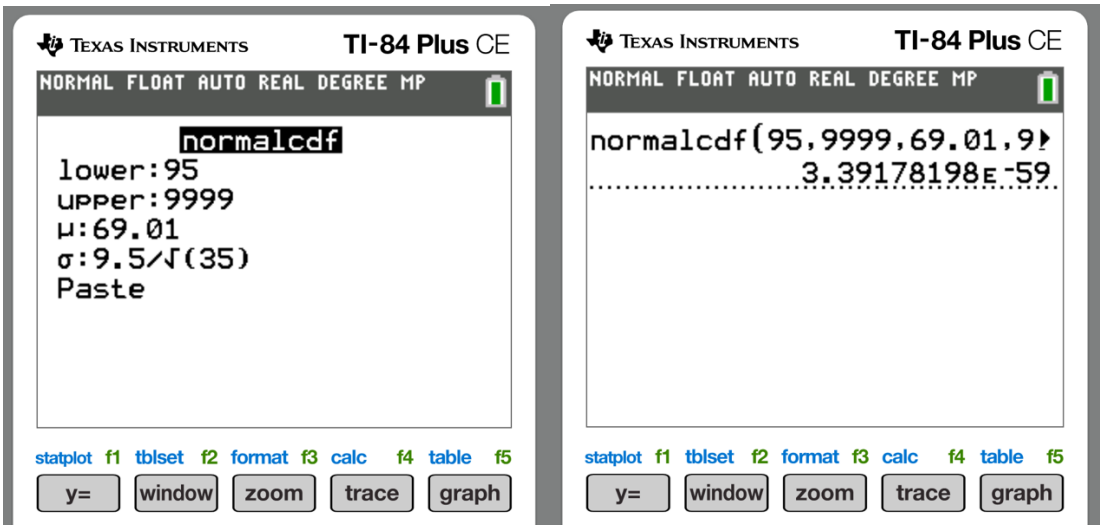
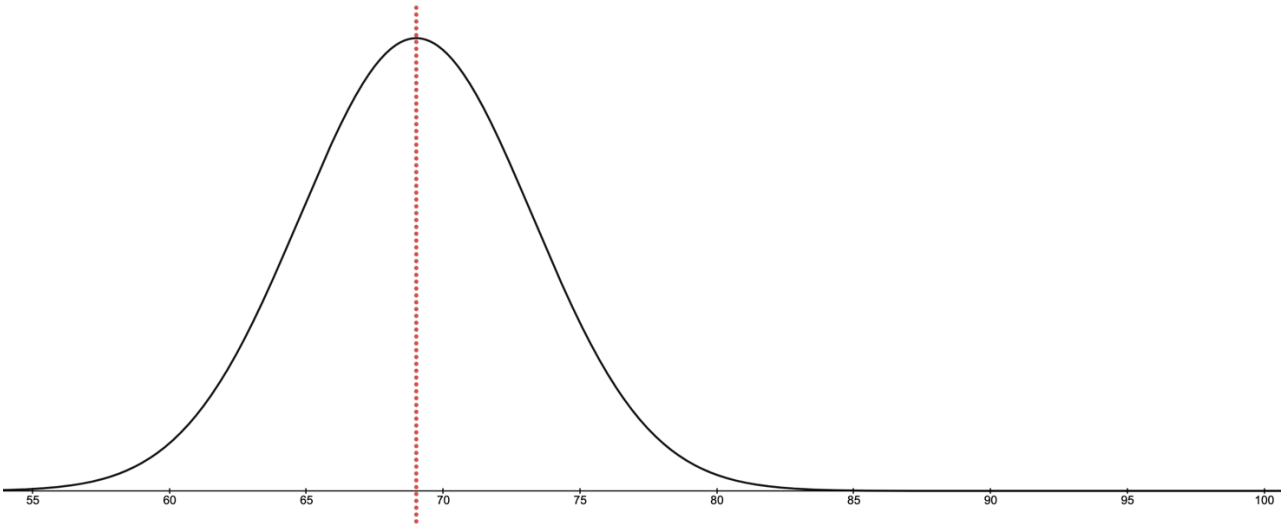


$$p(x \geq 95) \approx 0.000$$

Not Likely

15. What's the probability of 50 randomly selected African America males living between 95 and 100 years of age?



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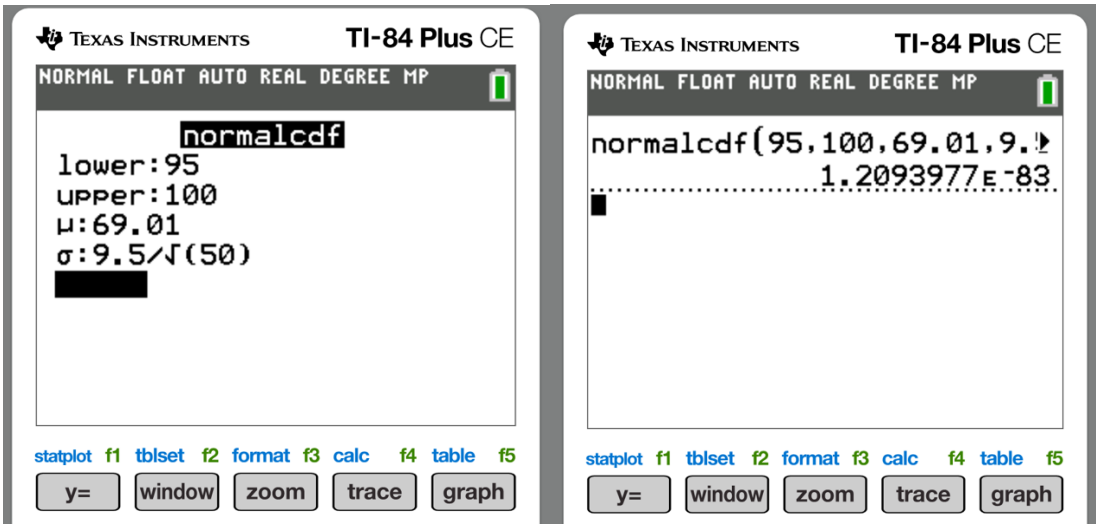


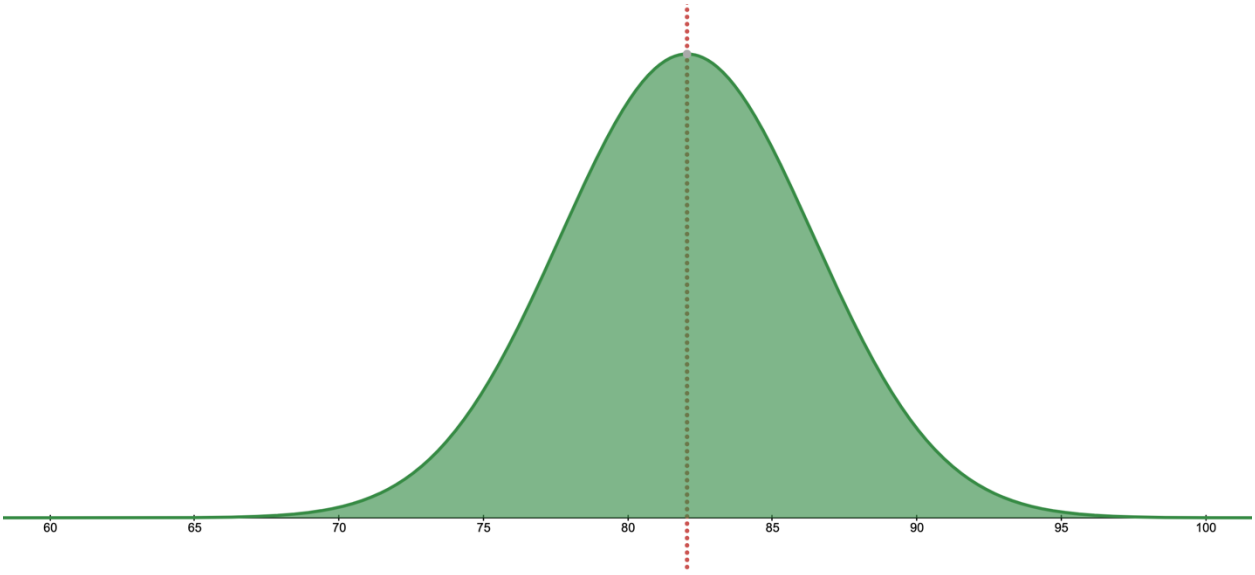
$$p(95 \leq x \leq 100) \approx 0.000$$

Not Likely

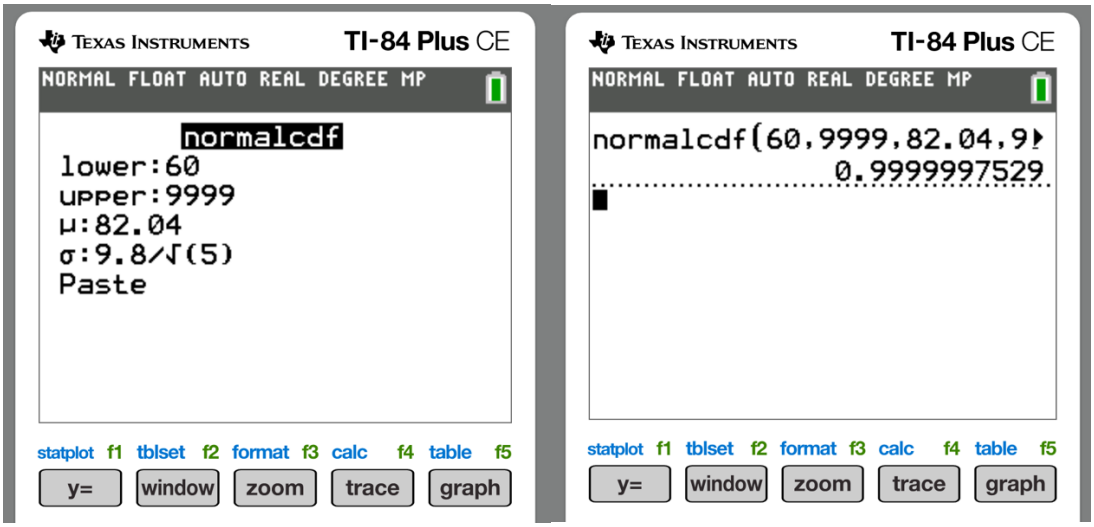
If the Life Expectancy of Asian Americans living in Hawaii is 82.04 years with a standard deviation of 9.8 years (this is an assumption): https://www.worldlifeexpectancy.com/usa/life-expectancy-hispanic

Approximate Answers to the Nearest Thousandths

16. What's the probability of 5 randomly selected Asian Americans from Hawaii living more than 60 years of age?



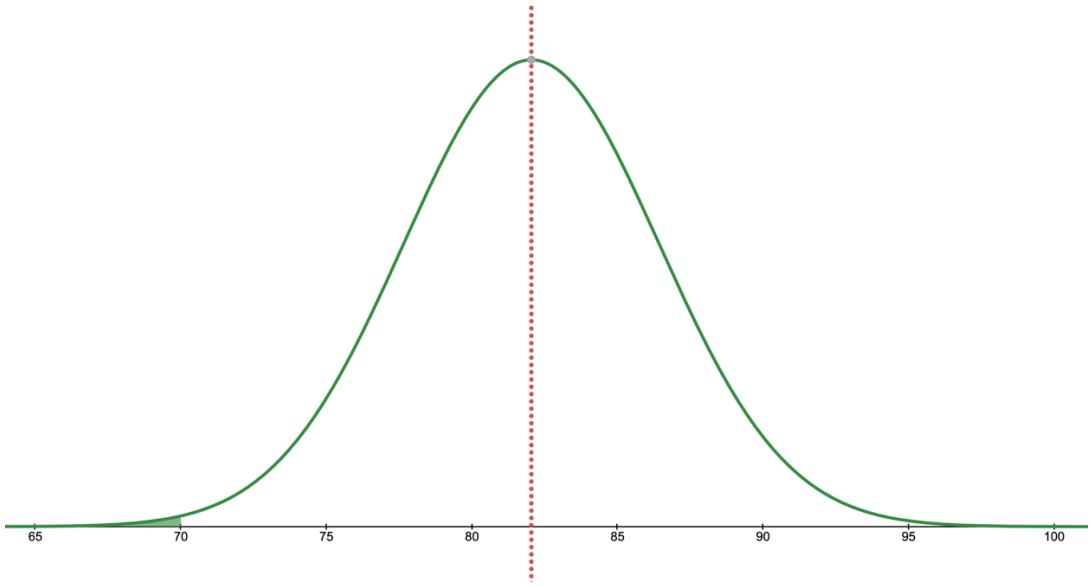
82.04



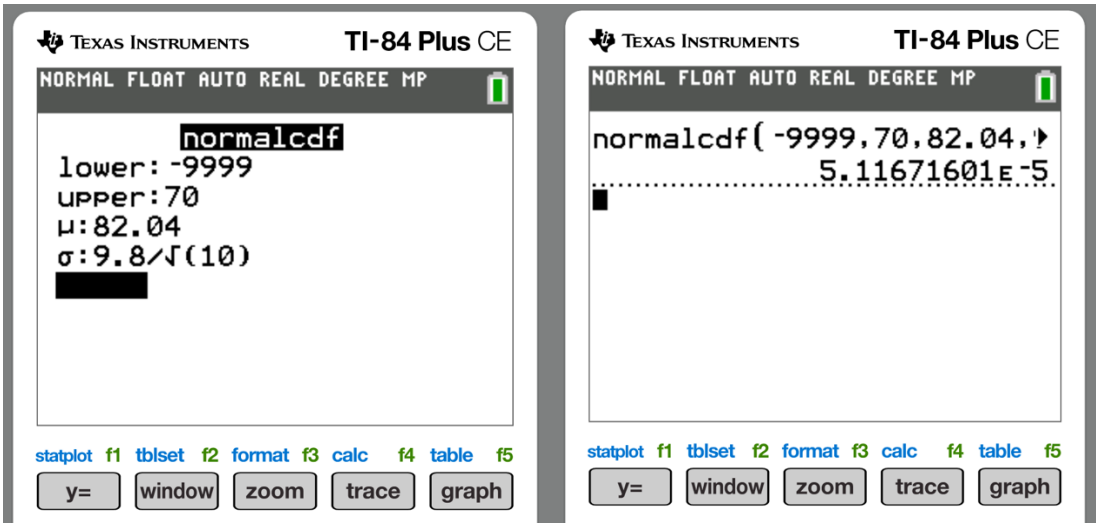
$$p(x \geq 60) \approx 1.000$$

Almost Certain

17. What's the probability of 10 randomly selected Asian Americans from Hawaii living less than 70 years of age?



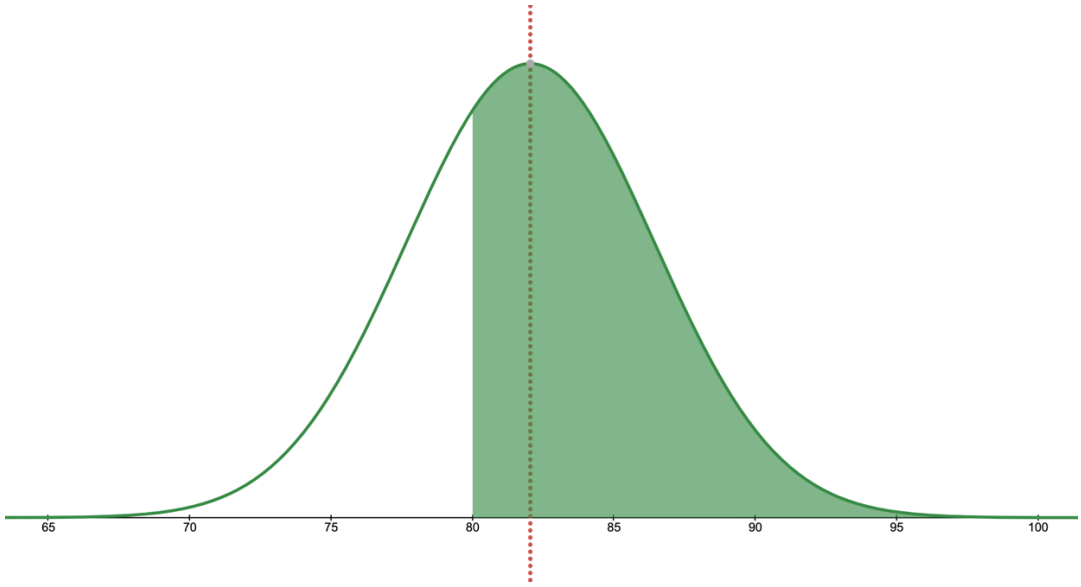
82.04

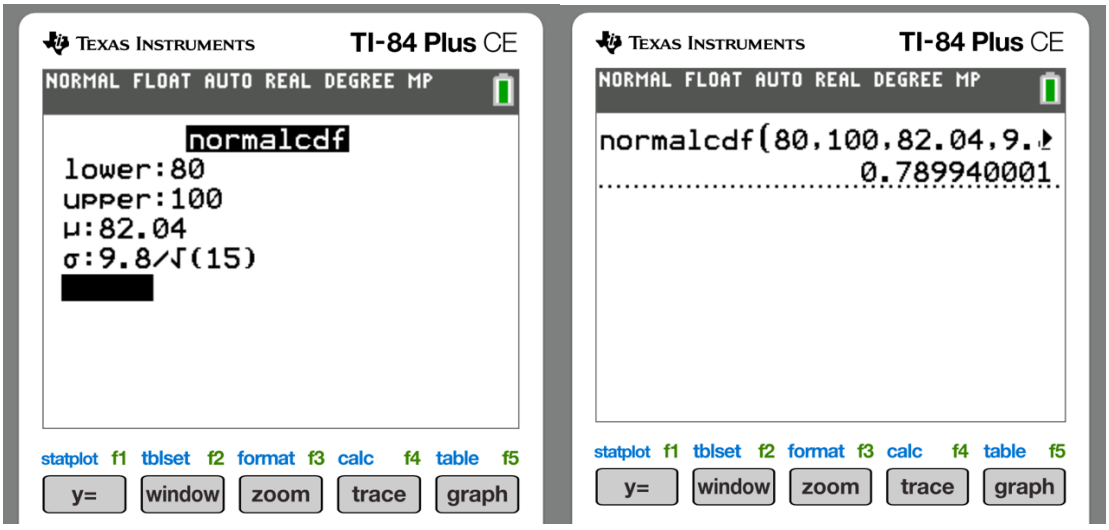


$$p(x < 70) \approx 0.000050 \approx 0.000$$

Not Likely

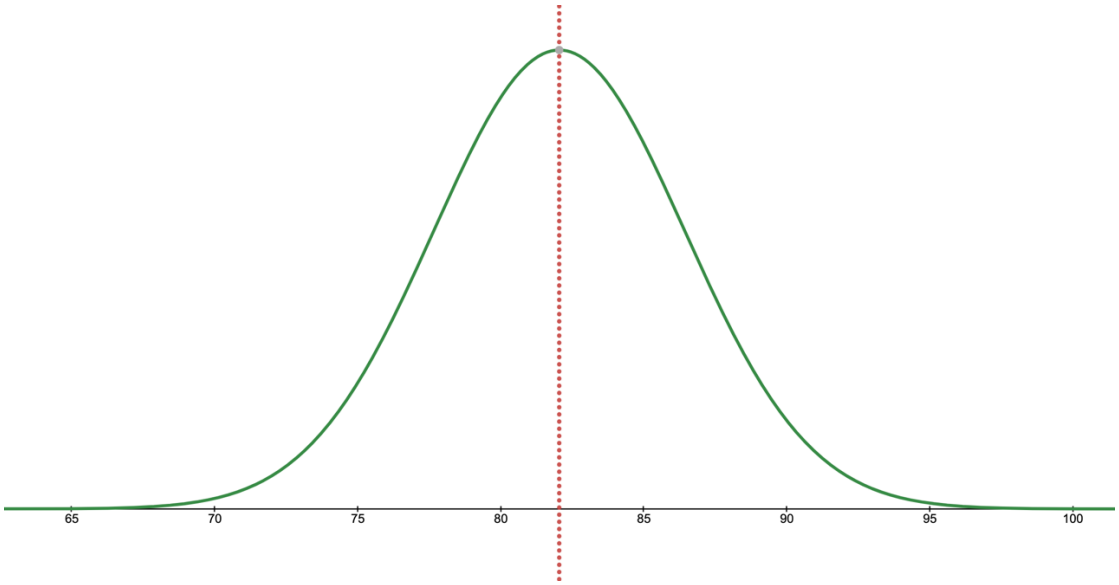
18. What's the probability of 15 randomly selected Asian Americans from Hawaii living between 80 and 100 years of age?



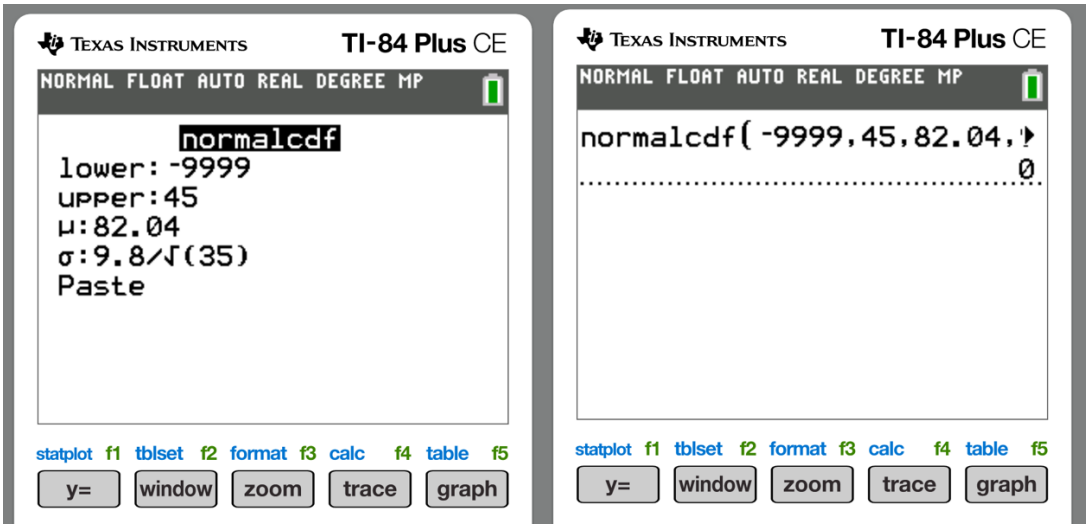


$$p(80 \leq x \leq 100) \approx 0.790$$

19. What's the probability of 35 randomly selected Asian Americans from Hawaii living less than 45 years of age?

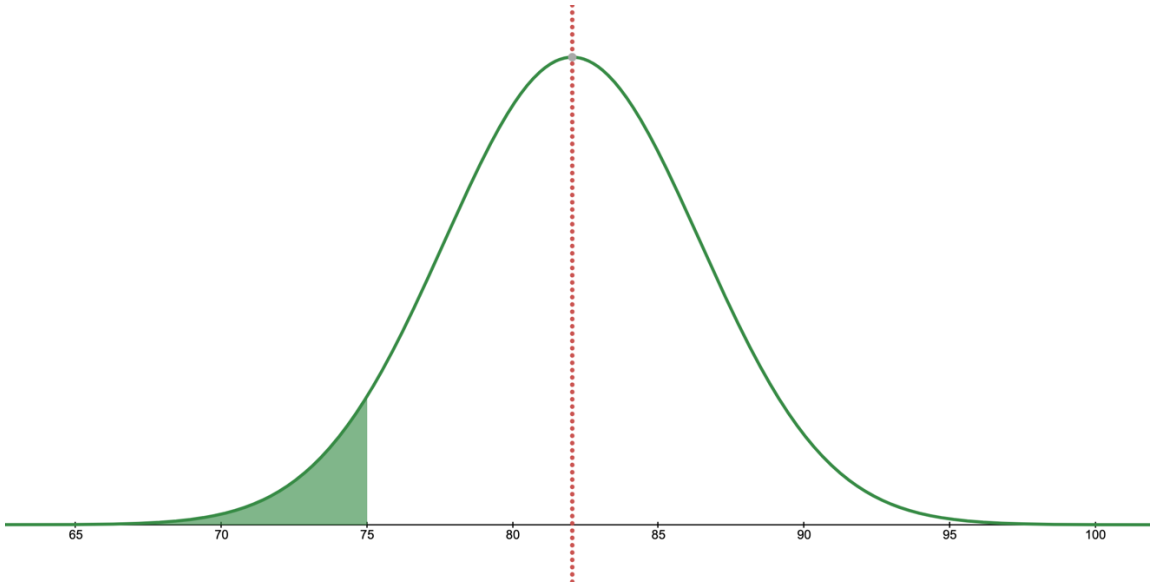


82.04

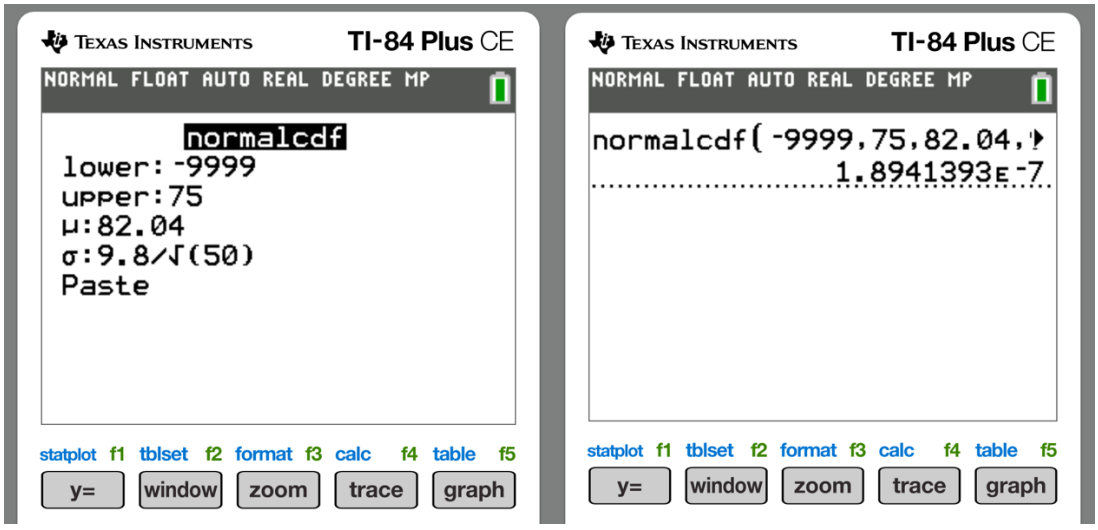


$$p(x < 45) \approx 0.000$$

20. What's the probability of 50 randomly selected Asian Americans from Hawaii living no more than 75 years of age?



82.04



$$p(x \leq 75) \approx 0.0000002 \approx 0.000$$

Not Likely