

Binomial Probability Distribution Solutions

5 Children

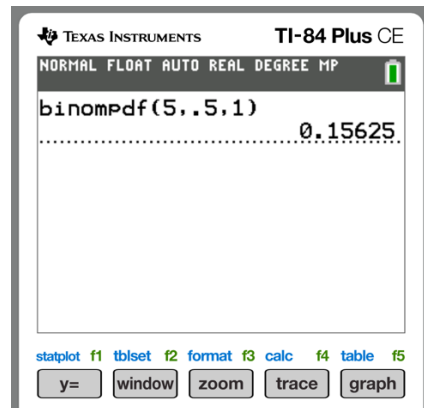
A couple plans on having 5 children. What's the probability of having:

Approximate your answers to the nearest thousandths.

$$n = 5, p = p(\text{girl}) = \frac{1}{2} = 0.5$$

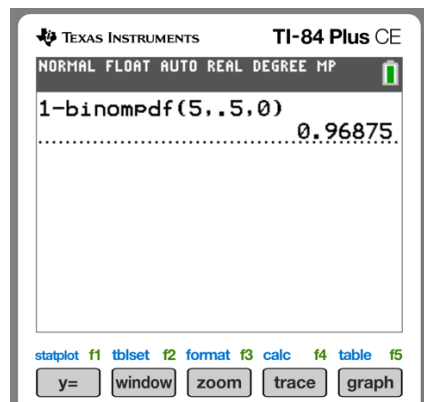
1. One girl?

$$p(1) \approx 0.156$$



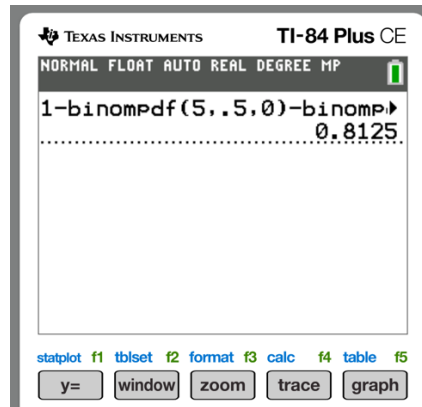
2. At least one girls?

$$p(x \geq 1) = 1 - p(0) \approx 0.969$$



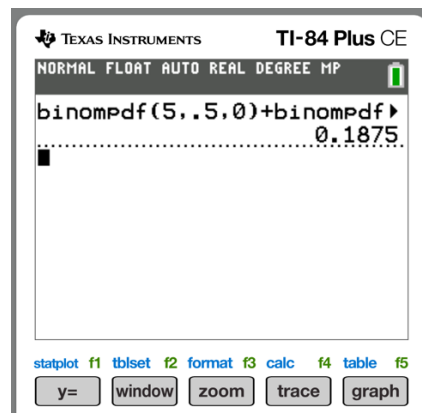
3. More than one girl?

$$p(x > 1) = 1 - p(0) - p(1) \approx 0.813$$



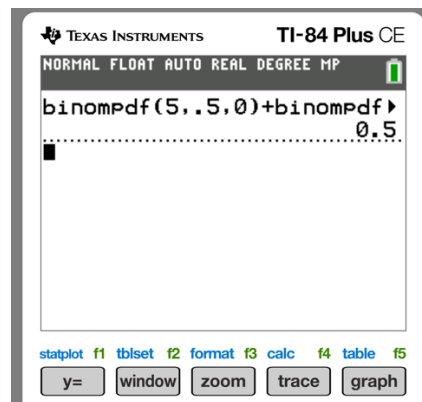
4. No more than one girl?

$$p(x \leq 1) = p(0) + p(1) \approx 0.188$$



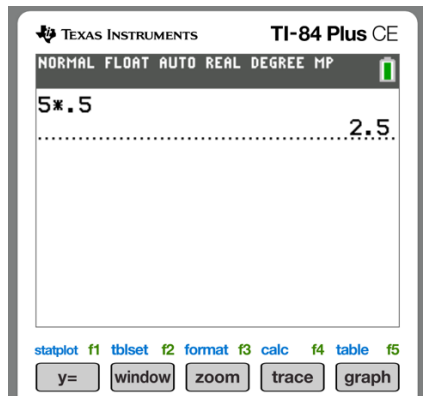
5. Less than three girls?

$$p(x \leq 3) = p(0) + p(1) + p(2) = 0.5$$



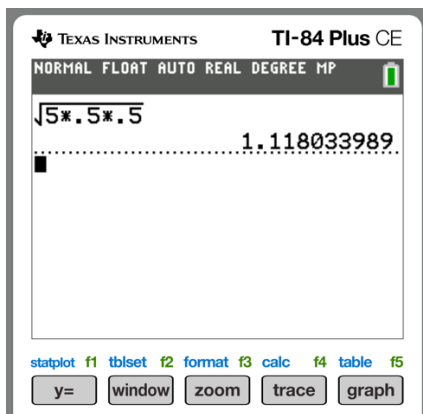
6. What is the expected number of girls?

$$\mu = 5 \cdot 0.5 = 2.5$$



7. What is the standard deviation for this distribution?

$$\sigma = \sqrt{5 \cdot 0.5 \cdot 0.5} \approx 1.118$$



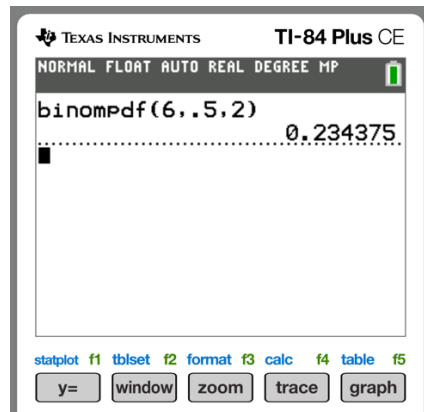
6 Children

A couple plans on having 6 children. What's the probability of having:
Approximate your answers to the nearest thousandths.

$$n = 6, p = p(\text{girl}) = \frac{1}{2} = 0.5$$

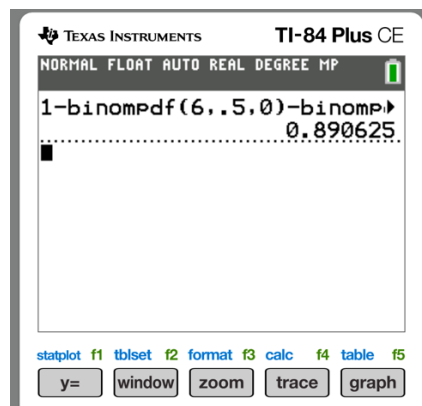
8. Two girls?

$$p(2) \approx 0.234$$



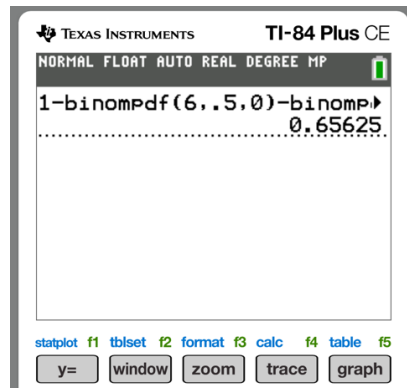
9. At least two girls?

$$p(x \geq 2) = 1 - p(0) - p(1) \approx 0.891$$



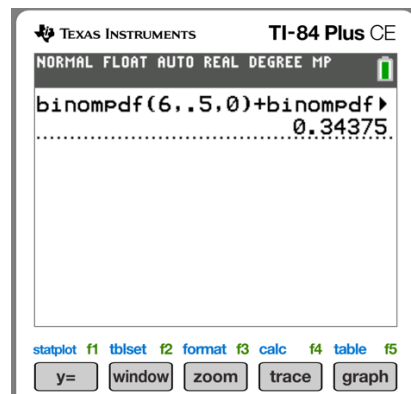
10. More than two girls?

$$p(x > 2) = 1 - p(0) - p(1) - p(2) \approx 0.656$$



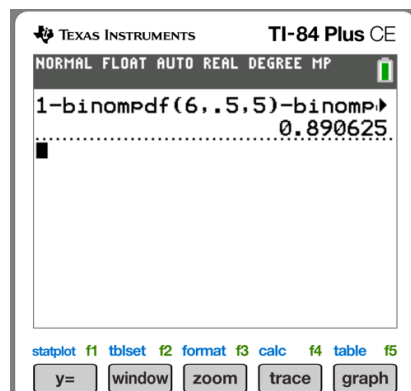
11. No more than two girls?

$$p(x \leq 2) = p(0) + p(1) + p(2) \approx 0.344$$



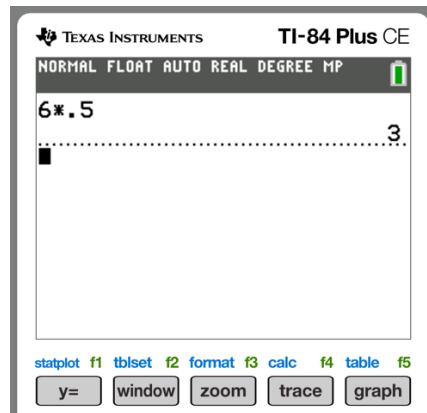
12. Less than five girls?

$$p(x < 5) = p(0) + p(1) + p(2) + p(3) + p(4) = 1 - p(5) - p(6) \approx 0.891$$



13. What is the expected number of girls?

$$\mu = 6 \cdot 0.5 = 3$$



14. What is the standard deviation for this distribution?

$$\sigma = \sqrt{6 \cdot 0.5 \cdot 0.5} \approx 1.225$$



Machine

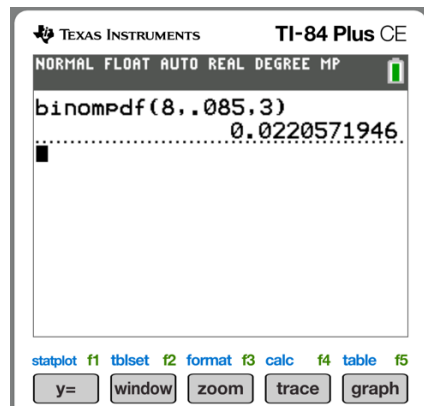
A machine has 8 components that function independently of one another. The probability that a component will fail is 0.085. What's the probability that:

Approximate your answers to the nearest thousandths.

$$n = 8, p = p(\text{fail}) = 0.085$$

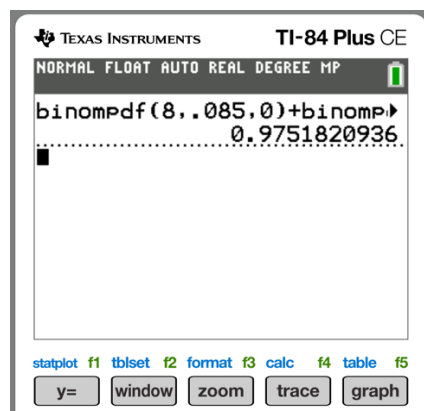
15. Three Components fail?

$$p(x = 3) \approx 0.022$$



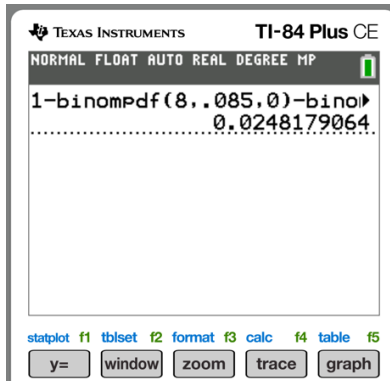
16. Fewer than three components fail?

$$p(x < 3) = p(0) + p(1) + p(2) \approx 0.975$$



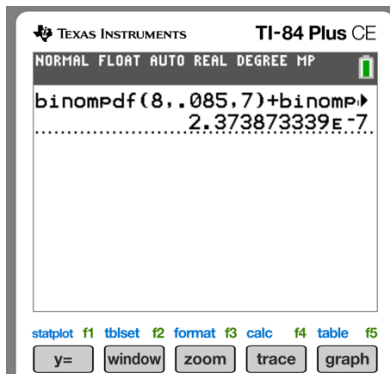
17. At least three components fail?

$$p(x \leq 3) = p(3) + p(4) + p(5) + p(6) + p(7) + p(8) = 1 - p(0) - p(1) - p(2) \approx 0.025$$



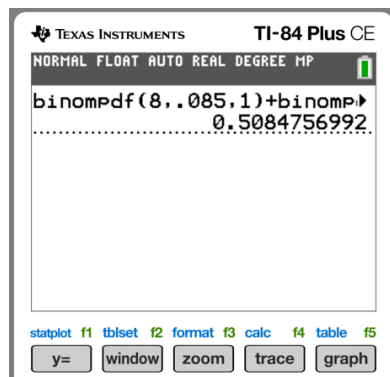
18. More than six components fail?

$$p(x > 6) = p(7) + p(8) \approx 0.000000237 \approx 0.000$$



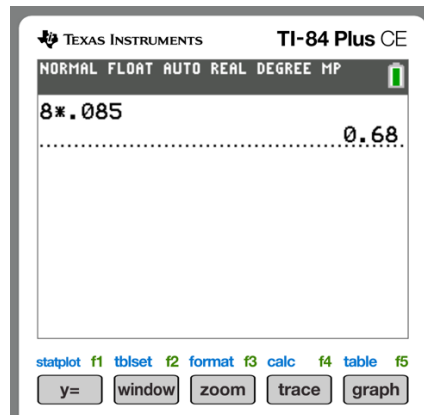
19. Between one and four components fail?

$$p(1 \leq x \leq 4) = p(1) + p(2) + p(3) + p(4) \approx 0.508$$



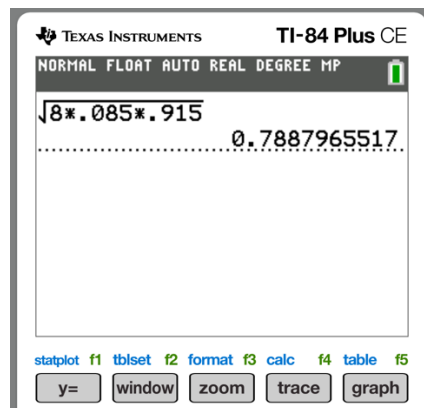
20. What is the expected number of failed components?

$$\mu = 8 \cdot 0.085 = 0.68$$



21. What is the standard deviation for this distribution?

$$\sigma = \sqrt{8 \cdot 0.085 \cdot 0.915} \approx 0.789$$



Ethnic Minority STEM Students

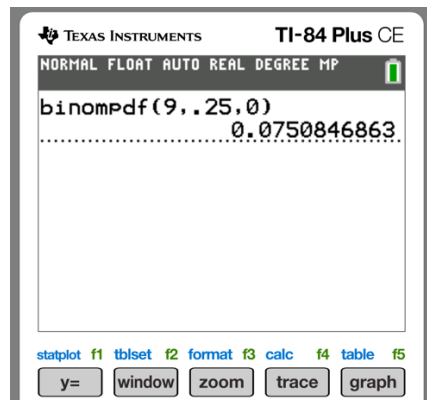
At a particular college, 25% of STEM students are people of color. In a science class of 9 students, what's the probability that:

Approximate your answers to the nearest thousandths.

$$n = 9, p = p(\text{ethnic minority}) = 0.25$$

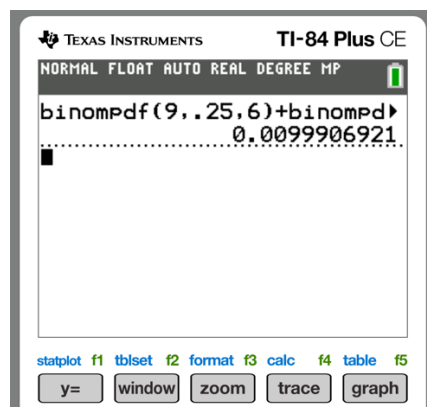
22. No ethnic minority students?

$$p(0) \approx 0.075$$



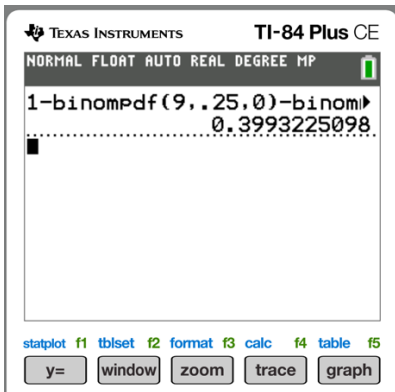
23. At least six ethnic minority students?

$$p(x \leq 6) = p(6) + p(7) + p(8) \approx 0.010$$



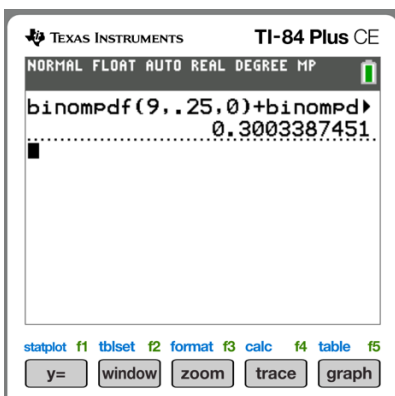
24. More than two students are ethnic minorities?

$$p(x > 2) = p(3) + p(4) + p(5) + p(6) + p(7) + p(8) = 1 - p(0) - p(1) - p(2) \approx 0.399$$



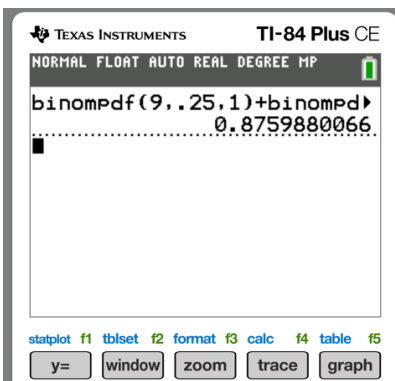
25. Less than two students are ethnic minorities?

$$p(x < 2) = p(0) + p(1) \approx 0.300$$



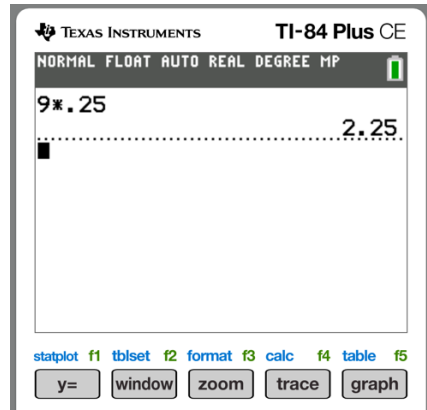
26. Between one and four students are ethnic minorities?

$$p(1 \leq x \leq 4) = p(1) + p(2) + p(3) + p(4) \approx 0.876$$



27. What is the expected number of STEM students that are ethnic minorities?

$$\mu = 9 \cdot 0.25 = 2.25$$



28. What is the standard deviation for this distribution?

$$\sigma = \sqrt{9 \cdot 0.25 \cdot 0.75} \approx 1.299$$



8 Question Multiple Choice Quiz

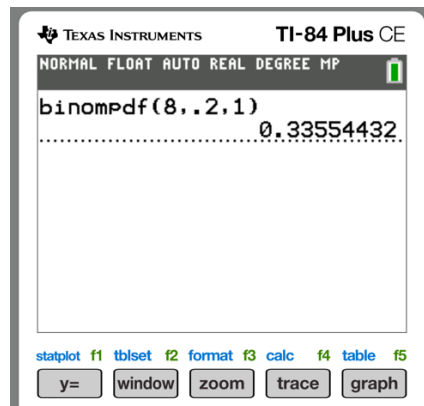
There is an 8-question multiple choice quiz that has 5 possible answers for each question (a), (b), (c), (d), and (e). If you guess on each question, what's the probability of getting:

Approximate your answers to the nearest thousandths.

$$n = 8, p = p(\text{correct Guess}) = 0.2$$

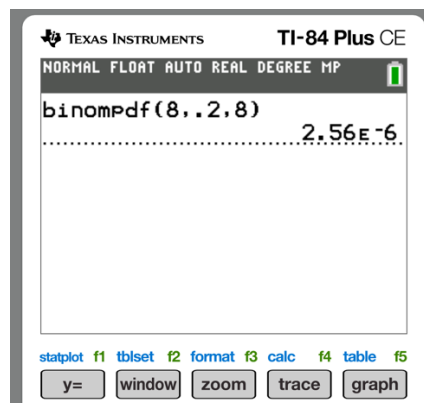
29. One correct guess?

$$p(1) \approx 0.336$$



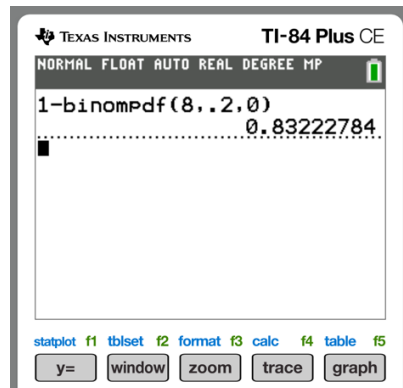
30. All correct guesses?

$$p(8) = 0.00000256 \approx 0.000$$



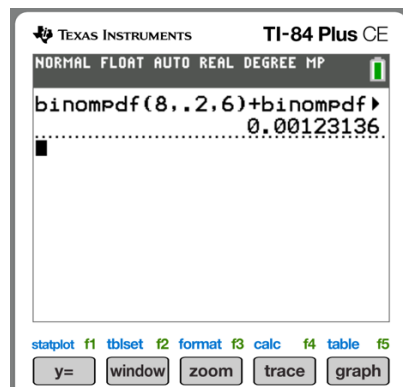
31. At least one correct guess?

$$p(x \geq 1) = 1 - p(0) \approx 0.832$$



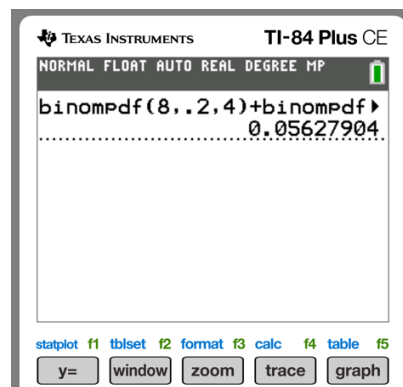
32. More than five correct guesses?

$$p(x > 5) = p(6) + p(7) + p(8) \approx 0.001$$



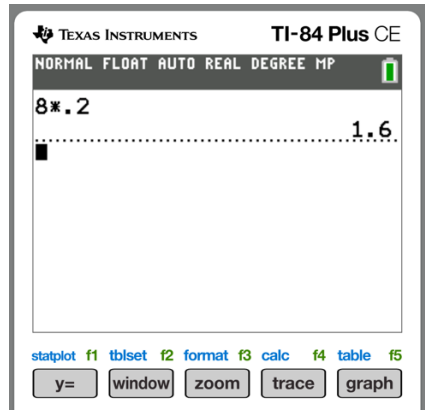
33. Between four and seven correct guesses?

$$p(4 \leq x \leq 7) = p(4) + p(5) + p(6) + p(7) \approx 0.056$$



34. What is the expected number of correct guesses?

$$\mu = 8 \cdot 0.2 = 1.6$$



35. What is the standard deviation for this distribution?

$$\sigma = \sqrt{8 \cdot 0.2 \cdot 0.8} \approx 1.131$$

