Poisson Probability Distribution Solutions

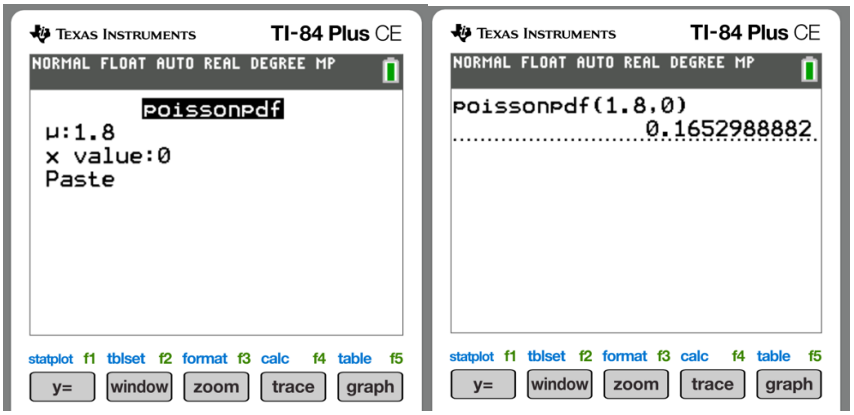
Computer Sales

A computer salesman averages 1.8 sales per week (7-days). In the next week, what's the probability the computer salesman will have:

Approximate your answers to the nearest thousandths.

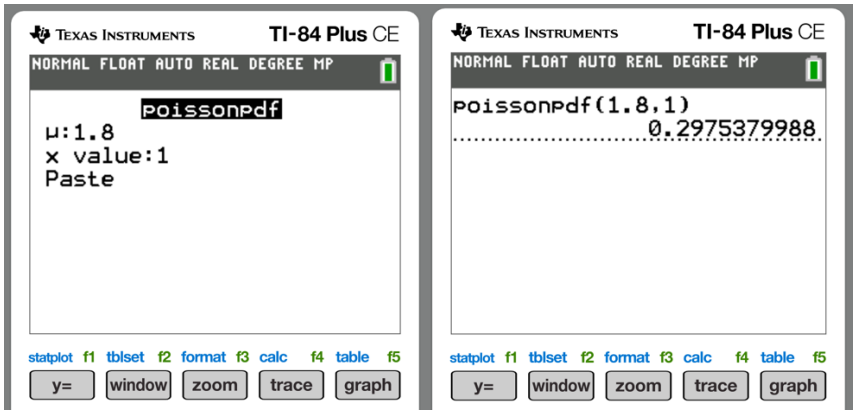
$$\mu = 1.8 \; sales \; per \; week$$
$$x = \#\; of \; sales$$

1. No Sales? $x = 0$



$$p(0) \approx 0.165$$

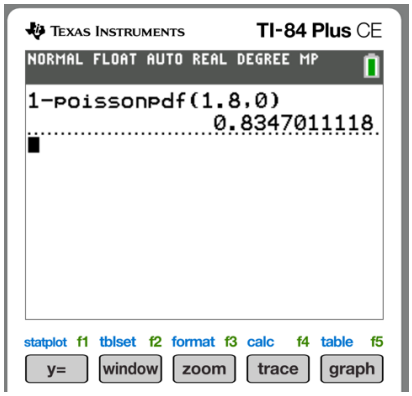
2. One sale? $x = 1$



$$p(1) \approx 0.298$$

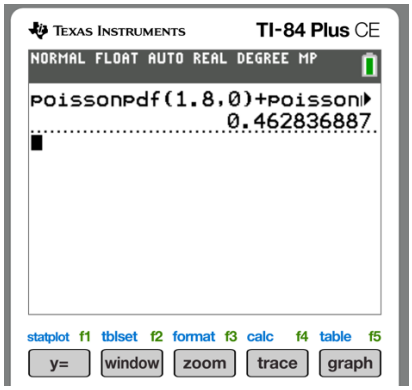
3. At least one sale? $x \geq 1$

$$p(x \geq 1) = p(1) + p(2) + p(3) + \cdots = 1 - p(0) \approx 0.835$$



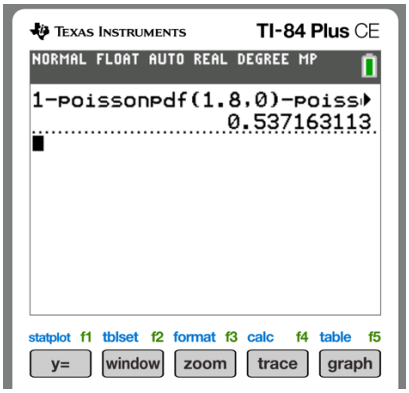
4. No more than one girl? $x \leq 1$

$$p(x \leq 1) = p(0) + p(1) \approx 0.463$$



5. More than one sale? $x > 1$

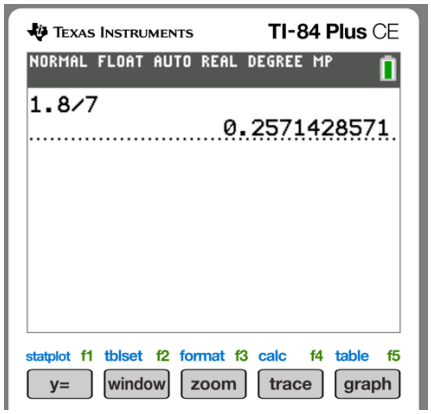
$$p(x > 1) = p(2) + p(3) + p(4) + \cdots = 1 - p(0) - p(1) \approx 0.537$$

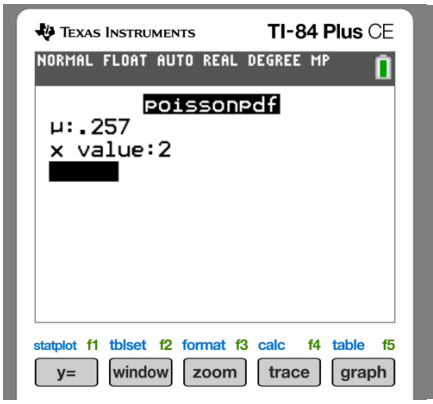


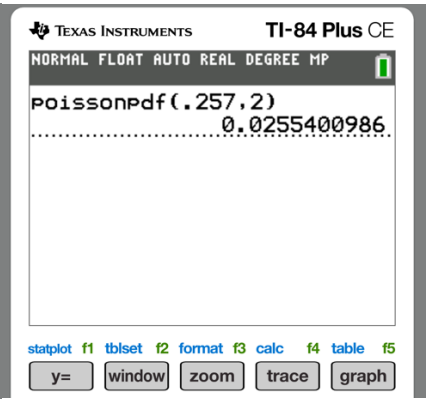
6. In the next day, what's the probability there will be two sales?

$$x = 2$$

$$\frac{1.8}{7} = \frac{\mu}{1} \rightarrow \mu \approx 0.257 \text{ per day}$$







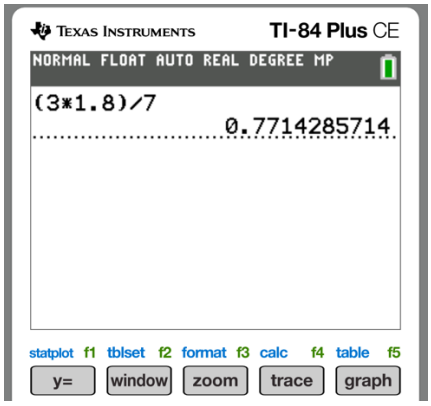
$$p(2) \approx 0.026$$

Not Likely

7. In the next 3-day interval, what's the probability there will be more than two sales?

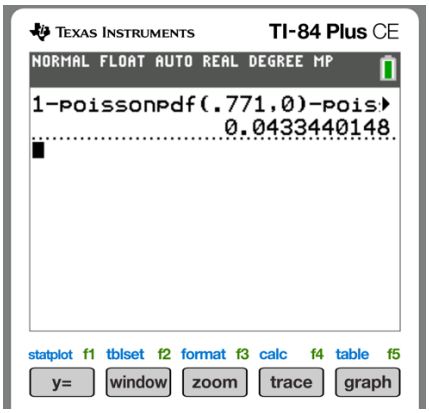
$$x > 2$$

$$\frac{1.8}{7} = \frac{\mu}{3} \rightarrow \mu = \frac{3 \cdot 1.8}{7} \approx 0.771 \rightarrow \mu \approx 0.771 \text{ per 3-day}$$



$$p(x > 2) = p(3) + p(4) + p(5) + \cdots = 1 - p(0) - p(1) - p(2) \approx 0.043$$

Not Likely



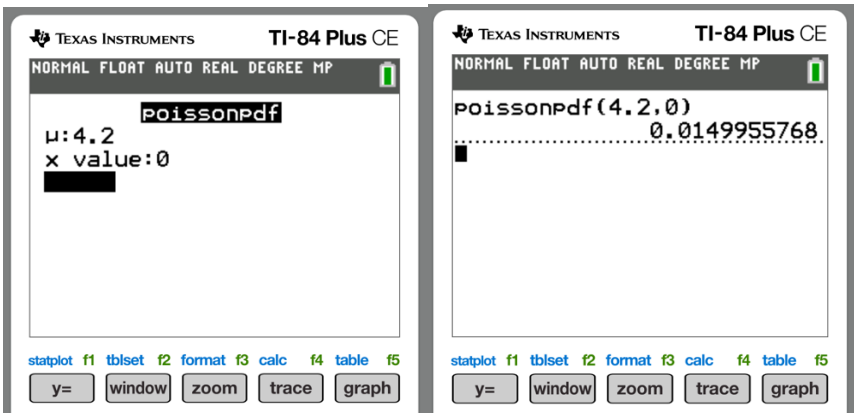
911 Calls

Emergency service experiences a mean of 4.2 calls per day (24 hours). In the next day, what's the probability there will be:

Approximate your answers to the nearest thousandths.

$$\mu = 4.2 \; sales \; per \; day$$
$$x = \#\; of \; 911 \; calls$$

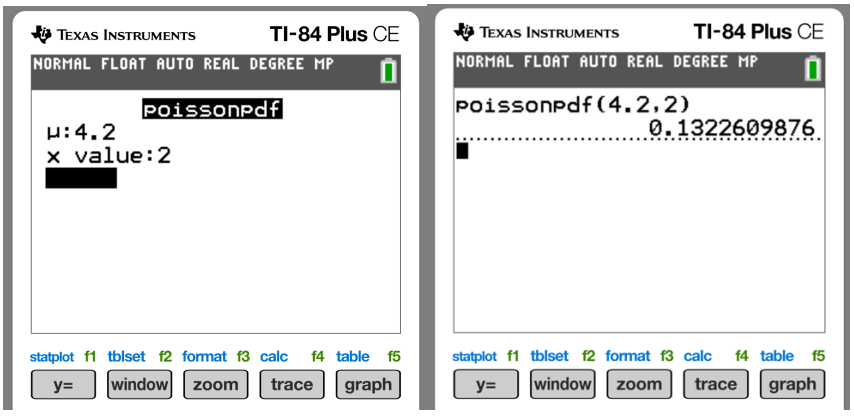
8. No calls? $x = 0$



$$p(0) \approx 0.015$$

Not Likely

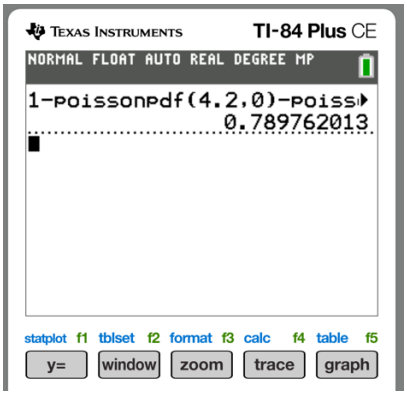
9. Two calls? $x = 2$



$$p(2) \approx 0.132$$

10. More than two calls? $x > 2$

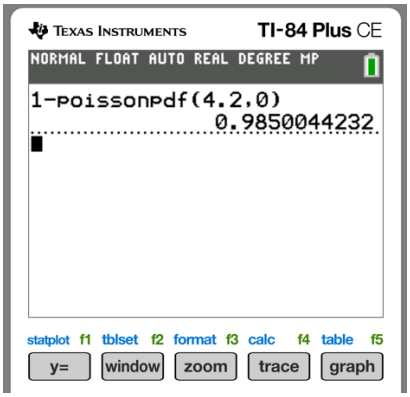
$$p(x > 2) = p(3) + p(4) + p(5) + \cdots = 1 - p(0) - p(1) - p(2) \approx 0.790$$



11. At least one call? $x \geq 1$

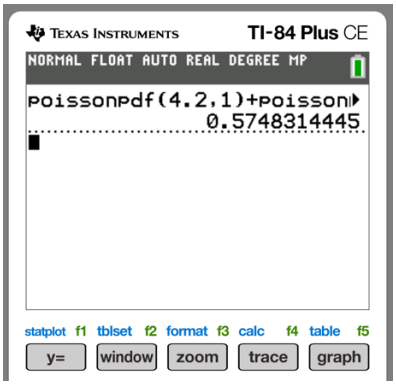
$$p(x \geq 1) = p(1) + p(2) + p(3) + \cdots = 1 - p(0) \approx 0.985$$

Almost Certain



12. Between one and four calls? $\mathbf{1 \leq x \leq 4}$

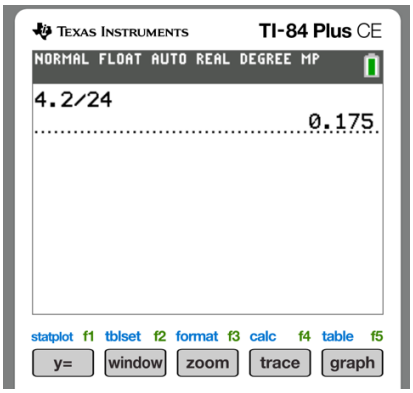
$$\boldsymbol{p(1 \leq x \leq 4) = p(1) + p(2) + p(3) + p(4) \approx 0.575}$$



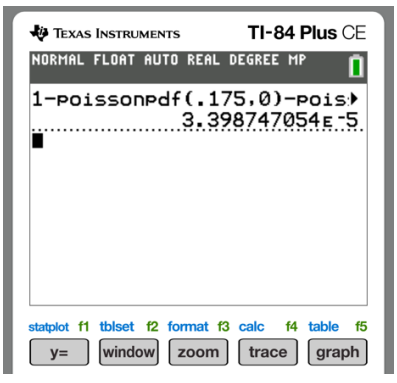
13. In the next, hour what's the probability there will be more than three calls?

$$\boldsymbol{x > 3}$$

$$\boldsymbol{\frac{4.2}{24} = \frac{\mu}{1} \rightarrow \mu = \frac{4.2}{24} \rightarrow \mu = 0.175} \text{ per hour}$$



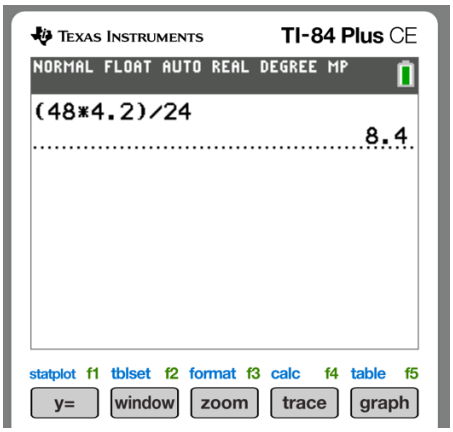
$$\boldsymbol{p(x > 3) = p(4) + p(5) + p(6) + \cdots = 1 - p(0) - p(1) - p(2) - p(3) \approx 0.000034 \approx 0.000}$$ **Not Likely**



14. In the next two days (48-hour time interval), what's the probability there will be less than three calls?

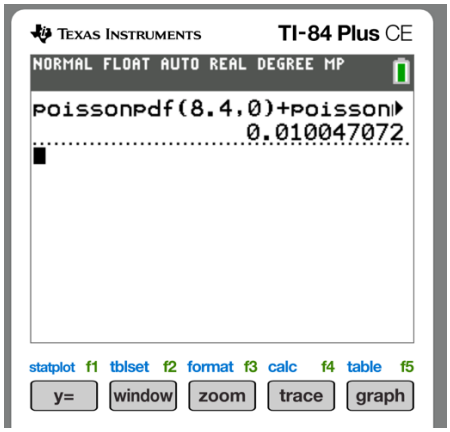
$$x < 3$$

$$\frac{4.2}{24} = \frac{\mu}{48} \rightarrow \mu = \frac{48 \cdot 4.2}{24} \rightarrow \mu = 8.4 \text{ per 48-hour}$$



$$p(x < 3) = p(0) + p(1) + p(2) \approx 0.010$$

Not Likely



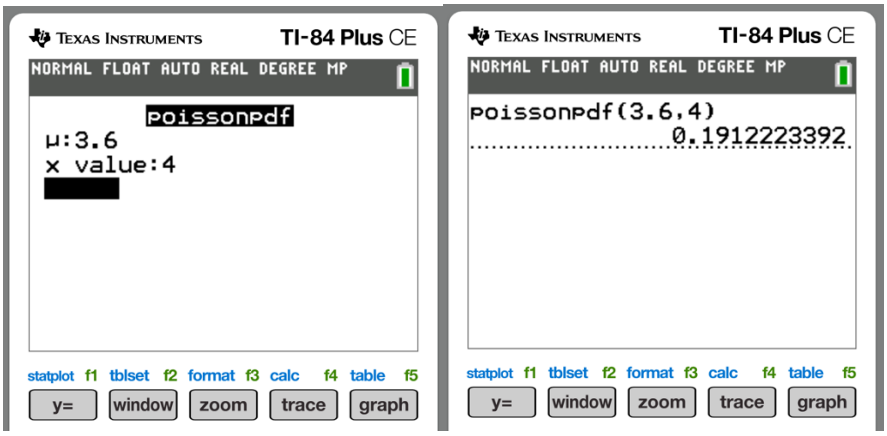
Lightning Strikes

The number of lightning strikes on ELAC Mountain occurs at a mean rate of 3.6 per year (365-days). In the next year, what's the probability there will be:

Approximate your answers to the nearest thousandths.

$$\mu = 3.6\ lightning\ Strikes\ per\ year$$
$$x = \#\ of\ lightning\ strikes$$

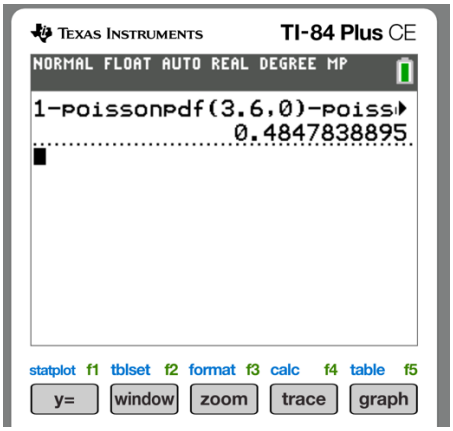
15. Four lightning strikes? $x = 4$



$$p(4) \approx 0.191$$

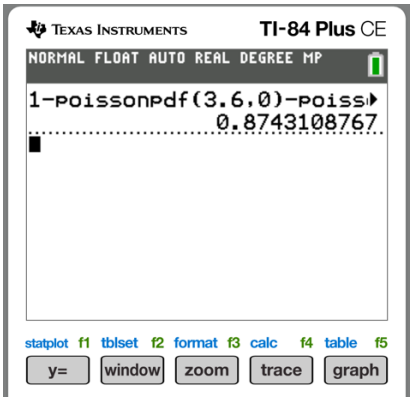
16. More than three lightning strikes? $x > 3$

$$p(x > 3) = p(4) + p(5) + p(6) + \cdots = 1 - p(0) - p(1) - p(2) - p(3) \approx 0.485$$



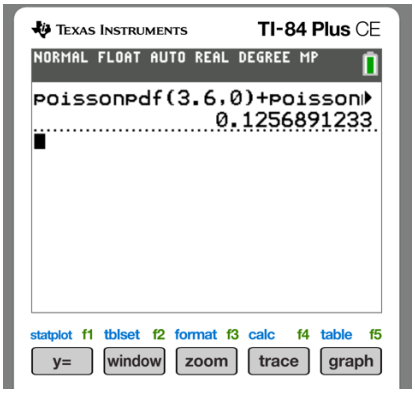
17. At least two lightning strikes? $x \geq 2$

$$p(x \geq 2) = p(2) + p(3) + p(4) + \cdots = 1 - p(0) - p(1) \approx 0.874$$

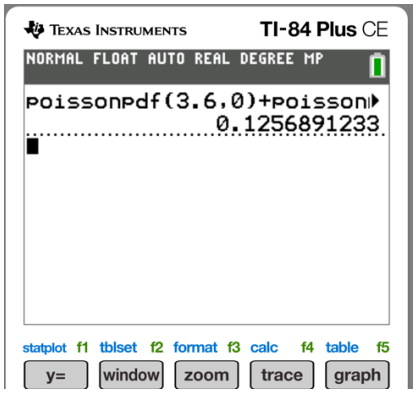


18. Less than two lightning strikes? $x < 2$

$$p(x < 2) = p(0) + p(1) \approx 0.126$$



19. No more than one lightning strikes? $x \leq 1$



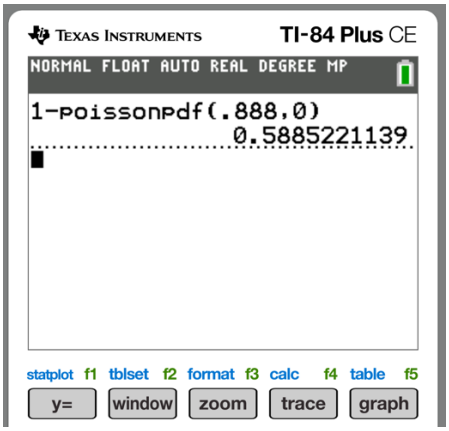
$$p(x \leq 1) = p(0) + p(1) \approx 0.125$$

20. In the next 90 days, what's the probability there will be at least one lightning strike?

$$x \geq 1$$

$$\frac{3.6}{365} = \frac{\mu}{90} \rightarrow \mu = \frac{90 \cdot 3.6}{365} \rightarrow \mu = 0.888 \text{ per 90-day}$$

$$p(x \geq 1) = p(1) + p(2) + p(3) + \cdots = 1 - p(0) \approx 0.589$$

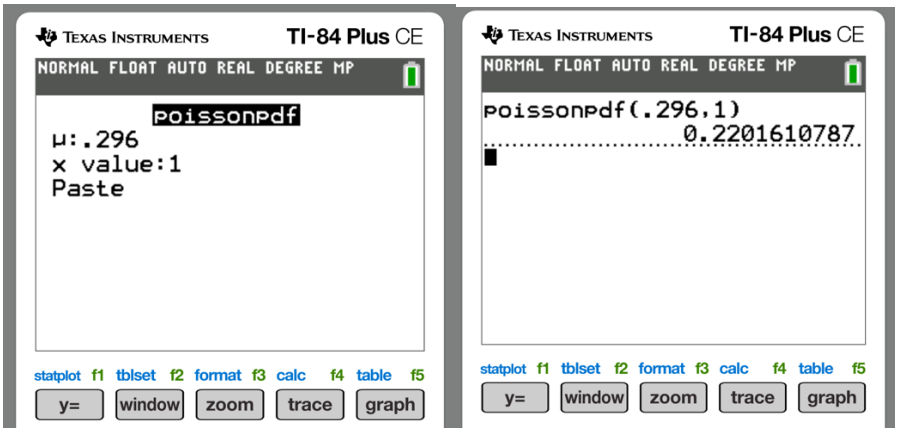


21. In the next, 30 days, what's the probability there will be a lightning strike?

$$x = 1$$

$$\frac{3.6}{365} = \frac{\mu}{30} \rightarrow \mu = \frac{30 \cdot 3.6}{365} \rightarrow \mu = 0.296 \text{ per 30-day}$$

$$p(1) \approx 0.220$$



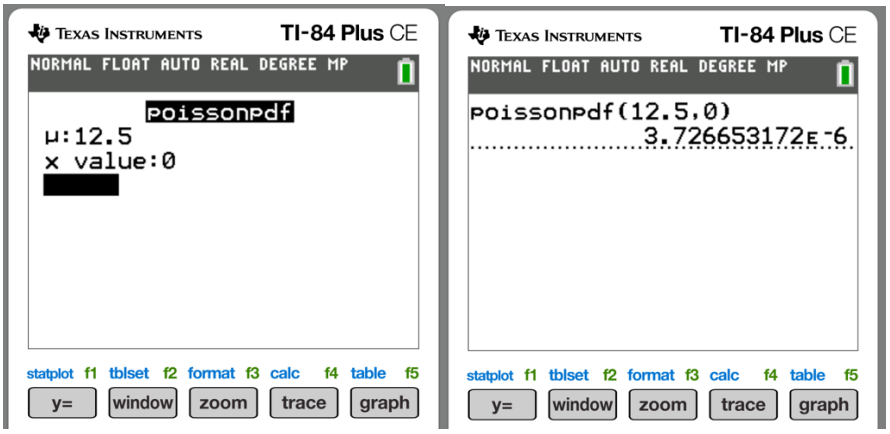
Murders

St Vegas experiences an average of 12.5 murders per month (30-day interval). In the next month, what's the probability there will be:

Approximate your answers to the nearest thousandths.

$$\mu = 12.5\ murders\ per\ month$$
$$x = \#\ of\ murders$$

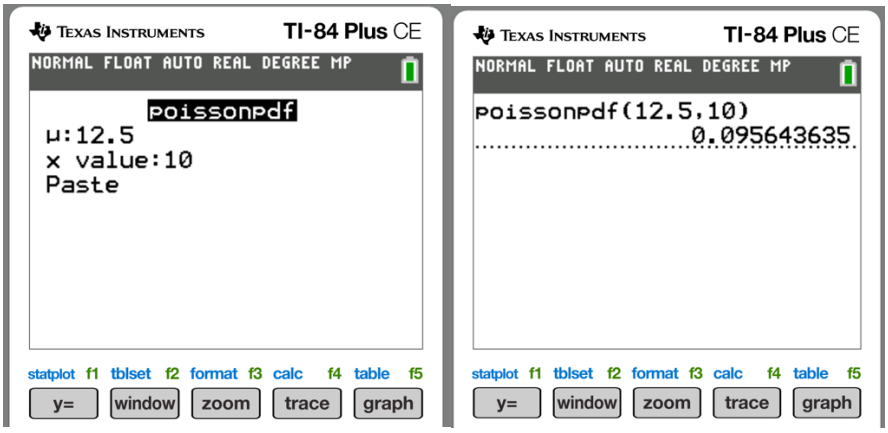
22. No murders? $x = 0$



$$p(0) \approx 0.00000373 \approx 0.000$$

Not Likely

23. Ten murders? $x = 10$

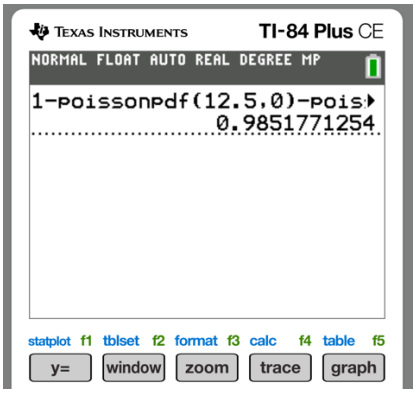


$$p(10) \approx 0.096$$

24. More than five murders? $x > 5$

$$p(x > 5) = p(6) + p(7) + p(8) + \cdots = 1 - p(0) - p(1) - p(2) - p(3) - p(4) - p(5)$$
$$\approx 0.985$$

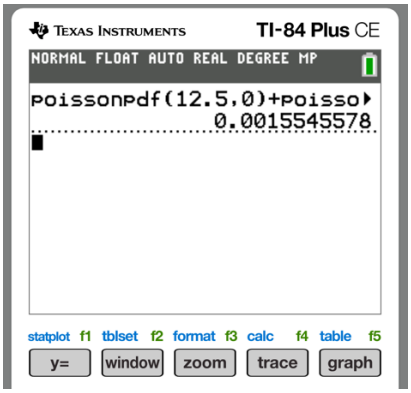
Almost Certain



25. No more than three murders? $x \leq 3$

$$p(x \leq 3) = p(0) + p(1) + p(2) + p(3) \approx 0.002$$

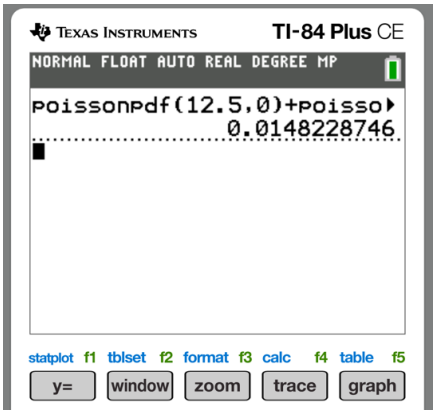
Not Likely



26. Less than six murders? $x < 6$

$$p(x < 6) = p(0) + p(1) + p(2) + p(3) + p(4) + p(5) \approx 0.015$$

Not Likely

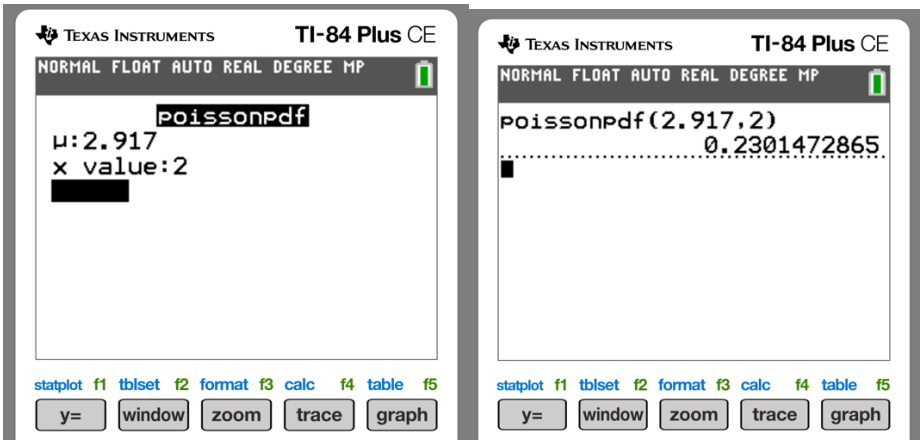


27. In the next week (7-day interval), what's the probability there will be two murders?

$$x = 2$$

$$\frac{12.5}{30} = \frac{\mu}{7} \rightarrow \mu = \frac{7 \cdot 12.5}{30} \rightarrow \mu = 2.917 \text{ per 7-day}$$

$$p(2) \approx 0.230$$



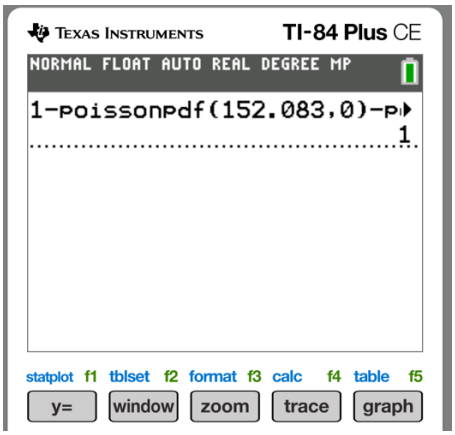
28. In the next year (365 days), what's the probability there will be at least two murders?

$$x \geq 2$$

$$\frac{12.5}{30} = \frac{\mu}{365} \rightarrow \mu = \frac{365 \cdot 12.5}{30} \rightarrow \mu = 152.083 \text{ per 365-day}$$

$$p(x \geq 2) = p(2) + p(3) + p(4) + \cdots = 1 - p(0) - p(1) \approx 1$$

Almost Certain



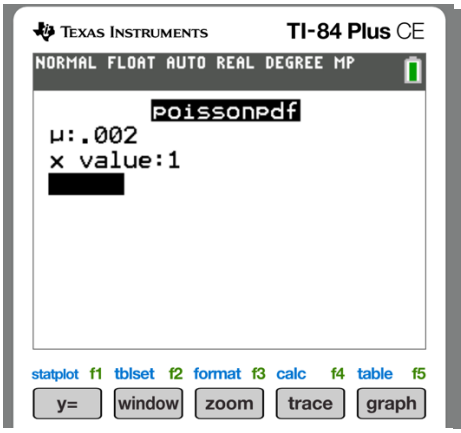
Earthquakes

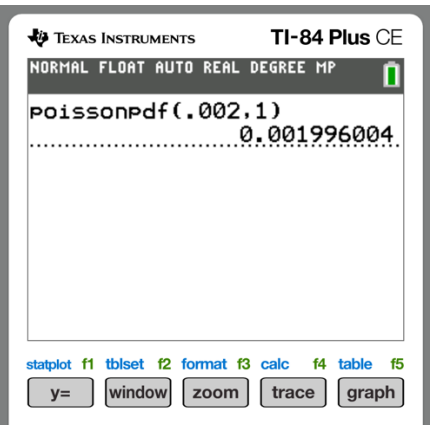
California experiences 1 Big One (earthquake above 6.0 on the Southern section of the San Andreas Fault) every 500 years. In the next year) what's the probability there will be:

Approximate your answers to the nearest thousandths.

$$\mu = \frac{1}{500} = 0.002 \text{ Big Ones per year}$$
$$x = \#\ of\ Big\ Ones$$

29. A big one? $x = 1$



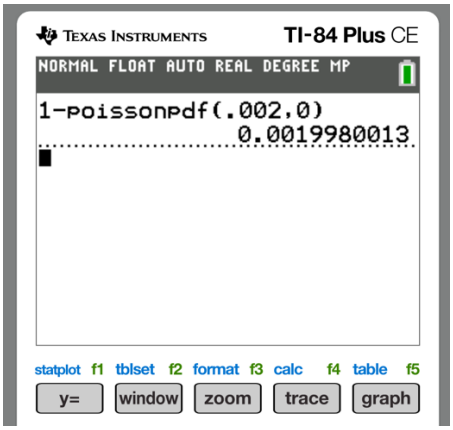


$$p(1) \approx 0.002$$

Not Likely

30. At least one big one? $x \geq 1$

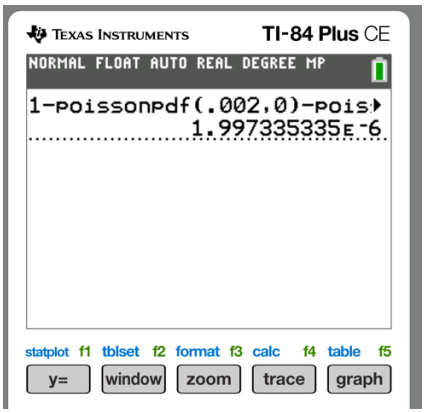
$$p(x \geq 1) = p(1) + p(2) + p(3) + \cdots = 1 - p(0) \approx 0.002$$



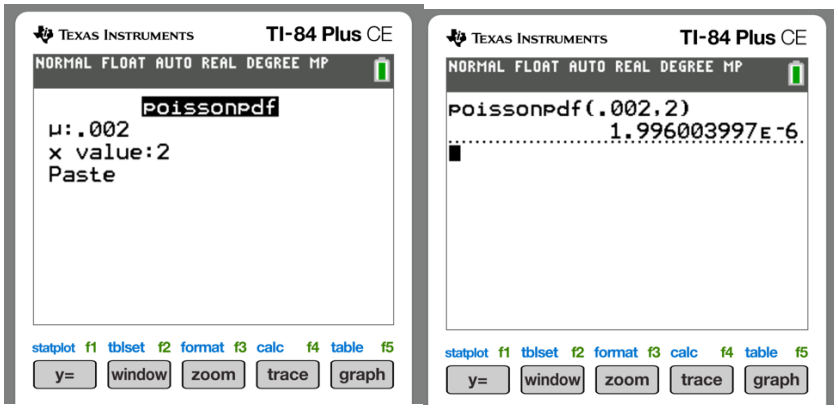
31. More than one big one? $x > 1$

$$p(x > 1) = p(2) + p(3) + p(4) + \cdots = 1 - p(0) - p(1) \approx 0.000002 \approx 0.000$$

Not Likely



32. Two big ones? $x = 2$



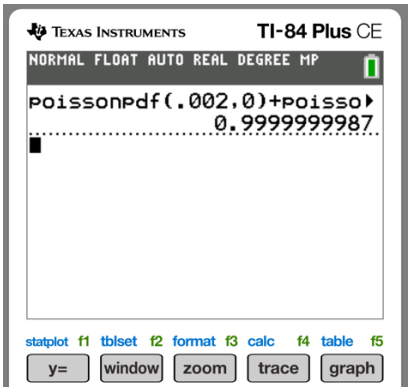
$$p(2) \approx 0.000002 \approx 0.000$$

Not Likely

33. No more than two big ones? $x \leq 2$

$$p(x \leq 2) = p(0) + p(1) + p(2) \approx 1.000$$

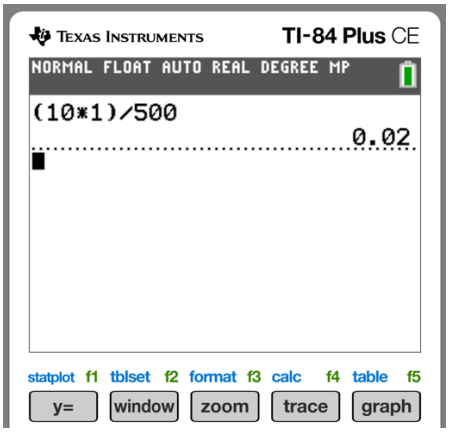
Almost Certain



34. In the next decade (10 years), what's the probability there will be a big one?

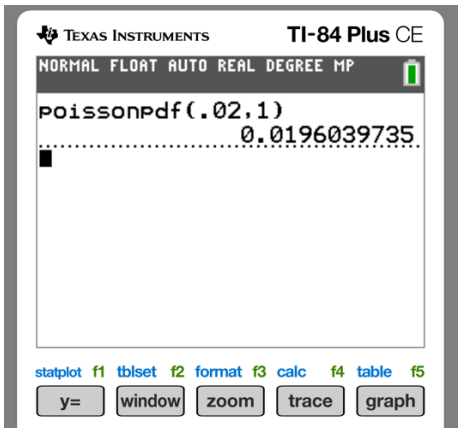
$$x = 1$$

$$\frac{1}{500} = \frac{\mu}{10} \rightarrow \mu = \frac{10 \cdot 1}{500} \rightarrow \mu = 0.02 \text{ per decade}$$



$$p(1) \approx 0.020$$

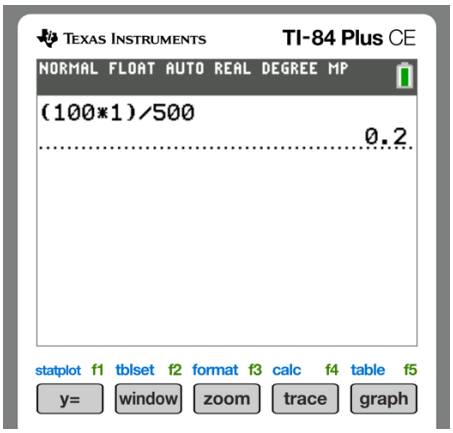
Not Likely



35. In the next century (100-years), what's the probability there will be more than two big ones?

$$x > 2$$

$$\frac{1}{500} = \frac{\mu}{100} \rightarrow \mu = \frac{100 \cdot 1}{500} \rightarrow \mu = 0.2 \text{ per century}$$



$$p(x > 2) = p(3) + p(4) = p(5) + \cdots = 1 - p(0) - p(1) - p(2) \approx 0.001$$

Not Likely