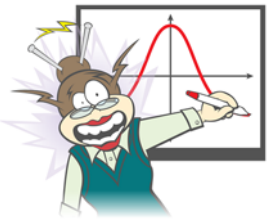
Mathematical Methods - The Binomial Distribution Revision Questions



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Each of the questions included here can be solved using either the TI-Nspire CX or CX CAS.

Question 1

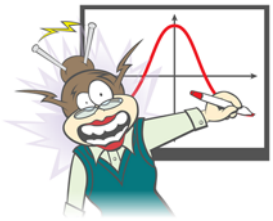
Ming is the goal shooter on his netball team. The probability that he will score a goal on any single attempt is 0.85. If Ming has 5 attempts at goal in the first quarter of the game, find the probability that he is successful on exactly 4 attempts.

Response:

Question 2

A fair die is rolled 60 times. Find, correct to three decimal places, the probability that the number 2 appears uppermost less than 10 times.

Response:



Question 3

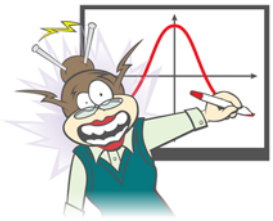
It is known that in a particular large city, 70% of school children travel to school via public transport. A group of 100 children from the city are selected at random. Find, correct to four decimal places, the probability that more than 80 of the children travel to school via public transport.

Response:

Question 4

The binomial random variable, Y, has a mean of 104 and variance of 78. Find the probability of success, p, and the number of independent trials, n.

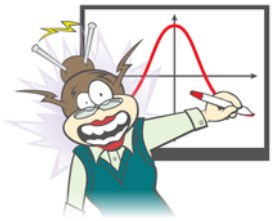
Response:



Question 5

The probability that Julian wakes up before 7am on any given school day is 0.2. The probability that Julian wakes up before 7am on at least one of the next n school days is more than 0.96. Find the least value of n.

Response:



Answers

Question 1

Let X = the number of goals Ming shoots in the first quarter.

X~Bi(5,0.85)

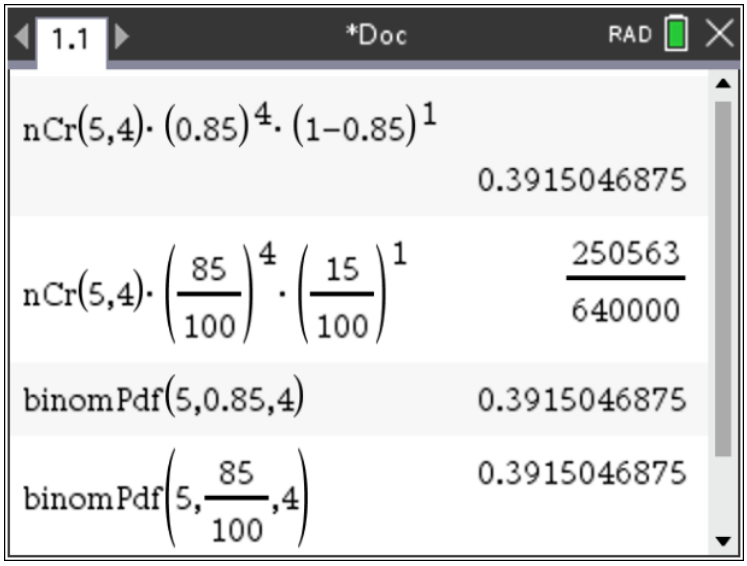
Pr(X=4) = ${}^{5}C_{4}(0.85)^{4}(0.15)$

$= \frac{250563}{640000}$

Note: there is no instruction to round your answer to a given number of decimal places, and so for this question the exact answer is required.

Using the inbuilt binompfd(function in the TInspire will generate a decimal approximation, even if you have entered the values as fractions. For the exact value, use the formula Pr(X=x) = ${}^{n}C_{x}p^{x}(1-p)^{n-x}$, entering your values as fractions, not decimals.

Solution: $\frac{250563}{640000}$



Question 2

Let X = the number of 2's rolled

X~Bi(60, 1/6)

Pr(X<10) = Pr($0 \leq X \leq 9$) $\approx$ 0.446

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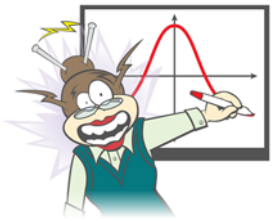
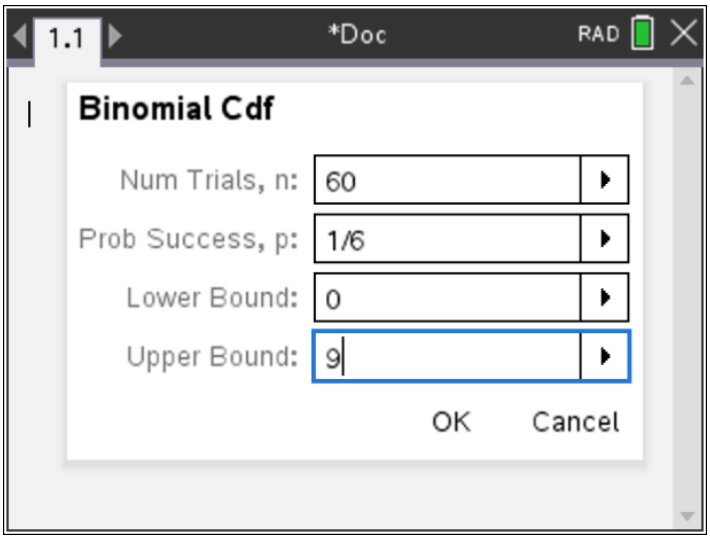
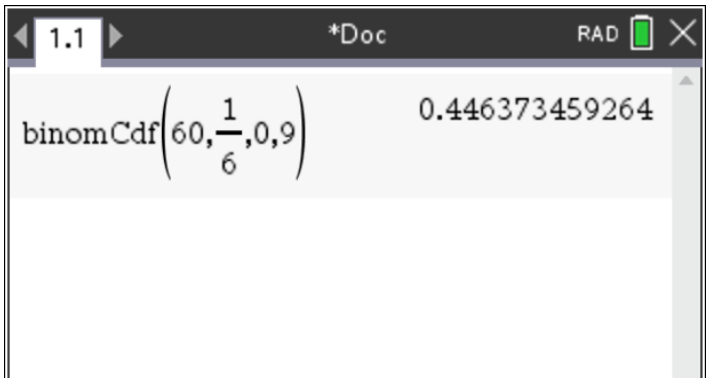
Solution: 0.446





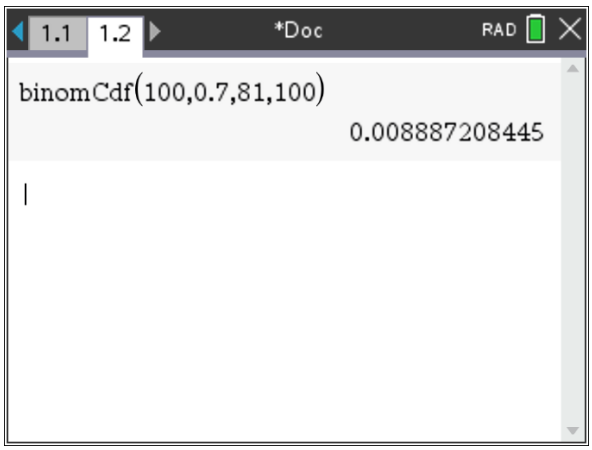


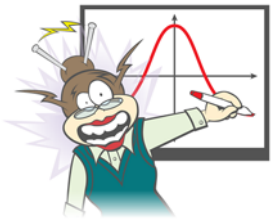
Question 3

Let X = the number of students who travel to school using public transport
X~Bi(100, 0.7)

$$\Pr(X > 80) = \Pr(81 \leq X \leq 100)$$
$$= 0.0089$$

Solution: 0.0089





Question 4

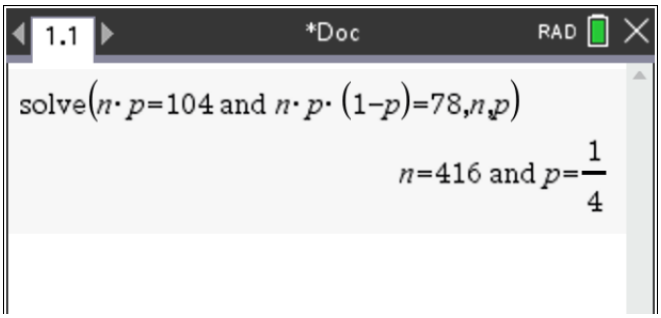
Y~Bi(n, p)

E(Y)=np Var(Y)=np(1-p)

104 = np (1) 78=np(1-p) (2)

Solve equations (1) and (2) simultaneously

n = 416 and p = ¼



Solution: n = 416 and p = ¼

Question 5

Let X = the number of days on which Julian wakes up before 7am
X~Bi(n, 0.2)

$\Pr(X \geq 1) > 0.96$

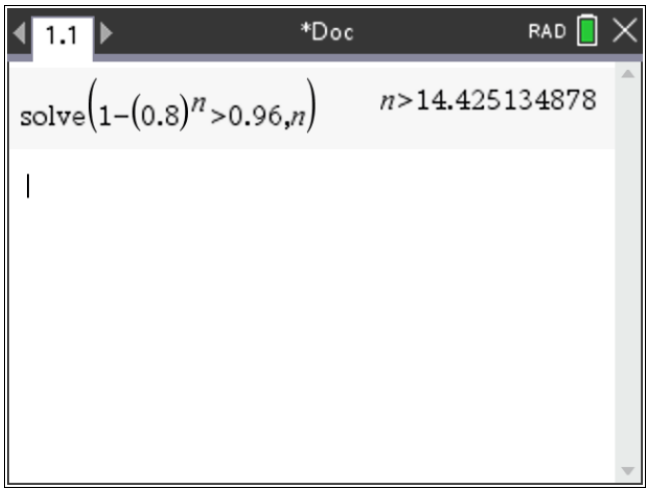
$1 - \Pr(X = 0) > 0.96$

$1 - {}^{n}C_0(0.2)^0(0.8)^n > 0.96$

$0.8^n < 0.04$

$n > 14.425$

Solution: The smallest value of n is 15.



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