# Binomial distribution

$X \sim B(n, p)$

$P(X = r) = \binom{n}{r} p^r (1-p)^{1-r}$, $r \geq 0$

n is the number of trial
r is the number of times of success
p is the probability of a success
$(1 - p)$ is the probability of a failure

## GDC Skills
## Casio
$X \sim B(8, 0.31)$

1. Find P(X = 4)
MENU → 2 STAT → F6 → F5 DIST → F5 BNM → F2 Bpd

| Data: Variable |
| --- |
| X: 4 |
| Numtrial: 8 |
| P: 0.31 |

2. Find P(X ≤ 3)
MENU → 2 STAT → F6 → F5 DIST → F5 BNM → F2 Bcd

| Data: Variable |
| --- |
| X: 3 |
| Numtrial: 8 |
| P: 0.31 |

## TI-84
$X \sim B(8, 0.31)$

1. Find P(X = 4)
2ND → VARS → binompdf → (8, 0.31, 4)

2. Find P(X ≤ 3)
2ND → VARS → binomcdf → (8, 0.31, 3)

## TI-nspire

X~B(8, 0.31)

1. Find P(X = 4)

Menu → 6: Statistics → 5: Distributions → D: Binomial Pdf

| | |
|---|---|
| n: | 8 |
| p: | 0.31 |
| X: | 4 |

2. Find P(X ≤ 3)

Menu → 6: Statistics → 5: Distributions → E: Binomial Cdf

| | |
|---|---|
| Data: | Variable |
| n: | 8 |
| p: | 0.31 |
| Lower: | 0 |
| Upper: | 3 |

## P(X = r)

1. 10% is the electric light bulbs are defective at manufacture. If 20 bulbs are tested at random with each one being replaced before the next is chosen, find the probability that

(a) four are defective

(b) nine are defective

(c) 5 are not defective

**P(X ≤ r), P(X < r), P(X ≥ r) or P(X > r)**

TI-84 GDC can only use binomcdf to calculate P(X ≤ r).

1. Given that 5% of the items assembled on a production line are faulty. A random sample of 20 items is selected with replacement. Find the probability that

(a) less than four will be faulty

(b) at most six will be faulty

**Exercise**

1. ⌨ Samantha goes to school five days a week. When it rains, the probability that she goes to school by bus is 0.5. When it does not rain, the probability that she goes to school by bus is 0.3. The probability that it rains on any given day is 0.2.

(a) On a randomly selected school day, find the probability that Samantha goes to school by bus.

(b) Given that Samantha went to school by bus on Monday, find the probability that it was raining.

(c) In a randomly chosen school week, find the probability that Samantha goes to school by bus on exactly three days.

(d) After $n$ school days, the probability that Samantha goes to school by bus at least once is greater than 0.95. Find the smallest value of $n$.

2. ▦ A forest has a large number of tall trees. The heights of the trees are normally distributed with a mean of 53 metres and a standard deviation of 8 metres. Trees are classified as giant trees if they are more than 60 metres tall.

(a) A tree is selected at random from the forest.

(i) Find the probability that this tree is a giant.
(ii) Given that this tree is a giant, find the probability that it is taller than 70 metres.

(b) Two trees are selected at random. Find the probability that they are both giant.

(c) 100 trees are selected at random.

(i) Find the expected number of these trees that are giants.
(ii) Find the probability that at least 25 of these trees are giant.

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