

Part 7.1: Probability it is Exactly

Let's look at the first formula, $P(X = x) = \binom{n}{x} \pi^x (1 - \pi)^{n-x}$. Fortunately if you have a graphics calculator you don't need to worry about using this formula unless you are going for excellence. This formula works out the probability of an event meeting a criteria exactly x times when it has a probability of π of meeting the criteria and happens n times. Let's look at an example:

Example

I was at an outlet store and there was a watch sale on, the only catch was there was a 40% chance that the watch didn't work. I decided that I would buy 5 watches and then sell on whichever ones did work that I didn't need. What is the probability exactly 3 watches work?

Answer (Graphics Calculator)

Again we go into STATS (2) → DIST (F5) and this time we go into BINM (F5) and when we are working out the probability it is exactly we use Bpd (Binomial Point Distribution). In this case $x = 3$, Numtrial = 5 and $p = 0.6$ as the probability of failing is 0.4 so the probability it works is 0.6. This would look like this:

```
Binomial P.D
Data      :Variable
x         :3
Numtrial :5
P         :0.6
```

Which gives us an answer of 0.3456.

Answer (Formula)

We can see that $x = 3$, $n = 5$ and $\pi = 0.6$ as the probability of failing is 0.4 so the probability it works is 0.6. We substitute these into the formula

$$P(X = x) = \binom{n}{x} \pi^x (1 - \pi)^{n-x} \text{ we get}$$

$$P(X = 3) = \binom{5}{3} 0.6^3 (1 - 0.6)^{5-3} = 0.3456$$

Note: $\binom{n}{x}$ means nC_x

As you can see these two answers match up.

Exercise 7.1

- The probability of a person being allergic to peanuts is 0.1. In a group of 10 students what is the probability:
 - Exactly 3 are allergic?
 - Exactly 2 are allergic?
 - Exactly 1 is allergic?
- In a manufacturing process 12% of items are faulty. What is the probability that there is exactly one faulty item:
 - In a sample of 30?
 - In a sample of 20?
 - In a sample of 10?