IB Math SL Year 2 **Binomial Distribution**

Unit 5 Notes – Day 6

1. **Expectation:**

**Ex:** A die is rolled 120 times. On how many occasions would you expect the outcome to be a three?

**Ex 2:** Each time a soccer player kicks for a goal he has a ¾ chance of being successful. In one game, he kicks for a goal 12 times. How many goals would you expect him to kick?

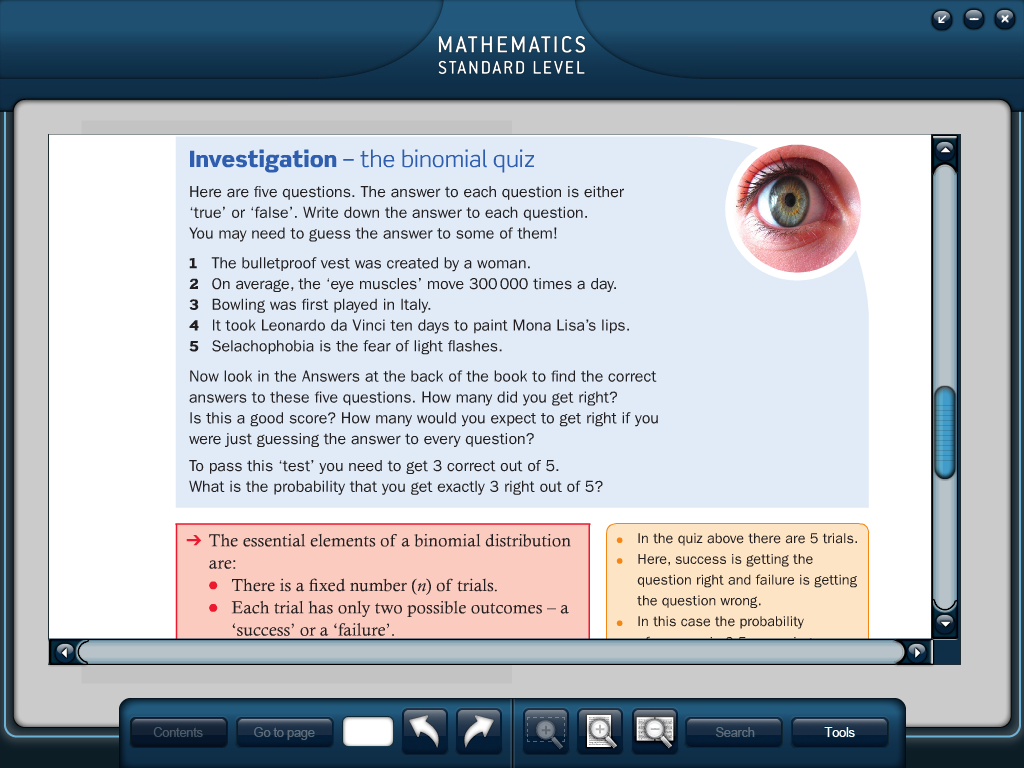
In general: If there are n members of a sample and the probability of an event occurring is p *for each* member, then the expectation of the occurrence of that event, E(x) is

When the probability for each outcome varies, the Expected Value, E(x) =.

**Ex 3:** An aircraft has three lavatories, each of which is occupied 40% of the time during a particular flight. Assuming that the lavatories are occupied independently,

1. Draw a table for the probability distribution of the number of lavatories which are occupied.
2. Find the expected number of occupied lavatories.
3. **Binomial Distribution:**

This type of distribution is applied to **sampling with replacement**.



What would be considered a successful outcome for each question?

How many did you get right?

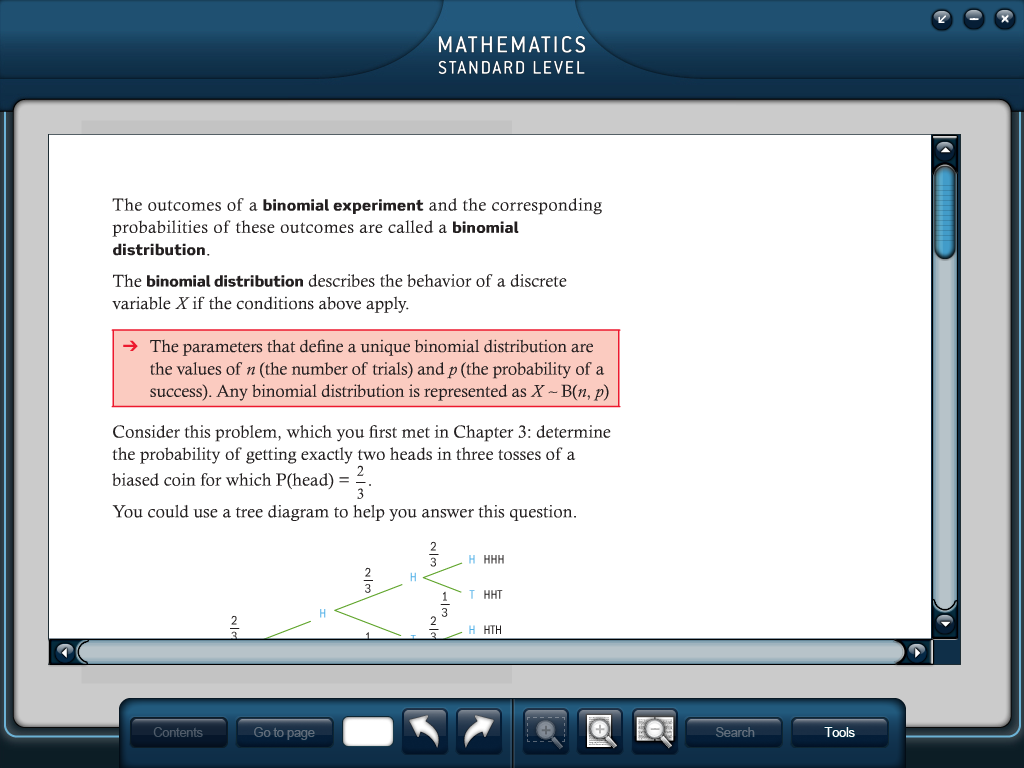
Is this a good score?

How many would you expect to get right by just guessing?

Let’s say “passing” is getting 3/5 correct. What is the probability that you would pass?

An experiment is a BINOMIAL EXPERIMENT if:

1. Each trial may be viewed as a success or a failure
2. The outcome of each trial is independent of the previous trial
3. Each trial has a constant probability of success

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**Ex:** Suppose a square game spinner has 4 equal sections, 3 are blue, one is white. Draw a probability tree diagram that displays the outcomes for spinning 1 time. Let X = the number of times a blue result would occur. X = { }

1. P(X =0) = P(X =1) =

Now draw the tree diagram for spinning 2 times. X = { }

1. P(X = 0)= P(X = 1) = P(X = 2) =

Now draw the tree diagram for spinning 3 times! (Last one) X = { }

1. P(X = 0)= P(X = 1) = P(X = 2) = P(X = 3) =

Summarize results from a – c:

Notice anything??? This is why it is called “binomial” distribution!

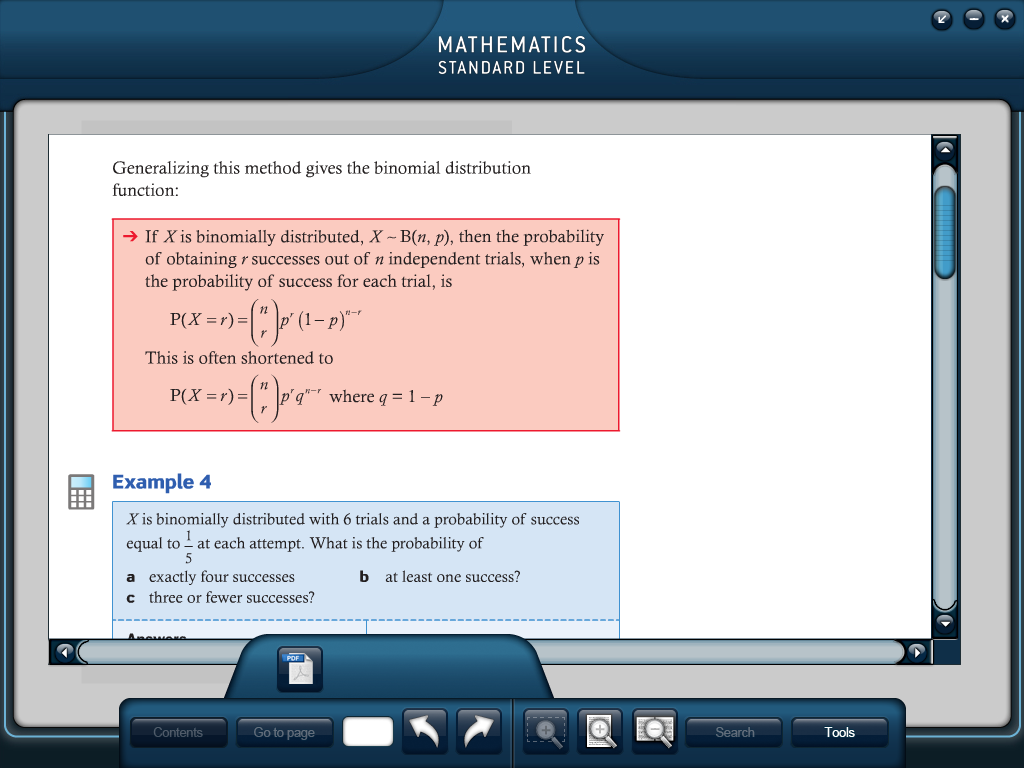
When we did binomial expansion, we found the coefficients by using nCr . However, there are other

notations used: or .

1. Re-write the summary above using combinations for the coefficients:

We can now “easily” find probabilities for a 4th spin without having to do a tree diagram!

1. Find the P(X = 2) after 4 spins.



**Ex 2:** A die is thrown 5 times. Find the probability of getting 2 sixes.

**Ex 3:** What is the probability of getting exactly 4 sixes after throwing a die 20 times?

**Ex 4:** What is the probability of getting 2 threes after throwing a die 8 times?

**Ex 5:** What is the probability of getting 4 heads when a coin is tossed 6 times?

**Ex 6:** Chocolates are manufactured by a machine which, on average, produces 0.4% defective chocolates. The chocolates are placed randomly into boxes containing 24 chocolates.

1. Find the probability that a box selected at random has
2. No defective chocolates
3. Exactly one defective chocolate
4. More than one defective chocolate
5. If a store buys 20 boxes of chocolates, find the probability that
6. None of these boxes contain defective chocolates
7. Exactly one box contains defective chocolates
8. More than one of these boxes contain defective chocolates

In the calculator: 2nd VARS, A: binompdf(n, p,x)

**Ex 7:** 72% of union members are in favor of a certain change to their conditions of employment. A random sample of five members is taken. Using your GDC, find the probability that:

1. Three of the five members are in favor
2. At least three of the five members are in favor
3. **Expectation of Binomial Distribution:**

If X is binomially distributed, i.e. X B(n, p), then E(X) =

**Ex 8:** If X is a random variable such that X B(18, p) and E(X) = 7.2, find the value of p.

**Ex 9:** A fair coin is tossed 50 times. Find the expected number of heads.

**Ex 10:** An unbiased six-sided die is rolled 60 times. Find the expected number of times a six is rolled.

IB Math SL Topic 6, Part II – HW Day 6 Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

