There is no way we could do this by hand and even our calculator can't do it. However, there is a way to get our calculator to do this problem. But first, it requires us to use our powers of insight as we examine the histogram of the probability model as *n* increases. We can see that the shape of the distribution is unimodal and that it becomes more symmetric as *n* increases. That's it it's looking more and more like a Normal model!

OK but how big does *n* have to get before the distribution is symmetric enough? We just need to remember how Normal models work. The problem is that a Normal model extends infinitely in both directions but a Binomial model must have between 0 and n successes, so if we use a Normal model to approximate a Binomial, we have to cut off its tails. That's not very important if the center of the Normal model is so far from 0 and n, that the lost tails have only a negligible area. More than three standard deviations should do it, because a Normal model has little probability past that.

So the mean needs to be at least 3 standard deviations from 0 and at least 3 standard deviations from n. Let's look at the 0 end.

We require:	$\mu - 3\sigma > 0$
Or in other words:	$\mu > 3\sigma$
For a Binomial that's:	$np > 3\sqrt{npq}$
Squaring yields:	$n^2p^2 > 9npq$
Now simplify:	$np > 9q$
Since $q \leq 1$, we can write:	$np > 9$

For simplicity we usually demand that *np* (and *nq* for the other tail) >= 10 to use the Normal approximation.

Assumptions and Conditions for using Normal Approximation.

The Binomial probability model becomes difficult/impossible for _____. Fortunately it can be approximated by _____ as long as we meet the _____ Condition that _____	large *n*. a Normal probability model Success/Failure we expect at least 10 successes and 10 failures: $np \geq 10$ and $nq \geq 10$
On the AP Exam students are required to _____, not just _____ the conditions. This means _____	check state using the values given in the question to show your work!