

## **An Approximation to the Binomial**

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### **Activity overview**

*Students will investigate the binomial distribution for a small sample size of 10 with several different values for the probability. Then students will graph a normal density curve along with the binomial distribution to roughly judge how accurately that model fits. Finally, students will discover that the larger the sample size, the less important the probability being close to 0.5 becomes. That is, the normal distribution is a reasonable approximation to the binomial distribution for large enough samples.*

### **Concepts**

- Approximate the binomial distribution with the normal distribution.
  - Justify why the rule of thumb  $n \cdot p \geq 10$  for using the normal distribution to approximate the binomial distribution is reasonable.
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### **Teacher preparation**

*Students should have experience working with probability problems in a binomial setting.*

*Students should recognize the TI function "binomcdf".*

*Students should recognize the formulas for mean and standard deviation of a binomial distribution.*

*Students should recognize the mean and standard deviation of a normal distribution on a normal density curve.*

*The screenshots on pages 2-4 demonstrate expected student results.*

### **Classroom management tips**

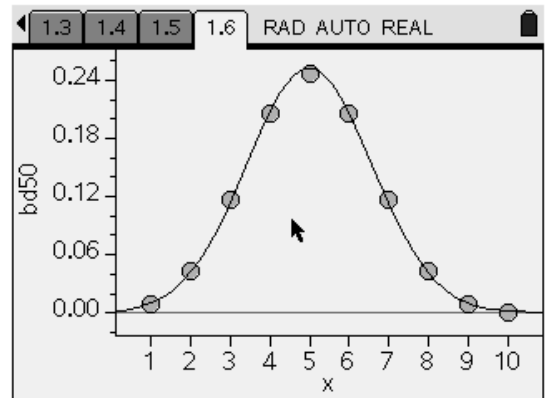
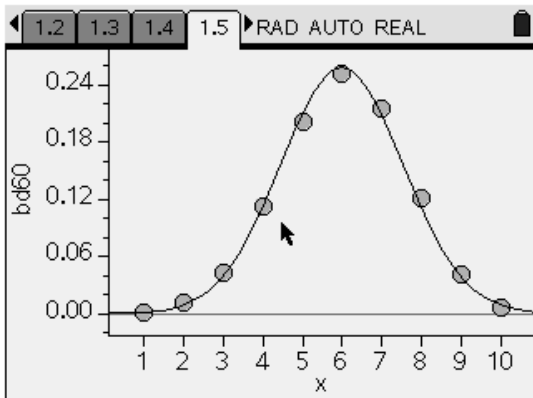
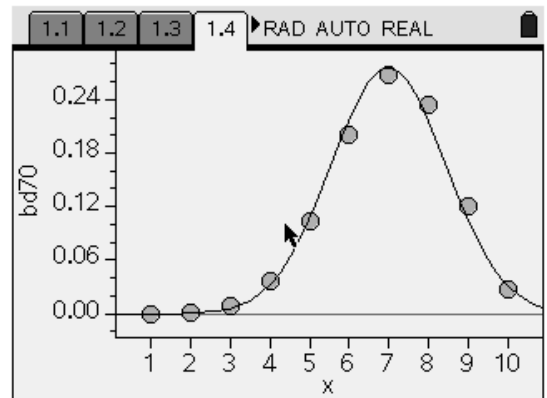
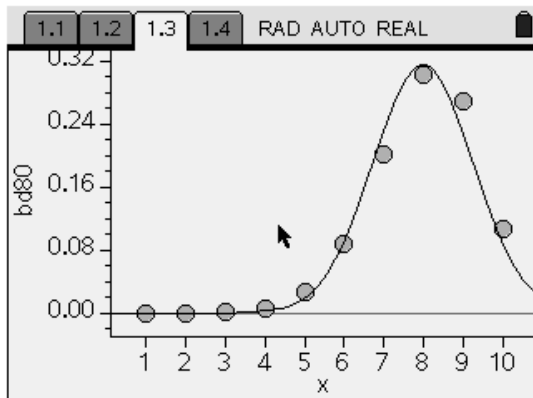
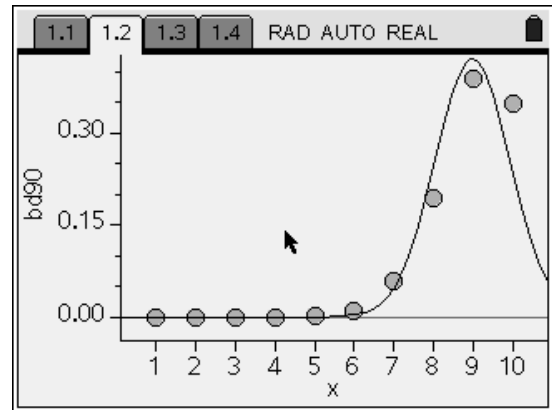
*This activity is designed to be student-centered with the teacher acting as a facilitator while students work cooperatively. The student worksheet is provided for students to record their answers to the questions asked in the activity.*

### **TI-Nspire Applications**

*Data & Statistics, Notes, Calculator, Lists & Spreadsheet*

Here are the results from Steps 1 to 9 on the Student Worksheet.

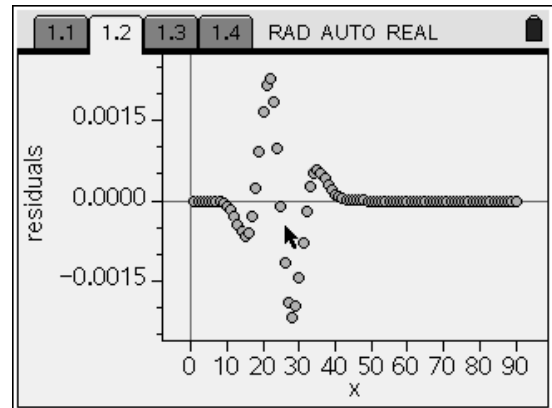
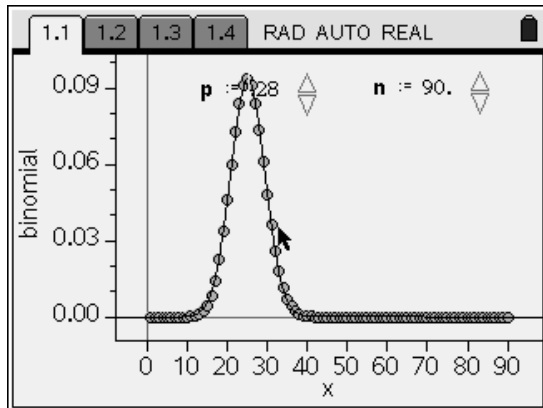
1.1	1.2	1.3	1.4	RAD	AUTO	REAL	
A	x	B	bd90	C	bd80	D	bd70
◆ =seq(w,w,1							
1	1	9.E-9	0.000004	0.000			
2	2	3.645E-7	0.000074	0.001			
3	3	0.000009	0.000786	0.009			
4	4	0.000138	0.005505	0.036			
5	5	0.001488	0.026424	0.102			
A1		=1					



Students should see the normal curve approximates the binomial distribution better as the probability gets closer to 0.5.

Open the file approx\_binomial.tns.

This file works faster using the slider arrows on the computer software. However, students can best utilize the sliders on the handheld by double clicking on the slider value and changing it.



The intent of question 9 is for students to discover higher residual values in cases where:

- small  $p$ , large  $n$
- large  $p$ , small  $n$

This lends support for an understanding of the condition  $n \cdot p \geq 10$ .