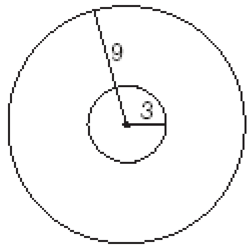
BINOMIAL PROBABILITY

MATH B APPEARANCES: 080334b 6-pointer
080128b, 010229b, 060331b, 010428b, 080430b, 060529b, 080630b, 010731b 4-pointer
060122b, 060223b, 010524b, 080522b, 010625b, 060625b 2-pointer
080201b, 010302b, 060402b multiple choice

	REGENTS QUESTIONS	SOLUTIONS
1	**010302b** The probability that Kyla will score above a 90 on a mathematics test is $\frac{4}{5}$. What is the probability that she will score above a 90 on three of the four tests this quarter? (1) ${}_4C_3(\frac{4}{5})^3(\frac{1}{5})^1$ (3) $\frac{3}{4}(\frac{4}{5})^3(\frac{1}{5})^1$ (2) ${}_4C_3(\frac{4}{5})^1(\frac{1}{5})^3$ (4) $\frac{3}{4}(\frac{4}{5})^1(\frac{1}{5})^3$	(1) ${}_4C_3(\frac{4}{5})^3(\frac{1}{5})^1$
2	**060402b** The Hiking Club plans to go camping in a State park where the probability of rain on any given day is 0.7. Which expression can be used to find the probability that it will rain on *exactly* three of the seven days they are there? (1) ${}_7C_3(0.7)^3(0.3)^4$ (3) ${}_4C_3(0.7)^3(0.7)^4$ (2) ${}_7C_3(0.3)^3(0.7)^4$ (4) ${}_4C_3(0.4)^4(0.3)^3$	(1) ${}_7C_3(0.7)^3(0.3)^4$
3	**080201b** Which fraction represents the probability of obtaining *exactly* eight	(1) ${}_{10}C_8(\frac{1}{2})^8(\frac{1}{2})^2 = \frac{45}{1024}$

	heads in ten tosses of a fair coin? (1) $\frac{45}{1,024}$ (3) $\frac{90}{1,024}$ (2) $\frac{64}{1,024}$ (4) $\frac{180}{1,024}$	
4	**060122b** At a certain intersection, the light for eastbound traffic is red for 15 seconds, yellow for 5 seconds, and green for 30 seconds. Find, to the ***nearest tenth,*** the probability that out of the next eight eastbound cars that arrive randomly at the light, exactly three will be stopped by a red light.	The probability of a red light is $\frac{15}{15+5+30}=\frac{3}{10}$. P(3 stopped) = $_8C_3(\frac{3}{10})^3(\frac{7}{10})^5=\frac{25412184}{100000000}\approx .3$
5	**060223b** After studying a couple's family history, a doctor determines that the probability of any child born to this couple having a gene for disease *X* is 1 out of 4. If the couple has three children, what is the probability that ***exactly*** two of the children have the gene for disease *X*?	$_3C_2(\frac{1}{4})^2(\frac{3}{4})^1=\frac{9}{64}$
6	**010524b** If the probability that it will rain on any given day this week is 60%, find the probability it will rain ***exactly*** 3 out of 7 days this week.	$_7C_3(\frac{3}{5})^3(\frac{2}{5})^4=\frac{15120}{78125}$
7	**080522b**	Since there are two even-numbered channels, the probability of selecting an

	The Coolidge family's favorite television channels are 3, 6, 7, 10, 11, and 13. If the Coolidge family selects a favorite channel at random to view each night, what is the probability that they choose exactly three even-numbered channels in five nights? Express your answer as a fraction or as a decimal rounded to four decimal places.	even number is $\frac{2}{6}=\frac{1}{3}$. $P(3\text{ evens}) = {}_5C_3(\frac{1}{3})^3(\frac{2}{3})^2 = \frac{40}{243}$
8	010625b During a recent survey, students at Franconia College were asked if they drink coffee in the morning. The results showed that two-thirds of the students drink coffee in the morning and the remainder do not. What is the probability that of six students selected at random, *exactly* two of them drink coffee in the morning? Express your answer as a fraction or as a decimal rounded to *four decimal places.*	${}_6C_2(\frac{2}{3})^2(\frac{1}{3})^4 = \frac{20}{243}$
9	060625b *Ginger and Mary Anne are planning a vacation trip to the island of Capri, where the probability of rain on any day is 0.3. What is the probability that during their five days on the island, they have no rain on exactly three of the five days?*	Note the problem gives you the value of q, instead of p. ${}_5C_3(\frac{7}{10})^3(\frac{3}{10})^2 = \frac{3087}{10000}$
10	080128b As shown in the accompanying diagram, a circular target with a radius of 9 inches has a bull's-eye that has a radius of 3 inches. If five arrows randomly hit the target, what is the probability that ***at least*** four hit the bull's-eye?	The areas of the circles are 81π and 9π. Therefore the probability of hitting the bull's-eye is $\frac{9\pi}{81\pi}=\frac{1}{9}$. $P(4\text{ hits}) = {}_5C_4(\frac{1}{9})^4(\frac{8}{9})^1 = \frac{40}{59049}$ $P(5\text{ hits}) = {}_5C_5(\frac{1}{9})^5(\frac{8}{9})^0 = \frac{1}{59049}$

		Add these two fractions to calculate the probability of at least four hits: $\frac{41}{59049}$
11	**010229b** Team *A* and team *B* are playing in a league. They will play each other five times. If the probability that team *A* wins a game is $\frac{1}{3}$, what is the probability that team *A* will win *at least* three of the five games?	$P(3 \text{ wins}) = {}_5C_3(\frac{1}{3})^3(\frac{2}{3})^2 = \frac{40}{243}$ $P(4 \text{ wins}) = {}_5C_4(\frac{1}{3})^4(\frac{2}{3})^1 = \frac{10}{243}$ $P(5 \text{ wins}) = {}_5C_5(\frac{1}{3})^5(\frac{2}{3})^0 = \frac{1}{243}$ Add these three fractions to calculate the probability of at least three wins: $\frac{51}{243}$
12	**060331b** On any given day, the probability that the entire Watson family eats dinner together is $\frac{2}{5}$. Find the probability that, during any 7-day period, the Watsons eat dinner together *at least* six times.	$P(6 \text{ dinners}) = {}_7C_6(\frac{2}{5})^6(\frac{3}{5})^1 = \frac{1344}{78125}$ $P(7 \text{ dinners}) = {}_7C_7(\frac{2}{5})^7(\frac{3}{5})^0 = \frac{128}{78125}$ Add these two fractions to calculate the probability of at least six dinners: $\frac{1472}{78125}$
13	**080430b** Tim Parker, a star baseball player, hits one home run for every ten times he is at bat. If Parker goes to bat five times during tonight's game, what is the probability that he will hit *at least* four home runs?	$P(4 \text{ homers}) = {}_5C_4(\frac{1}{10})^4(\frac{9}{10})^1 = \frac{45}{100000}$ $P(5 \text{ homers}) = {}_5C_5(\frac{1}{10})^5(\frac{9}{10})^0 = \frac{1}{100000}$ Add these two fractions to calculate the probability of at least four homers: $\frac{46}{100000}$
14	**060529b** The probability that a planted	$P(5 \text{ sprouts}) = {}_7C_5(\frac{3}{4})^5(\frac{1}{4})^2 = \frac{5103}{16384}$

	watermelon seed will sprout is $\frac{3}{4}$. If Peyton plants seven seeds from a slice of watermelon, find, to the *nearest ten thousandth*, the probability that *at least* five will sprout.	P(6 sprouts) = ${}_7C_6(\frac{3}{4})^6(\frac{1}{4})^1 = \frac{5103}{16384}$ P(7 sprouts) = ${}_7C_7(\frac{3}{4})^7(\frac{1}{4})^0 = \frac{2187}{16384}$ Add these three fractions to calculate the probability of at least five sprouts: $\frac{12393}{16384} \approx .7564$
15	080630b *On mornings when school is in session in January, Sara notices that her school bus is late one-third of the time. What is the probability that during a 5-day school week in January her bus will be late at least three times?*	P(3 times late) = ${}_5C_3(\frac{1}{3})^3(\frac{2}{3})^2 = \frac{40}{243}$ P(4 times late) = ${}_5C_4(\frac{1}{3})^4(\frac{2}{3})^1 = \frac{10}{243}$ P(5 times late) = ${}_5C_5(\frac{1}{3})^5(\frac{2}{3})^0 = \frac{1}{243}$ Add these three fractions to calculate the probability the bus will be late at least three times: $\frac{51}{243}$
16	010428b A board game has a spinner on a circle that has five equal sectors, numbered 1, 2, 3, 4, and 5, respectively. If a player has four spins, find the probability that the player spins an even number *no more than* two times on those four spins.	Since there are two even numbers, the probability of spinning an even number is $\frac{2}{5}$. P(0 evens) = ${}_4C_0(\frac{2}{5})^0(\frac{3}{5})^4 = \frac{81}{625}$ P(1 evens) = ${}_4C_1(\frac{2}{5})^1(\frac{3}{5})^3 = \frac{216}{625}$ P(2 evens) = ${}_4C_2(\frac{2}{5})^2(\frac{3}{5})^2 = \frac{216}{625}$ Add these three fractions to calculate the probability of no more than two even numbers: $\frac{513}{625}$
17	010731b *Dr. Glendon, the school physician in charge of giving sports physicals, has compiled his information and has determined*	P(4 students) = ${}_5C_4(.39)^4(.61)^1 \approx .071$ P(5 students) = ${}_5C_5(.39)^5(.61)^0 \approx .009$ Add to calculate the probability of at least four students: .08

	that the probability a student will be on a team is 0.39. Yesterday, Dr. Glendon examined five students chosen at random. Find, to the nearest hundredth, the probability that at least four of the five students will be on a team. Find, to the nearest hundredth, the probability that exactly one of the five students will not be on a team.	P(1 student) = ${}_5C_1(.61)^1(.39)^4 \approx .07$
18	080334b When Joe bowls, he can get a strike (knock down all the pins) 60% of the time. How many times more likely is it for Joe to bowl ***at least*** three strikes out of four tries as it is for him to bowl zero strikes out of four tries? Round your answer to the ***nearest whole number***.	P(3 strikes) = ${}_4C_3(\frac{6}{10})^3(\frac{4}{10})^1 = \frac{3456}{10000}$ P(4 strikes) = ${}_4C_4(\frac{6}{10})^4(\frac{4}{10})^0 = \frac{1296}{10000}$ Add these two fractions to calculate the probability of at least three strikes: $\frac{4752}{10000}$. P(0 strikes) = ${}_4C_0(\frac{6}{10})^0(\frac{4}{10})^4 = \frac{256}{10000}$ $\frac{\frac{4752}{10000}}{\frac{256}{10000}} = 18.5625 \approx 19$