A2.S.15: Binomial Probability 8: Know and apply the binomial probability formula to events involving the terms exactly, at least, and at most

1 If the probability of winning a game is $\frac{1}{4}$, find the probability of winning *at least* 3 games out of 4.

2 The probability of a biased coin coming up tails is $\frac{1}{4}$. When the coin is flipped four times, what is the probability of obtaining *at least* two tails?

3 The probability of a biased coin coming up heads is $\frac{3}{4}$. When the coin is flipped three times, what is the probability of *at least* two heads? When the coin is flipped four times, what is the probability of *at most* one head?

4 The probability of rain on any given day is $\frac{2}{3}$. What is the probability of at most one day of rain during the next three days?

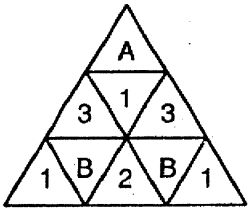
5 In a baseball game, the probability that Peter gets on base safely is $\frac{3}{7}$. If he comes to bat four times, what is the probability that he will get on base safely *at least* three times?

6 During the school year, Michele receives four report cards. The probability that she will get an A in mathematics on any one report card is $\frac{4}{5}$. What is the probability that she will get an A in mathematics on *at least* three of the four report cards?

7 Mrs. Gruber gave her history class a multiple choice quiz containing five questions. A student must answer at least four questions correctly to pass. Greg decided to guess on every question. If each of the four possible answers to each question is equally likely to be chosen, what is the probability that Greg passed the quiz?

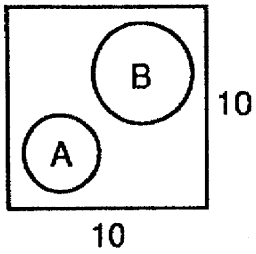
8 A mathematics quiz has five multiple-choice questions. There are four possible responses for each question. Jennifer selects her responses at random on every question. What is the probability she will select the correct response for *at most* one question? What is the probability she will select the correct response to *at least* three questions?

9 In the accompanying diagram, the triangular pad is divided into nine keys. The probability of pressing any key at random is the same.



Find the probability of pressing
(1) a letter key
(2) *exactly* two number keys on three random tries
(3) *at least* two letter keys on three random tries

10 The sides of a square dartboard have length 10. Circle *A*, with an area of 9, and circle *B*, with an area of 16, lie inside the square and do not overlap. [Assume that a dart has an equal probability of landing anywhere on the board.]



Find the probability that a dart hits the board
(1) inside circle *A*
(2) inside circle *B*
(3) outside both circles
If a dart hits the board three times, find the probability that it lands outside both circles *at most* once.

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Answer Section

1 ANS:
$\frac{13}{256}$

PTS: 2 REF: 068118siii
2 ANS:
$\frac{67}{256}$

PTS: 4 REF: 069941siii
3 ANS:
$\frac{54}{64}, \frac{13}{256}$

PTS: 6 REF: 089642siii
4 ANS:
$\frac{7}{27}$

PTS: 2 REF: 068819siii
5 ANS:
$\frac{513}{2401}$

PTS: 4 REF: 010142siii
6 ANS:
$\frac{512}{625}$

PTS: 4 REF: 060241siii
7 ANS:
$\frac{16}{1024}$

PTS: 4 REF: 010441siii
8 ANS:
$\frac{648}{1024}, \frac{106}{1024}$

PTS: 7 REF: 019941siii

9 ANS:
$\frac{3}{9}, \frac{4}{9}, \frac{7}{27}$

PTS: 10 REF: 089540siii

10 ANS:
$\frac{9}{100}, \frac{16}{100}, \frac{75}{100}, \frac{10}{64}$

PTS: 10 REF: 069438siii