

Binomial Probability Worksheet

$$\text{Mean} = n \times p \quad \text{St. dev} = \sqrt{n \times p \times (1 - p)}$$

Given the number of trials and the probability of success, find the mean, standard deviation, and the probability of:

1. $n = 12$, $p = 0.2$,
 2. $n = 20$, $p = 0.5$,
 3. $n = 11$, $p = 0.05$, find $P(3 \text{ failures})$
 4. $n = 6$, $p = 0.35$, find $P(\text{at least } 3 \text{ successes})$
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Find the probability of the Binomials given.

5. In a history class, Colin and Diana both write a multiple choice quiz.

There are 10 questions. Each question has five possible answers. What is the **probability** that

- a) Colin will pass the test if he guesses an answer to each question.
 - b) Diana will pass the test if she studies so that she has a 75% chance of answering each question correctly.
 - c) Expected number of correct guesses for Colin.
 - d) Expected number of correct guesses for Diana.
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6. The manufacturing sector contributes 17% of Canada's gross domestic product. A customer orders 50 components from a factory that has a 99% quality production rate (99% of the products are defect-free). Find the **probability** that:

- a) none of the components in the order are defective
 - b) there is at least one defective product in the order.
 - c) There are at least two defective products in the order.
 - d) Expected number of defective parts.
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7. Approximately 3% of the eggs in a store are cracked. If you buy two dozen eggs, what is the **probability** that

- a) none of your eggs are cracked
 - b) at least one of your eggs is cracked
 - c) exactly two of your eggs are cracked
 - d) Expected number of cracked eggs
 - e) Expected number of uncracked eggs
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8. The probability the Tim will sink a foul shot is 70%. If Tim attempts 10 foul shots, what is the **probability** that

- a) he sinks exactly 8 shots
- b) he sinks at least 8 shots
- c) he sinks at most 2 shots
- d) he sinks between 5 and 7 shots, inclusive.
- e) Expected number of sinks out of 10 foul shots

ANSWERS

1. $m=2.4, sd=1.386$ 2. $m=10, sd=2.236$
3. $m=.55, sd=.723$ 5.526×10^{-9} 4. $m=2.1, sd=1.168$ 0.353
5. a) 0.0007 b) 0.7759 c) 2 d) 7.5
6. a) 0.605 b) 0.395 c) 0.089 d) 0.05
7. a) 0.481 b) 0.519 c) 0.127 d) 0.72 e) 23.28
8. a) 0.2334 b) 0.3837 c) 0.0015 d) 0.5698 e) 7
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Solution

$$\text{Mean} = n \times p \quad \text{St. dev} = \sqrt{n \times p \times (1-p)}$$

1) $\text{Mean} = 12 \times 0.2 = 2.4$ $\text{St. dev} = \sqrt{12 \times 0.2 \times 0.8} = 1.386$

2) $\text{Mean} = 20 \times 0.5 = 10$ $\text{St. dev} = \sqrt{20 \times 0.5 \times 0.5} = 2.236$

3) $\text{Mean} = 11 \times 0.05 = 0.55$ $\text{St. dev} = \sqrt{11 \times 0.05 \times 0.95} = 0.723$ $\text{binompdf}(11, 0.05, 3) = 5.526 \times 10^{-9}$

4) $\text{Mean} = 6 \times 0.35 = 2.1$ $\text{St. dev} = \sqrt{6 \times 0.35 \times 0.65} = 1.168$

$$\begin{aligned} &\text{binompdf}(6, 0.35, 3) + \text{binompdf}(6, 0.35, 4) + \text{binompdf}(6, 0.35, 5) + \text{binompdf}(6, 0.35, 6) = \\ &0.2355 \quad + \quad 0.0951 \quad + \quad 0.0204 \quad + \quad 0.0018 \quad = \quad 0.3528 \end{aligned}$$

5-a) For Colin to pass, at least 7 out of 10 question must be guessed correctly to find that probability $n=10$, $p=1/5=.2$

$$\begin{aligned} &\text{binompdf}(10, 0.2, 7) + \text{binompdf}(10, 0.2, 8) + \text{binompdf}(10, 0.2, 9) + \text{binompdf}(10, 0.2, 10) = 0.0007741 \\ &0.0007 \quad + \quad 0.00007 \quad + \quad 0.000004 \quad + \quad 0.0000001 = 0.0007741 \end{aligned}$$

5-b) For Diana to pass, at least 7 out of 10 question must be guessed correctly to find that probability

$$n = 10, \quad p = 0.75$$

$$\begin{aligned} \text{binompdf}(10,0.75,7) + \text{binompdf}(10,0.75,8) + \text{binompdf}(10,0.75,9) + \text{binompdf}(10,0.75,10) &= 0.7759 \\ 0.2503 + 0.2816 + 0.1877 + 0.0563 &= 0.7759 \end{aligned}$$

5-c) Mean = $10 \times 0.2 = 2$

5-d) Mean = $10 \times 0.75 = 7.5$

6-a) $n = 50, \quad p = 0.99$ $\text{binompdf}(50,0.99,50) = 0.605$

6-b) $n = 50, \quad p = 0.99$ $1 - \text{binompdf}(50,0.99,50) = 0.395$
 $1 - 0.605 = 0.395$

6-c) $n = 50, \quad p = 0.99$ $1 - \text{binompdf}(50,0.99,50) - \text{binompdf}(50,0.99,49) = 0.089$
 $1 - 0.605 - .3056 = 0.089$

6-d) Mean = $50 \times 0.01 = 0.5$

7-a) $n = 24, \quad p = 0.03$ $\text{binompdf}(24,0.03,0) = 0.481$

7-b) $n = 24, \quad p = 0.03$ $1 - \text{binompdf}(24,0.03,0) = 0.519$

7-c) $n = 24, \quad p = 0.03$ $\text{binompdf}(24,0.03,2) = 0.127$

6-d) Mean = $24 \times 0.03 = 0.72$

8-a) $n = 10, \quad p = 0.70$ $\text{binompdf}(10,0.70,8) = 0.2334$

8-b) $n = 10, \quad p = 0.70$ $\text{binompdf}(10,0.70,8) + \text{binompdf}(10,0.70,9) + \text{binompdf}(10,0.70,10) = 0.3837$
 $0.2334 + 0.1211 + 0.0282 = 0.3837$

8-c) $n = 10, \quad p = 0.70$ $\text{binompdf}(10,0.70,0) + \text{binompdf}(10,0.70,1) + \text{binompdf}(10,0.70,2) = 0.0015$
 $0.0 + 0.0001 + 0.0014 = 0.0015$

8-d) $n = 10, \quad p = 0.70$ $\text{binompdf}(10,0.70,5) + \text{binompdf}(10,0.70,6) + \text{binompdf}(10,0.70,7) = 0.5698$
 $0.1029 + 0.2001 + 0.2668 = 0.5698$

8-e) Mean = $10 \times 0.7 = 7$