

Bullpen Probability Lab

It's World Series season, and every bullpen is full of numbers. Use made-up pitch charts, number cubes and spinners to find simple, compound and experimental probabilities. Every team and player on this sheet is made up.

Name _____

Date _____

PROBABILITY TOOLKIT

$$P = \frac{f}{t}$$

favorable outcomes
over total outcomes

0 to 1

every probability
lands in this range

$$1 - P(A)$$

complement:
 $P(\text{not } A)$

$$P(A) \times P(B)$$

both happen
(independent)

$$P \times n$$

expected count
in n tries

THE PROBABILITY SCALE



FROM NEVER TO ALWAYS

BULLPEN SESSION · JORDAN REYES, LAKEVIEW COMETS · 40 PITCHES

FASTBALL

18 pitches

CURVEBALL

10 pitches

SLIDER

8 pitches

CHANGEUP

4 pitches

Pitching coaches track every pitch. Use this chart for problems 1 to 4, and treat each pitch as one random pick from the mix.

ROOKIE

- 1 Use Jordan Reyes's bullpen session above. What is the probability his next pitch is a **fastball**? Write it as a fraction in simplest form.

WORK SPACE

ROOKIE

- 2 Write your answer to problem 1 as a **decimal** and as a **percent**.

WORK SPACE

_____ %

STARTER

- 3 What is the probability that Reyes's next pitch is **not** a changeup? (Hint: use the complement.)

WORK SPACE

STARTER

- 4 If Reyes throws **120 pitches** next week with the same mix, about how many curveballs should you expect?

WORK SPACE

_____ curveballs

PRO

- 5 Before a backyard game, the Comets flip a coin and roll a number cube. How many outcomes are in the sample space? What is $P(\text{heads and an even number})$?

WORK SPACE

_____ outcomes

PRO

- 6 A practice bag has **5 red, 3 blue** and **2 yellow** balls. Find $P(\text{blue})$. Then: pick one, put it back, pick again. Find $P(\text{both red})$.

WORK SPACE

ALL-STAR

- 7 A board-game spinner has 4 equal parts: SINGLE, DOUBLE, OUT, OUT. In 60 spins it landed on OUT **34 times**. Give the theoretical and the experimental $P(\text{OUT})$.

WORK SPACE

CHALLENGE ★

- 8 Challenge: The Lakeview Comets win each game with probability **0.6**, and games don't affect each other. Find $P(\text{win both of the next 2 games})$ and $P(\text{win at least 1})$.

WORK SPACE

A Fill In the Pitch Chart

Closer Ava Lindqvist of the Riverside Otters threw 50 pitches. Write each probability as a simplified fraction, a decimal and a percent, then predict how many of her next 200 pitches will be that type. The Total row is a built-in check.

PITCH TYPE	COUNT	FRACTION	DECIMAL	PERCENT	EXPECTED IN 200
Fastball	24				
Slider	15				
Curveball	8				
Changeup	3				
Total	50				

B Think Like a Manager

Multi-step problems. Show your work, and simplify every fraction.

- 1 The catcher signals one of **3 pitches** (fastball, curveball, slider) and one of **2 spots** (inside, outside). Draw a tree diagram. How many outcomes are there? If each is equally likely, what is $P(\text{curveball outside})$?

WORK SPACE

_____ outcomes _____

- 2 A bucket holds **12 practice balls**, and **4** are scuffed. Coach Dev Patel grabs 2 without looking and does **not** put the first back. Find $P(\text{both scuffed})$.

WORK SPACE

- 3 Reliever Maya Ortiz strikes out each batter with probability **0.3**, and batters don't affect each other. She faces 3 batters. Find $P(\text{no strikeouts})$, then $P(\text{at least one})$.

WORK SPACE

- 4 In their first **80 plate appearances**, Comets hitters drew **12 walks**. Use the experimental probability to predict how many walks they'll draw in the next **300**.

WORK SPACE

_____ walks

CHALLENGE ★ EXPLAIN IT

In dice baseball, you roll two number cubes and add them. Rookie Leo Brandt says, "A sum of 7 and a sum of 12 are equally likely, because each one is just one number." Make a list or table of all the outcomes. Find $P(\text{sum of } 7)$ and $P(\text{sum of } 12)$. How many times as likely is a 7? Is Leo right?

$P(7)$ _____ $P(12)$ _____ times _____

✓ **Answer Key** (for teachers & parents)

Answers for **Bullpen Probability Lab**. Print pages 1 and 2 for students and keep this page for checking. Accept equivalent forms (for example 0.25, 25% or 1/4) unless the problem asks for a specific form.

Page 1 Problems

- Answer: 9/20**
18 fastballs out of 40 pitches = 18/40
- Answer: 0.45 · 45%**
 $9 \div 20 = 0.45$
- Answer: 9/10**
 $P(\text{changeup}) = 4/40 = 1/10$, so $1 - 1/10$
- Answer: 30 curveballs**
 $10/40 = 1/4$, and $1/4 \times 120 = 30$
- Answer: 12 outcomes · 1/4**
 $2 \times 6 = 12$. H2, H4, H6 = 3 of 12
- Answer: 3/10 · 1/4**
Both red: $5/10 \times 5/10 = 25/100$
- Answer: theoretical 1/2 · experimental 17/30**
2 of 4 parts are OUT. 34/60 simplifies to 17/30.
- Answer: 0.36 · 0.84**
 $0.6 \times 0.6 = 0.36$. Lose both: $0.4 \times 0.4 = 0.16$, so $1 - 0.16$

Challenge · Explain It

- Answer: P(7) = 1/6 · P(12) = 1/36 · 6 times as likely**
36 outcomes. Six make 7 (1+6, 2+5, 3+4, 4+3, 5+2, 6+1), only 6+6 makes 12. Leo is not right.

Quick score

Page 1 problems	_____ / 8
A · Pitch Chart	_____ / 16
B · Think Like a Manager	_____ / 4
Challenge	_____ / 2
Total	_____ / 30

Skills practiced

Simple probability
Complements
Sample spaces
Compound events

Experimental vs. theoretical
Predictions
Fractions, decimals & percents

Teaching tip: Compare problem 6 with B2. Ask students why putting the ball back keeps the second pick at 5/10, but keeping it out changes the second pick to 3/11. That's the difference between independent and dependent events.

A · Pitch Chart

- Answer: Fastball: 12/25 · 0.48 · 48% · 96**
- Answer: Slider: 3/10 · 0.3 · 30% · 60**
- Answer: Curveball: 4/25 · 0.16 · 16% · 32**
- Answer: Changeup: 3/50 · 0.06 · 6% · 12**

Total row: $1 \cdot 1 \cdot 100\% \cdot 200$

B · Think Like a Manager

- Answer: 6 outcomes · 1/6**
3 pitches $\times$ 2 spots = 6
- Answer: 1/11**
 $4/12 \times 3/11 = 12/132$
- Answer: 0.343 · 0.657**
 $0.7 \times 0.7 \times 0.7 = 0.343$, then $1 - 0.343$
- Answer: 45 walks**
 $12/80 = 0.15$, and $0.15 \times 300 = 45$