1.0 Softballs vs Baseballs

GRADES 6th-8th

Data Collection **Results will vary among students. Example data below.**

	Distance (meters) Softball	Time (seconds) Softball	Distance (meters) Baseball	Time (seconds) Baseball
Hit 1	**20 m**	**2 s**	**25 m**	**3 s**
Hit 2	**22 m**	**2 s**	**27 m**	**3 s**
Hit 3	**27**	**3 s**	**28 m**	**3 s**

Calculations:

SOFTBALL **Answers will vary based on students results. Example data below.**

	Initial speed	Final Speed (distance divided by time)	Acceleration (initial-final divided by time)	Mass of ball	Force Acting on ball (Mass times Acceleration)
Tennis Ball	0 m/s	**10 m/s**	**5 m/s**	**0.08 kg**	**.40 N**
Golf Ball	0 m/s	**11 m/s**	**5.5 m/s**	**0.05 kg**	**.28 N**
Baseball	0 m/s	**9 m/s**	**4.5 m/s**	**0.14 kg**	**.63 N**

BASEBALL **Answers will vary based on students results. Example data below.**

	Initial speed	Final Speed (distance divided by time)	Acceleration (initial-final divided by time)	Mass of ball	Force Acting on ball (Mass times Acceleration)
Tennis Ball	0 m/s	12.5 m/s	6.25 m/s	.08 kg	.50 N
Golf Ball	0 m/s	13.5 m/s	6.75 m/s	.05 kg	.34 N
Softball	0 m/s	14 m/s	7 m/s	0.25 kg	1.75 N

***Extend only*:**

Diagrams: Draw a diagram that shows the amount of force acting on each ball and how it affects the motion.

Results will vary among students.

Underhand Throw/Pitch	Overhand Throw/Pitch

2.0 Evolution of a Softball Glove

GRADES 6th-8th

Match the glove with correct materials or time frame:

1. 	a. Made of Full-grain Leather
2. 	b. Made in the 1920's

3. 	c. Made of Synthetic Material
4. 	d. Made of Cowhide/Pigskin

1. __D.__
2. __B.__
3. __A.__
4. __C.__

Reading Questions: Answers may vary among students. Example responses below.

1) When was the first softball glove developed?

   By the late 1920's

2) How did the softball glove evolve over time?

   It began with additional padding to protect a player's hand. And by the 1930's, the glove's fingers were placed with lacing so players could better grip and retain the ball during play. During this time frame, the webbing of the glove was added; also known as the "basket" of the glove.

   By the 1950's, the glove began to really take shape to what we see in today's softball glove: holes to place your fingers for control and/or catch the ball correctly; a web/basket sewn alongside holes inside the glove for your thumb, index, middle, ring, and pinky fingers. Eventually, a hole was added to the glove to place the index finger outside of the glove for even better control, as well as deepening of the "pocket" to hold on to the ball.

3) What are some similarities and differences between the game's first softball gloves and today softball gloves?

   The game's first glove was really designed for protection and not performance, yet the structure of baseball gloves has remained relatively the same during its long history. In addition, the use of natural materials are still used today as they were back then.

4) Describe the various materials used in manufacturing a softball glove.

   Early gloves were made of cowhide, which is a specific type of leather. Today's technology has produced a glove composed of synthetic materials, as well as natural materials like pigskin and cowhide, full-grain leather, or steer hide leather, including a combination of synthetic and leather materials. Gloves are assembled by hand, using die cutters, stitching machines and hand lacing each glove with the combination of materials. Cowhides or pigskins need to be tanned into

leather. Tanning is a chemical process using either plant tannins or Chromium(III) sulfate to lower the pH.

The manufacturing of 'synthetic' materials for a softball glove is a bit more complicated. Synthetic leather is made from PVC, the same plastic in plumbing pipes. PVC is created in a lab using a type of processed fossil fuel called ethylene and salts. The liquid PVC is mixed with several other chemicals including leather fragrance, then stirred and dyed. A raising agent (like baking soda for cakes) is added and the paste is spread on a mold, then baked. The synthetic leather still is not done. It is covered with a fabric to protect and then laid with a protective chemical coat and textured using a roller. Once the synthetic leather is made, it goes through the same process as leather to become a softball glove.

5) Based on the information in the text, infer how synthetic leather and natural leather impact society and the natural world.

More resources are required to construct a synthetic glove, as well as chemical agents that may be harmful constructing synthetic-based gloves. In contrast, natural materials require less resources and chemical agents to create a baseball glove, yet are composed of materials from animals, affecting the supply chain of products produced from these materials.

6) Compare and contrast the past and present gloves.

The glove's materials from the past were natural and/or did not require the same time and/or resources as today's glove by way of synthetic materials. The overall structure of the baseball glove has remained relatively the same, yet with more protection and amendments provided to ensure performance at designated field positions: catcher, infielders, first baseman, and outfielders.

3.0 Forces in Softball

GRADES 6th-8th

Data Collection: Measure and Collect distance in feet.

Answers will vary based on student results.

Swing Type	Hit 1	Hit 2	Hit 3	Hit 4	Hit 5	Average
Full Swing						
Bunt						

QUESTIONS:

1) How does bunting the ball versus hitting the ball change how Newton's Third Law is demonstrated?
   Answers will vary based on student results.

2) Make a hypothesis on how throwing/pitching the ball faster would change the forces acting on the ball.
   Answers will vary based on student results.

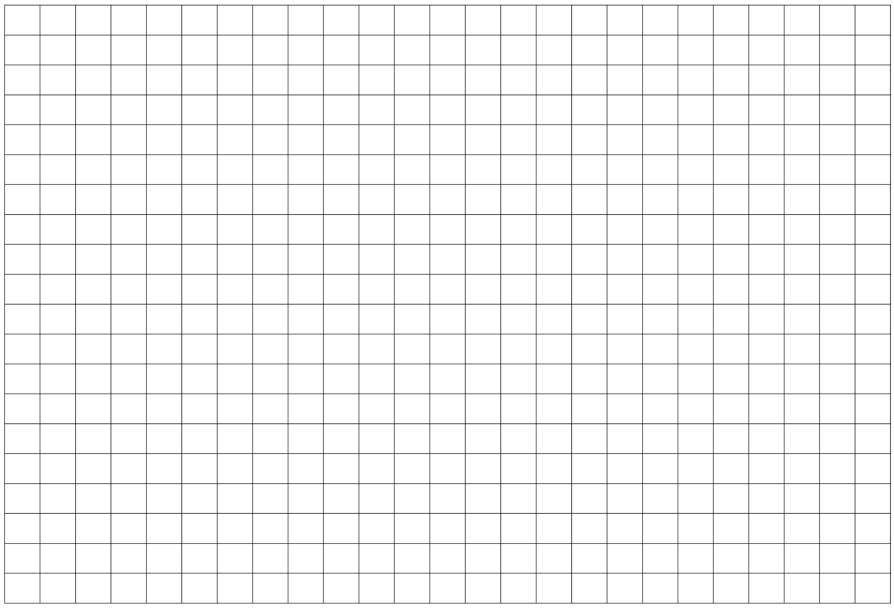
4.0 Is it Fast or Slow?

GRADES 6th-8th

Answers will vary based on student results. Example data below.

Pitches	Pitch 1	Pitch 2	Pitch 3	Average Velocity	Mass (.25 kg)	Kinetic Energy (Calculated) K=1/2 MV2
Fastball	36 MPH	38 MPH	42 MPH	39 MPH	.25 kg	9.75 J
Curveball	28 MPH	26 MPH	31 MPH	28 MPH	.25 kg	7 J
Change-up	24 MPH	22 MPH	26 MPH	24 MPH	.25 kg	6 J

Graph the kinetic energy of each pitch: **Answers will vary based on student results.**



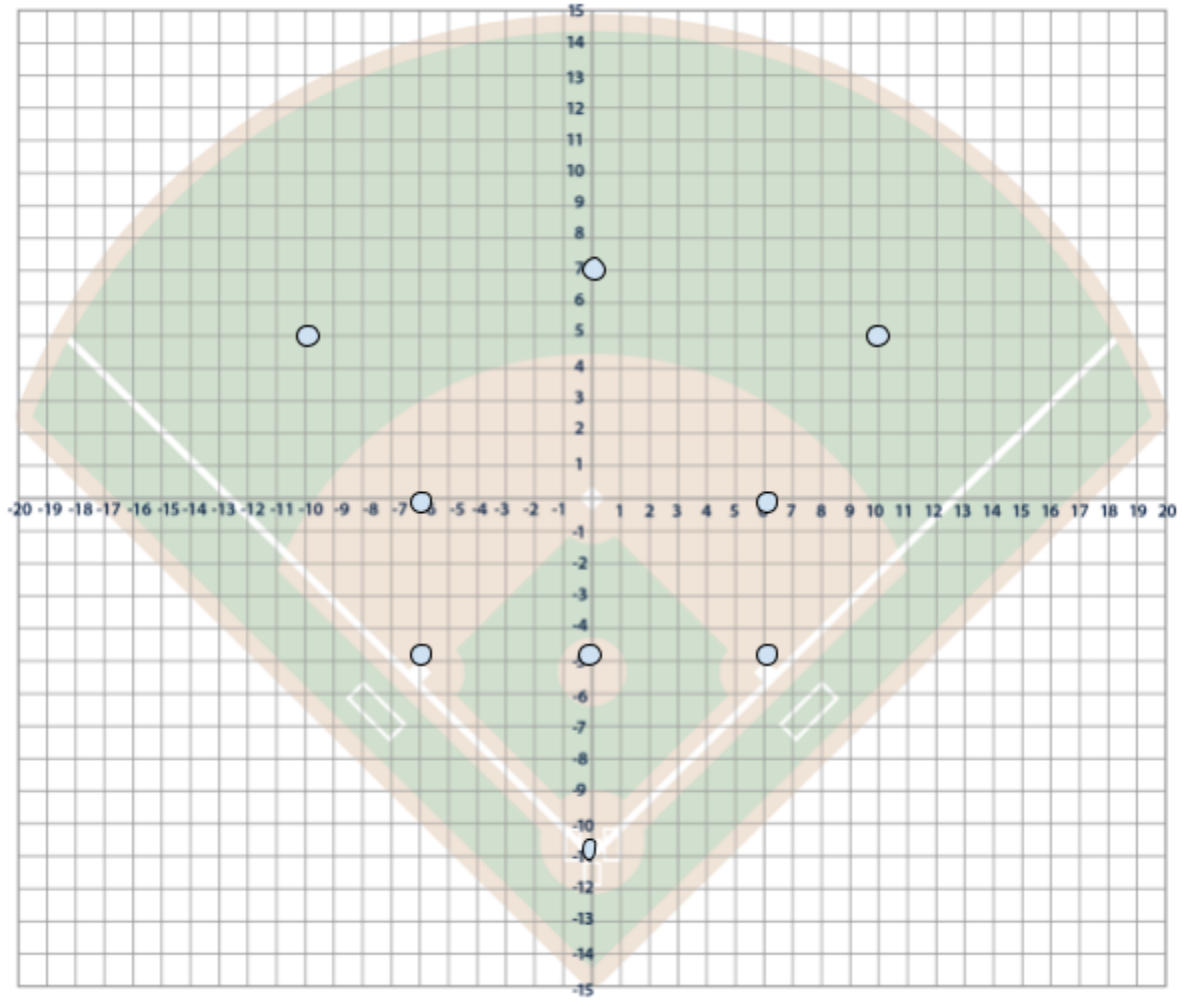
Why do some pitches have more kinetic energy than others? Support your claim with evidence and reasoning.

Example: Because some pitches are thrown with less force and motion, affecting the amount of kinetic energy in each pitch type. As demonstrated in this experiment, the data supports a significant difference in force and motion between a fastball and change-up.

5.0 The Field of Play

GRADES 6th-8th

6th grade specific standards
Plot each player on the coordinate plane. Label their x,y coordinates.



Center field: **(0,7)**

Left Field: **(10,5)**

Right Field: **(-10,5)**

Pitcher: **(0,-5)**

First Base:**(6,-5)**

Second Base:**(4,0)**

Shortstop:**(-4,0)**

Third Base:**(-6,-5)**

Catcher:**(0,-11)**

Use the coordinate plane to determine the absolute value between players.

1. How far would the Second Base player need to throw to the Shortstop?

-8

2. How far would the Third Base player need to throw to the First Base player?

12

3. How far would the Pitcher need to throw to the Catcher?

-6

4. How far does the Center Fielder need to throw to the Pitcher?

-18

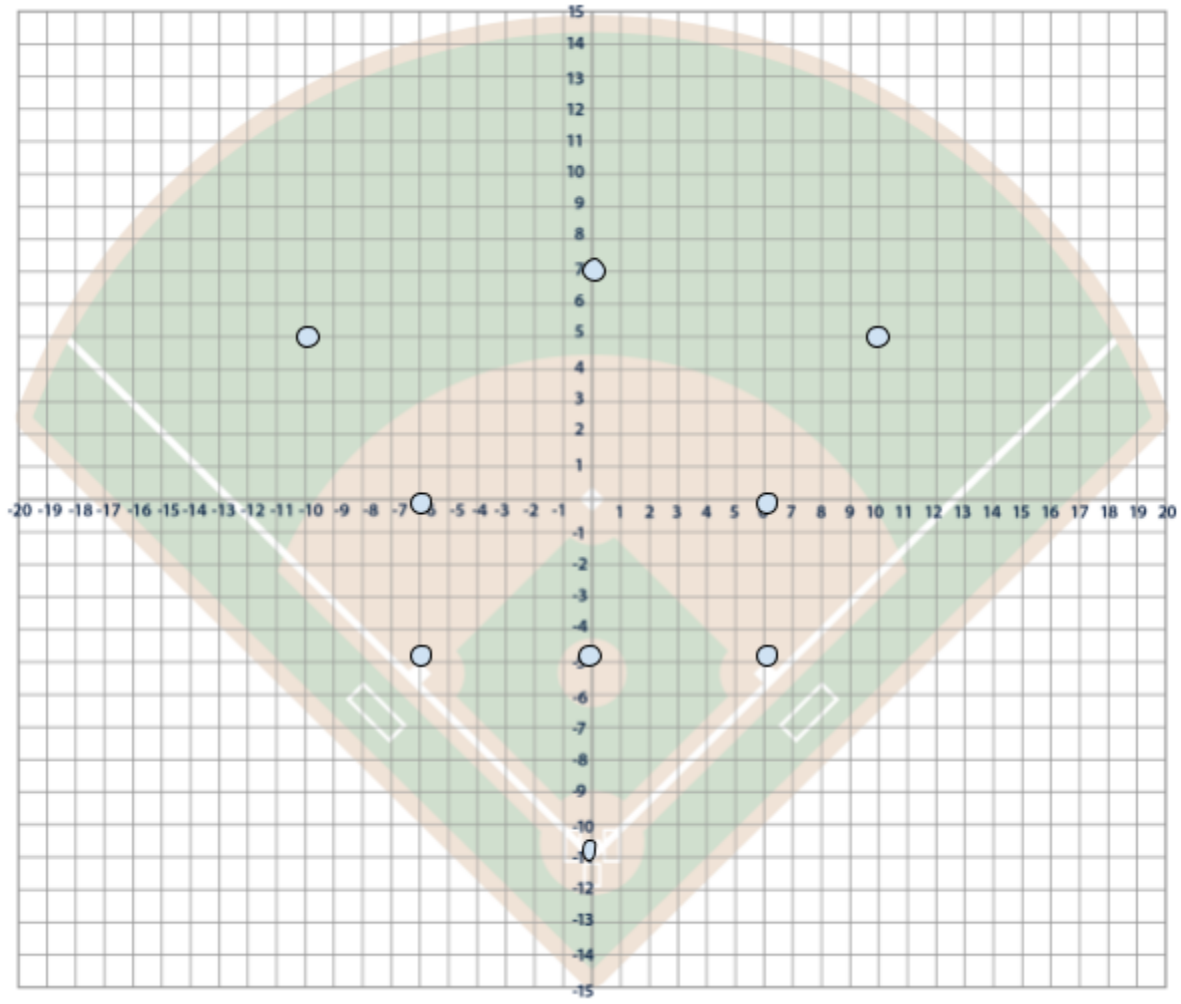
5. If the First Baseman ran to (0, 6) to catch the ball and then needed to throw to Home to make the play, how far would they throw?

-17

6. If the Catcher (-11) was trying to throw out a runner stealing Third, how far would they throw?

6

8th grade specific standards
Plot each player on the coordinate plane. Label their x,y coordinates.



Center field: **(0,7)**

Left Field: **(10,5)**

Right Field: **(-10,5)**

Pitcher: **(0,-5)**

First Base: **(6,-5)**

Second Base: **(4,0)**

Shortstop: **(-4,0)**

Third Base: **(-6,-5)**

Catcher: **(0,-11)**

1. Use the distance between the Pitcher and First Base (A), and the Pitcher and Catcher (B). Use the Pythagorean Theorem to calculate the distance between First Base and Catcher. $A^2+ B^2 =C^2$

8.49

2. Use the distance between the Pitcher and Third Base (A), and the Pitcher and Catcher (B). Use the Pythagorean Theorem to calculate the distance between Third Base and Catcher. $A^2+ B^2 =C^2$

8.49

3. Use the distance between the Pitcher and Center Field (A), and the Pitcher and Third Base (B). Use the Pythagorean Theorem to calculate the distance between Third Base and Center Field. $A^2+ B^2 =C^2$

13.42

4. Use the distance between the Pitcher and Center Field (A), and the Pitcher and First Base (B). Use the Pythagorean Theorem to calculate the distance between First Base and Center Field. $A^2+ B^2 =C^2$

13.42

5. The Catcher moves to (6, -11). Use the distance between First Base and Catcher (A) and First Base and Pitcher (B). Use the Pythagorean Theorem to calculate the distance between the Pitcher and Catcher. $A^2+ B^2 =C^2$

8.4

6. The Right Fielder moves to (4, 7) in line with the Second Base player. Use the distance between the Second Base player and the Right Fielder (A) and the Second Base player and Shortstop (B). Use the Pythagorean Theorem to calculate the distance between Right Field and Shortstop. $A^2 + B^2 = C^2$

10.63

6.0 Be a Hitter!

GRADES 6th-8th

X = Hit O = No Hit

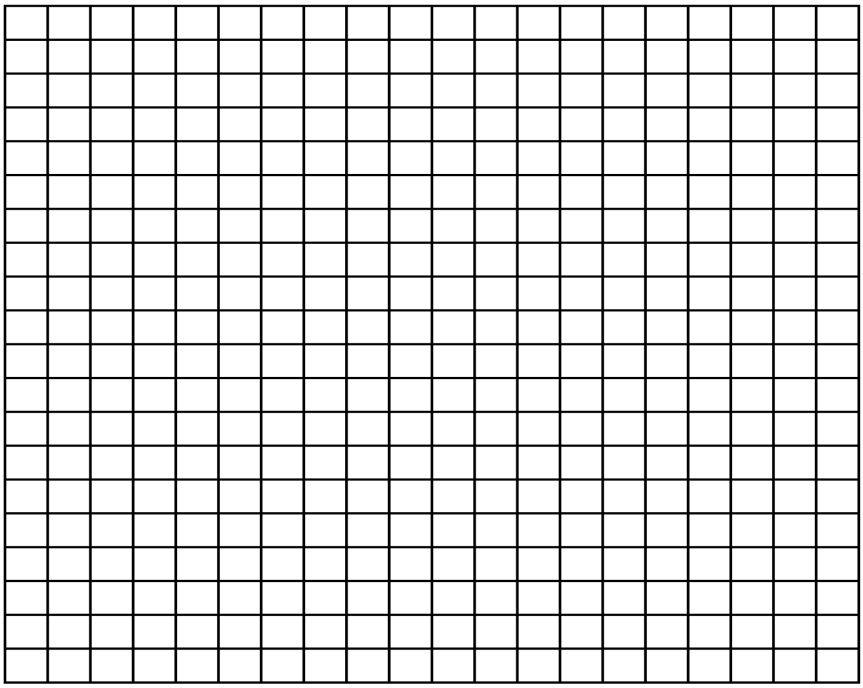
Trial 1

Swing	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	Probability
Hitter	O	O	X	X	O	X	X	O	O	X	5/10

Trial 2

Swing	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	Probability
Hitter	X	O	X	X	O	X	X	O	X	X	7/10

Graph the probability of each trial below: Answers will vary based on student results.



1) Based on Trial 1 probability, how many successful hits would you have out of 100 hits? **50**

2) Based on Trial 1 probability, how many successful hits would you have out of 1,000 hits? **500**

3) Based on Trial 1 probability, how many successful hits would you have out of 10,000 hits? **5,000**

4) Based on Trial 2 probability, how many successful hits would you have out of 100 hits? **70**

5) Based on Trial 2 probability, how many successful hits would you have out of 1,000 hits? **700**

6) Based on Trial 2 probability, how many successful hits would you have out of 10,000 hits? **7000**

Based on this information, were you more or less successful before or after watching the video and implementing a change to your swing mechanics? Support your answer with data.

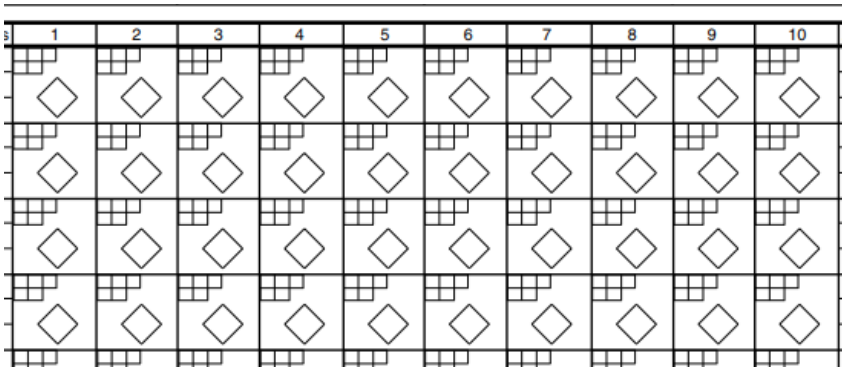
Example: I was more successful after watching the video on hitting mechanics, as I hit .50 or a batting average of .500 pre-video and hit .70 or a batting average of .700 post video.

7.0 Keeping Score

GRADES 6th-8th

Option 1: Scoring the Game

Results will vary among students.



Option 2: Scoring the game

Add a tally mark, as needed.

Results will vary among students.

Inning	Runs	
	Team 1	Team 2
1		
2		
3		
4		
5		
6		
7		

Team 1 **Results will vary among students.**

Inning	Strikes (3)				Balls (4)			
	Hitter 1	Hitter 2	Hitter 3	Hitter 4	Hitter 1	Hitter 2	Hitter 3	Hitter 4
1								
2								
3								
4								
5								
6								
7								

Team 2 **Results will vary among students.**

Inning	Strikes (3)				Balls (4)			
	Hitter 1	Hitter 2	Hitter 3	Hitter 4	Hitter 1	Hitter 2	Hitter 3	Hitter 4
1								
2								
3								
4								
5								
6								
7								

Put your data above in ratios and simplify to unit rate in the tables below.

Strike to Pitch **Results will vary among students.**

	Ratio	Unit Rate

Inning 1:		
Inning 2:		
Inning 3:		
Inning 4:		

Strike to Ball **Results will vary among students.**

	Ratio	Unit Rate
Inning 1:		
Inning 2:		
Inning 3:		
Inning 4:		

Ball to Pitch **Results will vary among students.**

	Ratio	Unit Rate
Inning 1:		
Inning 2:		
Inning 3:		
Inning 4:		

Runs to Batters **Results will vary among students.**

	Ratio	Unit Rate
Team 1:		

Team 2:		

Inning score to total score **Results will vary among students.**

	Ratio	Unit Rate
Inning 1:		
Inning 2:		
Inning 3:		
Inning 4:		

Team 1 total score; Team 2 total score **Results will vary among students.**

	Ratio	Unit Rate
Team 1: Team 2		
Team 2: Team 1		

Team 1 inning score; Team 2 inning score **Results will vary among students.**

	Ratio	Unit Rate
Inning 1:		
Inning 2:		
Inning 3:		
Inning 4:		

Answer the questions:

1) Based on the Run to Hitter ratios, who is a more effective pitcher? How do the ratios support your claim?

Based on results, answers will vary among students.

2) Based on your inning Runs to Total Runs ratio, which inning was the best played inning? How do the ratios support your claim?

Based on results, answers will vary among students.

3) If your team out scores the other team at a ratio of 2:1, what will the score be for each inning and the end of the game?

Based on results, answers will vary among students.

Results will vary among students.

Innings	Opponent score	Your score
1	1	
2	2	
3	4	
4	3	
5	0	
6	1	
7	2	

4) If a pitcher's ratio of pitches to strikes is 5:2, how many strikes will the pitcher throw during a game of 50 pitches?

Based on results, answers will vary among students.

5) If a relief pitcher strikes out a player 1/3 times, what is their ratio of strikes to pitches?

Based on results, answers will vary among students.

8.0 Advancements in Softball

GRADES 6th-8th

Circle your Position: For or Against

Brainstorm: What problems does increased use of instant replay in softball solve?

OR

What problems does increased use of instant replay in softball cause?

Criteria for Improvements/Changes to Instant Replay	Constraints for Improvements/Changes to Instant Replay
Examples: **Ensure play does not slow down.** **Designate officials to view and operate instant replay.**	**Examples:** **Play is slowed down even more.** **Technological support is the same or ineffective as before.**

Letter to NCAA Softball League Officials:

Does science and technology (instant replay) make softball more fair? Would an increased use of instant replay enhance or detract from the game? How can instant replay be improved to meet the needs of all stakeholders (players, coaches, fans)?

Stances and responses will vary among students