Name: KEY Class:

2.1 Probability and Penalty Kicks

GRADES 6-8

Collect Data Results will vary. Example data below.

	Shots Made	Total Kicks	Probability (calculated)
Partner 1 - Right Foot	2	11	.18
Partner 2 - Right Foot	4	13	.31
Partner 1 - Left Foot	5	14	.36
Partner 2 - Left Foot	3	9	.33

Based on your dominant foot probability	Predicted Outcome	Actual Outcome	Error (absolute value of actual subtracted from predicted)
12 Kicks	Example: 0.36 *12 = 4.3	6	1.7
15 Kicks	Example: 0.36 *15 = 5.4	5	.4
100 Kicks	Example: 0.36 *100 = 36		
1,000 Kicks	Example: 0.36 *1000 = 360		
2,000 Kicks	Example: 0.36 *2000 = 720		

Name: KEY **Class:**

Explain how probability can be a helpful tool to make predictions.

Answers will vary.

Example: Probability can support a more accurate prediction based on data.

Explain how probability can have limitations in predictions.

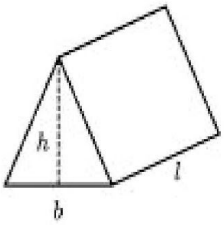
Answers will vary.

Example: Probability does not equal the actual results, so there may be errors involved.

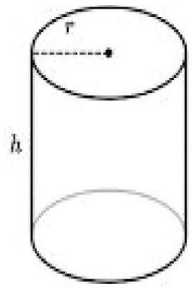
Name: KEY **Class:**

3.1 Properties of a Football and Foam Football

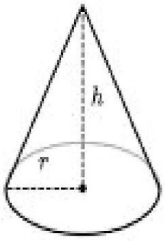
GRADES 6-8



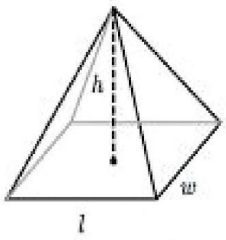
$$V = \frac{b \cdot h \cdot l}{2}$$



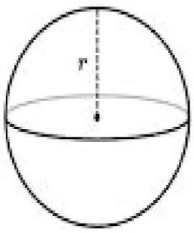
$$V = \pi r^2 h$$



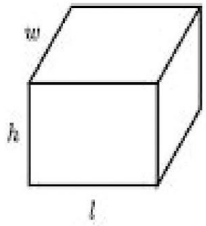
$$V = \frac{\pi r^2 h}{3}$$



$$V = \frac{l \cdot w \cdot h}{3}$$



$$V = \frac{4}{3}\pi r^3$$



$$V = l \cdot w \cdot h$$

Volume of object 1: **Will vary based on the object.**	Volume of object 2: **Will vary based on the object.**
Volume of object 3: **Will vary based on the object.**	Volume of object 4: **Will vary based on the object.**

Name: KEY Class:

3.1 Properties of a Football and Foam Football

GRADES 6-8

Behaviors

	Volume of the center cylinder	Volume of the end cone	Approximate volume of the football	Mass of the football	Density of the football D=M/V
Youth Football	**Will vary based student measurements**	**Will vary based student measurements**	**= 280 in3**	**320 g**	**1.14 g/in3**
Foam Football	**Will vary based student measurements**	**Will vary based student measurements**	**= 262 in3**	**150 g**	**1.75 g/in3**

Claim: How does the density of a football affect its behavior? Use evidence to support your answer.

Answers will vary.

Example: A higher density object bounces less than a lower density object. A foam football has a higher density (1.75 g/in3) and when observing the differences in bounce-ability of balls, it bounced less than the youth football. The youth football has a density of 1.14 g/in3 and bounces almost double the height of the foam ball.

Name: KEY **Class:**

4.1 Advancements In Shoe Technology

GRADES 6-8

Observations will vary. Example observations below.

Shoe	Observations with numbers	Observations with words	Inference about why there was a design change
	**1 material**	**Thin sole Flat Made of leather**	**N/A**
	**12 eyelets 2 or more materials**	**Made of cotton/fabric Flat**	**Needed more sole support**
	**Multiple (3+) materials**	**Shaped foot bed (rise in the toe) Thicker material**	**Needed more ankle support**
	**Multiple (3+) materials**	**Thicker material Thicker heel support Lower ankle support**	**Need better jumping/landing absorption**
	**Multiple (3+) materials 9 eyelets**	**Made of synthetics Thinner material Taller ankle support Flexible foot bed**	**Lighter and better material**

What would you consider the single greatest advancement in basketball shoe technology in the last 100 years? Why? Explain.

Answers will vary. Example: Synthetic material technology: When basketball shoes were first created they used natural fibers and materials like cotton and leather. Now they are made of synthetic materials that are light and provide support.

Hypothesize why basketball shoes have changed more in the last 45 years (1972 – present) than they did the previous 60+ years (1910 to 1972).

Name: KEY **Class:**

Answers will vary.
Example: In the past 40 years, basketball became part of the mainstream culture, brands started to advertise and compete for the market, driving product development.

Do you think high-top shoes reduce ankle injuries compared to low-top shoes? Why? Explain.
Answers will vary.
Example: The high top shoe provides support around the ankle to keep it stable/keep a player from rolling or twisting his/her ankle when the body moves quickly.

For many athletes, Converse Chuck Taylor sneakers lasted an entire season, if not more. Now most players change their shoes every week, if not every day. Explain.
Answers will vary.
Example: The synthetic material can compact due to use and then lose some of its cushioning or traction effect. In addition, shoes are made differently now then in the past.

Brainstorm three designs that improve shoe technology to increase performance and decrease injury: Answers will vary.

Select your best design: Use your observations and inferences from the shoe advancement data table to justify why your design will increase performance and decrease injury.
Answers will vary.

Name: KEY Class:

5.1 Adaptive Technology

GRADES 6-8

Create a device that will help adaptive players retrieve the ball after a play.

Brainstorm ways to help adaptive players.

Results may vary among students.

Name: KEY Class:

5.1 Adaptive Technology

GRADES 6-8

Select a Design (draw in detail, label materials and provide measurements)

Results may vary among students.

Prototype testing plan:

Name: KEY Class:

6.1 Calculating Calories and Heart Rate

GRADES 6-8

Results will vary based on student data.

Beats per minute (bpm)	Partner 1	Partner 2
Resting heart rate (measured)		
Heart rate after 2.5 minutes of play		
Heart rate after 5 minutes of play		
Maximum heart rate (calculated)		

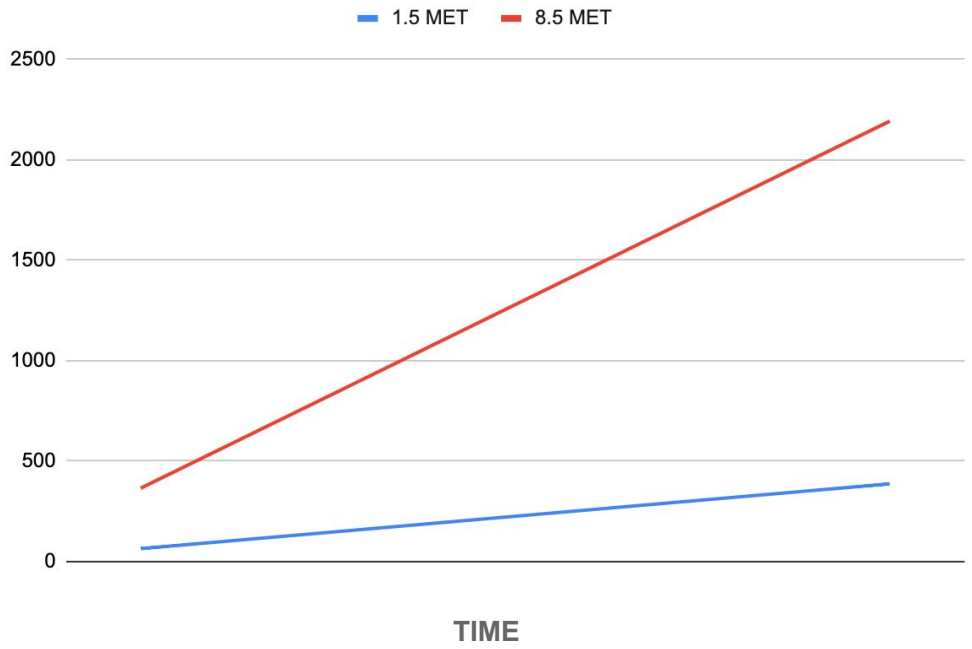
Using the equation C = (MET*weight)*t, complete the data table and graph.

Results will vary based on student data.

Example below is based on a *95 pound player*.

Time of Activity (hours) *t*	@ Resting Heart Rate (MET 1.5)	@ Heart Rate for Playing Soccer (MET 8.5)
0	0	0
1	64.5	365.5
2	129	731
3	193.5	1096.5
4	258	1462
5	322.5	1872.5
6	387	2193

Name: KEY **Class:**



Using the graph:

How many calories did you burn when you played soccer for 5 minutes?

C = (MET*weight)*t,
C = (8.5*43)*(5/60)
30 Calories

If you played soccer for 45 minutes, how many calories would you burn?

C = (MET*weight)*t,
C = (8.5*43)*(45/60)
274 Calories

If you played soccer for 90 minutes, how many calories would you burn?

C = (MET*weight)*t,
C = (8.5*43)*(90/60)
548 Calories

How did your calculations compare to those provided by the heart rate monitor?

Answers will vary based on student data.

How does the MET value change the slope of the line?

An increased MET value increases the slope.

Name: KEY Class:

7.1 The Evolution of the Football Helmet

GRADES 6-8

No Helmet	HELMET 1 
HELMET 2 	HELMET 3 
HELMET 4 	HELMET 5 
HELMET 6 	HELMET 7 

Name: KEY Class:

7.1 The Evolution of the Football Helmet

GRADES 6-8

Helmet	Observations	Advantages	Limitations	Rating
NO HELMET	N/A	None	No protection	100%
H1	Leather, thin, worn out, two materials (inside and outside)	Provides warmth Protects from abrasions Protects ears	No contact protection No strap; easy to fall off in contact Made of soft material	98%
H2	Thicker than helmet 1, leather, smooth, wool or fabric lining, more shape.	Provides warmth Protects from abrasions Protects ears	No contact protection. No strap - easy to fall off in contact. Made of soft material.	94%
H3	Hardened leather, shaped, black, chin strap	A little contact protection Absorbs some energy from contact Chin strap to keep the helmet on	Heavy No strap - easy to fall off in contact Thin padding	85%
H4	Looks like soft plastic; includes chin strap, smooth ear holes, leather inside material.	Some contact protection from the shape and material. Chin strap to keep the helmet on.	Heavy Thin padding	75%
H5	Made of hard plastic, little to no padding, smooth, no chin strap.	More contact absorption of the material and form.	Heavy No strap - easy to fall off with contact. No padding to absorb energy from collisions.	65%
H6	Face guard, hard plastic, some inside padding.	More contact absorption of the material and form. Protection for chin and jaw.	Eyes and neck injury from frontward collision.	45%

Name: KEY Class:

		Chin strap to keep the helmet on/in place.		
H7	Full face guard, hard plastic, thick with foam padding inside.	Contact absorption of the material, padding and form. Face guard to protect face, frontward collisions/contact. Lightweight	Doesn't keep the head from rebounding. Doesn't absorb all the energy from a collision.	40%

Name: KEY **Class:**

8.2 Shot Tracking with Technology

GRADES 6-8

Probabilities of Success **Example data below.**

	Self	Partner 1	Partner 2	Partner 3
FT	.7	.6	.85	.4
2PT	.65	.7	.7	.4
3PT	.1	.3	.25	.1

Calculate your frequency of success for the following:

If you attempted 27 - 3PT shots: 2.7 shots

If you attempted 93 - 2PT shots: 60.5 shots

If you attempted 21 - FT shots: 14.7 shots

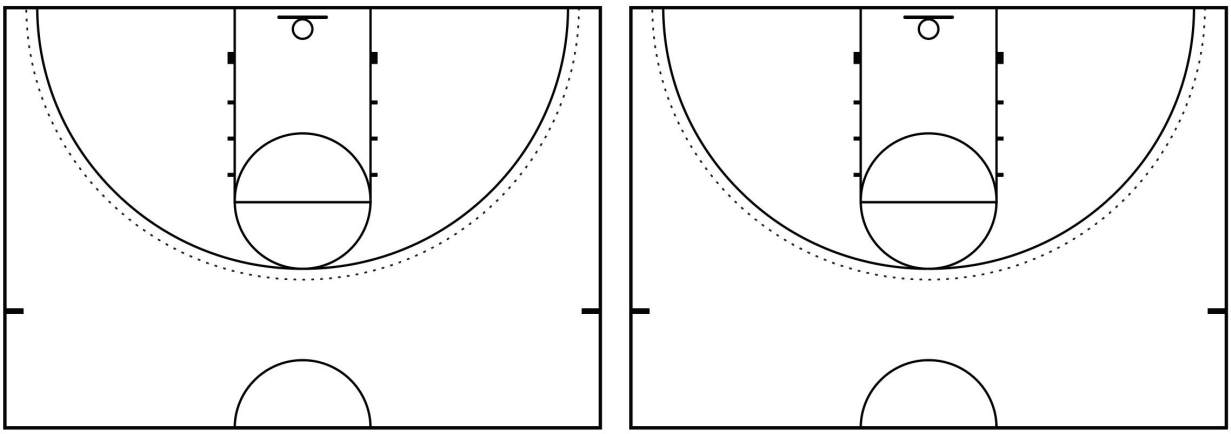
Based on the graph you constructed with your class data, and your frequency and probability above, make a claim that expresses who would be the highest paid player on your class' team. Support your claim with evidence and reasoning.

Answers will vary based on student data. Example is based on data table only.

Partner 1 would likely be the highest paid player. He/she has the highest probability of shot success for both 2PT and 3PT shots, which are the most common points earned throughout a game. Although, this individual has a slightly lower probability for free throw shots, these points would be made by his/her increased success rate in 3-pointers.

Name: KEY Class:

8.2 Shot Tracking (*Non-technology Option*)



O - Shots Made X - Shots Missed

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	TOTAL Made
Free Throws	O	X	X	O	X	X	X	X	X	X	X	O	O	X	0	.66
Lay-Ups	X	X	X	X	O	O	O	X	O	O	X	X	O	X	O	.53

Write a mathematical expression that states if your free throw accuracy is greater than or less than your layup accuracy. Justify it with evidence.

Answers will vary based on data.

Example: Lay up < free throw

Because I only made 8/15 lay-up shots or 53% and for free throws I made 10/15 or 66%.