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IA-EN-O8-MAT-C7-LSP-m1



Topic	Estimating Pi
Class Description	Narrative You are organizing a field day event in your school. All the games are going to be inspired by the Olympics. MATH You use your mathematical concepts of ESTIMATING THE VALUE OF π and ESTIMATING THE CIRCUMFERENCE and AREA OF A CIRCLE to make this event a success.
Class time	60 mins
Goal	<ol style="list-style-type: none">1. (-1) Recall. Recall π and use it to find the area and circumference of a circle. (7.G.B.4)2. (0) Core. Estimate value of pi and expressions containing pi to nearest hundredths. (8.NS.A.2) .3. (+1) Advanced. Use estimation to find the circumference and area of a circle. (HSG.GMD.A.1).
Resources Required	<ul style="list-style-type: none">• Teacher Resources<ul style="list-style-type: none">◦ Earphone with mic◦ Tablet-Stylus◦ Calculator• Student Resources<ul style="list-style-type: none">◦ Earphone with mic (optional)◦ Paper- Pen◦ Tablet-Stylus (Optional)◦ Calculator



Class structure	<ol style="list-style-type: none"> 1. Warm-Up 2. TA and SA 3. AA1, AA2 and AA3 (Based on student ability) 4. Create 5. Wrap Up 	<ol style="list-style-type: none"> 1. 3 Mins 2. 30 Mins 3. 5 Mins per AA 4. 10-15 Min 5. 3 Mins <p>Use discretion</p>
Start the video call from H2H		

Warm-up (3 min)

- Connect with the student.
- Engage the student, make her/him feel comfortable.

Teacher Action	Student Action
<p>Hello <...>,</p> <p>Q How are you? How is your day going?</p> <p><i>Encourage the student to share about their day. Show interest and curiosity without asking any personal questions.</i></p>	<p>A Student shares about their day.</p>
<p>I'm sure you had fun last time! Now, we are going to do something different and fascinating as always!</p> <p>Q But before that, can you tell me what topics we discussed in the previous class?</p>	<p>Give the student space to recall.</p> <p>A Expected: Yes. I learned about irrational numbers and estimating cube root.</p>



Wow! It's great that you remember!

Yeah, we have seen that irrational numbers are the numbers which cannot be represented in the form p/q . Decimal expansion of irrational numbers is non-terminating and non-repeating.

Q Can you tell me, what does circumference of a circle mean?

A Expected: The distance around the circle.

Q Yes and how do we calculate it?

A Expected: By using $2\pi r$ or πd

Q What are the values of π that we use?

A Expected: $22/7$ or 3.14

Q Do you think we are using the exact value of π ?

A Expected: No

If the student says yes, explain:

Generally we use the approximate value of π as 3.14 or $22/7$ to simplify our calculations.

Q Then what is the exact value of π ?

A Expected: $\pi = 3.141519\dots$

It is $3.141519\dots$

Q So, can we say π is irrational? Explain.

Exactly!

If the student struggles, say:

A Expected: Yes, because π has non-terminating and non-repeating



<p>π is irrational because it has non-terminating and non-repeating decimals.</p> <p>3.14 and $22/7$ are just the approximate values of π, not the exact values!</p> <p>Today we are going to learn more about this amazing irrational number in detail and its application.</p>	decimals.
You're the student president. The school has put you in charge of organizing the field day! This is your first event as the student president so you're determined to make it a success!	<i>The student gets an idea about the narrative.</i>
So, are you excited? Let's begin!	Expected: Yes! <i><Student is expected to be excited></i>

Core Concepts

- (-1)Recall π and use it to find the area and circumference of a circle.
- (0) Estimate value of pi and expressions containing pi to nearest hundredths.

Teacher Activity (15 mins)

Mandatory

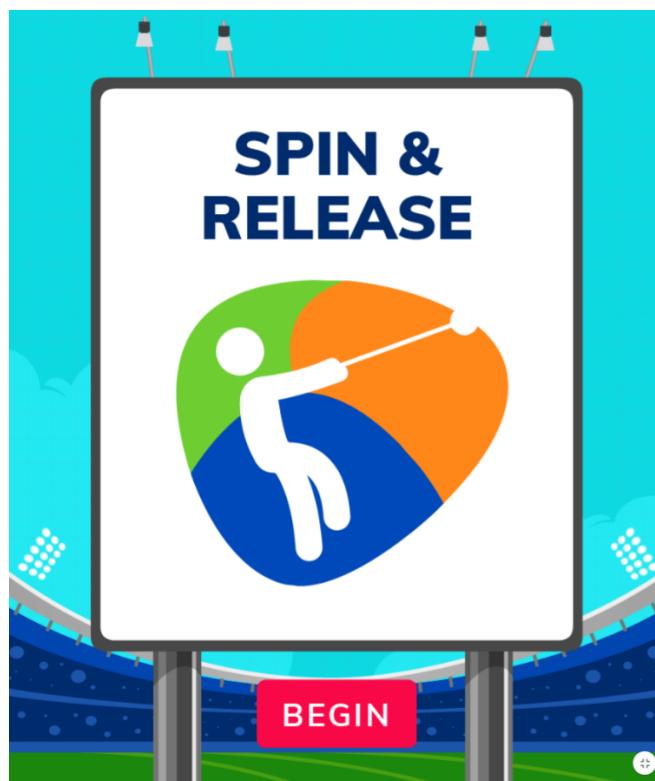
- Allow the student to "do" the activities.
- Provide support where needed.



Q Are you excited about being the student president?
Let's make this Field Day special by modelling the competitions on the olympics.
Let's start with the throwing games.

You decide to organize a hammer throw game, and for that you need to organize a few things first.

A Expected: Yes



Press **Begin**

To conduct a hammer throw event, you need to draw a circle in which the participant will stand.

You and your friends draw three concentric



circles of diameter 1 foot, 2 feet, and 3 feet for the same.

You need the three circles to look regularly spaced out so let's check the ratios of their circumferences to their diameters.

What do you observe?

Reference:

C - Circumference

D- Diameter

Q.01

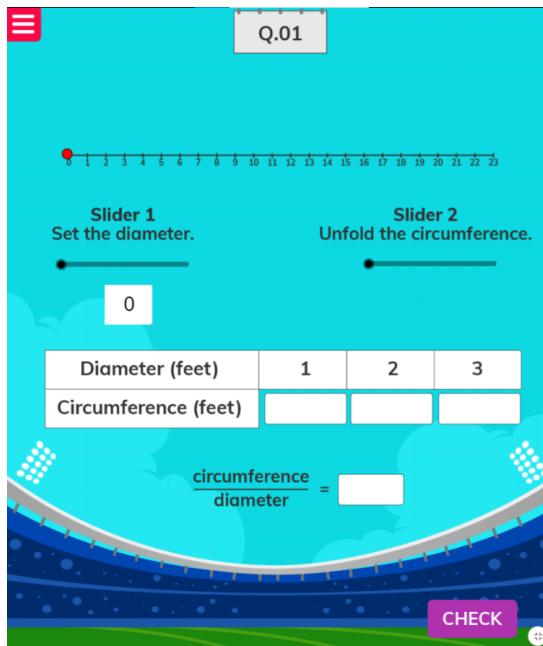
Slider 1 Set the diameter. Slider 2 Unfold the circumference.

0

Diameter (feet)	1	2	3
Circumference (feet)			

$\frac{\text{circumference}}{\text{diameter}} =$

CHECK



Q What is the distance covered by the circle called?

Yes!

A Expected: Circumference



Q Now set the diameter to 1 foot, then use slider 2 to find the circumference of the circle.

Q Repeat the same for diameters 2 and 3 feet.

Q Calculate the ratios of Circumference and Diameter for the 3 circles

Q What do you observe?

If the student struggles, say:

The C/D ratio is constant for all the circles.

Q Yes! And what does C/D imply?

Exactly, so π is estimated as 3.14 by using C/D ratio.

Exactly! So π is estimated by C/D.

A Expected: 3.14 feet <Student unfolds the circle>

A Expected: 6.28 feet and 9.42 feet. <Student enters the circumference in the table>

A Expected:
When D = 1 foot, $C/D = 3.14/1 = 3.14$.
When D = 2 feet, $C/D = 6.28/2 = 3.14$.
When D = 3 feet, $C/D = 9.42/3 = 3.14$.

A Expected: C/D ratio is constant, i.e., 3.14 for all the circles.

A Expected: π



Q.01

Slider 1 Set the diameter.

Slider 2 Unfold the circumference.

Diameter (feet) Circumference (feet)

1	2	3
3.14	6.28	9.42

$\frac{\text{circumference}}{\text{diameter}} = 3.14$

THAT'S CORRECT! **NEXT**

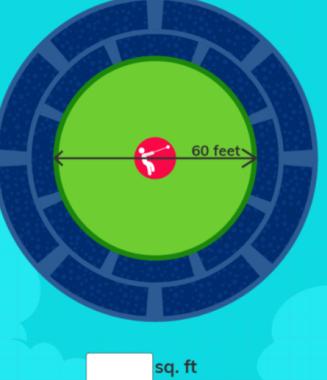
The student can enter the answer and press on **Check** to see if they answered correctly.

Now you need to figure out where the audience can watch the game safely. For that, you need to draw a bigger circle to mark the line for the audience. So you decide to draw a circle of diameter 60 feet.



Q.02

Calculate the area of a circle with a diameter of 60 feet. (Use $\pi = 3.14$)



sq. ft

CHECK

Q How can we calculate the area?

Q What is the radius of the circle if the diameter is 60 feet?

Good!

Q Calculate the area of the circle.

Explain how the answer is calculated and parallelly show the steps on the whiteboard.

W

A Expected: πr^2

A Expected: $60/2=30$ feet

A Expected: 2826 sq. feet

Student sees on the whiteboard how to calculate the area if he/she doesn't know to proceed further.



$$\begin{aligned}\text{Area of the circle} &= \pi r^2 \\ &= 3.14 \times 30 \times 30 \\ &= 2826 \text{ square feet}\end{aligned}$$

Please take a snap of the class using



Screenshot

or



Click Photo

on the top right.

Keep asking the student if she/he can see the whiteboard activity.

Student enters the correct answer and presses **Next** to move to the next question.

Q.02

Calculate the area of a circle with a diameter of 60 feet. (Use $\pi = 3.14$)

60 feet

2826 sq. ft

THAT'S CORRECT!

NEXT



You used π to find the circumference and area of the circle.

Have you ever wondered how the value of π is approximated as 3.14?

Let's try to find out today!

There's a circle drawn on the tiled floor of the indoor assembly hall (which forms a grid of squares) to mark where the winner podiums should be placed. Can you use just this circle and nothing else to derive the value of π ?

Q Shall we find out how to estimate the value of π ?

Q.03

The radius of a circle is 6 units. Estimate the value of π using the given information.

Area (1/4 circle) = sq. units

Area (circle) = sq. units

$\pi =$

CHECK

Let's say each square occupies an area of 1 square foot.

Figure out the number of squares in the

A Expected: Yes!



quadrant or $1/4$ th of the circle.

This gives the area of $1/4$ of the circle.

Q So, can you tell me the area of the quadrant?

Q Yes! But are they all complete squares? Right! The corner squares are partly inside the circle.

But let's assume that all 28 squares are inside the circle to find the approximate value of π .

Q Do you think 3.11 is a good approximation of π ?

Explain how the answer is calculated using the whiteboard.

Say:

This is one of the ways we can estimate the value of π .

If we increase the diameter of the circle, we can get a better approximation of π .

As we assumed the corner squares to be fully inside the circle, we didn't get a good approximation of π .

But, if we increase the diameter of the circle, the value of π is approximated to 3.14!

A Expected: 28 sq. feet

A Expected: No

A Expected: No/Yes



Area of quadrant = 28

Area of circle = $4 \times 28 = 112$

$$\pi r^2 = 112$$
$$\pi = \frac{112}{r^2} = \frac{112}{\sqrt{r} \times r} = \frac{112}{6 \times 6}$$
$$\pi = 3.11$$

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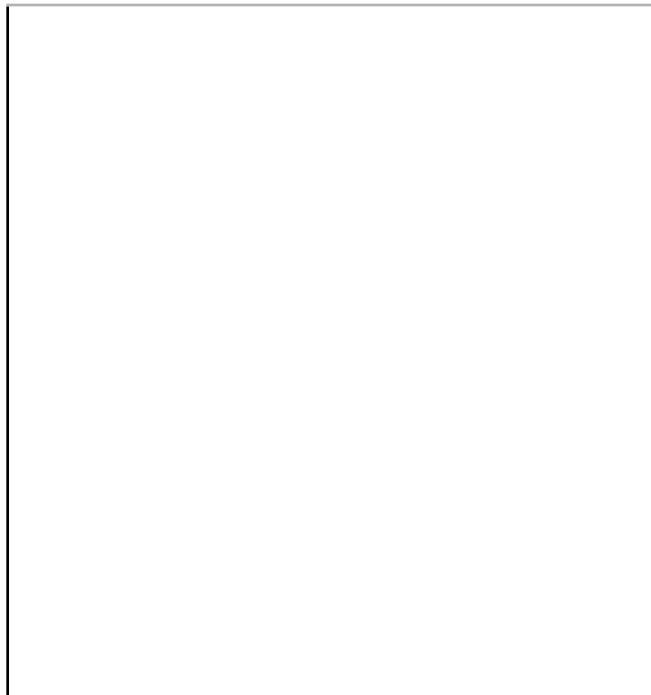
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on the top right.

Keep asking the student if she/he can see the whiteboard activity.

Well done! You've estimated the value of π .

Student enters the correct answer and presses **Next** to move to the next question.



Q.03

The radius of a circle is 6 units. Estimate the value of π using the given information.

Area (1/4th circle) = sq. units

Area (circle) = sq. units

π =

THAT'S CORRECT! NEXT

As you have done the estimations, your friends agree to arrange the benches the way you wanted.

Q Can you guess how π can be helpful here?

Let's find out!

We have a long way to go when it comes to knowing more about the applications of this amazing irrational number.

While you drew the circle for the participants and the audience, your friend calculated the circumference of the audience area to be 80π feet to rope it off.

A <*The student may guess*>



Q.04

Circumference of the audience seating area is 80π feet.
Estimate its value till hundredths. (Use $\pi = 22/7$).



CHECK

A Expected: 251.43 feet

Q What is the estimated value of circumference till hundredths?
(Use $\pi = 22/7$)
Show whiteboard calculation, if necessary.

The student uses the whiteboard and calculator to estimate.



The student sees how to estimate the expressions containing pi.



Given,

$$\begin{aligned}\text{Circumference} &= 80\pi \\ &= 80 \times \frac{22}{7} \\ &= 251.4285\end{aligned}$$

Approximate till hundredths,
= 251.43

Student enters the correct answer and presses **Next** to move to the next question.

Q.04

Circumference of the audience seating area is 80π feet.
Estimate its value till hundredths. (Use $\pi = 22/7$).

251.43 feet

THAT'S CORRECT!

NEXT

The area covered within the chalk circle was found to be π^2 . Your helpers are confused about where π^2 would lie on the measuring tape. Why don't you help them?



Q.05

Where will π^2 lie on the number line? (Use $\pi = 3.14$)

(Area) chalk circle = π^2

3 4 5 6 7 8 9 10 11 12

π^2

CHECK

A large blue stadium background with a red running track.

Q What is the value of π^2 ?

Q Good, so it would lie between which two integers?

Using the whiteboard, explain how approximation of π^2 can be done.



A Expected: Approximately 9.86

A Expected: 9 and 10

As we know $\pi = 3.14$, i.e.,

$$\pi > 3$$

$$\pi^2 > 3^2$$

$$\pi^2 > 9$$

As π is little more than 3, we can say that π^2 lies between 9 and 10.



As we know $\pi = 3.14$, i.e.,

$$\pi > 3$$

$$\pi^2 > 3^2$$

$$\pi^2 > 9$$

As π is little more than 3, we can say that π^2 lies between 9 and 10.

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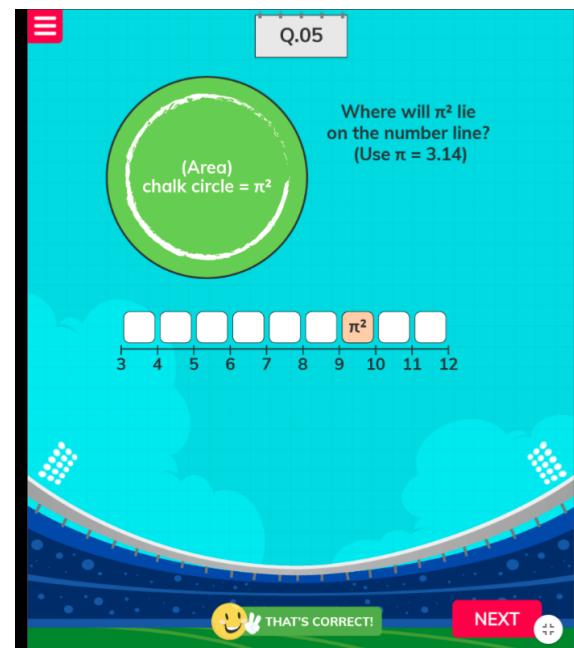
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Keep asking the student if she/he can see the whiteboard activity.



Student drags π^2 and fixes it on the number line, presses **NEXT** and moves to the next question.



Along with learning the estimation of π , you've also learned how to use the value to calculate the circumference and area. Let's see how you can use that here.

The hammer throw event is about to start. The hammer which is held at a distance of 4 feet from the participants, is rotated in circular motion as shown.



Q.06

Estimate the distance covered by the ball in a single rotation, if it is held 4 feet away from the body.
(Use $\pi = 3.14$)



CHECK

Q What is the distance covered by the hammer in a single rotation called?

Q Can you estimate the distance covered?

A Expected: Circumference of the circle.

A Expected: Yes!
Student uses the whiteboard to do the calculation.





Distance covered=Circumference

$$\begin{aligned}\text{Circumference} &= 2\pi r \\ &= 2 \times \pi \times 4 \\ &= 8\pi \\ &= 8 \times 3.14 \\ &= 25.12\end{aligned}$$

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on the top right.

Keep asking the student if she/he can see the whiteboard activity.

Student enters the correct answer and presses **Next** to move to the next question.



Q.06

Estimate the distance covered by the ball in a single rotation, if it is held 4 feet away from the body.
(Use $\pi = 3.14$)



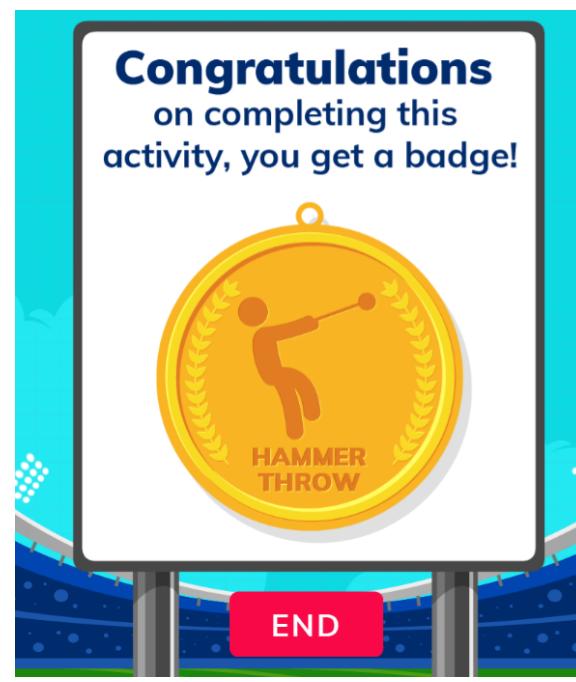
25.12 feet

 THAT'S CORRECT!

NEXT

Great! Well done!

Student collects the badge and moves to the **Next Activity**.





Before moving to the next activity, use the probing questions given here to ensure that the rigor and depth needed for this concept is taken care of.

Q Is $22/7$ rational or irrational? Why?

Students may have confusion in as π is irrational. Say:

$22/7$ and 3.14 are the approximate values of π used to simplify our calculations. They are not the exact values.

Both $22/7$ and 3.14 can be represented in the form of p/q .

A Expected: $22/7$ is rational, because it can be represented in the form of p/q .

Q Is $16\pi - 15$ irrational? Why?

A Expected: Yes. The product of a rational number and irrational number is always irrational. So 16π is irrational and if we subtract a rational from irrational, then the answer will be always irrational.

Q Choose irrational number:

$$3\pi, \frac{0}{\pi}, \frac{\pi}{\pi}, \frac{\pi}{3}$$

A Expected: $3\pi, \frac{\pi}{3}$

Q How did you find it?

A Expected: $\frac{0}{\pi} = 0, \frac{\pi}{\pi} = 1$; 0 and 1 are rational numbers. They can be



represented in the form of p/q . The product of rational and irrational is always irrational. So 3π and $\frac{\pi}{3}$ are irrational.

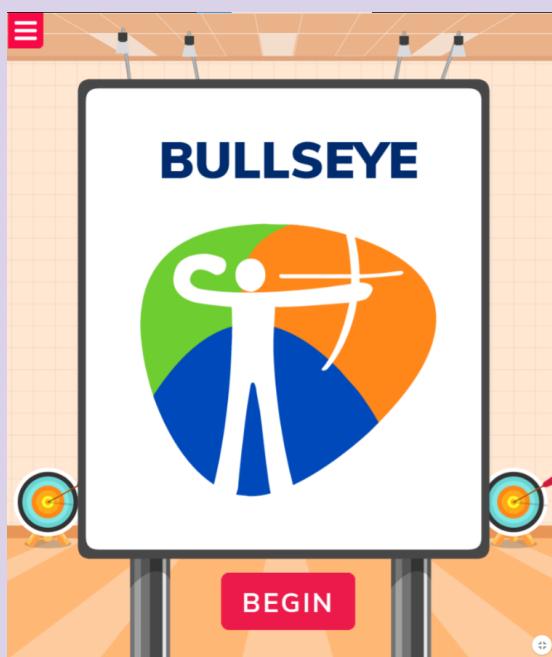
Student Activity (10 mins)

- **Optional**, if the student has confidently solved all the problems in Teacher Activity 1.
- **Compulsory**, if the student struggled in the earlier activities.
- Lead the student to solve the problems in these activities.

Archery

After the throwing games comes archery!
Let's keep going!

Student presses on **Begin** to start the activity.



In the game of archery, there are two targets A and B whose circumference and diameter are given.
Both the targets are set up at the same



distance from the participants.

Q.01

Which target is easier to hit? (Use $\pi = 3.14$)

Circumference = 20 feet Diameter = 3 feet

Target A Target B

Target A Target B

 CHECK

Q How will you compare the sizes of the two targets?

A Expected: (Either)

By calculating the circumference of target B, then comparing the circumference of both the targets.

OR

By calculating the diameter of target A, then comparing the diameter of both the targets.

A Expected: Target A

Q Which target would be easier to hit?

The greater the diameter/circumference of a target, the easier to hit!

Accept the option given by the student.

That was great! <Appreciate the student.>



The student uses the whiteboard to calculate the answer.



Target A:

$$C = 20 \text{ feet}$$
$$\pi D = 20 \text{ feet}$$
$$D = \frac{20}{\pi} = \frac{20}{3.14}$$
$$D \approx 6.36 \text{ feet}$$

Target B

$$D = 3 \text{ feet}$$

Diameter of Target A > Diameter of Target B

(OR)

TARGET A

$$C = 20 \text{ feet}$$
$$D = ?$$

TARGET B

$$C = ?$$
$$D = 3 \text{ feet}$$
$$C = \pi \times D$$
$$= 3\pi$$
$$= 3 \times 3.14$$
$$= 9.42$$

Circumference of Target A > circumference of Target B

Please take a snap of the class using



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on the top right.

Keep asking the student if he/she can see the whiteboard activity.



Student enters the correct answer and presses **Next** to move to the next question.

Q.01

Which target is easier to hit? (Use $\pi = 3.14$)

Circumference = 20 feet Diameter = 3 feet

 Target A  Target B

Target A Target B



 THAT'S CORRECT! **NEXT**

Q.02

We know that $\frac{\text{Circumference}}{\text{Diameter}}$ is an irrational number.

$\frac{\text{Circumference}}{\text{Radius}}$ will be?

A rational number
 An irrational number
 A whole number
 A natural number



CHECK



Q Can you convert C/D to C/R?

Q Good! What is C/D?

As discussed before, π is an irrational number.

Q So, C/D will be?

Yes!

Q If C/D is π , then C/R will be?

Q If π is irrational, then 2π will be?

Yes! Hence, C/R will also be an irrational number.

[C - Circumference

D - Diameter

R - Radius]

Using the whiteboard, explain how the answer is calculated.



A Expected: Yes, $C/D = C/2R$

A Expected: π

A Expected: Irrational

A Expected: 2π

A Expected: Irrational. It can not be represented in the form of p/q and the decimal expansion of 2π is also non-terminating and non-repeating.

Student sees on the whiteboard how to compare the given ratios.



$$\frac{C}{A} = \frac{C}{2R} = \frac{1}{2} \frac{C}{R}$$

$$\frac{C}{A} = \pi$$

$$\frac{1}{2} \frac{C}{R} = \pi$$

$$\frac{C}{R} = 2\pi$$

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on the top right.

Keep asking the student if he/she can see the whiteboard activity.

Student ticks the correct answer and presses **Next** to move to the next question.



Q.02

We know that $\frac{\text{Circumference}}{\text{Diameter}}$ is an irrational number.

$\frac{\text{Circumference}}{\text{Radius}}$ will be?

A rational number
 An irrational number
 A whole number
 A natural number



 THAT'S CORRECT!

NEXT

The circumference of the target board with radius 4.5 feet was calculated by your friend. But he is not sure about his answer and seeks your help.

Q.03

Your friend calculated the circumference of the target board to be 26.26 feet. ($\pi = 3.14$)



He followed the following steps. Identify the mistake/s.

Circumference = $2 \times \pi \times 4.5$
 Circumference = 9π
 Circumference = 26.26 feet



CHECK



Q Solve it step by step first.

Q Now, do you find any mistakes in your friend's calculation?

Well done!

If the student struggles, explain the same on the whiteboard.

A The student solves using the whiteboard.

A Expected: Yes, 3rd step.

Student calculates on the whiteboard.



$$\begin{aligned}\text{Circumference} &= 2 \times \pi \times 4.5 \\ &= 9 \times \pi \\ &= 9 \times 3.14 \\ &= 28.26 \text{ feet}\end{aligned}$$

Hence, the 3rd step is wrong.

Please take a snap of the class using



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on the top right.

Keep asking the student if he/she can see the whiteboard activity.

Student ticks the correct answer and presses **Next** to move to the next question.



Q.03

Your friend calculated the circumference of the target board to be 26.26 feet. ($\pi = 3.14$)



He followed the following steps. Identify the mistake/s.

- Circumference = $2 \times \pi \times 4.5$
- Circumference = 9π
- Circumference = 26.26 feet



 THAT'S CORRECT! NEXT

The circumference of the innermost circle in the target board is $16 - 4\pi$ feet.

Regulations require that the innermost circle has a minimum circumference of 3 feet. Check if the target qualifies.



Q.04

Estimate $16 - 4\pi$ to the nearest hundredth.
(Use $\pi = 22/7$)

feet

CHECK

A Expected: 3.43

A Expected: Yes, as $3.43 > 3$.

Q Estimate the value of $16 - 4\pi$.

Good!

Q Does this qualify?

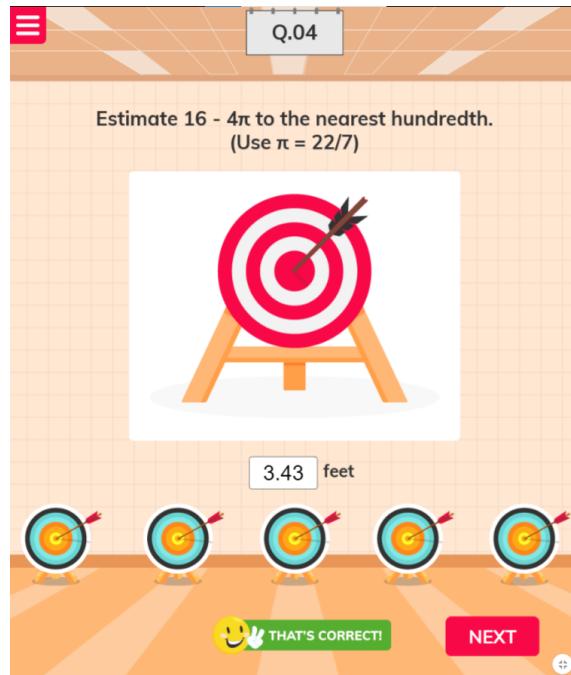
The student uses the whiteboard and calculator to do estimation.



$$\begin{aligned}16 - 4\pi &= 16 - [4 \times \pi] \\&= 16 - [4 \times \frac{22}{7}] \\&= 16 - 12.5714... \\&= 3.42857... \\&\approx 3.43\end{aligned}$$

(Approximated to the nearest hundredths)



	<p><i>Please take a snap of the class using</i></p> <div style="display: flex; justify-content: space-around; align-items: center;">  Screenshot or  Click Photo </div> <p><i>on the top right.</i></p> <p><i>Keep asking the student if he/she can see the whiteboard activity.</i></p>
	<p>Student ticks the correct answer and presses Next to move to the next question.</p> 
<p>PAS (Public Address System) is set in the ground in such a way that the announcement of the results after each game of archery can be heard upto 0.5 miles, in all the directions.</p>	



<p>Q. For how many square miles can the announcement be heard?</p>  <p><input type="text"/> square miles (Approximate your answer to the nearest hundredth and use $\pi = 3.14$)</p>  <p>CHECK</p>	
<p>Q. For how many sq. miles can the announcement be heard? Approximate your answer to the nearest hundredth.</p>	<p>A. Expected: 0.79 sq. miles</p> <p>The student uses the whiteboard to calculate the area of the circle.</p>  <div style="border: 1px solid lightblue; padding: 10px;">$\begin{aligned} \text{Area} &= \pi r^2 \\ &= 3.14 \times 0.5 \times 0.5 \\ &= 3.14 \times 0.25 \\ &= 0.785 \\ &= 0.79 \text{ sq. miles} \end{aligned}$<p>(to the nearest hundredth)</p></div>



Please take a snap of the class using



Screenshot

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on the top right.

Keep asking the student if he/she can see the whiteboard activity.

Student enters the correct answer and presses **Next** to move to the next question.

Q.05

For how many square miles can the announcement be heard?

0.79 square miles

(Approximate your answer to the nearest hundredth and use $\pi = 3.14$)

THAT'S CORRECT!

NEXT

Do we have enough space for all the events? Let's see.
The circular school ground has a circumference of 1256 meters.



Q.06

What is the maximum possible distance between any two points on the ground? (Use $\pi = 3.14$)

School ground Circumference = 1256 meters



5 targets are shown on the ground.

CHECK

Q What is the maximum distance in a circle called?

Good!

Q Calculate the diameter.

Great! Seems like we have more than enough space for the events.

A Expected: Diameter

A Expected: 400 meters

The student uses the whiteboard to calculate the diameter of the ground.





$$\begin{aligned}C &= 1256 \text{ meters} \\ \pi \times d &= 1256 \\ 3.14 \times d &= 1256 \\ d &= \frac{1256}{3.14} \\ &= 400\end{aligned}$$

Please take a snap of the class using

Screenshot

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on the top right.

Keep asking the student if he/she can see the whiteboard activity.

Student enters the correct answer and presses **Next** to move to the next question.



Q.06

What is the maximum possible distance between any two points on the ground? (Use $\pi = 3.14$)

School ground Circumference = 1256 meters

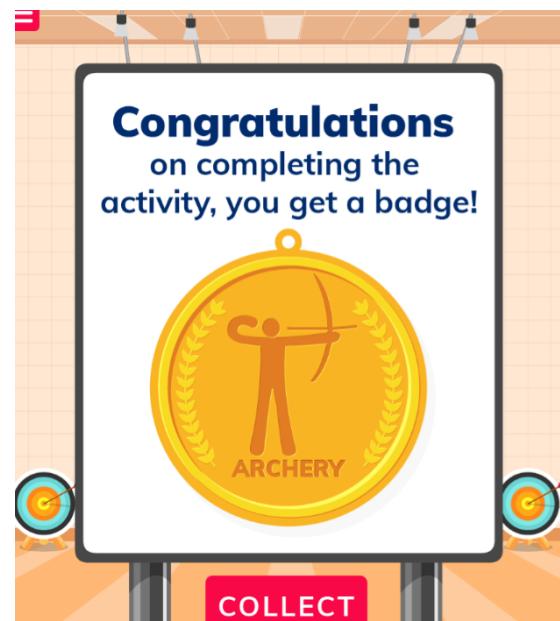
400 meters

THAT'S CORRECT!

NEXT

Well done! **You get a badge.**

The student collects the badge and moves to the next activity.





Before moving to the next activity, use the probing questions given here to ensure that the rigor and depth needed for this concept is taken care of.

Q Can you arrange π , π^2 , 2π , $\sqrt{\pi}$ and $\pi/2$ in ascending order?

Q How did you do that?

A Expected: Yes, $\pi/2, \sqrt{\pi}, \pi, 2\pi, \pi^2$.

A Expected: $\pi/2 = 1.5707..$

$$\sqrt{\pi} = 1.77..$$

$$\pi = 3.141519..$$

$$2\pi = 6.2831..$$

$$\pi^2 = 9.8696..$$

The student arranges them by comparing their values.

Great!

Q Are all these irrational? Explain.

A Expected: Yes, because the decimal expansion of these are non-terminating and non-repeating.

Advanced Activity

Concepts

- (+1) Create equations describing relations using one variable and use them to solve problems.

Advance Activity 1

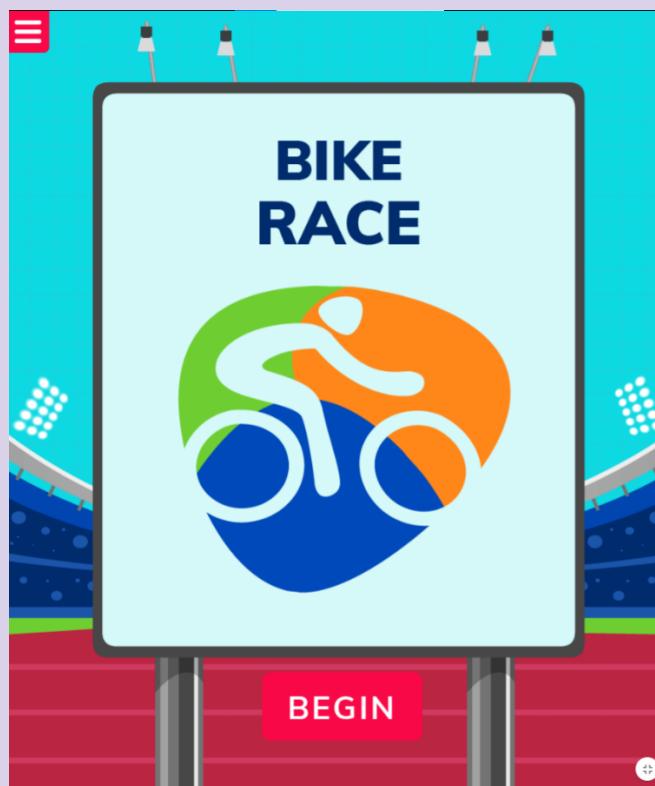
Optional

- +1 above the grade level.
- Start only after more than 15 minutes on the clock.
- Skip to Create Activity if only 10 minutes left.

Question 1: Teacher Led

**Bike Race:**

How about a bicycle race for the next event? That should be fun and unique!



The path of the race track forms 4 semicircles.



Q.01

How long is the path?
Approximate your answer to the nearest hundredth.
Use $\pi = 3.14$

miles

CHECK

A Expected: Circumference

A Expected: 9.42 miles

Q What is the length of the path called?

Good!

Q Now, find the distance covered by the track.

Explain how the answer is calculated using the whiteboard.

Q If the circumference of a circle is $2\pi r$, what will the circumference of a semicircle be?

Diameter of semicircles is given.

If required:

Hint: Find the radius of the semicircle beforehand.

A Expected: πr



Circumference of the track =
Circumference of (1st + 2nd + 3rd + 4th)
semicircle
$$(Circumference)_{\text{semicircle}} = (\frac{1}{2}) (Circumference)_{\text{circle}}$$
$$= \pi \times r$$

Circumference of the track:
$$= (\pi \times 1) + (\pi \times 0.5) + (\pi \times 0.5) + (\pi \times 1)$$

$$= \pi(1 + 0.5 + 0.5 + 1)$$

$$= \pi \times 3$$

$$= 3.14 \times 3$$

$$= 9.42 \text{ miles}$$

Please take a snap of the class using



Screenshot

or



Click Photo

on the top right.

Keep asking the student if he/she can see
the whiteboard activity.

Student enters the correct answer
and presses **Next** to move to the next
question.



Q.01

How long is the path?
Approximate your answer to the nearest hundredth.
Use $\pi = 3.14$

9.42 miles

THAT'S CORRECT!

NEXT

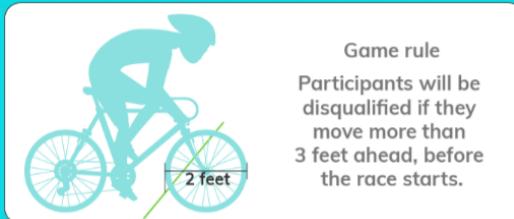
Question 2: Student Led

One of the participants started before the whistle was blown. This is not allowed in the game. According to the rules, the participants who move 3 feet ahead before the game starts will be disqualified.



Q.02

A participant's wheel moved three-fourths of a revolution across the starting line.



Game rule

Participants will be disqualified if they move more than 3 feet ahead, before the race starts.

How far did the contestant move? _____ feet
(Approximate to the nearest tenths)

Will the participant be disqualified?
 Yes No



A Expected: 4.71 feet

A Yes, as $4.71 \text{ feet} > 3 \text{ feet}$.

Q How far across the starting line did the contestant move?

Q Is the contestant disqualified?

Explain how the answer is calculated using the whiteboard.

Q How will you calculate three-fourths of a revolution?

Yes, that's good. Proceed your calculations on the whiteboard.

A Expected: Three-fourths of a revolution is nothing but the $\frac{3}{4} \times$ circumference.





Distance moved by the wheel:

$$= \left(\frac{3}{4} \times \text{circumference}\right)_{\text{wheel}}$$

$$= \frac{3}{4} \times \pi d$$

$$= \frac{3}{4} \times 3.14 \times 2$$

$$= 4.71 \text{ ft} = 4.7 \text{ ft} (\text{ nearest tenth})$$

$$4.7 \text{ ft} > 3 \text{ ft}$$

Please take a snap of the class using

Screenshot

or

Click Photo

on the top right.

Keep asking the student if he/she can see the whiteboard activity.

Student enters the correct answer and presses **Next** to move to the next question.



Q.02

A participant's wheel moved three-fourths of a revolution across the starting line.

Game rule
Participants will be disqualified if they move more than 3 feet ahead, before the race starts.

How far did the contestant move?
(Approximate to the nearest tenths) feet

Will the participant be disqualified?

Yes No

THAT'S CORRECT! **NEXT**

The student collects the badge.



Advance Activity 2

Optional

- +1 above the grade level.
- Start only after more than 15 minutes on the clock.
- Skip to Create Activity if only 10 minutes left.

Question 1: Teacher Led

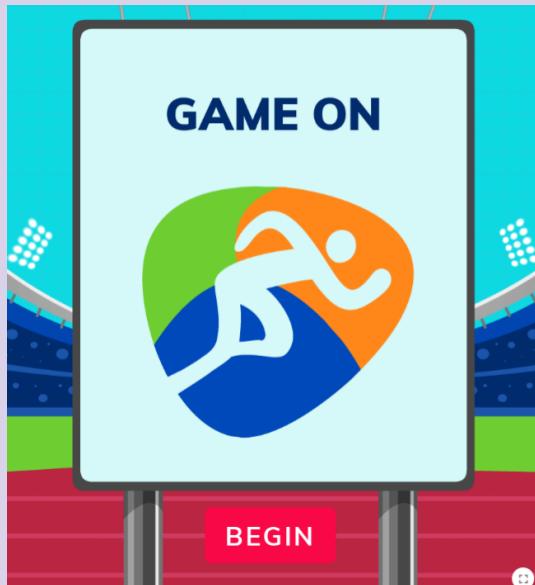
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Keep your footing! Relay race.

The relay is the highlight of Field Day. The racetrack is as represented as shown.



The student clicks on **BEGIN**.

The corners of the race track are semi-circular. The diameters of the inner and outer semicircle are 50 m and 60 m, respectively.



Q.01

Find the difference between the lengths of the outer and inner track on just the semicircular sections.
Approximate your answer to the nearest tenth.
(Use π key on calculator to estimate the value.)



A

Expected: Diameter of outer semicircle = 60 meter, then radius = 30 meter;
circumference = $r\pi = 30\pi$ meter

A

Expected: 25π meter

A

Expected: $30\pi - 25\pi = 5\pi$ meter

A

Expected: $2 \times 5\pi = 10\pi$ meter

Q What is the circumference of the outer semicircle?

Good!

Q Now calculate the circumference of the inner semicircle.

Q What's the difference between them?

Q There are two such semicircles, what will be the total difference?

Explain how the answer is calculated using the whiteboard.



Circumference of outer semicircle = $r \times \pi = 30 \times \pi$
= 30π meters

Circumference of inner semicircle = $r \times \pi = 25 \times \pi$
= 25π meters

Difference between them = $(30 - 25)\pi$
= 5π meters

Total difference = $2 \times 5\pi = 10\pi$
= 3.14×10
= 31.4 meters

Please take a snap of the class using



Screenshot

or



Click Photo

on the top right.

Keep asking the student if he/she can see
the whiteboard activity.

Student enters the correct answer
and presses **Next** to move to the next
question.



Q.01

Find the difference between the lengths of the outer and inner track on just the semicircular sections.
Approximate your answer to the nearest tenth.
(Use π key on calculator to estimate the value.)

31.4 meters

THAT'S CORRECT! **NEXT**

Question 2: Student Led

Q.02

Estimate the area covered by the whole track.
Approximate your answer to the nearest hundredth.
(Use π key on calculator to estimate the value.)

square meters

CHECK

Q What is the area covered by the 2



semicircular sections?

Q What is the area covered by the rectangular track?

Q What is the total area covered by the track?

Explain how the answer is calculated using the whiteboard.



Area covered by the track = Area of semicircular track + 2x area of rectangular track

$R = 30 \text{ m}$
 $r = 25 \text{ m}$

A Expected: 863.94 m^2

$$\begin{aligned}2(\text{Area})_{\text{Semicircle}} &= \pi 30^2 - \pi 25^2 = \\&= 275\pi \text{m}^2 \\&= 863.94 \text{ m}^2\end{aligned}$$

A Expected: 1000 m^2

$$\begin{aligned}\text{Area covered by the rectangular path} \\ \text{is} &= 2 \times 100 \times 5 \\&= 1000 \text{ m}^2\end{aligned}$$

A Expected: 1863.94 m^2

$$863.94 + 1000 = 1863.94 \text{ m}^2$$



$$\begin{aligned}\text{Area of circular track} &= \pi R^2 - \pi r^2 \\&= \pi (R^2 - r^2) \\&= \pi (R+r)(R-r) \\&= \pi (55)(15) \\&= 275\pi \text{ m}^2\end{aligned}$$

$$\begin{aligned}2 \times \text{Area of rectangle} &= 2 \times 100 \times 5 = 1000 \text{ m}^2 \\ \text{Area covered by track} &= 275\pi + 1000 = 1863.92 \text{ m}^2 \\&= 1863.94 \text{ m}^2\end{aligned}$$

Please take a snap of the class using



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or



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on the top right.

Keep asking the student if he/she can see the whiteboard activity.

Student enters the correct answer and presses **Next** to move to the next question.



Q.02

Estimate the area covered by the whole track.
Approximate your answer to the nearest hundredth.
(Use π key on calculator to estimate the value.)

1863.94 square meters

THAT'S CORRECT! NEXT

The student collects the badge.

Congratulations
on completing the activity,
you get a badge.

COLLECT



Advance Activity 3

Optional

- +1 and +2 above the grade level.
- Start only after more than 15 minutes on the clock.
- Skip to Create Activity if only 10 minutes left.

Question 1: Teacher Led

It's time for the most exciting event of the Field Day—pole vaulting!

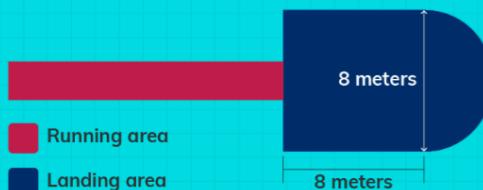


To ensure safe landing, you decide to increase the area of the square landing mat by adding a semicircle to it.



Q.01

Estimate the area of the landing mat to the nearest hundredths.
(Use π key on the calculator)



CHECK

Q What is the area occupied by the square mat?

Q What is the area occupied by the semicircular mat?

Q Now, what is the total landing area?

A Expected: 64 square meters

Area occupied by square mat is
 $= 8^2 = 64$ square meters

A Expected: 25.12 square meters

Area occupied by the semicircular mat is:

$$= \text{Area of circle}/2 = \frac{1}{2}\pi r^2$$

$$= \frac{1}{2} \times \pi \times 4 \times 4$$

$$= 25.1327\dots \text{ square meters}$$

(Use π key on the calculator.)

A Expected: 89.13 square meters

Total landing area =
Area of square + Area of semicircle
 $= 64 + 25.1327\dots$
 $= 89.13$ square meters



Using the whiteboard, explain how the answer is calculated.

W →

$$\begin{aligned} \text{Area occupied by the square mat} &= 8^2 = 64 \text{ sq. meters} \\ \text{Area occupied by the semicircular mat} &= \frac{1}{2} \times \pi \times r^2 \\ &= \frac{1}{2} \times \pi \times 4^2 \\ &= 8\pi \\ &= 25.1327\dots \text{ meters} \\ \text{Total landing area} &= 64 + 25.1327\dots \\ &= 89.1327\dots \\ &\approx 89.1329 \text{ meters} \end{aligned}$$

Please take a snap of the class using



Screenshot

or

Click Photo

on the top right.

Keep asking the student if he/she can see the whiteboard activity.

	Student enters the correct answer and presses Next to move to the next question.
--	---



Q.01

Estimate the area of the landing mat to the nearest hundredths.
(Use π key on the calculator)

Running area
Landing area

8 meters

89.13 square meters

THAT'S CORRECT! **NEXT**

Question: Student Led

You need to draw the exact outline of where the mat needs to be placed in the school grounds.



Q.02

Estimate the perimeter of the landing mat to the nearest hundredths.
(Use π key on the calculator)



CHECK

A

Expected: By adding the perimeters of the shape formed by square and semicircle.

A

Expected: $4\pi + 24 = 36.5663\dots$
 ≈ 36.57 meters

Q How will you estimate the perimeter of the landing area?

Q Yes! Calculate the perimeter of the landing area.

The student uses the whiteboard to depict calculations.





$$\begin{aligned} \text{Perimeter of the } & [] = \text{Circumference of semicircle} + \text{Boundary of square} \\ & = \pi r + 3 \times 8 \\ & = 4\pi + 24 \\ & [\text{Use } \pi \text{ key on a calculator}] \\ & = 12.5663\ldots + 24 = 36.56637\ldots \\ & \approx 36.57 \text{ (Approx. to the nearest hundredths)} \end{aligned}$$

Please take a snap of the class using



Screenshot

or

Click Photo

on the top right.

Keep asking the student if he/she can see the whiteboard activity.

Student enters the correct answer and presses **Next** to move to the next activity.



Q.02

Estimate the perimeter of the landing mat to the nearest hundredths.
(Use π key on the calculator)

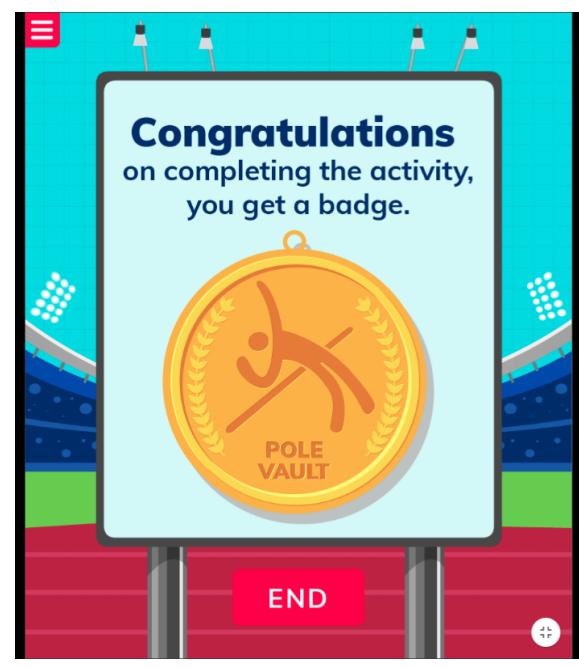
Running area Landing area

8 meters 8 meters

36.57 meters

THAT'S CORRECT! NEXT

The student collects the badge.





Create Activity (10 mins)

Compulsory

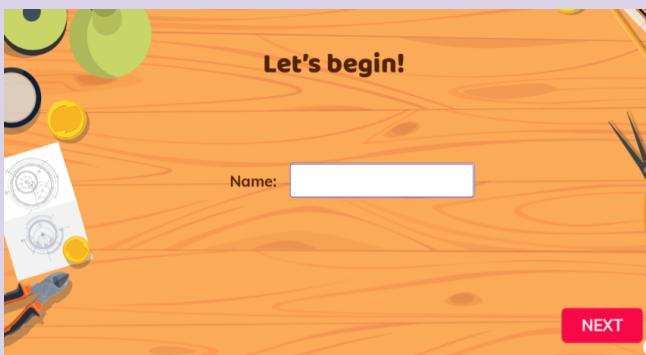
- Design a Medal for the Bike Race.

Someone forgot to buy the medals for the bike race! This is a disaster!

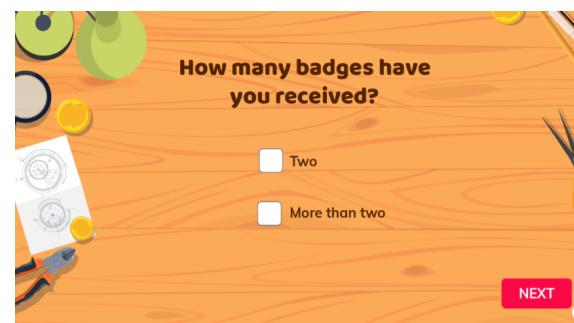
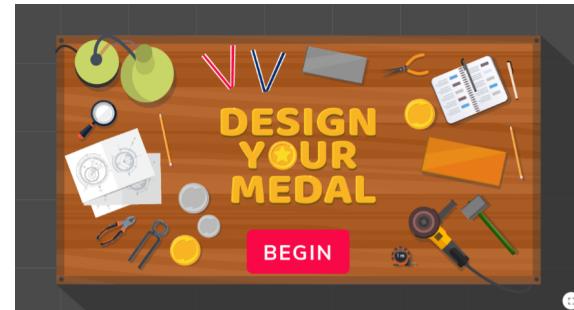
The only possible solution is to design a medal yourself.

Let's **design a medal for the bike race** using circles and semicircles!

Make sure that the medal is unique.



The student starts the activity.

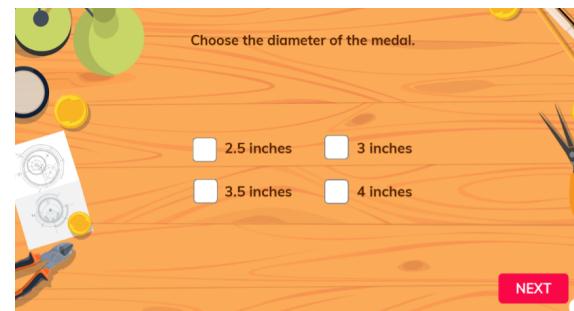


First, you need to choose the diameter of the medal.

The available set of possible diameters include 2.5 inches, 3 inches, 3.5 inches, and 4 inches.

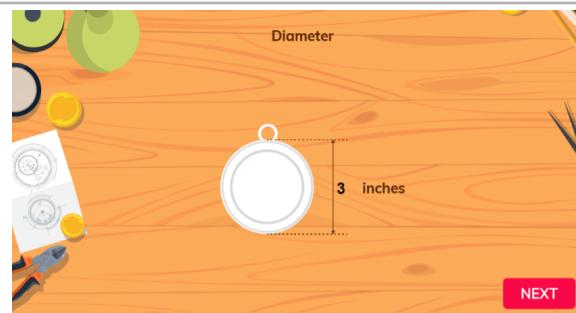
Q Choose the diameter of the medal.

The student chooses either one of the 4 given options.





Great! You've decided the diameter.

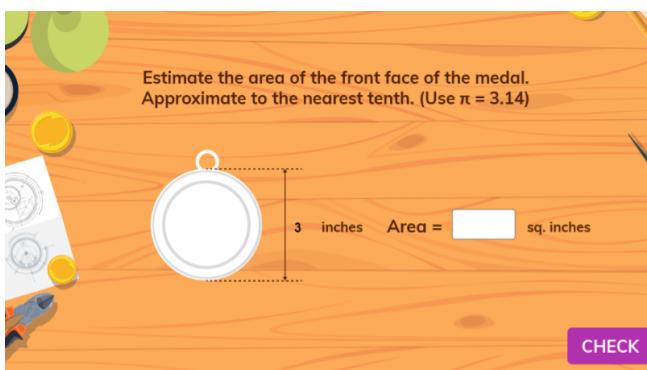


Diameter

NEXT

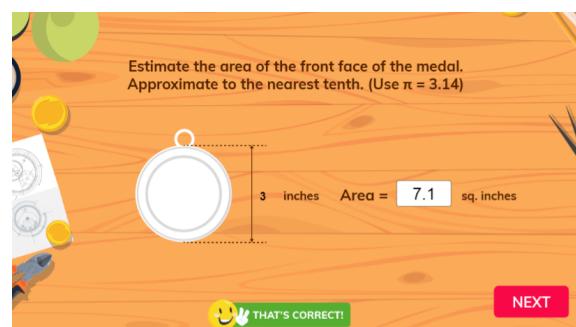
The student uses the value of the diameter to calculate its area.

Now, based on that, you need to estimate the area of the front face of the medal.



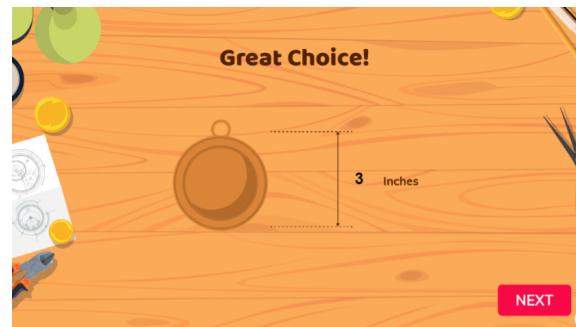
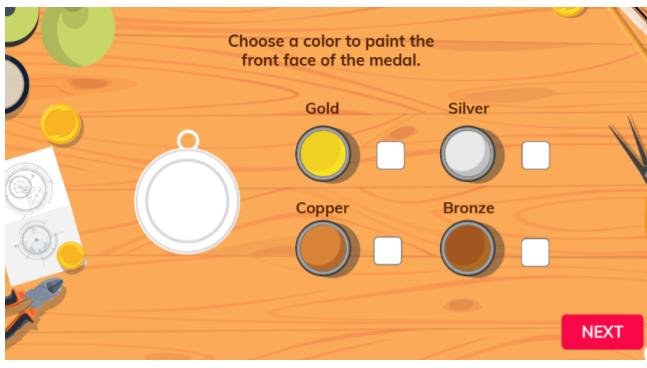
$$\text{Area} = \pi (\text{diameter}/2)^2$$

Student enters the correct answer, checks, and presses **Next** to move to the next question.



The student chooses any one of the colors from the provided options.

Good! It's time to choose the color to paint the front face of the medal.





Next, you need to choose the ribbon pattern for the medal.

Choose a ribbon pattern for the medal.

NEXT

Student selects a pattern and presses **Next** to move to the next question.



Q Choose the ribbon pattern for the medal.

The area of the hole through which the ribbon passes is $(2\pi + 1.5)$ sq. millimeters. Estimate it to the nearest hundredth.

The area of the hole through which the ribbon passes is $(2\pi + 1.5)$ sq. millimeters. Approximate to the nearest hundredth. (Use $\pi = 3.14$)

Area = sq. millimeters

CHECK

The area of the hole through which the ribbon passes is $(2\pi + 1.5)$ sq. millimeters. Approximate to the nearest hundredth. (Use $\pi = 3.14$)

Area = 7.78 sq. millimeters

THAT'S CORRECT!

NEXT

Q Can you estimate the expression $(2\pi + 1.5)$ sq. millimeters to the nearest hundredth?

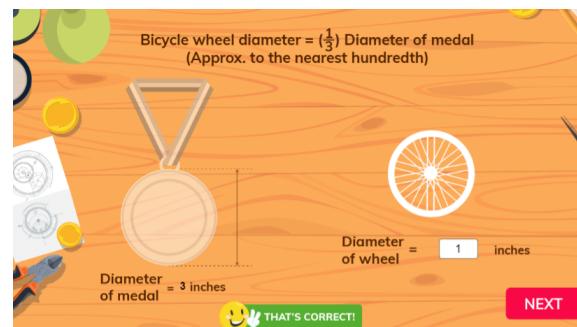
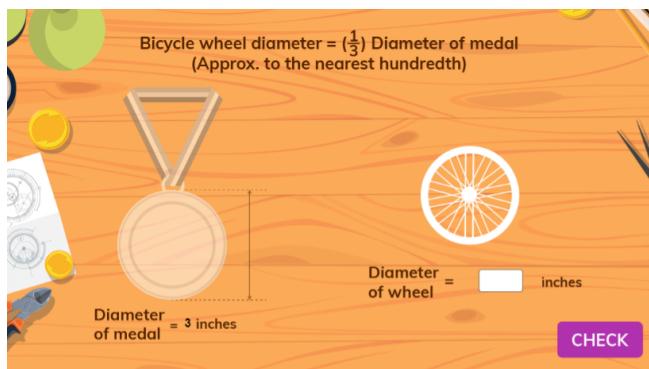
A Expected: 7.78 sq. millimeters
Student enters the correct answer, checks and presses **Next** to move to the next question.



As you are designing the medal for the bike race, you decide to engrave the image of a bicycle on the medal.



If the diameter of the bicycle wheel has to be $(\frac{1}{3})^{\text{rd}}$ of the diameter of the medal, can you find the diameter of the bicycle wheel?



Bicycle wheel diameter = $(\frac{1}{3})$ Diameter of medal.

Q Find the diameter of the wheel.

The engraved bicycle should have a chain wheel and its diameter should be (0.2) times the diameter of the wheel.

A $\langle \text{Expected: } x/3 \rangle$ Answer depends on the diameter of the medal chosen.
 $x - \text{diameter of the medal}$



Chain wheel diameter =
 $(0.2) \times \text{Diameter of wheel}$
(Approx. to the nearest hundredth)

Diameter of wheel inch(es) Diameter of chain wheel inch(es)

CHECK

Chain wheel diameter =
 $(0.2) \times \text{Diameter of wheel}$
(Approx. to the nearest hundredth)

Diameter of wheel inch(es) Diameter of chain wheel inch(es)

THAT'S CORRECT! **NEXT**

Q If chain wheel diameter = (0.2)
Diameter of wheel
Estimate the value of the chain wheel
diameter to the nearest hundredth.

A <Expected: $0.2x/3$ > Answer
depends on the diameter of the medal
chosen.

Your cycle is ready!

1 0.2

NEXT

Time to engrave it on the medal!

NEXT

Yay! We are almost done.

NEXT

The student is expected to find the circumference of the medal using the value of diameter that he/she chose before.



The medal has to be decorated with a chain along its rim. How long do you think this chain should be?

What is the length of the chain required to decorate the rim of the medal?
Length of the chain = Circumference of the medal

Circumference 3 inches [blank box] inches

CHECK

What is the length of the chain required to decorate the rim of the medal?
Length of the chain = Circumference of the medal

Circumference 3 inches 9.42 inches

THAT'S CORRECT!

NEXT

Q What is the length of the chain required to decorate the rim of the medal?

A <Expected: $\pi \times$ > Answer depends on the diameter of the medal chosen.

Select a chain.

Choose a chain from the given options.

A B C

NEXT

The student selects a chain from the provided options.

Congratulations!
Your medal is ready.

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Level 2:

You need to add engraved text on the medal rim and for that you need to choose the maximum height of the fonts possible, depending upon the thickness of the rim.



If you know that the area of the rim is 0.785 square inches, can you find the thickness of the rim?

Engrave text on the rim of the medal. The area of the rim is 0.785 square inches. Choose the height of the alphabets that will fit on the rim (thickness of the rim):

0.6 inches
 0.07 inches
 0.09 inches
 0.1 inches

CHECK

Engrave text on the rim of the medal. The area of the rim is 0.785 square inches. Choose the height of the alphabets that will fit on the rim (thickness of the rim):

0.6 inches
 0.07 inches
 0.09 inches
 0.1 inches

THAT'S CORRECT!

NEXT

Q Find the thickness of the rim. From the given options, choose the height of the alphabets that will fit on the rim (thickness of the rim).

Wow! Let's have a look at the medal.

Enter the year:

NEXT

A Expected:

$$\begin{aligned} \text{Area of the rim} &= \pi(r_1)^2 - \pi(r_2)^2 \\ 0.785 &= \pi[(\text{radius of the medal})^2 - (r)^2] \\ 0.785/3.14 &= (x^2/4) - r^2 \\ 0.25 &= (x^2/4) - r^2 \\ r^2 &= (x^2/4) - 0.25 \\ r &= \sqrt{(x^2/4) - 0.25} \\ \text{Thickness of rim} &= (x/2) - r \\ (\text{i.e., radius of the medal} - r) \end{aligned}$$



Hurray!
You've designed the medal
and everyone is happy.
The Field Day was a grand success!

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Great, you did it! <student's name>
You've designed the medal and
 everyone is happy! And needless to say,
 the Field Day was a grand success!
 All thanks to the π and its versatility!

The student collects the badge.

Wrap Up (3 min)

Compulsory

- Reflection
- Summary
- Hats off

Please Share the Wrap-Up screen with the student.

During wrap-up, the teacher reiterates the key points that were discussed in the class.

Key Learnings!

- Ratio of circumference to diameter is always constant, known as π . It is an irrational number.
- $\pi=3.141519\dots$
- The decimal expansion of π is

KEY LEARNINGS M1C7 GRADE 8

- Ratio of circumference to diameter is always constant, and is known as π . It is an irrational number.
- $\pi = 3.141519\dots$
- The decimal expansion of π is non-terminating and non-repeating.
- 3.14 and 22/7 are the approximate values of π .
- Circumference of a circle = $2\pi r = \pi d$
- Circumference of a semicircle = πr
- Area of a circle = πr^2
- Area of a semicircle = $\frac{1}{2} (\pi r^2)$

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non-terminating and non-repeating.

- 3.14 and $22/7$ are the approximate values of π .
- Circumference of circle= $2\pi r = \pi d$
- Circumference of semicircle= πr
- Area of circle= πr^2
- Area of semicircle= $\frac{1}{2}\pi r^2$

Q What was the wow moment in class for you?

A Expected: It's so interesting to see the application of this amazing irrational number in all circular fields.

(Give at least 2 hats off)

Press the Hats Off icon for **Creatively Solving Activities**.



Press the Hats Off icon for **Great Question**.



You did great today as well!

Press the Hats Off icon for "**Strong**



You get two hats off.

Concentration.."

Strong
Concentration 

 End Class

Teacher Clicks

GGB Links for the activities

Activity	Activity Name	Links
Teacher Activity 1	Spin & Release	https://www.geogebra.org/m/bgjhzwsd
Student Activity 1	Bullseye	https://www.geogebra.org/m/ychc35ue
Advanced Activity 1	Bike Race	https://www.geogebra.org/m/qtsqtpy4
Advanced Activity 2	Game On	https://www.geogebra.org/m/dqbsgwbn
Advanced Activity 3	Poling it High!	https://www.geogebra.org/m/bsqrpgvw
Create Activity	Design your Medal!	https://www.geogebra.org/m/nmfmbmpe
Quiz Activity	As Easy As Pie!	https://www.geogebra.org/m/upjnxf8e
Wrap up		https://www.geogebra.org/m/fmwdsbrx



Glossary:

Name	Meaning
Hammer throw	Hammer throw is a game in which a hammer is hurled/thrown in a particular direction, using two hands within a throwing circle.
Archery	Shooting with a bow and arrows, especially at a target.
Relay Race	A relay race is a racing competition where members of a team take turns completing parts of the racetrack.
Pole vaulting	Pole vaulting is a track and field event in which a person uses a long flexible pole as an aid to jump over a bar.