π DAY IN HIGH SCHOOLS

THE MATHEMATICAL CONSTANT PI (π) can be approximately written as 22/**7 or 3.14**. Many educational institutions in the world observe 22/7 i.e. **22nd of July as π DAY**. Some others, mostly in the USA do the same on 14th of March. July date is the only choice for our [state] school system. On that date all the students could be included without any pressure of exams or syllabus deadlines.

INFO ON π

Detailed information on the definition, value, calculation and historical aspects of this mathematical subject is available in **WIKIPEDIA**. Even though the article is lucid [= easily understandable] I do not recommend it for high school students [even if they are in English medium]. Hence I recommend that the teachers could draw from this article and any other sources and give a brief summary. [If a guest lecturer could be found, it is even better]. The Wikipedia article is good from the point of view of historical aspects including the contribution of Indian astronomers and mathematicians. Teachers could use the info to motivate students. But there are ways by which children can be made to participate. I give below some of them.

Determination of the value of π – Hands-on methods

1.. Draw **circles of known radii**- measure the circumferences**[[c]]-** tabulate the ratio **c/2r** --find the mean value - use a sharp pencil and keep a steady hand to draw the circles- use a string [or twine, or silken thread] to measure the c.- no rubber bands, no elastic ones. Use pins if necessary during the measurement of c----- r is already chosen – do at least three times using different r values,

2 In 1 above, **use a graph paper-----** draw at least three circles on the graph paper . ------ measure the **area[A]** by actually counting the small squares. ------- CALCULATE r square [i.e. rxr] - tabulate – for each circle [i.e. Each row in the table] ----find the **ratio A/[rxr]** - find the average- teachers may ask the students about counting the squares on the graph paper. There is a lot to learn in this activity. --- The circles can be away from one another or even concentric.

3. In method 1 above, a variation can be made. -------Instead of drawing a circle, take a number of **circular objects** ordinarily available – either use them as they are OR draw a neat outline - measure the diameter **{d}**

and circumference {c}----- make a table . **Calculate π= c/d-** --------find the mean value. –the objects selected could be a plate, bangles, lids, wheels, drums etc. – for measuring c , string method can be used – if the object is a tin or wheel even a tailor's tape is ok. ----- For measuring d, use a vernier caliper ---- a handmade version of calipers is two blocks [bricks or tiles or books or setsquares] –

4 In 2 above, instead of drawing circles, we can use readily available circular objects. See 3 above- measure the area by counting the squares. - For a circle which is already drawn, finding the diameter is easier than radius. – d is found as in 3 above. Use formula: **π = 4A/[dxd]** ------- this needs 2 more columns in the table A, d, 4A, [dxd], 4a/[dxd] - take the average of the last column.

5. Do by volume measurement ----- use the formula **V= {π] [rxr} [h]** for a **cylinder**. –--use perfectly cylindrical objects like old-fashioned rice-measurer—Or oil measurer [in this case even the volume in litres is known]------ or use cylindrical portion of objects e.g. Water bottle, some dubbas [containers[, measuring jar, beakers [from the lab], long pipes etc.

Other methods are more abstract and very difficult and therefore less fun. For high school students all or one or two of the above methods may be sufficient and interesting. There are fall-out benefits of this activity. One is that multiple measurements should be made to get at one value for a parameter. Second is that if you do an experiment by varying the variables , you can find the mean value of the results. Thirdly, the simple act of tabulating data itself is of value to the learner.

6. There is a cut-and-paste activity given in text books. Make a circle on cardboard. Cut it into 16 or more EQUAL PARTS by cutting along the diameters. You can then arrange the pieces in the shape of a rectangle. The length of this rectangle will be [π]x[R] and the breadth will be [R] . This observation assumes that circumference **{c} = {2x(πx[R]}.** Knowing that the area of a rectangle = [length[x[breadth] one can show that area of a circle = (π x{rxr} [experimentally!] . Whether this activity was done earlier or not, now is an occasion to do this also. A group of students could take this idea and pretend that they do not know either the value of π or the relevant formulas. This may be fun for the top percentile students.

ಶಾಲೆಯಲ್ಲಿ ಪೈ ದಿನ

(ಪೈ ಬಗ್ಗೆ ಮಾಹಿತಿ ಮತ್ತು ಪ್ರಯೋಗಗಳು)

ಪೈ ಎಂಬುದು ಗಣಿತ ಶಾಸ್ತ್ರದಲ್ಲಿ ಬರುವ ಒಂದು ಸ್ಥಿರಾಂಕ. ಇದು ವೃತ್ತಾಕಾರದ ವಸ್ತುವನ್ನು ಲೆಕ್ಕ ಮಾಡಲು ಅನಿವಾರ್ಯ. ಇದರ ಬೆಲೆಯು ಅಂದಾಜಾಗಿ 22/7 ಅಥವಾ 3.141. ಜುಲೈ 22 ನ್ನು 22/7 ಎಂದು ಬರೆಯುವುದರಿಂದ ಆ ದಿನವನ್ನು ಪೈ ದಿನ ಎಂದು ಆಚರಿಸುತ್ತಾರೆ. Π ಎಂಬುದು ವೃತ್ತದ ಪರಿಧಿ ಮತ್ತು ವ್ಯಾಸದ ಅನುಪಾತ (π=C/D).

Π ಬೆಲೆ ಕಂಡು ಹಿಡಿಯುವ ವಿಧಾನಗಳು:

ಕೆಳಕಂಡ ಪ್ರಯೋಗಗಳನ್ನು ಮೂರು ವಿಭಿನ್ನ ರೀತಿಯಲ್ಲಿ ಮಾಡಿ ಸರಾಸರಿ ಕಂಡು ಹಿಡಿಯಿರಿ.

1. ಕಾರ್ಡ್ ಬೋರ್ಡಿನಲ್ಲಿ ಒಂದು ವೃತ್ತವನ್ನು ರಚಿಸಿ. ಅದರ ವ್ಯಾಸಗಳನ್ನು ಕತ್ತರಿಸಿ. 16 ಅಥವಾ ಇನ್ನೂ ಹೆಚ್ಚು ಸಮ ಭಾಗಗಳನ್ನಾಗಿ ಮಾಡಿ. ಈಗ ಕತ್ತರಿಸಿದ ತ್ರಿಭುಜಗಳನ್ನು ಆಯತಾಕಾರದಲ್ಲಿ ಜೋಡಿಸಿ. ಆಯತದ ಉದ್ದ ಮತ್ತು ಅಗಲವನ್ನು ಅಳೆಯಿರಿ. Π ಬೆಲೆಯನ್ನು ಕಂಡುಹಿಡಿಯಿರಿ.
Π= ಈ ಆಯತದ ಉದ್ದ / ಈ ಆಯತದ ಅಗಲ

2. ಕೈವಾರದಿಂದ ಒಂದು ನಿರ್ದಿಷ್ಟ ತ್ರಿಜ್ಯ (r) ವನ್ನು ಅಳೆದು ಒಂದು ವೃತ್ತ ರಚಿಸಿ. ವೃತ್ತದ ಪರಿಧಿ (C) ಯನ್ನು ದಾರದ ಸಹಾಯದಿಂದ ಅಳತೆ ಮಾಡಿ. Π ಬೆಲೆಯನ್ನು ಕಂಡುಹಿಡಿಯಿರಿ. ($\pi = [c] / [2r]$).

3. ಮೇಲ್ಕಂಡ ಪ್ರಯೋಗವನ್ನು ವೃತ್ತಾಕಾರದ ವಸ್ತುವನ್ನು ಉಪಯೋಗಿಸಿ ರಚಿಸಿ. ಅದರ ವ್ಯಾಸ (d) & ಸುತ್ತಳತೆ (c) ಯನ್ನು ಅಳೆದು ಪಟ್ಟಿ ಮಾಡಿ. ನಂತರ Π ಬೆಲೆಯನ್ನು ಕಂಡುಹಿಡಿಯಿರಿ. ($\pi = [c] / [d]$).

4. ಕೈವಾರದ ಸಹಾಯದಿಂದ ಒಂದು ನಿರ್ದಿಷ್ಟ ತ್ರಿಜ್ಯ (r) ದ ವೃತ್ತವನ್ನುಗ್ರಾಫ್ ಪೇಪರ್ ಅಲ್ಲಿ ರಚಿಸಿ. ರಚಿಸಿದ ವೃತದ ವಿಸ್ತೀರ್ಣ (A) ವನ್ನು ಕಂಡು ಹಿಡಿಯಲು ಸಣ್ಣ ಸಣ್ಣ ಚೌಕವನ್ನು ಎಣಿಸಿ, ನೂರರಿಂದ (100) ಭಾಗಿಸಿದರೆ ವಿಸ್ತಿರ್ಣವು ಚ.ಸೆಂ.ಮೀ. ನಲ್ಲಿ ಸಿಗುತ್ತದೆ.

Π ಬೆಲೆಯನ್ನು ($\pi = [A] / [r \times r]$) ಸೂತ್ರದಿಂದ ಕಂಡುಹಿಡಿಯಿರಿ.

5. ಮೇಲ್ಕಂಡ ಪ್ರಯೋಗವನ್ನು ವೃತ್ತಾಕಾರದ ವಸ್ತುವನ್ನು ಉಪಯೋಗಿಸಿ ಗ್ರಾಫ್ ಪೇಪರ್ ಅಲ್ಲಿ ರಚಿಸಿ. ಅದರ ವ್ಯಾಸ (d) ಯನ್ನು ಕಂಡುಹಿಡಿಯಿರಿ. ವಿಸ್ತೀರ್ಣವನ್ನು ಈ ಮೊದಲೇ ಹೇಳಿದಂತೆ ಸಣ್ಣ ಸಣ್ಣ ಚೌಕವನ್ನು ಎಣಿಸಿ ಕಂಡುಹಿಡಿಯಿರಿ. ನಂತರ Π ಬೆಲೆಯನ್ನು ಕಂಡುಹಿಡಿಯಿರಿ ($\pi = [4 \times A] / [d \times d]$).

6. ಸಿಲಿಂಡರ್ ಆಕಾರದ ವಸ್ತು (ಉದಾ: ನೀರಿನ ಬಾಟಲ್, ಡಬ್ಬ, ಬೀಕರ್, ಪೈಪ್ ಇತ್ಯಾದಿ) ವನ್ನು ತೆಗೆದುಕೊಂಡು ಅದರಲ್ಲಿ ನೀರು ತುಂಬಿಸಿ. ನೀರಿನ ಘನಫಲ (V, cc ಅಲ್ಲಿ) ವನ್ನು ಕಂಡುಹಿಡಿಯಿರಿ. ಸಿಲಿಂಡರಿನ ಪಾದದ ತ್ರಿಜ್ಯ (r), ಎತ್ತರ (h) ಗಳನ್ನು ಸೆಂ.ಮೀ. ನಲ್ಲಿ ಅಳೆಯಿರಿ. ನಂತರ Π ಬೆಲೆಯನ್ನು ಕಂಡುಹಿಡಿಯಿರಿ

($\pi = [V] / [r \times r \times h]$). h= ನೀರಿನ ಎತ್ತರ

ಈ ಚಟುವಟಿಕೆಯನ್ನು ಮೊದಲೇ ಮಾಡಿದ್ದರೂ ಅಥವಾ ಇಲ್ಲದಿದ್ದರೂ ಈಗ ಈ ಚಟುವಟಿಕೆಯನ್ನು ಮಾಡಿ. ಒಂದು ಗುಂಪಿನ ವಿದ್ಯಾರ್ಥಿಗಳು ಈ ಉಪಾಯವನ್ನು ತೆಗೆದುಕೊಂಡು ತಮಗೆ ಪೈನ ಬೆಲೆ ಹಾಗೂ ಅದಕ್ಕೆ ಸಂಭಂದಿಸಿದ ಸೂತ್ರಗಳು ಗೊತ್ತಿಲ್ಲ ಎಂದು ನಟಿಸಬಹುದು.

<u>ಪೈ ಬಗ್ಗೆ ಮಾಹಿತಿ</u>:

ಪೈನ ಬೆಲೆ, ಲೆಕ್ಕಾಚಾರ ಮತ್ತು ಅದರ ಇತಿಹಾಸದ ಬಗ್ಗೆ ವಿಕಿಪೀಡಿಯಾದಲ್ಲಿ ವಿಸ್ತಾರವಾದ ಮಾಹಿತಿ ಸಿಗುತ್ತದೆ. ಈ ಲೇಖನವನ್ನು ಅರ್ಥೈಸಿಕೊಳ್ಳಲು ಸುಲಭವಾದರೂ ಇದನ್ನು ಪ್ರೌಢಶಾಲಾ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಶಿಫಾರಸ್ಸು ಮಾಡುವುದಿಲ್ಲ. ಆದರಿಂದ ನಾನು ಶಿಫಾರಸ್ಸು ಮಾಡುವುದೇನೆಂದರೆ ಶಿಕ್ಷಕರು ಈ ಲೇಖನವನ್ನು ಓದಿ ಸಾರಾಂಶವನ್ನು ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಹೇಳಬಹುದು.
ಮೇಲಿನವು ನಮ್ಮ ಕೆಲವು ಸಲಹೆಗಳು - ನಿಮ್ಮ ಸಲಹೆಗಳನ್ನು ಸ್ವೀಕರಿಸಲು ನಮಗೆ ಸಂತೋಷವಾಗುತ್ತದೆ.

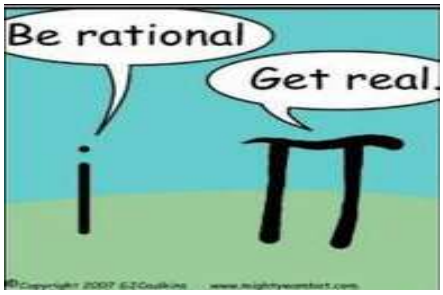
<u>"Jokes on Pi"</u>

(Collected from Web)

"May i have a large container of coffee?" *Gives 3.1415926*

"Pi" is an irrational number.

"i" is an imaginary number.

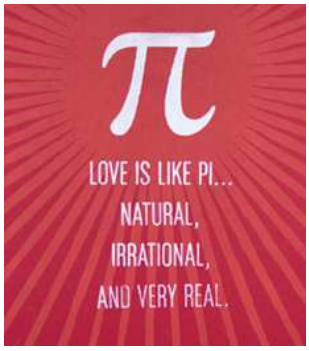


$$\sqrt{-1}\ 2^3 \sum \pi$$

...it was delicious!

I ate some (sum) pi.

It was delicious



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SUGGESTED STUDENT ACTIVITIES FOR FINDING PI

Students can work in pairs –groups of even 10 or 20 can take part in the playground activities-

Four types of measurements[mt] are suggested

A [i] mt of **circumference** [c] and radius [r]
[ii] mt of circumference [c] and diameter [d]

B [i] mt of **area [A]** and radius
[ii] mt of area [A] and diameter

C mt of **volume [V]** and the parameters needed for using appropriate formulas

D simple cut and paste method given below

A simple fun activity

Draw a fairly large circle on a cardboard of medium thickness [say 10 cm radius] – draw diameters such that the circle is divided into equal sector shapes [12 or 16 or 24 sectors ok]-

A sector looks like a piece of pizza or pie or birthday cake i.e conical shape---. cut so many pieces – arrange them in the form of a rectangle- measure the length[l] of this constructed rectangle- breadth of the rectangle is the same as the radius[r] of the starting circle – divide l by r to get pi = [l/r]

Teachers may show stepwise pictures to students .[tip for the teachers : cut the last sector into 2 equal small sectors and take them to opposite ends of the rectangle to give you s decent looking rectangle]

Activities below are indicated by the types mentioned above-

* type A[i] uses the formula **pi = c/2r** -- type A[ii] uses the formula **pi = c/d**

** type B[i] uses the formula **pi = A/[rxr]**--- type B[ii] uses the formula **pi =4A/[dxd]**

** type C formulas depend on the shape of the volume e.g cylinder, sphere

LIST OF ACTIVITIES

1 circles drawn on plain paper with a compass – known radius
2 circles drawn on graph paper with a compass – known radius
3 circles drawn on playground with an improvised compass – known radius
4 half circle drawn on a wall with an improvised compass – known radius
5 playground fun with human hand-held circle – both r and d using ropes

[1 to 5 belong type A[i] using the formula given above]

6 circles drawn on plain paper using circular objects – mt of diameter [dia]
7 circles drawn on graph paper using circular objects – dia mt
8 Circles drawn on playground using large circular objects – dia mt e.g large wheel.

Big drum standing-

9 roll a tin or dabba on the table and measure distance [l]- measure dia using improvised Vernier calipers –stick a thin tape or a thread on the dabba to easily count the number of rotations[n] – here **c= l/n**

10 Do 9 above outdoors – use a tyre or wheel or cycle etc.

11 Do 10 above using a drum – **have fun** kicking the drum carefully between two straight lines – don't forget to put a mark on the side of the drum

12 Take a solid pipe – tightly wind a wire or twine around it – compact the wire/ string leaving no space between rings- count the number of rings [n]- unwind the wire /string and measure the length [l] – find dia of the pipe using a vernier – see 9

13 Go to the packing department- take a roll of cello tape or any thin adhesive tape- make a mark simultaneously [meaning 'at the same time' 'at one stroke'] in many layers by pricking a pin radially (Along the radius) - unwind the tape and stick it on the side of the table

[i.e along a perfect straight line] –measure the total length [l]- number or rotations

[n = pricked points] – see 9

14 This is special for senior ITI students - ask your teacher if he can give you a gear which converts circular motion [=rotation, revolution] to linear motion – use the arrangement to measure c. Diameter to be separately found – method similar to 9 to 13 above

[6 to 14 belong type A[ii] using the formula given above]

15 Draw circles on a graph sheet , using compass – physically count the small squares , thus finding the area--- radius is known while drawing the circle – use formula [[teachers/ volunteers can help in square counting method]

16. In 15 above another person can draw concentric circles and do as before

[15 to 16 belong type B[i] using the formula given above]

17. Draw circles on a graph sheet , using available [perfectly] circular objects – physically count the small squares --- measure diameter- teachers/ volunteers can help to get the dia from the graph paper itself.

18. If there is a large room with tiled floor , 17 can be done – all square tiles is preferred--,

[17 to 18 belong type B[ii] using the formula given above]

19. Volume of a cylinder= [pi]x [rxr] x [h] use this formula to calculate pi – a calculator may be needed.

20. use water and measuring jar/cylinder to find the volume --- many cylindrical objects can be found around you- Tiffin or lunch box, water bottle,

21. Volume of a sphere = [4/3] x [pi] x [rxrxr] – this formula can be used – find fairly spherical shapes which can be filled with water – e.g *binthige* (pot in Kannada) , water filled
balloon. Rubber ball cut into half

22. volume of A very long cylinder- take a garden hose pipe [,the longer the better]—fill up and carefully pour water into a bucket – carefully measure the volume of this water – find the INTERNAL DIA by a suitable method- [teachers/ volunteers can help in this]- stretch and find the length of the pipe [l]- in cylinder formulas use l in place of h

23. Do 22 above – find CROSS SECTION AREA , INTERNAL, by imprint method [or any other]

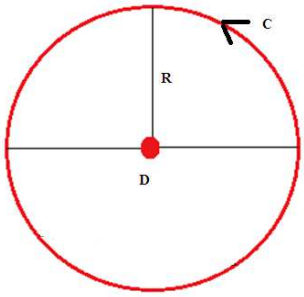
[19 to 23- belong type C- use proper formulas]

Anyone interested in the above and want help can write to engoneforall@gmail.com

Those who have tried the above or their own methods may aldo contact , it wi;ll boost our confidence.

“Π DAY / Π ದಿನ ”

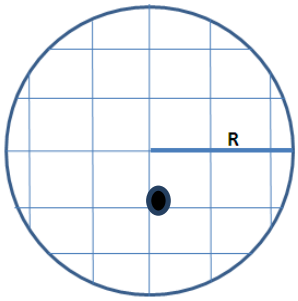
22 ಜುಲೈ--22/7--22ND JULY



C=Circumference / ಪರಿಧಿ

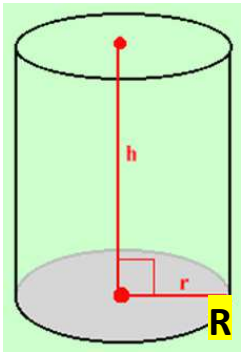
R=Radius / ತ್ರಿಜ್ಯ

D=Diameter / ವ್ಯಾಸ



$A=\prod \times R^2$

A=Area / ವಿಸ್ತೀರ್ಣ



$V=\prod \times R^2 \times h$

V=Volume / ಘನಫಲ

h=height / ಎತ್ತರ

$C=\prod \times D$

$C=2 \times \prod \times R$

On ∏ day get out of the class room,
do activities and be happy.

∏ ದಿನದಂದು ತರಗತಿಯಿಂದ ಹೊರಬಂದು ಚಟುವಟಿಕೆಗಳನ್ನು ಮಾಡಿ ನಲಿಯಿರಿ.

- We can calculate the value of **∏** by measuring **C, A or V** and using appropriate formulas.

- **C, A ಅಥವಾ V** ಗಳನ್ನು ಅಳೆದು ಸೂಕ್ತ ಸೂತ್ರಗಳನ್ನು ಉಪಯೋಗಿಸಿ **∏** ಬೆಲೆಯನ್ನು ಕಂಡುಹಿಡಿಯಬಹುದು.

Contact your teacher for exciting activities
ಆಕರ್ಷಕ ಚಟುವಟಿಕೆಗಳಿಗಾಗಿ ನಿಮ್ಮ ಶಿಕ್ಷಕರನ್ನು ಸಂಪರ್ಕಿಸಿ

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