

DOOM

ED
EUCLIDE



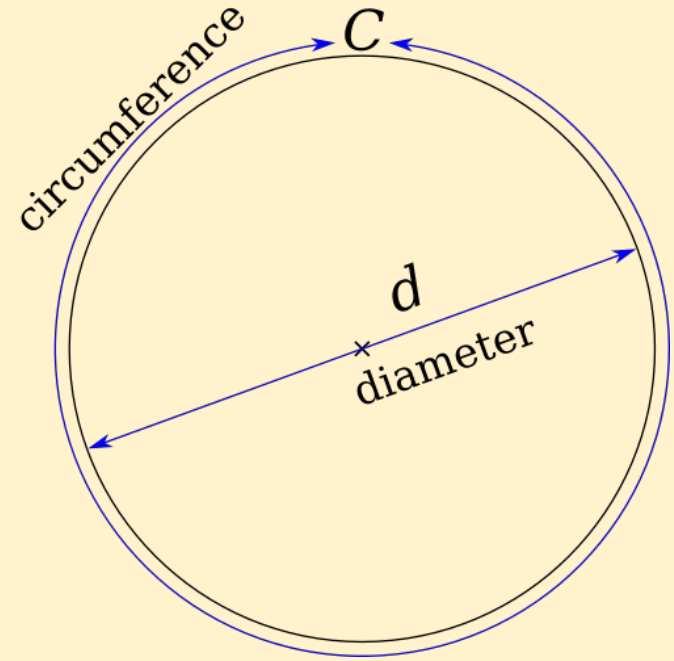
Geometria euclidea

È la geometria basata sugli assiomi di Euclide:

1. Congiungendo due punti qualsiasi si ottiene un segmento di retta;
2. Si può prolungare un segmento oltre i due punti indefinitamente;
3. Dato un punto e una lunghezza, è possibile descrivere un cerchio;
4. Tutti gli angoli retti sono congruenti tra loro;
5. Se una retta che taglia altre due rette determina dallo stesso lato angoli interni la cui somma è minore di due angoli retti, prolungando le due rette, esse si incontreranno dalla parte dove i due angoli hanno somma minore di due retti.

Pi Greco: cos'è?

- Pi Greco (π) è una costante matematica
- Corrisponde al rapporto tra una **circonferenza** e il suo **diametro**
- È nota da migliaia di anni prima della nascita di Cristo.



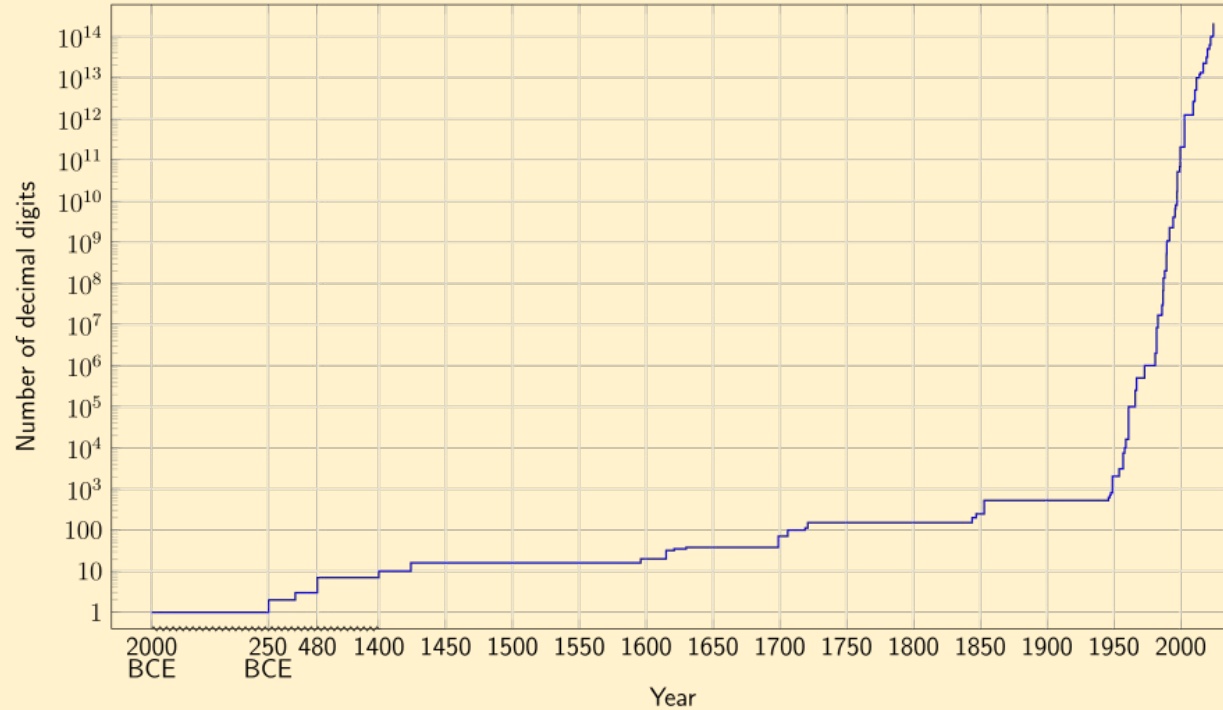
$$\pi = 3.14159\dots$$

3 e qualcosa

[Circumference = ? \(Animation\) - GeoGebra](#)

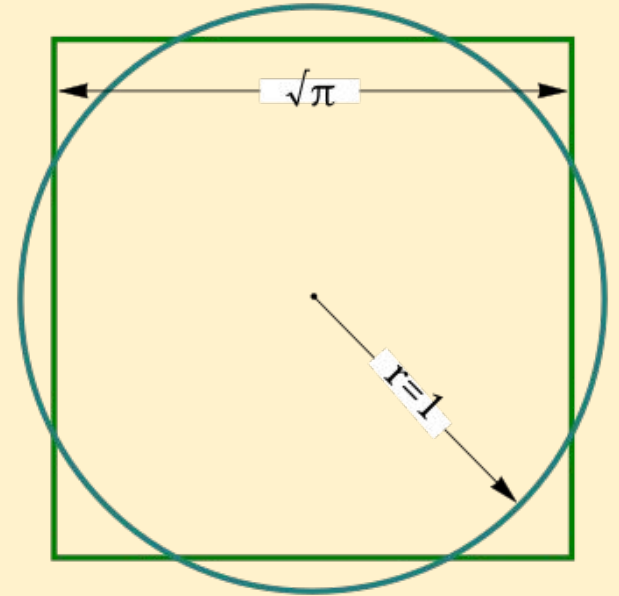
Pi Greco negli anni

Record approximations of π



Pi Greco: caratteristiche

- È un numero **irrazionale**
(non può essere espresso come frazione di interi)
- È un numero **trascendente**
(In matematica un numero trascendente è un numero irrazionale che non è un numero algebrico, ossia non è la soluzione di nessuna equazione polinomiale di una certa forma)



Pi Greco è irrazionale

Hermite's proof [edit]

Written in 1873, this proof uses the characterization of π as the smallest positive number whose half is a zero of the cosine function and it actually proves that π^2 is irrational.^{[R][4]} As in many proofs of irrationality, it is a proof by contradiction.

Consider the sequences of real functions A_n and U_n for $n \in \mathbb{N}_0$ defined by:

$$A_0(x) = \sin(x), \quad A_{n+1}(x) = \int_0^x y A_n(y) dy$$

$$U_0(x) = \frac{\sin(x)}{x}, \quad U_{n+1}(x) = -\frac{U_n'(x)}{x}$$

Using induction we can prove that

$$A_n(x) = \frac{x^{2n+1}}{(2n+1)!!} - \frac{x^{2n+3}}{2 \times (2n+3)!!} + \frac{x^{2n+5}}{2 \times 4 \times (2n+5)!!} - \dots$$

$$U_n(x) = \frac{1}{(2n+1)!!} - \frac{x^2}{2 \times (2n+3)!!} + \frac{x^4}{2 \times 4 \times (2n+5)!!} - \dots$$

and therefore we have:

$$U_n(x) = \frac{A_n(x)}{x^{2n+1}}.$$

So

$$\begin{aligned} \frac{A_{n+1}(x)}{x^{2n+3}} &= U_{n+1}(x) = -\frac{U_n'(x)}{x} = -\frac{1}{x} \frac{d}{dx} \left(\frac{A_n(x)}{x^{2n+1}} \right) \\ &= -\frac{1}{x} \left(\frac{A_n'(x) \cdot x^{2n+1} - (2n+1)x^{2n} A_n(x)}{x^{2(2n+1)}} \right) \\ &= \frac{(2n+1)A_n(x) - xA_n'(x)}{x^{2n+3}} \end{aligned}$$

which is equivalent to

$$A_{n+1}(x) = (2n+1)A_n(x) - x^2 A_{n-1}(x).$$

Using the definition of the sequence and employing induction we can show that

$$A_n(x) = P_n(x^2) \sin(x) + xQ_n(x^2) \cos(x),$$

where P_n and Q_n are polynomial functions with integer coefficients and the degree of P_n is smaller than or equal to $\lfloor \frac{1}{2}n \rfloor$. In particular, $A_n(\frac{1}{2}\pi) = P_n(\frac{1}{4}\pi^2)$.

Hermite also gave a closed expression for the function A_n , namely

$$\text{rang} \left(\frac{\Phi}{\omega} \right) = \frac{\Phi}{\omega} - \frac{\Phi \Phi}{3\omega} + \frac{\Phi \Phi \Phi}{5\omega} - \frac{\Phi \Phi \Phi \Phi}{7\omega} + \frac{\Phi \Phi \Phi \Phi \Phi}{9\omega} - \dots$$

Scan of formula on page 288 of Lambert's "Mémoires sur quelques propriétés remarquables des quantités transcendentes, circulaires et logarithmiques". Mémoires de l'Académie royale des sciences de Berlin (1768), 265–322

$$A_n(x) = P_n(x^2) \sin(x) + xQ_n(x^2) \cos(x),$$

where P_n and Q_n are polynomial functions with integer coefficients and the degree of P_n is smaller than or equal to $\lfloor \frac{1}{2}n \rfloor$. In particular, $A_n(\frac{1}{2}\pi) = P_n(\frac{1}{4}\pi^2)$.

Hermite also gave a closed expression for the function A_n , namely

$$A_n(x) = \frac{x^{2n+1}}{2^n n!} \int_0^1 (1-z^2)^n \cos(xz) dz.$$

He did not justify this assertion, but it can be proved easily. First of all, this assertion is equivalent to

$$\frac{1}{2^n n!} \int_0^1 (1-z^2)^n \cos(xz) dz = \frac{A_n(x)}{x^{2n+1}} = U_n(x).$$

Proceeding by induction, take $n = 0$.

$$\int_0^1 \cos(xz) dz = \frac{\sin(x)}{x} = U_0(x)$$

and, for the inductive step, consider any natural number n . If

$$\frac{1}{2^n n!} \int_0^1 (1-z^2)^n \cos(xz) dz = U_n(x),$$

then, using integration by parts and Leibniz's rule, one gets

$$\begin{aligned} \frac{1}{2^{n+1}(n+1)!} \int_0^1 (1-z^2)^{n+1} \cos(xz) dz &= \frac{1}{2^{n+1}(n+1)!} \left(\overbrace{(1-z^2)^{n+1} \frac{\sin(xz)}{x}}^{=0} \Big|_{z=0}^{z=1} + \int_0^1 2(n+1)(1-z^2)^n z \frac{\sin(xz)}{x} dz \right) \\ &= \frac{1}{x} \frac{1}{2^n n!} \int_0^1 (1-z^2)^n z \sin(xz) dz \\ &= \frac{1}{x} \cdot \frac{d}{dx} \left(\frac{1}{2^n n!} \int_0^1 (1-z^2)^n \cos(xz) dz \right) \\ &= \frac{U_n'(x)}{x} \\ &= U_{n+1}(x). \end{aligned}$$

If $\frac{1}{4}\pi^2 = p/q$, with p and q in \mathbb{N} , then, since the coefficients of P_n are integers and its degree is smaller than or equal to $\lfloor \frac{1}{2}n \rfloor$, $q^{\lfloor n/2 \rfloor} P_n(\frac{1}{4}\pi^2)$ is some integer N . In other words,

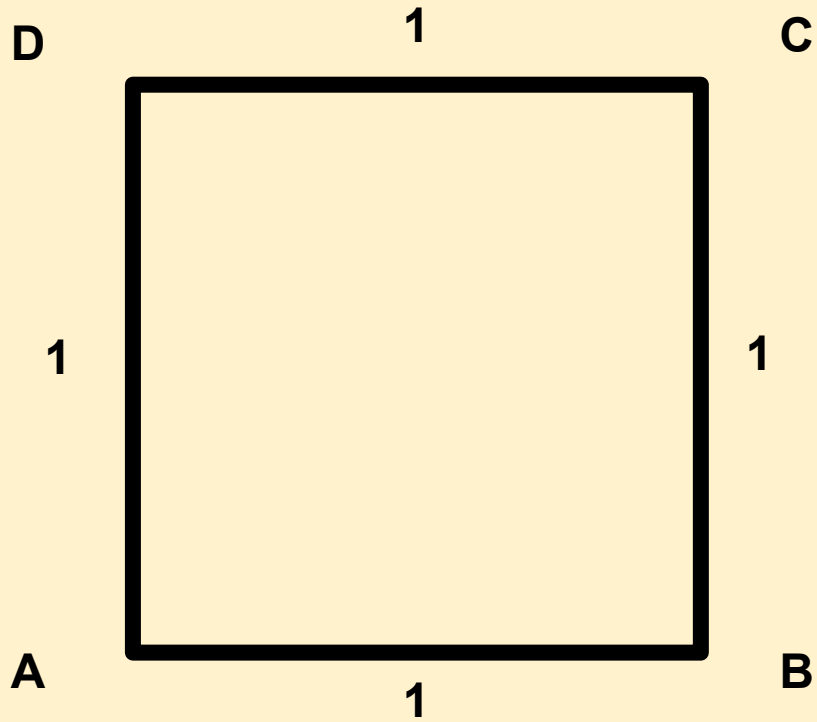
$$N = q^{\lfloor n/2 \rfloor} A_n\left(\frac{1}{2}\pi\right) = q^{\lfloor n/2 \rfloor} \frac{1}{2^n n!} \left(\frac{p}{q}\right)^{n+1} \int_0^1 (1-z^2)^n \cos\left(\frac{1}{2}\pi z\right) dz.$$

But this number is clearly greater than 0. On the other hand, the limit of this quantity as n goes to infinity is zero, and so, if n is large

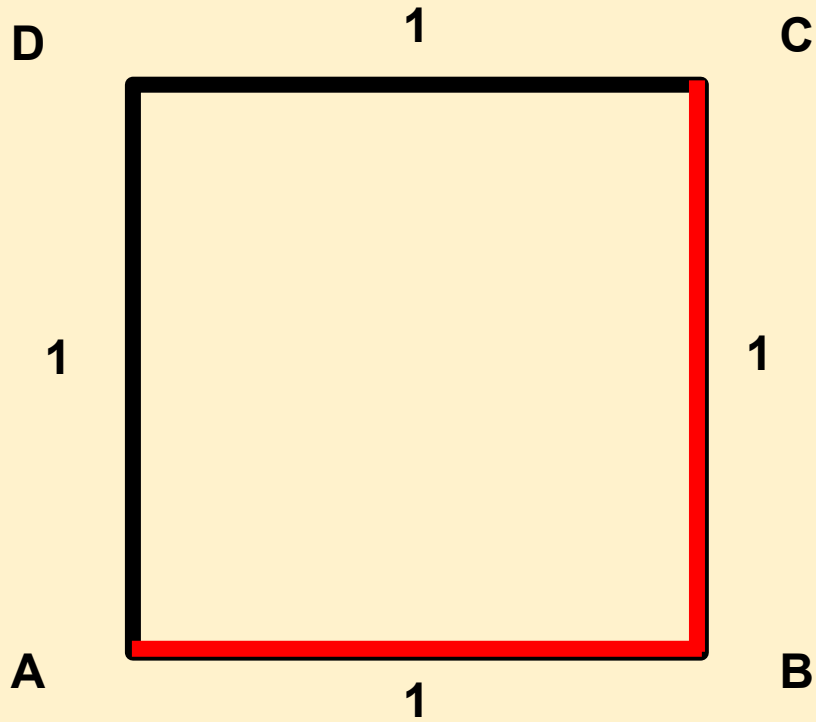
Pi Greco: a cosa serve?

- Essendo una costante relativa alla circonferenza, è fondamentale in tutti i campi in cui si vuole comprendere lo spazio, come la geometria, l'analisi matematica, ma anche l'elettronica, la fisica, la statistica...
- È un'unità di misura, i **radianti**

Esempio

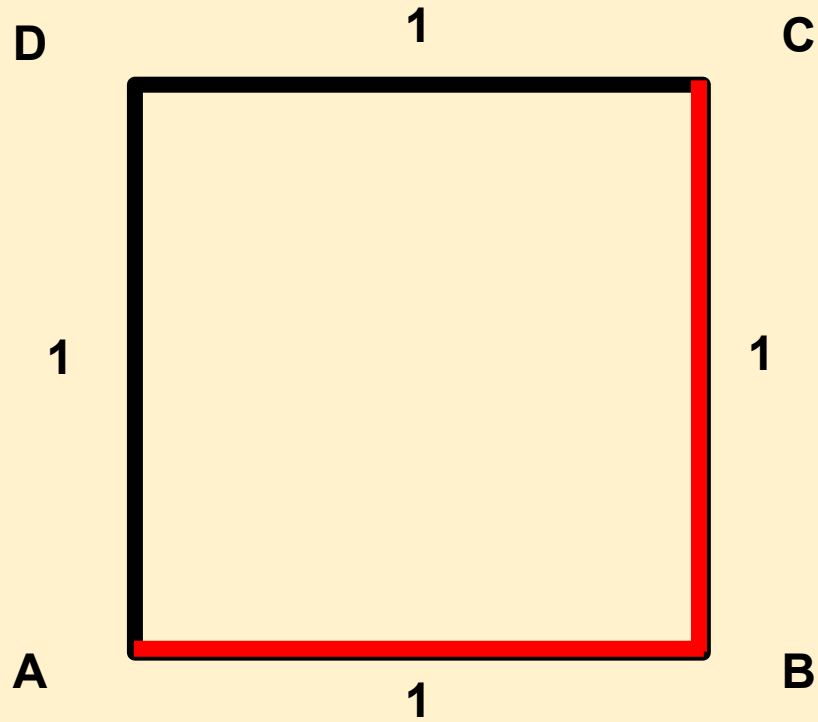


Esempio



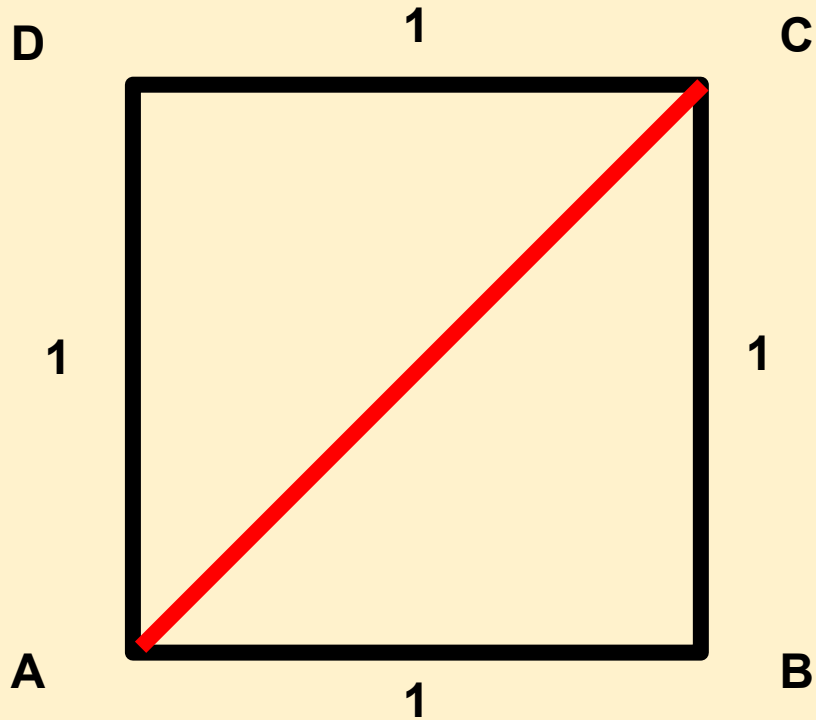
• $AB-BC =$

Esempio



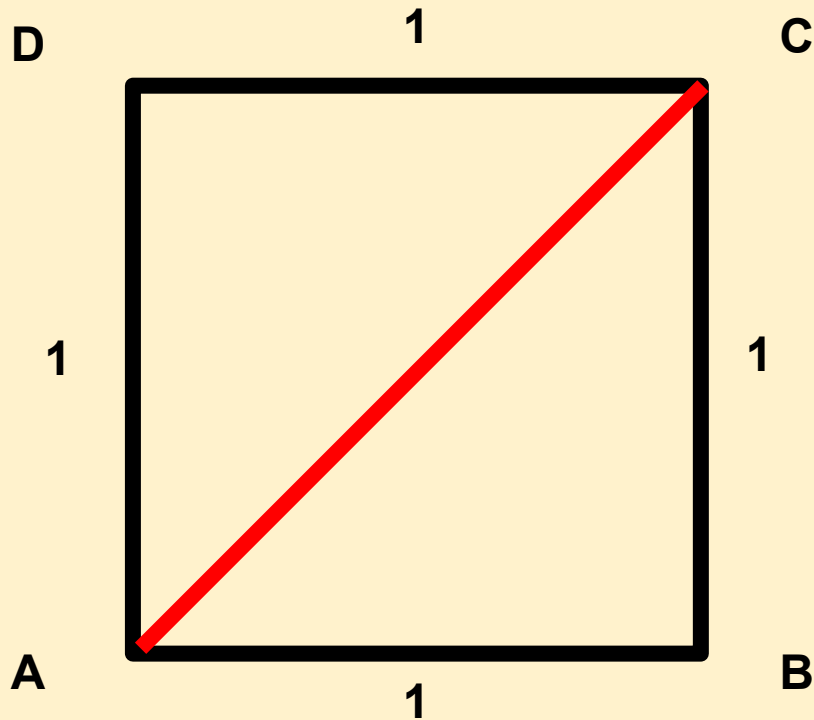
- $AB - BC = 2$

Esempio



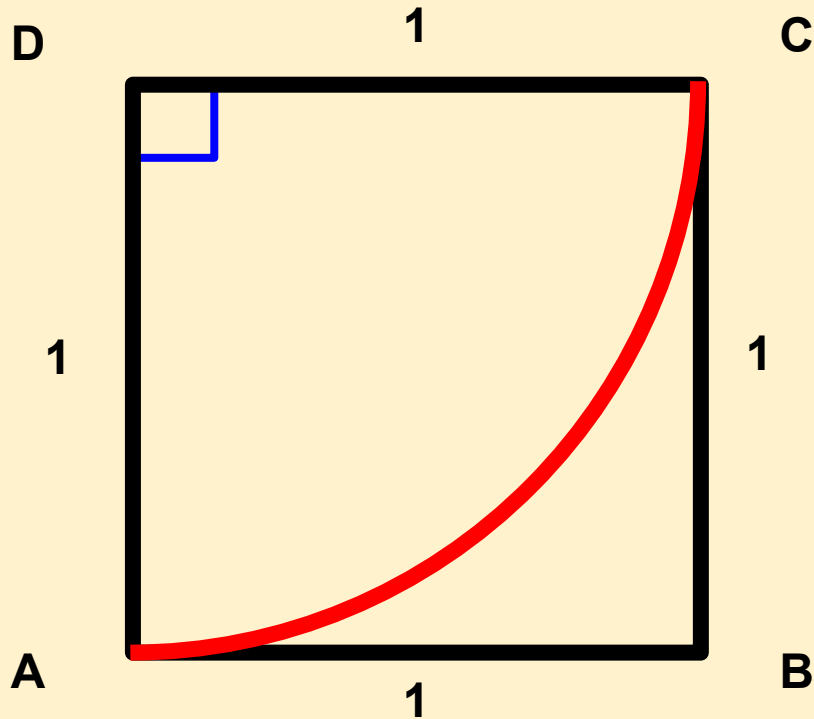
- $AB - BC = 2$
- $AC =$

Esempio



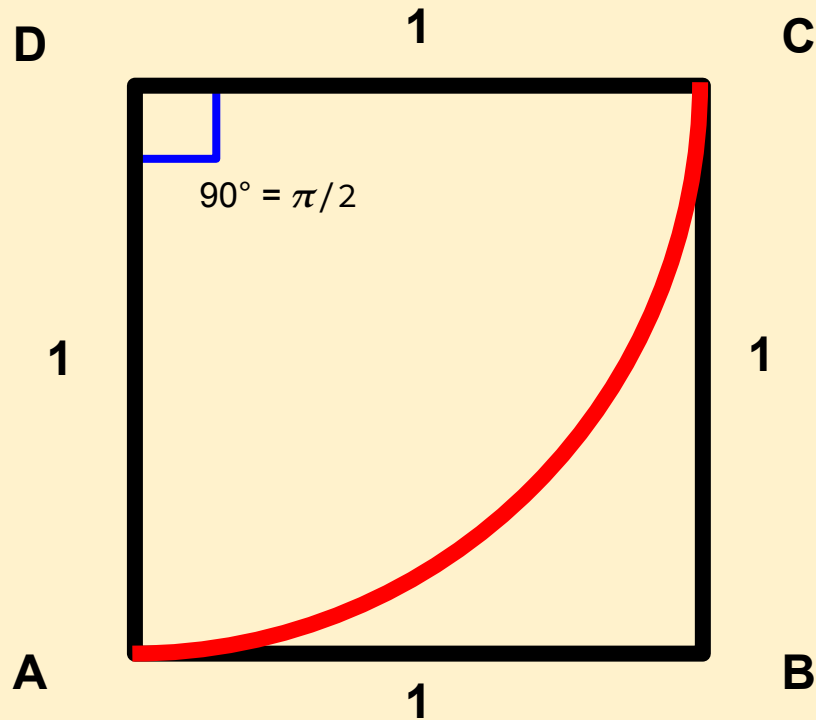
- $AB + BC = 2$
- $AC = \sqrt{1^2 + 1^2} = \sqrt{2} \approx 1,4$

Esempio



- $AB - BC = 2$
- $AC = \sqrt{1^2 + 1^2} = \sqrt{2} \approx 1,4$
- AC (arco) =

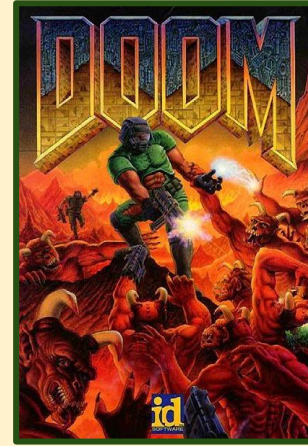
Esempio



- $AB+BC = 2$
- AC (retta) = $\sqrt{1^2+1^2} = \sqrt{2} \approx 1,4$
- AC (arco) = $\pi/2 \approx 1,6$

Doom (1993)

- È un gioco rilasciato nel 1993 da **id software**
- È stato uno dei primi **sparatutto in prima persona**
- È diventato un **fenomeno mondiale**
- L'engine è **open source**



id Software

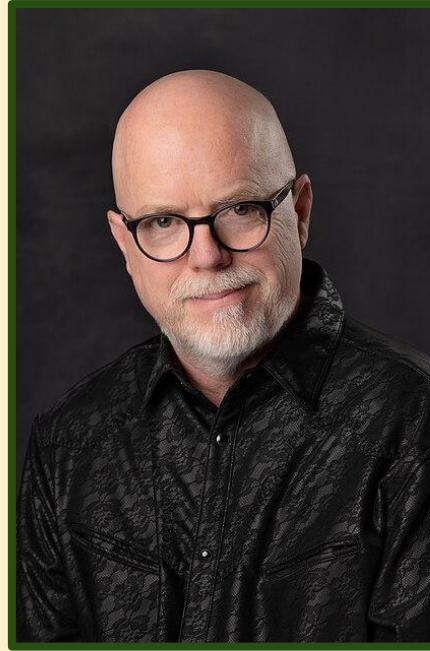
Shreveport, Louisiana, 1991



John Carmack



John Romero



Tom Hall

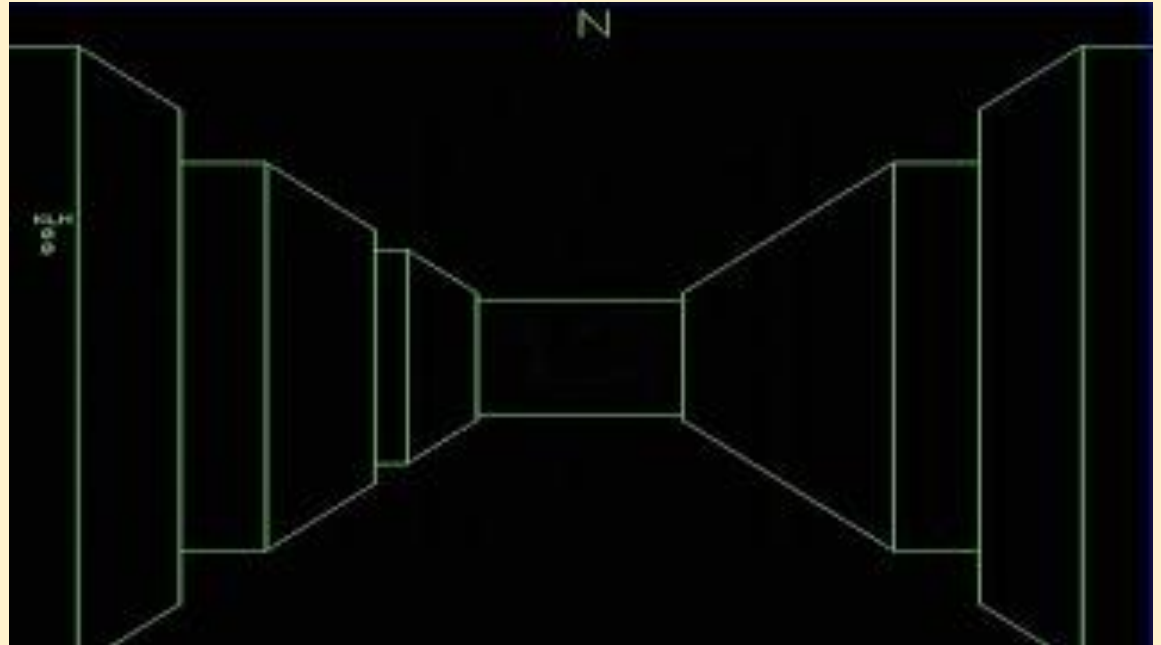


Adrian Carmack

FPS negli anni

- **Maze War (1974)**

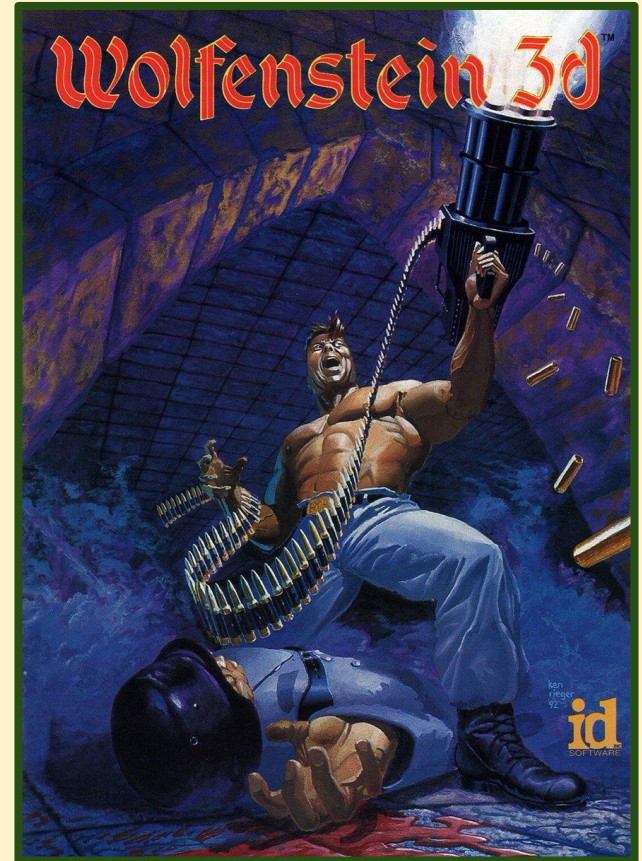
Creato da 4 studenti del
liceo in America



FPS negli anni

- Wolfenstein 3D (1992)

Primo FPS sviluppato dalla id Software

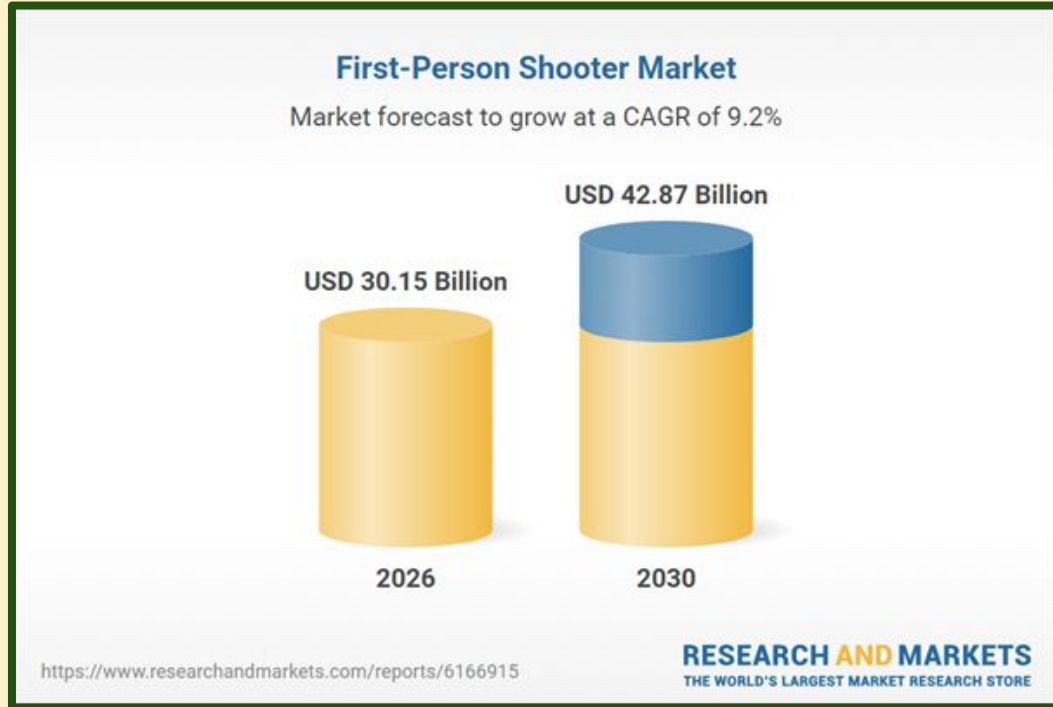


FPS negli anni

- Doom (2016), Doom Eternal (2020) e Doom The Dark Ages (2025)

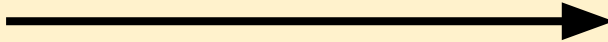


FPS negli anni





27 anni di videogiochi

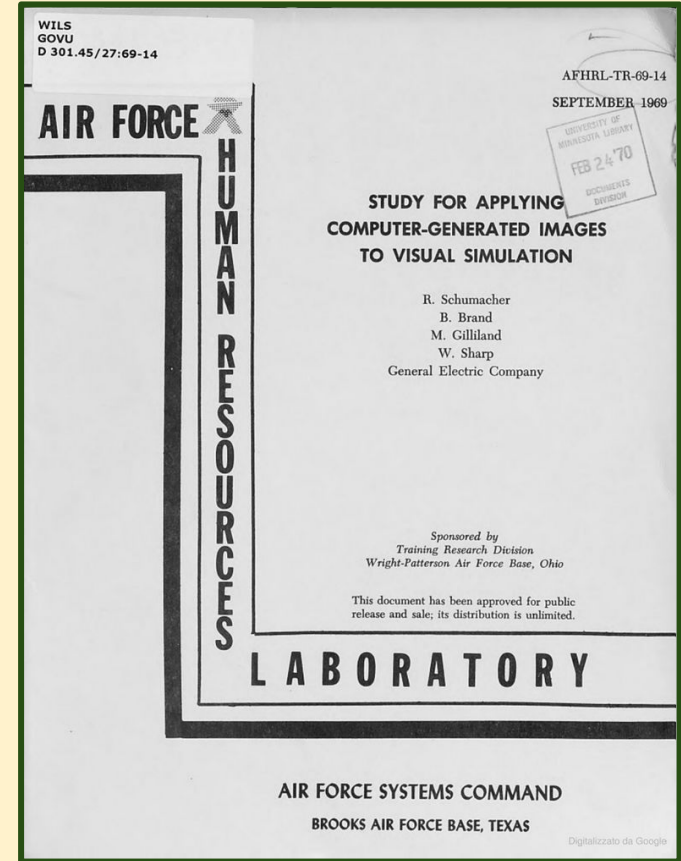
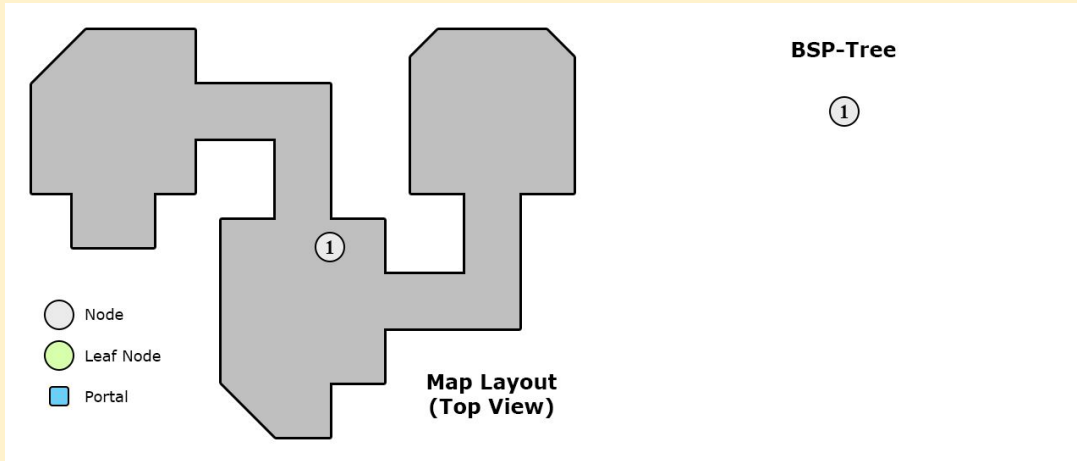


Spazi 3D (circa)

- Doom è 2.5D
- Non si può guardare in alto

Ottimizzazione

- **BSP:** Binary Space Partition



Facile da girare

IMPORTANT

Please read the following information before you attempt to install DOOM™ on your system.

WELCOME TO DOOM...

Before you can play this mind-blowing game, you must first install it to your hard disk. Please read the installation instructions in the manual carefully. Once the game is installed, you should also run the README.EXE file which can be found in the directory where you installed DOOM. This file contains important additional information and instructions for Multiplayer Mode. You can run the file by typing README at the prompt from the directory where you have installed DOOM.

To avoid compatibility errors, please make sure that your machine and network conform to the system requirements listed below:

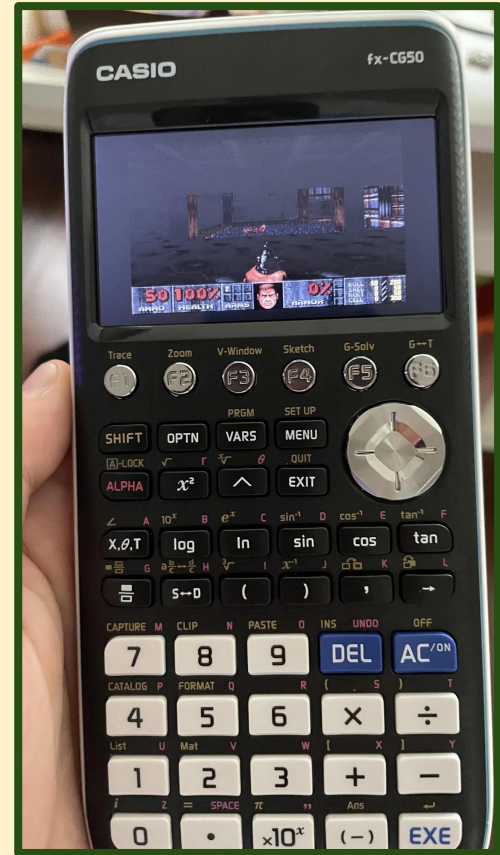
- IBM or compatible 386 or better computer;
- 4Mb RAM;
- VGA graphics card;
- Hard disk drive.

Facile da girare

[My office phone runs doom : r/itrunsdoom](#)

[r/itrunsdoom on Reddit: Does Chandler's laptop run DOOM? So I found out which laptop Chandler had, fixed it and installed Doom on it.](#)

[Scientists get Doom running on chips powered by 200,000 human neurons, and those clever little cells are playing it too](#)



CPU, GPU E FPU

- All'epoca di Doom le **CPU** non erano dotate di **FPU** (Floating Point Unit), e le **GPU** per consumatori non esistevano. Niente *3D acceleration*.
- Per evitare di calcolare gli angoli mentre gira il gioco, John Carmack usò delle *look-up tables*.

Cosa c'entra pi in Doom?



- **Pi greco** è usato per tutti i calcoli relativi agli angoli (trigonometria), perciò lo troviamo proprio nelle funzioni che generano le *look-up tables*
- Sono un po' come un formulario in matematica (o qualsiasi materia)

Cosa c'entra pi in Doom?


```
//  
// R_InitPointToAngle  
//  
void R_InitPointToAngle (void)  
{  
    // UNUSED - now getting from tables.c  
  
    int i;  
    long t;  
    float f;  
  
    slope (tangent) to angle lookup  
  
    for (i=0 ; i<=SLOPERANGE ; i++)  
    [  
    f = atan( (float)i/SLOPERANGE ), (3.141592657)*2);  
    t = 0xffffffff*f;  
    tantoangle[i] = t;  
    ]  
}
```

3.141592657

Cosa c'entra pi in Doom?

 **John Carmack** 
@ID_AA_Carmack






It is true, I incorrectly recalled the tenth digit of Pi.


 **doom_txt** @doom_txt · Mar 14, 2019

Happy #PiDay the Doom source code includes an incorrect approximation of pi as 3.141592657 instead of the correct 3.141592654. I hope someone got fired for that blunder

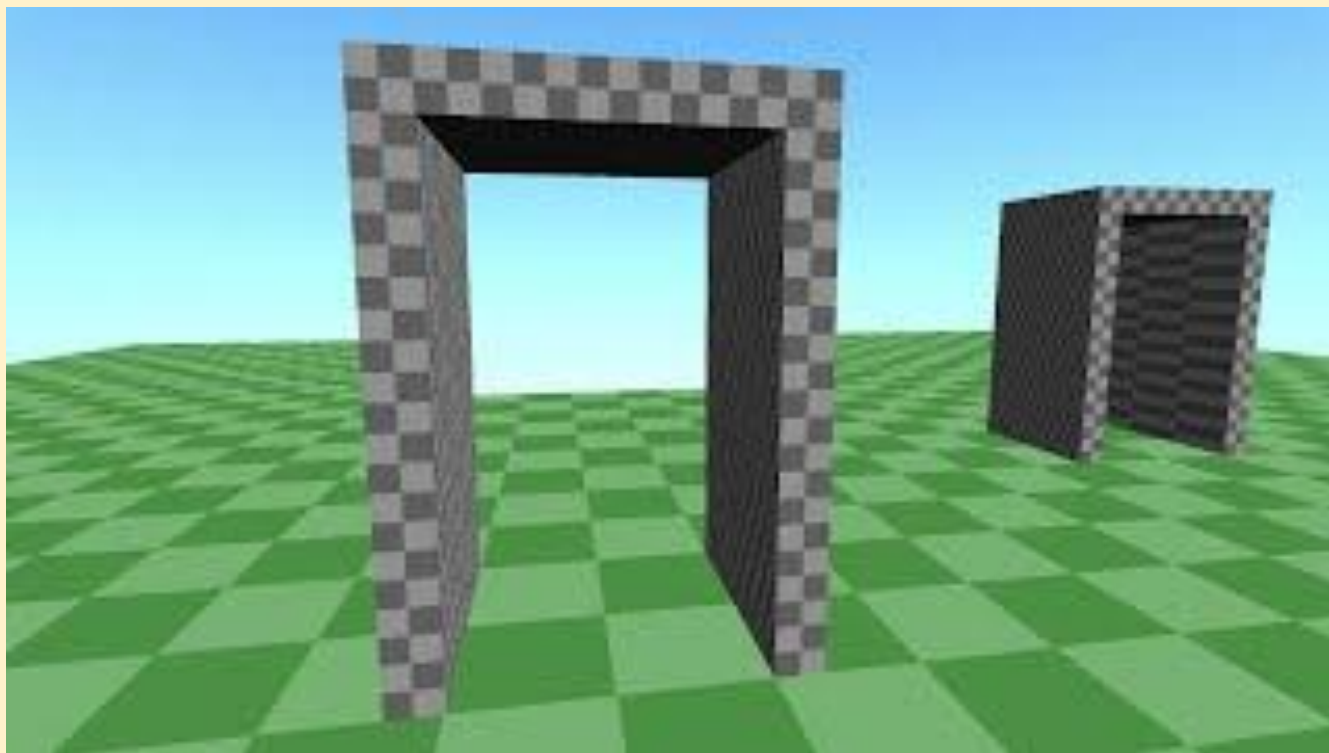
```
41 #ifdef LINUX
42 #include <math.h>
43 #else
44 #define PI 3.141592657
45 #endif 3.141592654
46
47
```

8:14 PM · Mar 14, 2019

 101  995  4.3K  27 

 Read 101 replies

Spazi non euclidei



DOOM normale

The screenshot displays a macOS desktop environment with several windows open:

- Terminal:** Shows the execution of `git checkout -b normale` in the directory `~/Documents/Doom/chocolate-doom-310_Pineg10000`. The output indicates a successful checkout to a new branch named 'normale'.
- OBS Studio:** A recording window titled 'OBS 30.0.2.1-3build1 - Profile: Untitled - Scenes: Untitled'. The 'Scenes' panel shows a scene named 'chocolate-doom' selected. The 'Sources' panel includes 'Screen Capture (X)' and 'Desktop Audio'. The 'Controls' panel shows 'Stop Recording' and 'Start Virtual Camera' buttons.
- File Browser:** A window showing the contents of the `~/Documents/Doom/chocolate-doom-310_Pineg10000` directory. The files listed include `INCLUDE.STATEM`, `match = re.matc`, `words = [word r`, `line = re.sub(`, `match = re.sear`, `if re.match(\s`, `if not re.matc`, `munged_line = r`, `make(3): Leav`, `make(2): Enter`, `make(2): Leav`, `make(1): Leav`, and `anbello@marco-ide`.

The system status bar at the bottom shows the date and time as 01 Mar 19:31, with system icons for CPU, memory, network, and battery.

PI = 4

The screenshot displays a Linux desktop environment with the following components:

- Terminal:** Shows the execution of a command to build the Chocolate Doom source code. The output includes a syntax warning: `./docgen:437: SyntaxWarning: invalid escape sequence '\s'`. The terminal prompt is `anbello@marco-ideapad: ~/Documents/Doom/chocolate-doom-310_P1neg10000`.
- File Manager:** Displays the file system structure, including folders like `Computer`, `Desktop`, `Documents`, and `Downloads`. The `chocolate-doom` folder is highlighted.
- OBS Studio:** Shows the recording interface with a scene named `chocolate-doom`. The `Audio Mixer` shows `Desktop Audio` and `Mic/Aux` levels. The `Controls` panel includes buttons for `Start Streaming`, `Stop Recording`, and `Start Virtual Camera`.
- System Tray:** Shows system status including CPU usage (1.0%), memory usage (60.00 / 60.00 FPS), and network connectivity.
- Taskbar:** Displays the application dock with icons for `Apps`, `Release Chocola...`, `OBS 30.0.2.1-3b...`, `Doom - Thunar`, `src - Thunar`, and `Terminal - anbel...`.

PI = 10

The screenshot displays a Linux desktop environment with several windows open:

- Terminal:** Shows the execution of a build script for the game Doom. The script includes commands like `make` and `make[2]: Leaving`. It also displays a syntax warning: `SyntaxWarning: invalid escape sequence '\s'`.
- OBS Studio:** A streaming software window titled "OBS 30.0.2.1-3build1 - Profile: Untitled - Scenes: Untitled". It shows a scene collection and a preview window. The "Recording" button is highlighted, and the status bar indicates "Recording saved to '/home/anbello/Videos/OBS/Doom/2026-03-01 19:36-05.mp4'", "00:00:00", "00:00:00", "CPU: 0.9%", and "60.00 / 60.00 FPS".
- Web Browser:** A window showing the GitHub repository page for "chocolate-doom/chocolate-doom/releases/tag/chocolate-doom-3.1.0".
- File Manager:** A window showing the file system structure, including directories like `/home/anbello/Do` and files like `chocolate-doom`.

The desktop background is a dark, textured pattern. The system tray at the bottom shows the date and time as "01 Mar 19:36".

PI = 67000

The screenshot displays a Linux desktop environment with several windows open:

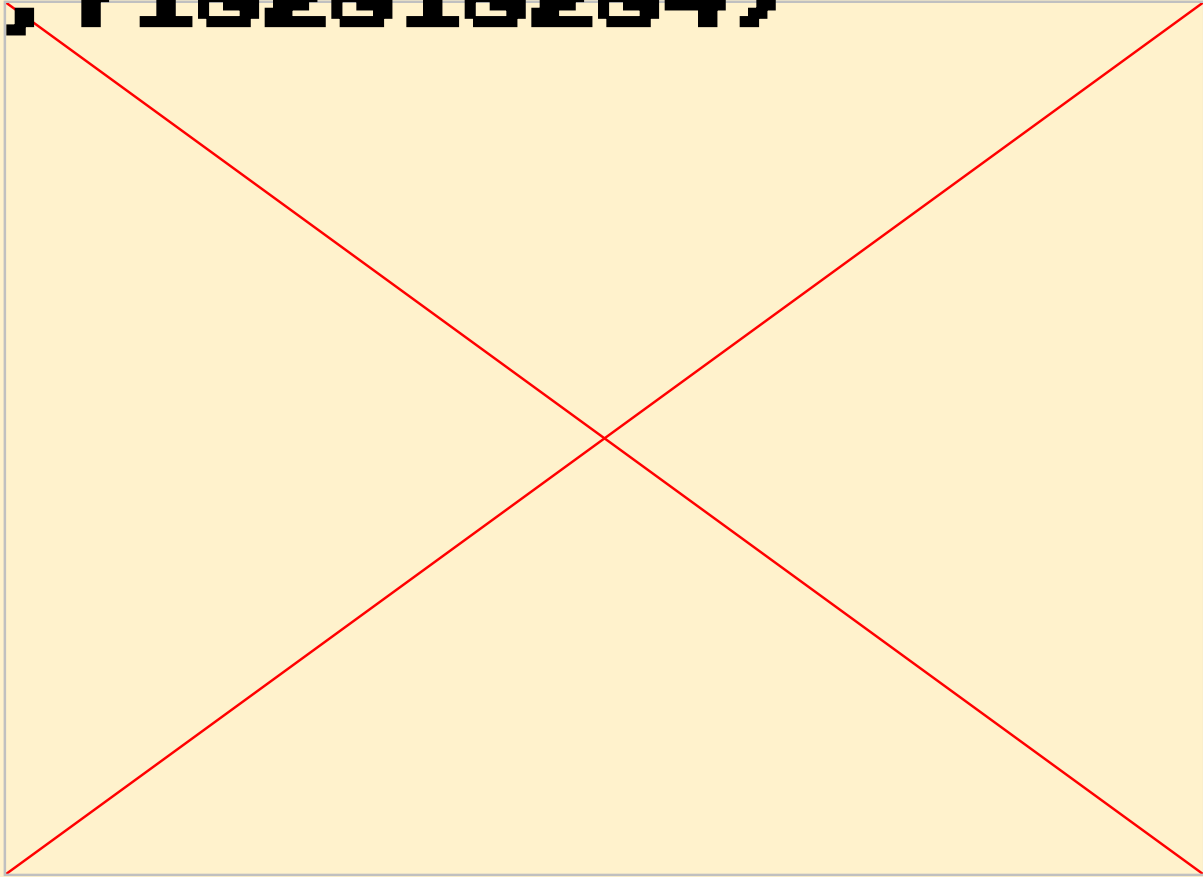
- Terminal:** Shows the execution of a `make` command in the directory `~/Documents/Doom/chocolate-doom-310_PiNeg10000`. The output includes several `SyntaxWarning: invalid escape sequence '\s'` messages and a list of files being processed, such as `chocolate-doom-setup`, `chocolate-heretic-setup`, `chocolate-hexen-setup`, `chocolate-hexen-setup`, `chocolate-server`, `chocolate-setup`, `chocolate-strife-setup`, `CMakeLists.txt`, `d_dedicated.c`, `d_dedicated.o`, `déh_defs.h`, and `déh_io.c`. The final output is `"chocolate-doom" | 3.2 MiB (3,328,376 bytes) | Exec`.
- OBS Studio:** A window titled "OBS 30.0.2.1-3build1 - Profile: Untitled - Scenes: Untitled" is open, showing a scene collection and a preview window. The "Audio Mixer" section is visible, with "Desktop Audio" and "Mic/Aux" levels set to 0.0 dB. The "Controls" panel shows "Start Streaming", "Stop Recording" (highlighted), "Start Virtual Camera", "Studio Mode", "Settings", and "Exit".
- Browser:** A window titled "github.com/chocolate-doom/chocolate-doom/releases/tag/chocolate-doom-3.1.0" is open, showing the GitHub release page for chocolate-doom 3.1.0.

The desktop background is a dark, textured pattern. The system tray at the bottom shows the date and time as "11 Mar 19:37" and the CPU usage as "60.00 / 60.00 FPS".

PI = 3

The screenshot displays a Linux desktop environment with several windows open. At the top, a web browser shows the GitHub release page for chocolate-doom-3.1.0. Below it, a terminal window is open, showing a file manager interface with a list of files and folders. The file manager is displaying the contents of a directory, including files like 'chocolate-doom', 'chocolate-doom-setup', and 'chocolate-heretic'. In the foreground, OBS Studio is running, showing a scene collection and a preview window. The OBS interface includes a 'Scenes' panel, a 'Sources' panel, an 'Audio Mixer', and a 'Controls' panel. The 'Controls' panel has buttons for 'Start Streaming', 'Stop Recording', 'Start Virtual Camera', 'Studio Mode', 'Settings', and 'Exit'. The 'Stop Recording' button is highlighted. At the bottom of the screen, a system tray shows the date and time as 01 Mar, 19:33, along with system icons for CPU, memory, and network. The system status bar at the very bottom indicates '© 2026 GitHub, Inc.' and provides links for Terms, Privacy, Security, Status, Community, Docs, Contact, and Manage cookies.

**PI = e
(2, 7182818284)**



PI = 2

The screenshot displays a Linux desktop environment with several applications open:

- Code Editor:** Shows a file named `tables.txt` with the following content:

```
src > C tables.c > fghesine
41 int StopDlv(unsigned int num, unsigned int den)
{
    if re_match("\\s*$", line);
    /home/anello/Documents/Doom/chocolate-doom-310_PI2/./docgen:424: SyntaxWarning: invalid escape sequence '\s'
    if not re_match("\\s*/", line);
    /home/anello/Documents/Doom/chocolate-doom-310_PI2/./docgen:436: SyntaxWarning:
    munged_line = re_
/home/anello/Do
munged_line = r
/home/anello/Do
match = re.sear
/docgen -n "cho
```
- Terminal:** Shows the execution of `make` commands and the output of `cat tables.txt`, displaying a list of file names and their sizes.

```
make[3]: Leaving
make[2]: Leaving
make[2]: Entering
make[2]: Leaving
make[1]: Leaving
anello@marco-ideap:
C w_checksum.c
C w_checksum.f
F w_checksum.c
C w_file_posix.c
F w_file_posix.o
C w_file_std.c
F w_file_std.o
C w_file_win32.c
F w_file_win32.o
C w_file.h
97
98
99
100
```
- OBS Studio:** A window titled "OBS 30.0.2.1-3build1 - Profile: Untitled - Scenes: Untitled" is open, showing a scene with a video source and a "Build with Agent" overlay.
- System Tray:** Shows system status including CPU (0.9%), RAM (60.00/60.00 FPS), and network (Ln 79, Col 1).

PI = 1

The screenshot displays a Linux desktop environment with several windows open:

- Terminal:** Shows a compilation error in a C++ file. The error message is: `./docgen:437: SyntaxWarning: invalid escape sequence '\s'`. The code being compiled includes a `munged_line` variable and a `match` function.
- OBS Studio:** A window titled "OBS 30.0.2.1-3build1 - Profile: Untitled - Scenes: Untitled" is open, showing a preview of a desktop recording. The interface includes a "Scenes" panel, "Sources" (Desktop Audio, Screen Capture), "Audio Mixer", "Scene Transitions", and "Controls" (Stop Recording, Start Virtual Camera, Studio Mode, Settings, Exit).
- Web Browser:** A window titled "Building Chocolate Doom" is open, showing a GitHub page for the "chocolate-doom" project. The URL is `github.com/chocolate-doom/chocolate-doom/releases/tag/chocolate-doom-3.1.0`.

The desktop environment includes a file manager on the left showing the project directory structure, and a system tray at the bottom with various icons and system information (CPU: 1.0%, 60.00 / 60.00 FPS).

PI = -3.14

The screenshot displays a Linux desktop environment with several windows open:

- Terminal:** Shows a directory listing of `/home/anello/Documents/Doom/chocolate-doom-310_PIneg10000/man/`. It contains two syntax warning messages: `SyntaxWarning: invalid escape sequence '\s'` and `SyntaxWarning: invalid escape sequence '\s'`, both pointing to `munged_line = re.sub('\s*/\s*', '', line, 1)` in `docgen-437`.
- File Manager:** Shows the file system tree with `chocolate-doom` selected under `Documents`.
- OBS Studio:** Recording a screen capture of the terminal window. The interface shows the `Scene` selected, `Screen Capture (X)` as the source, and `Desktop Audio` as the audio source. The recording status is `Recording saved to /home/anello/Videos/OBS/Doom/2026-03-01 19:38-07.mp4` with a duration of `00:00:00` and `CPU: 0.9%` / `60.00 / 60.00 FPS`.

At the bottom of the screen, there is a system tray with application icons, a taskbar showing `Release Chocola...`, `OBS 30.0.2.1-3b...`, `Doom - Thunar`, and `Terminal - anbel...`. The system status bar shows `CPU MEM`, `78%` battery, and the date `01 Mar, 19:38`.

PI = -10000

The screenshot displays a Linux desktop environment with several windows open. At the top, a browser window shows the GitHub repository page for chocolate-doom. Below it, a terminal window shows the following output:

```
File Edit View Terminal Tabs Help
/home/anello/Documents/Doom/chocolate-doom-310_P1neg10000/man/./docgen:437: SyntaxWarning: invalid escape sequence '\s'
munged_line = re.sub('\s/V/\s*', '', line, 1)
/home/anello/Documents/Doom/chocolate-doom-310_P1neg10000/man/./docgen:437: SyntaxWarning: invalid escape sequence '\s'
munged_line = re.sub('\s*$', '', munged_line)
/home/anello/Doc...
munged_line =
/home/anello/Doc...
match = re.sea...
match = re.sea...
./docgen -n "cho...
Places
Computer
/home/anello/Doc...
INCLUDE_STATEH...
/home/anello/Doc...
Desktop
/home/anello/Doc...
Recent
/home/anello/Doc...
Trash
/home/anello/Doc...
Documents
/home/anello/Doc...
Music
/home/anello/Doc...
Pictures
/home/anello/Doc...
Videos
/home/anello/Doc...
Downloads
/home/anello/Doc...
Devices
/home/anello/Doc...
File System
/home/anello/Doc...
OS
/home/anello/Doc...
Network
/home/anello/Doc...
Browse Netw...
make[1]: Leaving...
make[2]: Leaving...
make[2]: EnterInc...
make[2]: Leaving...
make[1]: Leaving...
anello@marco-ide...
"chocolate-doom" | 3.2 MiB (3,328,392 bytes) | Exe...
```

An OBS Studio window is overlaid on the terminal, showing a scene collection and recording controls. The recording controls are highlighted, with the "Start Recording" button being the most prominent. The OBS interface includes sections for Scenes, Sources, Audio Mixer, Scene Transitions, and Controls. The recording status at the bottom indicates "Recording saved to /home/anello/Videos/OBS/Doom/2026-03-01 19:38:59.mp4".

At the bottom of the screen, the system tray shows the date and time as "01 Mar 19:39" and the system status as "CPU 1.0% 60.00 / 60.00 FPS".

Come farlo a casa (per esperti)

- Scaricate **Chocolate Doom** (versione 3.1.0!) da [Github](#)
- Seguite le informazioni sul [sito ufficiale](#) per scaricare e compilare il gioco (serve un .WAD)
- Su `r_main.c`, aggiungete un `#define PI "XX"` e sostituite l'unico PI esplicito che c'è con PI.
- Scommentate le funzioni `R_InitPointToAngle` e `R_InitTables`
- Fate salvare i valori dei 3 array *finesine*, *finetangent* e *tantoangle* su file di testo.
- Sostituite questi valori in `tables.c` e ricompilate!

Ringraziamenti

- Cambiare il valore di Pi greco in Doom è un'idea di Luke Gotszling, presentata al WHY hacker camp 2022
- <https://www.youtube.com/watch?v=ZSFRWJCUY4&t=484s>



EXIT

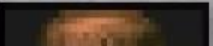
FINE

4 2 1 1 1

7

7

9



2 1 1 1

HEALTH

50

700