#### The constant $\tau$ , a transcendental number

 $\begin{array}{c} 6,283\ 185\ 3071\ 795\ 864\ 7692\ 528\ 676\ 6559\ 005\ 768\ 3943\ 387\ 987\ 5021\\ 164\ 194\ 9889\ 184\ 615\ 6328\ 125\ 724\ 1799\ 725\ 606\ 9650\ 684\ 234\ 1359\\ 642\ 961\ 7302\ 656\ 461\ 3294\ 187\ 689\ 2191\ 011\ 644\ 6345\ 071\ 881\ 6256\\ 962\ 234\ 9005\ 682\ 054\ 0387\ 704\ 221\ 1119\ 289\ 245\ 8979\ 098\ 607\ 6392\\ 885\ 762\ 1951\ 331\ 866\ 8922\ 569\ 512\ 9646\ 757\ 356\ 6330\ 542\ 403\ 8182\\ 912\ 971\ 3384\ 692\ 069\ 7220\ 908\ 653\ 2964\ 267\ 872\ 1452\ 049\ 828\ 2547\\ 449\ 174\ 0132\ 126\ 311\ 7634\ 976\ 304\ 1841\ 925\ 658\ 5081\ 834\ 307\ 2873\\ 578\ 518\ 0720\ 022\ 661\ 0610\ 976\ 409\ 3304\ 276\ 829\ 3903\ 883\ 023\ 2188\\ 661\ 145\ 4073\ 151\ 918\ 3906\ 184\ 372\ 2347\ 638\ 652\ 2358\ 621\ 023\ 7096\\ 148\ 924\ 7599\ 254\ 991\ 3470\ 377\ 150\ 5449\ 782\ 455\ 8763\ 660\ 238\ 9825\\ \end{array}$ 



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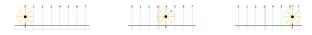
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# 0 1 2 3 4 5 6 7





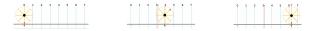
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## The constant au, a transcendental number

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Fans celebrate the international au day on June 28th. They think that au is twice as good as  $\pi= au/2$ , because many formulas don't actually involve  $\pi$ , but  $2\pi$ as good as  $\lambda = 7/2$ , because many commission tractions involve  $\lambda$ , but  $2\lambda$  as a unit; and interpreted as radians,  $\tau$  corresponds to the full circle while  $\pi$  only corresponds to the semi circle. The **continued fraction expansion** yields 19:3 as an approximation for au. Its decimal expansion contains a sequence of seven nines starting at position 761. The circumference of a circle with radius r is  $\tau r$ . Its area is  $\frac{1}{2}\tau r^2$ . The number  $\tau$  is irrational, hence cannot be written as a fraction of is  $\frac{1}{2}\tau r^2$ . The number  $\tau$  is **irrational**, hence cannot be written as a fraction of integers. It is even **transcendental**, hence not a solution of any polynomial equation.

Open question: Do the ten digits occur equally often in the decimal expansion of 
$$\tau$$
? 
$$1-\frac{1}{3}+\frac{1}{5}-\frac{1}{7}+\frac{1}{9}-\ldots=\frac{\tau}{8} \qquad 1=e^{i\tau} \qquad \tau=6+\frac{1}{3+\frac{1}{1+\frac{1}{1+\cdots}}}$$
 
$$\frac{2}{1}\cdot\frac{2}{3}\cdot\frac{4}{3}\cdot\frac{4}{5}\cdot\frac{6}{5}\cdot\frac{6}{7}\cdot\frac{8}{7}\cdot\frac{8}{9}\cdot\ldots=\frac{\tau}{4} \quad \chi(M)=\frac{1}{\tau}\int_{M}K\,dA \quad f(z)=\frac{1}{\tau i}\oint\frac{f(\zeta)}{\zeta-z}\,d\zeta$$

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$$\frac{2}{1} \cdot \frac{2}{3} \cdot \frac{4}{3} \cdot \frac{4}{5} \cdot \frac{6}{5} \cdot \frac{6}{7} \cdot \frac{8}{5} \cdot \frac{8}{9} \cdot \dots = \frac{\tau}{4} \qquad \chi(M) = \frac{1}{\tau} \int_{M} K \, dA \qquad f(z) = \frac{1}{\tau i} \oint \frac{f(\zeta)}{\zeta - z} \, d\zeta$$

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$$\begin{split} 1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \frac{1}{9} - \ldots &= \frac{\tau}{8} & 1 = e^{i\tau} & \tau = 6 + \frac{1}{3 + \frac{1}{1 + \frac{1}{1 + \cdots}}} \\ \frac{2}{1} \cdot \frac{2}{3} \cdot \frac{4}{3} \cdot \frac{4}{5} \cdot \frac{6}{5} \cdot \frac{6}{7} \cdot \frac{8}{7} \cdot \frac{8}{9} \cdot \ldots &= \frac{\tau}{4} \quad \chi(M) = \frac{1}{\tau} \int_{M} K \, dA \quad f(z) = \frac{1}{\tau i} \oint \frac{f(\zeta)}{\zeta - z} \, d\zeta \end{split}$$

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$$\tau$$
? 
$$1-\frac{1}{3}+\frac{1}{5}-\frac{1}{7}+\frac{1}{9}-\ldots=\frac{\tau}{8} \qquad 1=e^{i\tau} \qquad \tau=6+\frac{1}{3+\frac{1}{1+\frac{1}{1+\frac{\tau}{1+\cdots}}}}$$
 
$$\frac{2}{1}\cdot\frac{2}{3}\cdot\frac{4}{3}\cdot\frac{4}{5}\cdot\frac{6}{5}\cdot\frac{6}{7}\cdot\frac{8}{7}\cdot\frac{8}{9}\cdot\ldots=\frac{\tau}{4} \quad \chi(M)=\frac{1}{\tau}\int_{M}K\,dA \quad f(z)=\frac{1}{\tau i}\oint\frac{f(\zeta)}{\zeta-z}\,d\zeta$$

Fans celebrate the international au day on June 28th. They think that au is twice as good as  $\pi=\tau/2$ , because many formulas don't actually involve  $\pi$ , but  $2\pi$  as a unit; and interpreted as radians,  $\tau$  corresponds to the full circle while  $\pi$  only corresponds to the semi circle. The **continued fraction expansion** yields 19:3 as an **approximation** for  $\tau$ . Its decimal expansion contains a sequence of **seven nines** starting at position 761. The circumference of a circle with radius r is  $\tau r$ . Its area is  $\frac{1}{2}\tau r^2$ . The number  $\tau$  is **irrational**, hence cannot be written as a fraction of integers. It is even **transcendental**, hence not a solution of any polynomial equation In a lumber  $\tau$  is irrational, neither cannot be written as a fraction of integers. It is even transcendental, hence not a solution of any polynomial equation. Open question: Do the ten digits occur equally often in the decimal expansion of  $\tau$ ?  $1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \frac{1}{9} - \ldots = \frac{\tau}{8} \qquad 1 = e^{i\tau} \qquad \tau = 6 + \frac{1}{3 + \frac{1}{1 + \frac{1}{1 + \cdots}}}$ 

$$\begin{aligned} 1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \frac{1}{9} - \ldots &= \frac{\tau}{8} & 1 = e^{i\tau} & \tau = 6 + \frac{1}{3 + \frac{1}{1 + \frac{1}{1 + \cdots}}} \\ \frac{2}{1} \cdot \frac{2}{3} \cdot \frac{4}{3} \cdot \frac{4}{5} \cdot \frac{6}{5} \cdot \frac{6}{7} \cdot \frac{8}{7} \cdot \frac{8}{9} \cdot \ldots &= \frac{\tau}{4} \quad \chi(M) = \frac{1}{\tau} \int_{M} K \, dA \quad f(z) = \frac{1}{\tau_i} \oint \frac{f(\zeta)}{\zeta - z} \, d\zeta \end{aligned}$$

Fans celebrate the international au day on June 28th. They think that au is twice as good as  $\pi=\tau/2$ , because many formulas don't actually involve  $\pi$ , but  $2\pi$  as a unit; and interpreted as radians,  $\tau$  corresponds to the full circle while  $\pi$  only corresponds to the semi circle. The **continued fraction expansion** yields 19:3 as corresponds to the semi circle. The **continued fraction expansion** yields 19:3 as an **approximation** for  $\tau$ . Its decimal expansion contains a sequence of seven nines starting at position 761. The **circumference** of a circle with radius  $\tau$  is  $\tau \tau$ . Its area is  $\frac{1}{2}\tau \tau^2$ . The number  $\tau$  is **irrational**, hence cannot be written as a fraction of integers. It is even **transcendental**, hence not a solution of any polynomial equation. **Open question:** Do the ten digits occur equally often in the decimal expansion of  $\tau$ ?  $1-\frac{1}{3}+\frac{1}{5}-\frac{1}{7}+\frac{1}{9}-\dots=\frac{\tau}{8} \qquad 1=e^{i\tau} \qquad \tau=6+\frac{1}{3+\frac{1}{1+\frac{1}{1+\dots}}}$ 

$$\begin{aligned} 1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \frac{1}{9} - \ldots &= \frac{\tau}{8} & 1 = e^{i\tau} & \tau = 6 + \frac{1}{3 + \frac{1}{1 + \frac{1}{1 + \cdots}}} \\ \frac{2}{1} \cdot \frac{2}{3} \cdot \frac{4}{3} \cdot \frac{4}{5} \cdot \frac{6}{5} \cdot \frac{6}{7} \cdot \frac{8}{7} \cdot \frac{8}{9} \cdot \ldots &= \frac{\tau}{4} \quad \chi(M) = \frac{1}{\tau} \int_{M} K \, dA \quad f(z) = \frac{1}{\tau i} \oint \frac{f(\zeta)}{\zeta - z} \, d\zeta \end{aligned}$$