The constant e, Fermat's Theorem, the Binomial Theorem, and Relativity

"Flamenco Chuck" Keyser

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e (mathematical constant) – Wikipedia

Math is Fun

The Relativistic Unit Circle

Define $\gamma = \frac{\tau'}{\tau},\ \beta = \frac{v}{c}$,

$$\{c, v, \tau, \tau'\} > 0$$
$$c\tau' > c\tau \Leftrightarrow \tau' > \tau$$

Proof of Fermat's Theorem (verification of Binomial Theorem for positive real numbers) for $n = 2$

$$\varphi = c\tau' = v\tau' + c\tau$$
$$\varphi^2 = (c\tau')^2 = (v\tau')^2 + (c\tau)^2 + 2(v\tau')(c\tau)$$
$$(\tau')^2 = \beta^2 + (\tau)^2 + 2(v)(\tau)$$
$$\gamma^2 = \frac{(\tau')^2}{(\tau)^2} = \left(\frac{1}{(\tau)^2}\right)\beta^2 + 1^2 + 2\left(\frac{v}{\tau}\right)$$
$$\gamma^2 = \frac{(\tau')^2}{(\tau)^2} = 1^2 + \left(\frac{1}{(\tau)^2}\right)\beta^2 + 2\left(\frac{v}{c\tau}\right)c$$
$$\gamma = \sqrt{1^2 + \left(\frac{1}{(\tau)^2}\right)\beta^2 + 2\left(\frac{v}{c\tau}\right)c}$$
$$\gamma = 1 \Leftrightarrow v = 0$$
$$n\gamma = n \Leftrightarrow v = 0,\ \forall n$$
$$v\tau' = 0,\ \forall n$$

$$\psi = c\tau' = c\tau + v\tau'$$
$$\psi\psi^* = (c\tau)^2 + (v\tau')^2 \neq (c\tau')^2$$
$$(c'\tau')^2 = \psi\psi^* = (c\tau)^2 + (v\tau')^2 \neq (c\tau')^2$$
$$\frac{(c'\tau')^2}{(c\tau)^2} = \psi\psi^* = 1^2 + (\beta\gamma')^2$$

Let $\psi\psi^* = (c\tau')^2 = (c\tau)^2 + (v\tau')^2 \neq (\varphi)^2$

The expression for e is given by

$$e = \lim_{n\to\infty}\left(1+\frac{1}{n}\right)^n$$

Periodic Compounding

$FV = PV\left(1+\frac{r}{n}\right)^n$, where FV represents future value, PV represents present value, r represent compounding rate, and n represents the number of periods in a year. $n \to \infty$ represents continuity

$$\tau' = \lim_{\beta\to 1, n\to\infty} \tau\left(1+\frac{\beta}{n}\right)^n,\ \beta = \frac{v}{c}$$
$$\gamma = \frac{\tau'}{\tau} = \lim_{\beta\to 1, n\to\infty}\left(1+\frac{\beta}{n}\right)^n$$
$$\beta = 1$$
$$e = \gamma = \frac{\tau'}{\tau} = \lim_{n\to\infty}\left(1+\frac{1}{n}\right)^n$$

This suggests that its expression may be given by

$$e=\lim_{n\to\infty}\left(\frac{c\tau}{c\tau}+\frac{\beta}{n}\right)^{n}$$

$$e=\lim_{v\to c}\left(\beta+\frac{1}{\gamma}\right)^{\gamma}$$, which in terms of the relativistic unit circle can be expressed by

$$e=\lim_{\theta\to\frac{\pi}{2}}\left(\sin\theta+\cos\theta\right)^{\cos\theta}$$ for $v\tau'<c\tau$

Note that for the Binomial Expansion, this is only valid for $n=2$ for integers, but is expanded to positive real numbers by the RUC.

$$\varphi=\psi=1+\frac{1}{n}$$

$$\varphi^{2}=\left(1+\frac{1}{n}\right)^{2}=1^{2}+\left(\frac{1}{n}\right)^{2}+2\frac{1^{2}}{n}$$

$$\psi\psi^{*}=\left[1+i\left(\frac{1}{n}\right)\right]\left[1-i\left(\frac{1}{n}\right)\right]=1^{2}+\left(\frac{1}{n}\right)^{2}$$

From the Binomial Theorem for positive integers (and real numbers):

$$\varphi^{n}=\left(1+\frac{1}{n}\right)^{n}=1^{n}+\left(\frac{1}{n}\right)^{n}+rem\left[1,\left(\frac{1}{n}\right),n\right]$$

$$e=\lim_{n\to\infty}\left(\varphi^{n}\right)=\lim_{n\to\infty}\left(1+\frac{1}{n}\right)^{n}=\lim_{n\to\infty}\left\{1^{n}+\left(\frac{1}{n}\right)^{n}+rem\left[1,\left(\frac{1}{n}\right),n\right]\right\}$$

Which can only be valid if

$rem\left[1,\left(\frac{1}{n}\right),n\right]=0$ at $n=\infty$; i.e., $\frac{1}{n}$ is undefined, so that $e_{0}=e^{0}=1$

Therefore, $e=\lim_{v\to c}\left(\beta+\frac{1}{\gamma}\right)^{\gamma}$ can only be defined by complex numbers such that $v\tau'>c\tau$:

$$\gamma=1+\beta\gamma\Leftrightarrow 1=\gamma-\beta\gamma=\gamma\left(1-\beta\right)$$
$$\varphi=\gamma-\gamma\left(1-\beta\right)=\gamma\left[1-\left(1-\beta\right)\right]=\beta=0$$
$$\varphi^2=\beta^2=0^2$$

Physically, however, this represents equal and opposite force for positive numbers:

$\varphi^2=\beta^2\left[\overleftrightarrow{0}\right]$ where the dimension for γ no longer exists in the limit as $\gamma\to 0$

Therefore, e only exists in the limit (which is why $\frac{d\left(e^x\right)}{dx}=e^x=\left(1\right)e^x=\left(e^0\right)\left(e^x\right)=e^{(x+0)}$

Where $f'(e^x)=\lim_{h\to 0}\frac{f(e^x+h)-e^x}{h}=1,\ h\neq 0$

(The following has to be revised, and is only a direction right now…. I have to go to lunch… :)

This is a conjecture that the number e is related to the Binomial and Multinomial Theorem as the limit to the variable selected as "fundamental" (in physics, the "rest" mass) as the limit in which "changes" to his fundamental go to zero divided by the "kernel" $\left(x^n+y^n\right)$.

$$e=\lim_{n\to\infty,y\to 0}\left[\frac{x_0{}^n+y^n+rem\left(x_0,y,n\right)}{\left(x_0{}^n+y^n\right)}\right]$$

For the case $n=2$, $rem\left(x_0,y,n\right)$ can be removed by conjugation, but then x_0 and y do not commute.

$$e = \lim_{n\to\infty, y\to 0}\left[\frac{\left(x_0^{\ n}+x_1^{\ n}+\ldots+x_n\right)+rem\left(x_0,x_1,\ldots,x_n\right)}{\left(x_0^{\ n}+x_1^{\ n}+\ldots x_n^{\ n}\right)}\right]$$

For physics, the case for $n=2$ is obvious, and for differential geometry where ALL elements are differential (including x_0), e is undefined, if the choice is to be global (i.e., any element can be taken to be "rest", the result is the determinant of the Jacobian divided by the trace. (or something like that). In that case, if even one of the elements is equal to zero, then $e=0$

This shows the relation of the irrational and transcendental numbers to the constant e (the actual values depend on the base of the number system selected….)

The implication is that unless all the elements of the Universe are taken into account, there is no Universe… Therefore, the Big Bang must have been the event that occurred just before the gleam in your father's eye faded…. ☺

I only have access to Wikipedia (unless someone can point me to a Dover book I don't already have), so don't know if this has been conjectured before (I assume that it has, but I haven't seen it….)