

# IMSCRÚDÚ AR UIMHREACHA I GCOMHTHÉACS

Cliceáil le téacs a bhreacadh

Cá mhéad?

Laethanta i mbliain = 365

Uair an chloig i mbliain?

Nóiméad i mbliain?

Soicind i mbliain?



what if?

Dá mbeadh €1 agam le hinfheistiú ar feadh bliana agus gur thairg banc ús millteach ard dom de 100%. Cá mhéad a mbeinn ag súil leis?

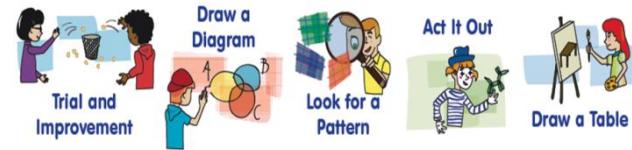


**Smeach-chairt:** Sainmhínigh athróga



Tá €1 agam le hinfheistiú ar feadh bliana ar ús 100%

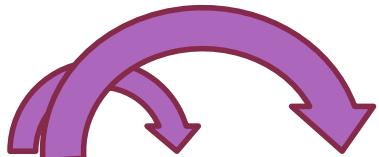
## Problem Solving Strategies



1

1

1



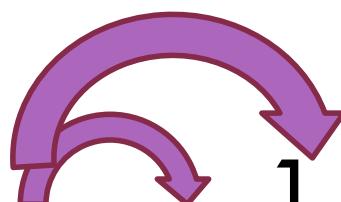
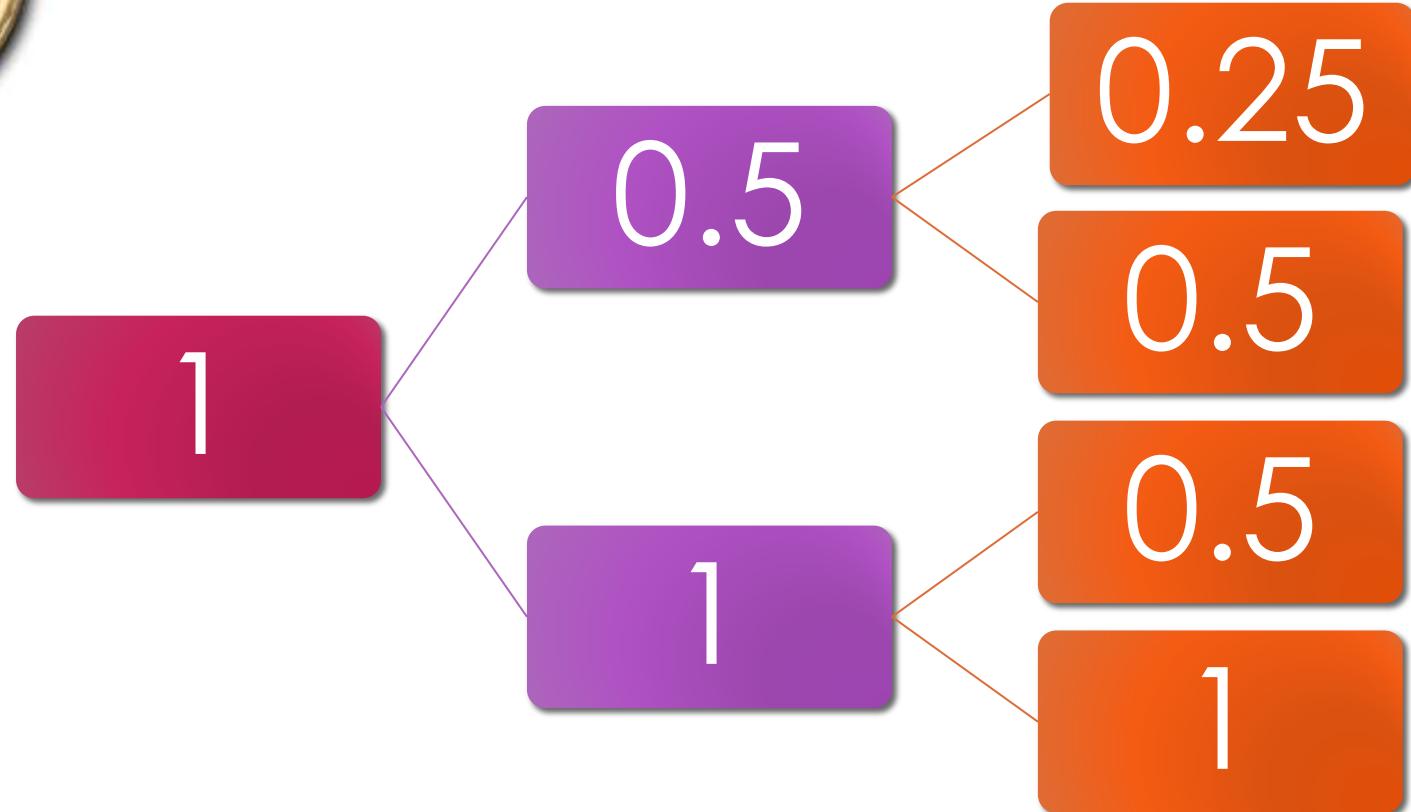
$$1(1+1) = 1 + 1 = 2$$



## Problem Solving Strategies



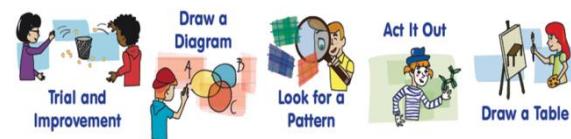
# Gach sé mhí?



$$1 \left(1 + \frac{1}{2}\right) \left(1 + \frac{1}{2}\right) = 1 + 0.5 + 0.5 + 0.25 = 2.25$$

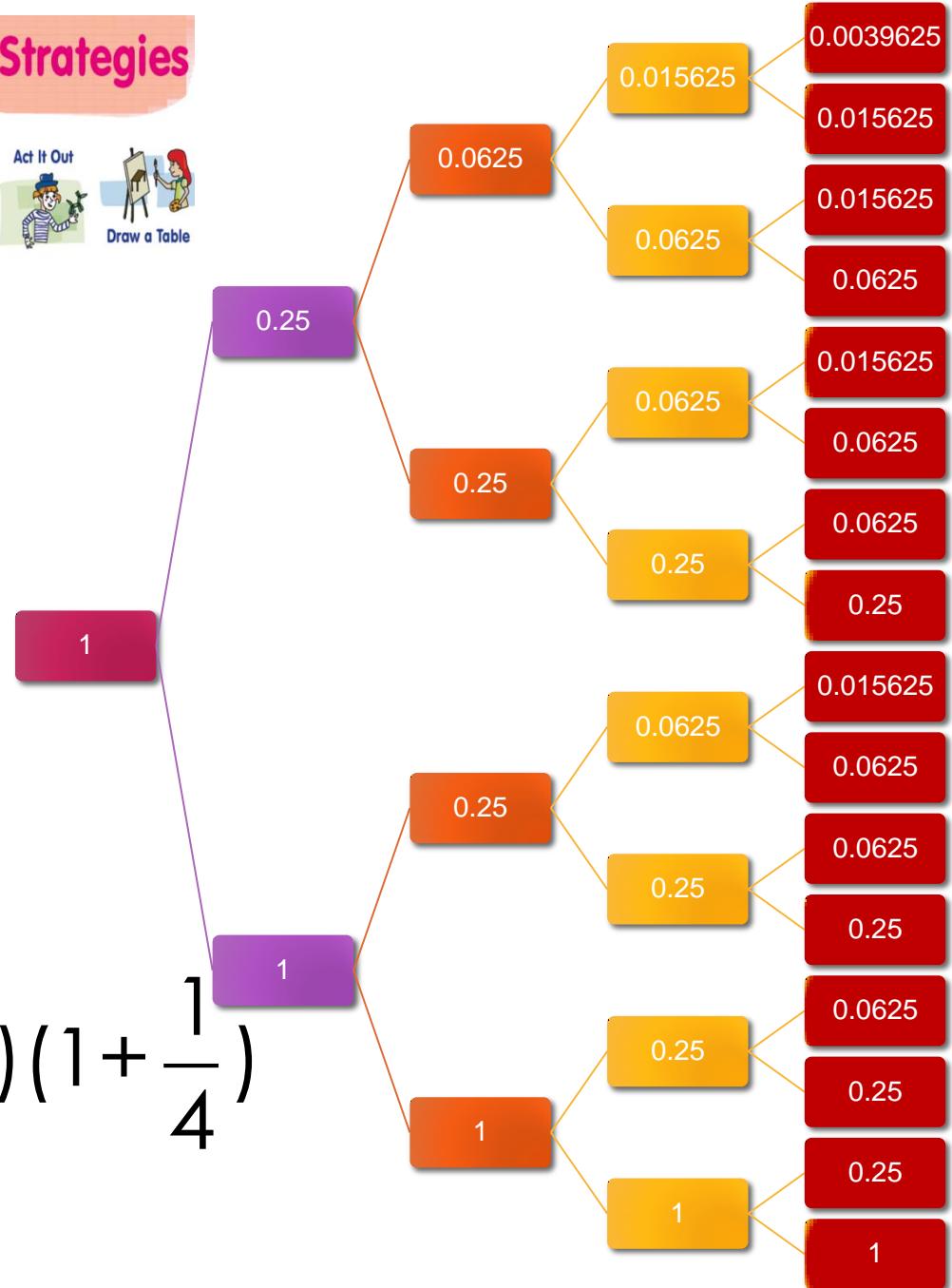


## Problem Solving Strategies



# Gach 3 mhí?

$$1 \left(1 + \frac{1}{4}\right) \left(1 + \frac{1}{4}\right) \left(1 + \frac{1}{4}\right) \left(1 + \frac{1}{4}\right) \\ = 2.44140625$$





what if?

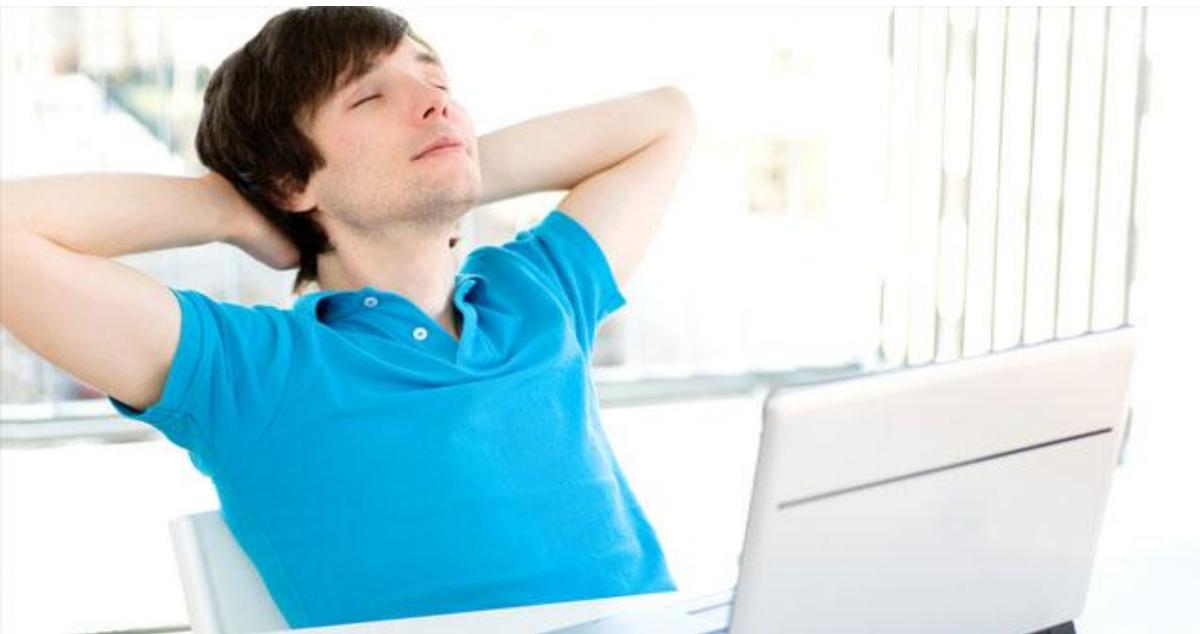
Dá n-iolrófaí mo chuid airgid  
Gach sé mhí?  
Gach trí mhí?



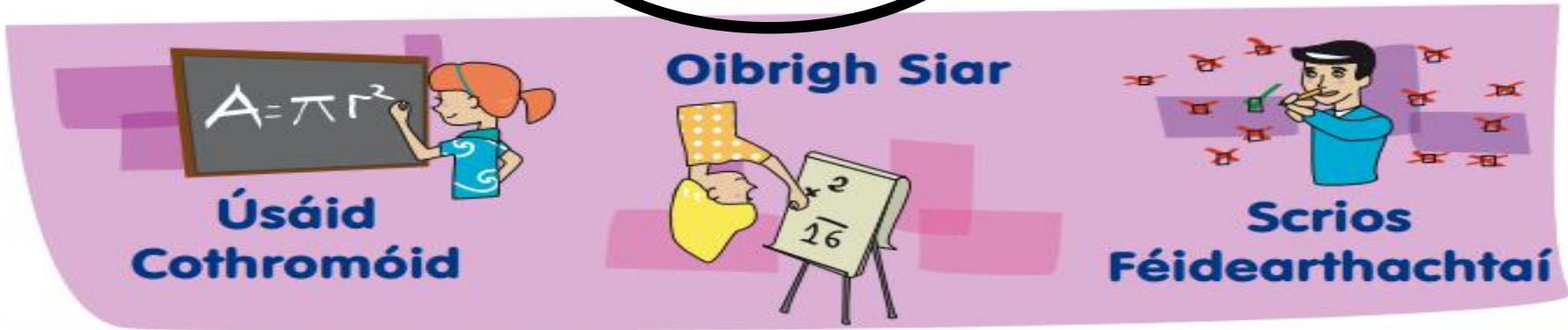


what if?

Dá n-iolrófaí mo chuid airgid  
Gach sé mhí?  
Gach trí mhí?  
Gach mí?  
Gach lá?  
Gach uair an chloig.....



# Straitéisí Chun Fadhbanna a Réiteach



| A mhinice a iolraítear an t-ús | An Luach Deiridh F  |              |
|--------------------------------|---|--------------|
| Yearly                         | $F = 1(1 + 1)^2$  | = 2.0        |
| Every 6 months                 | $F = 1\left(1 + \frac{1}{2}\right)^2$                               | = 2.25       |
| Every 3 months                 | $F = 1\left(1 + \frac{1}{4}\right)^4$                               | = 2.44140625 |
| Every month                    | $F = 1\left(1 + \frac{1}{12}\right)^{12}$                           | = 2.61303529 |
| Every week                     | $F = 1\left(1 + \frac{1}{52}\right)^{52}$                           | = 2.69259695 |
| Every day                      | $F = 1\left(1 + \frac{1}{365}\right)^{365}$                         | = 2.71456748 |
| Every hour                     | $F = 1\left(1 + \frac{1}{365(24)}\right)^{365(24)}$                 | = 2.71812669 |
| Every minute                   | $F = 1\left(1 + \frac{1}{365(24)(60)}\right)^{365(24)(60)}$         | = 2.71827923 |
| Every second                   | $F = 1\left(1 + \frac{1}{365(24)(60)(60)}\right)^{365(24)(60)(60)}$ | = 2.71828162 |

## Déanmís ginearalú..... má roinnimid an bhliain in n tréimhse iolraithe, conas a gheibhimid F?

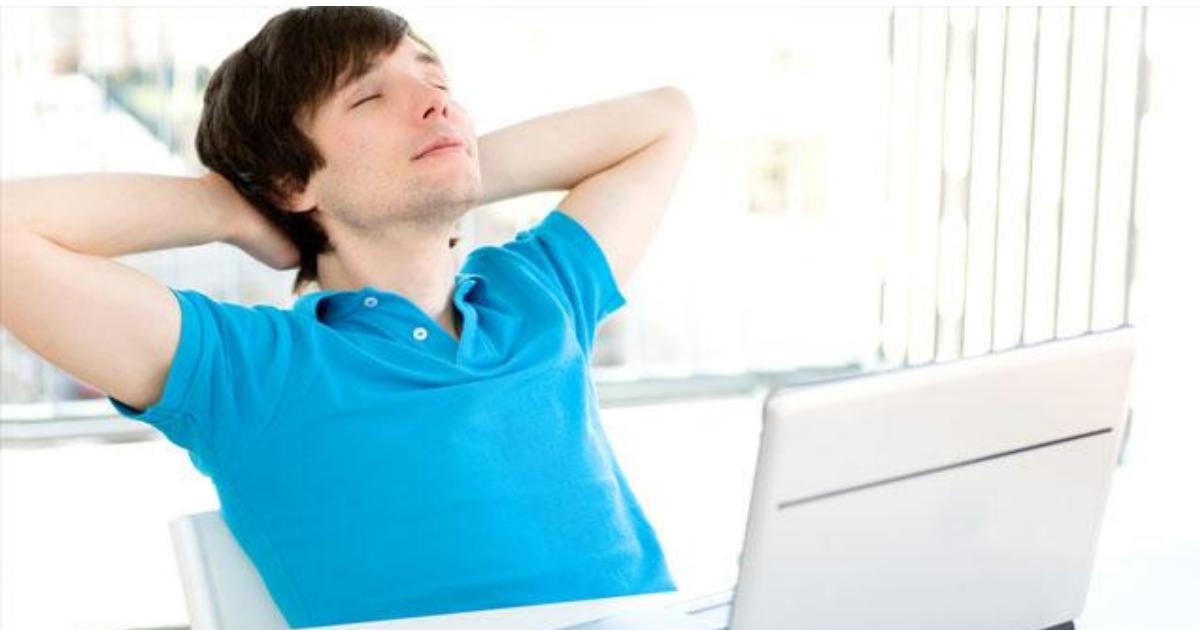
|                |   |              |
|----------------|---|--------------|
| Yearly         | $F = 1(1 + 1)^2$                                      | = 2.0        |
| Every 6 months | $F = 1\left(1 + \frac{1}{2}\right)^2$                 | = 2.25       |
| Every 3 months | $F = 1\left(1 + \frac{1}{4}\right)^4$                 | = 2.44140625 |
| Every month    | $F = 1\left(1 + \frac{1}{n}\right)^n$                 | 2.61303529   |
| Every week     | $F = 1\left(1 + \frac{1}{n}\right)^n$                 | 2.69259695   |
| Every day      | $F = 1\left(1 + \frac{1}{365}\right)^{365}$           | = 2.71456748 |
| Every hour     | $F = 1\left(1 + \frac{1}{8760}\right)^{8760}$         | = 2.71812669 |
| Every minute   | $F = 1\left(1 + \frac{1}{525600}\right)^{525600}$     | = 2.71827923 |
| Every second   | $F = 1\left(1 + \frac{1}{31536000}\right)^{31536000}$ | = 2.71828162 |



Dá leanfaí leis an iolrú ar feadh tréimhsí iolraigthe níos lú agus níos lú?

Deallraíonn sé gur ar éigean a bhíonn éifeacht ar bith ar an toradh ag aon mhéadú ar an líon tréimhsí iolraigthe –

**tarlóidh na hathruithe i ndigití is lú agus is lú suntas.**



2.7

2.71

2.718

2.7182

2.71828

2.718281

2.7182818

2.71828182

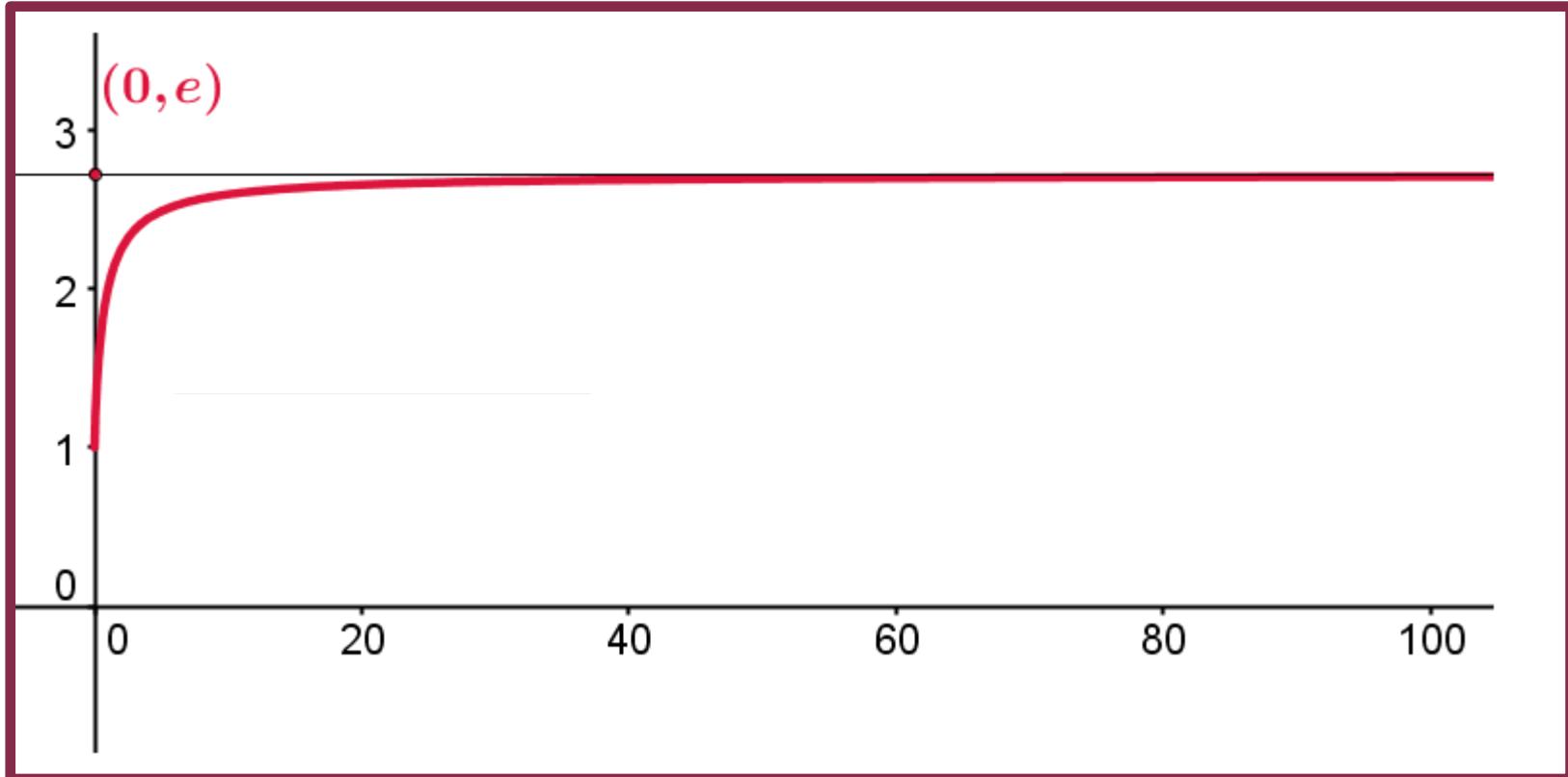
2.718281828

2.7182818284.....

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

áireamhán

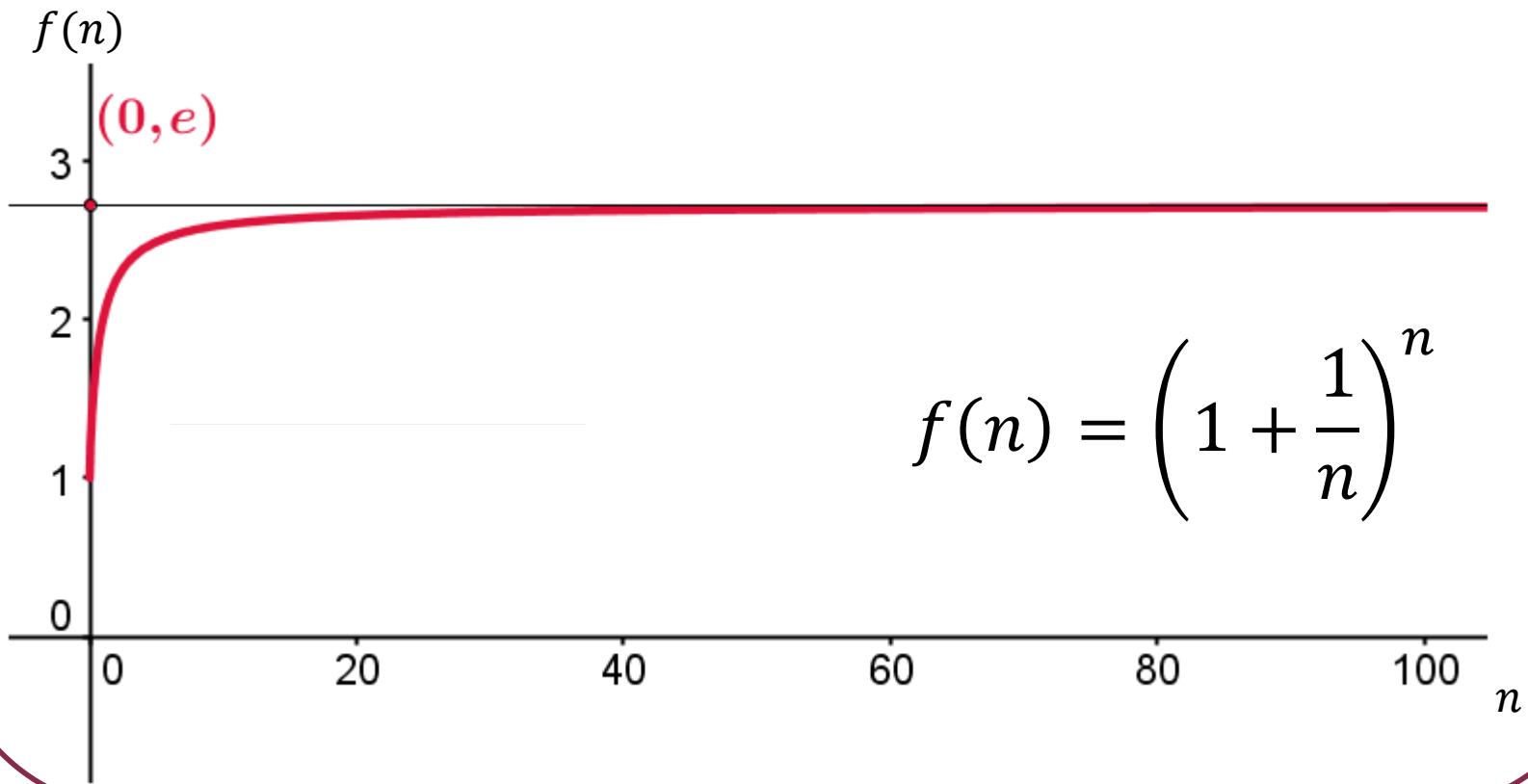
$$\lim_{n \rightarrow \infty} \left(1 + \frac{1}{n}\right)^n = e$$



Má thosaímid le €1 agus má iolraímid gan stad ar feadh 1 bhliain ag 100%, gheibhimid €e



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

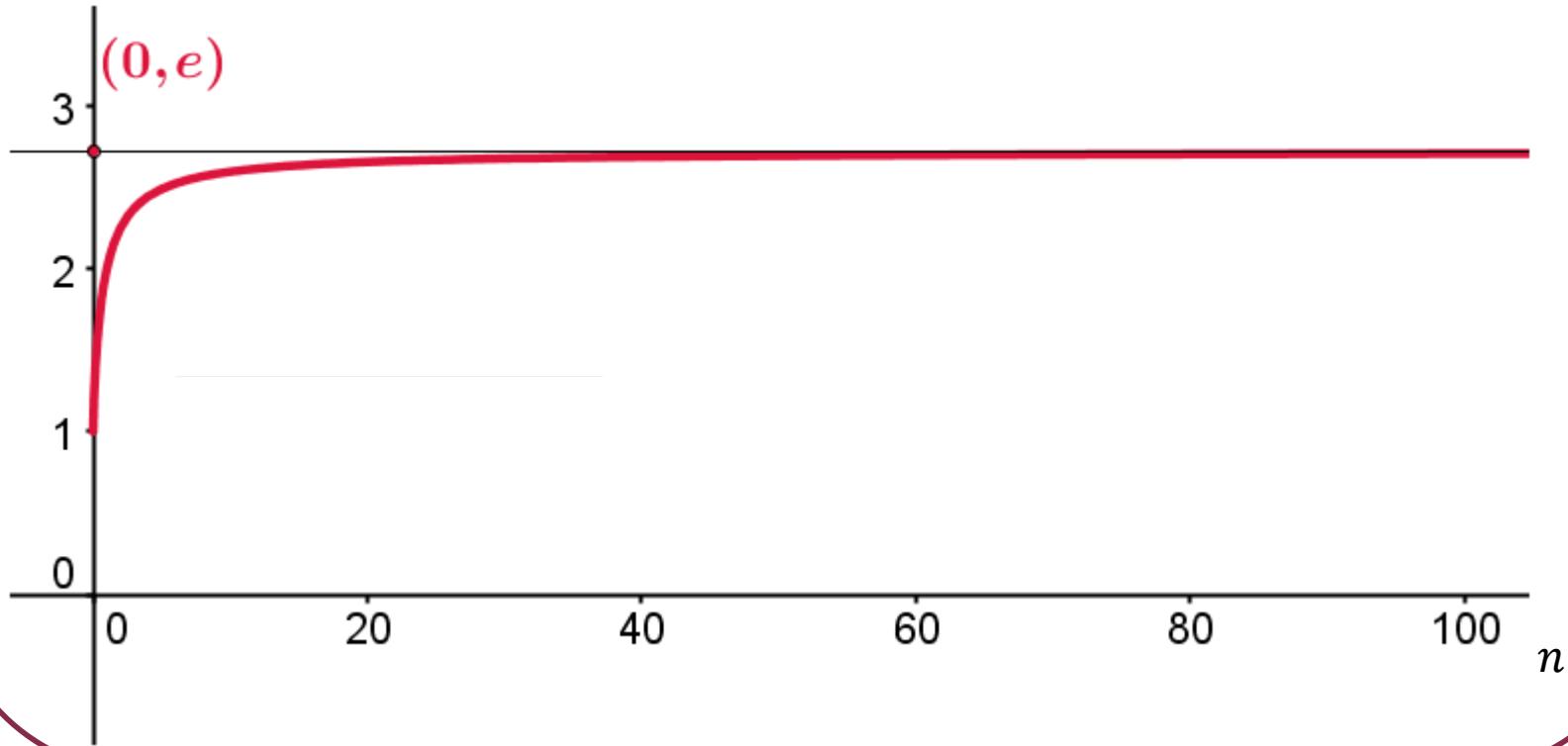


Má thosaímid le €1 agus má iolraímid gan stad ar feadh 1 bhliain ag 100%, gheibhimid €e



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

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



Má thosaímid le €1 agus má iolraímid gan stad ar feadh 1 bhliain ag 100%, gheibhimid €e



# Ní amháin gur uimhir é e .....

- Is é e an bunráta fáis atá i gcomhpháirt ag gach próiseas leanúnach fáis.
- Tagann e i dtreis aon áit a bhfásann córais go heaspónantúil agus go leanúnach: daonra, meath radaighníomhach, ríomhanna úis, agus tuilleadh.
- Fiú córais spiacánacha nach bhfásann go comhréidh, is féidir neaslúach a chur orthu le e.

e

## World Population Growth

billions  
10  
8  
6  
4  
2  
0

- Developing regions
- Industrialized regions



World  
Resources  
Institute

Sources: United Nations Population Division and Population Reference Bureau, 1993.

e

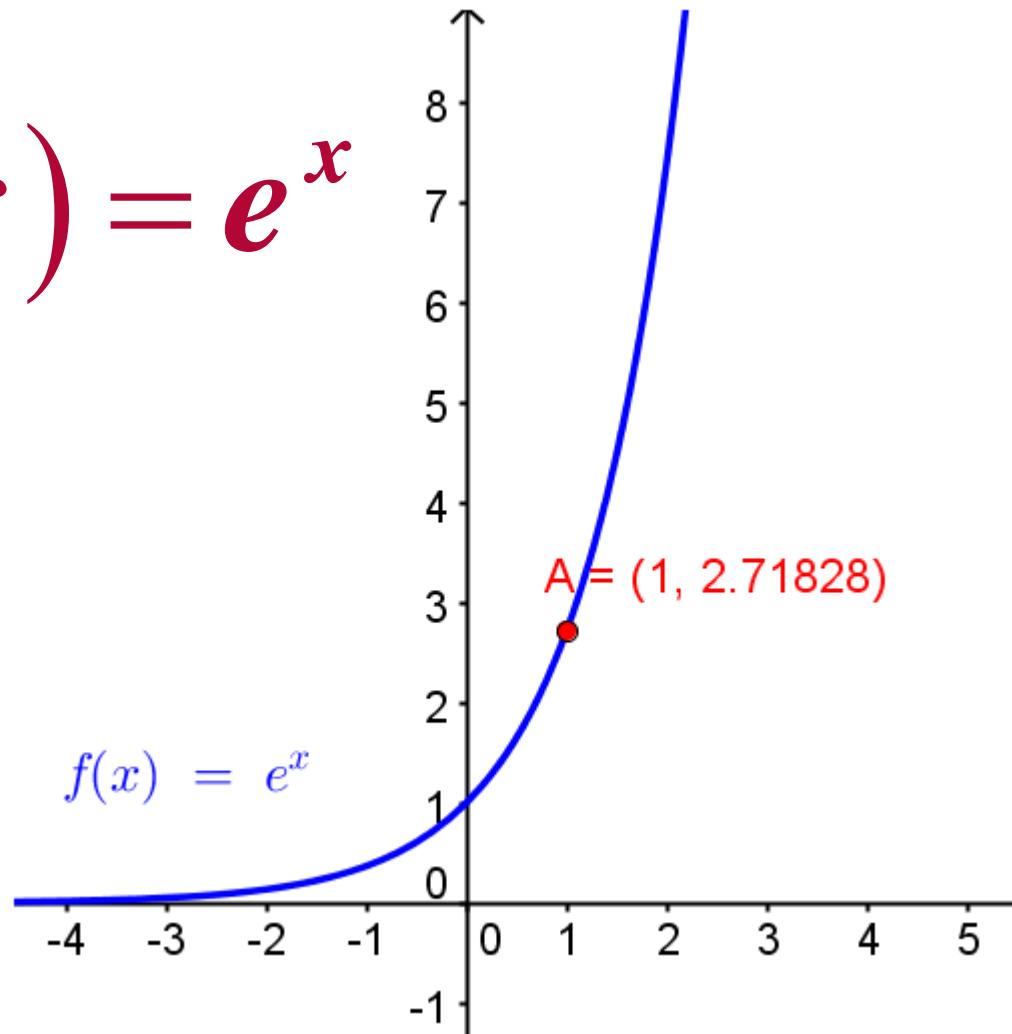


$$N = N_0 e^{-\lambda t}$$

$$P(Z \leq z) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^z e^{-\frac{1}{2}t^2} dt$$

# An fheidhm easpónantúil nádúrtha

$$f(x) = e^x$$



# Léirshamhail Mhatamaiticiúil do Fhás

Do fhás scoite,  
bainfear usáid as  
 $(1 + i)$   
mar bhunluach



Do fhás leanunach,  
bainfear usáid as  $e$ .

Is féidir linn neaslúach a chur ar fhás scoite ag baint úsáide as  $e$ .

$e$



what if?

❑ Dá mbeadh an ráta úis níos lú ná 100%?

❑ Munarb ionann an méid a infheistíodh agus €1?

❑ Dá mbeadh an tréimhse infheistithe níos faide ná bliain?



# Rátaí úis, amanna agus bunairgid eile .....

The final value  $F$ , when €1 is invested at 100% continuously compounded interest is

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

If the interest rate is  $i \neq 1$ , (still continuous compounding) and  $t = 1$  year,

$$F = \lim_{n \rightarrow \infty} \left(1 + \frac{i}{n}\right)^n$$

Let  $\frac{i}{n} = \frac{1}{x} \Rightarrow n = xi$

As  $n \rightarrow \infty$ ,  $x \rightarrow \infty$

$$\Rightarrow F = \lim_{x \rightarrow \infty} \left(1 + \frac{1}{x}\right)^{xi} = \left( \lim_{x \rightarrow \infty} \left( \left(1 + \frac{1}{x}\right)^x \right)^i \right) = e^i$$

If the time is  $t$  years:

$$F = (e^i)^t = e^{it}$$

If the principal is € $P$ :

$$F = Pe^{it}$$

Is leaganacha scálaithe de ráta coiteann iad córais atá ag fás go leanúnach.