Tags
Edited Oct 28, 2021 11:11 AM by admin...

Populations Mods 23-24

First of all a flow diagram:

Click for full-size image

Note that this is for a country, not the planet, since people (so far) are not leaving the planet...or arriving from elsewhere.
National version as a formula:

$$\text{National population growth rate} = \frac{[(CBR + \text{immigration}) - (CDR + \text{emigration})]}{10}$$

If you look at the planet as a whole (sans aliens or Elon Musk):

$$\text{Global population growth rate} = \frac{[CBR - CDR]}{10}$$

so, there is a neat shorthand formula for this:

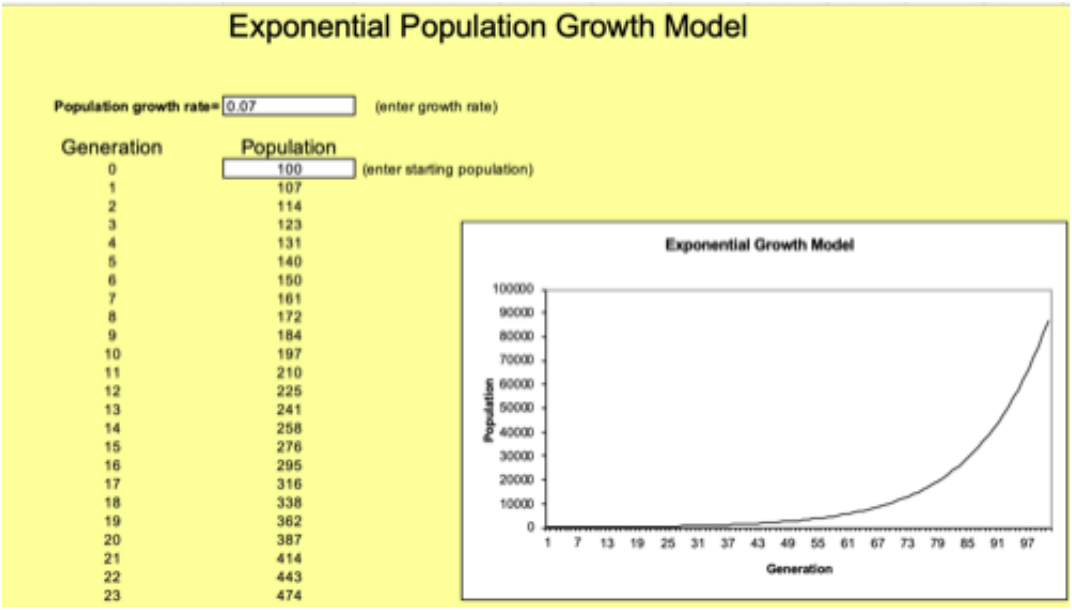
$$\text{Doubling time (years)} = \frac{70}{\text{growth rate}}$$

Which is an estimate, the real number is 69.3 (why? look below if you want to know)
Here is an example:

$$\frac{70}{2} = 35 \text{ years}$$

Note that as the growth rate increases, the doubling time decreases.
Look for this on the AP as multiples/fractions of 70: 14, 28, 35, and so on...

You can also see this by using our previous formula: Nt = Noe^rt
Set N to 100, try with a 7% growth rate (0.07 is r) and set time to be 10 years (70/10)
Calculate Nt
Here's what this might look like:



Click for full-size image

When calculating growth rates, always use the CHANGE in population divided by the base population, e.g. 7/100 is 7% growth rate, so this population would go from 100 to 107, like in the chart above.

Now, to babies: TFR is the total number of babies a woman will have in her lifetime.
Replacement level fertility (RLF) is just above 2.0, (usually 2.1, as some babies don't reproduce or make it to reproductive age).
What does this mean in Japan, where young people are not having babies?

RLF depends on developed/developing nations as well (clean water, medical care, access to food, war)
Life expectancy: depends on these as well...
Infant mortality: under age 1 (reason for big Hawaiian one year birthdays)
child mortality: under 5

Look up life expectancy in 1900...
Look up the average family size and how many made it to age of 5 in 1900
What portion of the US population was farmers then?

Age structure diagrams/population pyramids-check these out: UAE, Japan, Sudan, Iraq/Iran, Russia----WHY?
See also baby boom and boom echoes...
Check this out:
https://www.populationpyramid.net/world/2021/

...and look these up:

1. Go to 1950 and look at the US population. Look again in 1960. Where is the baby boom? Why were there so few babies born during 1940-45?
2. If you were a 42 year old American in 2000, when were you born? How old are your kids? Find the "boom echo".
3. Find the impact of the Iran/Iraq war of 1980-89, which side had the biggest impact? If you were a 35 year old Iraqi man in 1995, how old were you during this war?
4. If you are a 30 year old German man in 1950, when were you born? How old were you in WWII (1936-1945)?
5. If you were a 35 year old woman in Japan in 1960, why are there so few men to choose from?
6. Look at the UK in 1960. Where are the casualties of WWII, and are they both male and female? Explain.
7. What the heck is going on in UAE?
8. Look at Russia in 1960. What gaps do you see? Why?
9. Information about China is very spotty-why would this be? See if you can find the impact of the one-child policy from 1979-2021.
10. Compare present day Japan to Africa. What issues will they need to address?
11. Look at present day Italy, Japan and Germany. What is common?
12. Compare present day India and China. What do you see?

Terms to know: Human Populations----------

Fecundity: the ability to reproduce

Fertility: production of offspring

CBR: crude birth rate: births per 1000 people

TFR: total fertility rate: total kids per woman in her lifetime (25-30!)

ZPG: zero population growth: 5+ where infant mortality is high, 2.1 is normal

China: was 6 -> 1.8 (below replacement level since 1979, one child policy)

China has a 140/100 male to female ratio: why?

Global TFR is 2.6

CDR: crude death rate: deaths per 1000

Why is there a life span? mitochondrial DNA...

1900 Indian man had life expectancy of 23! Trace this to now...

Not now, reasons: nutrition CLEAN WATER, sanitation, education

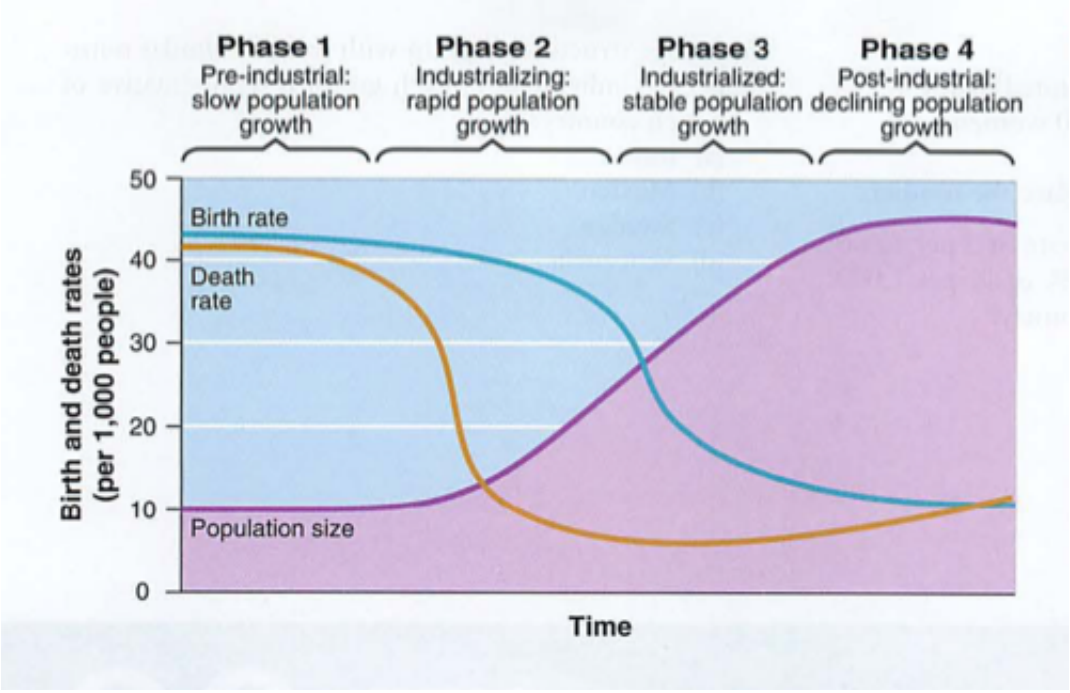
75 men, 85 women (testosterone, war, "hold my beer and watch this!", Darwin Awards)

Dependency ratio; baby boomers and your future: how many workers to retirees

imagine your life at your age in other countries...

Russia low TFR: alcoholism and antibiotic resistant Tuberculosis

Module 23 Demographic Transition



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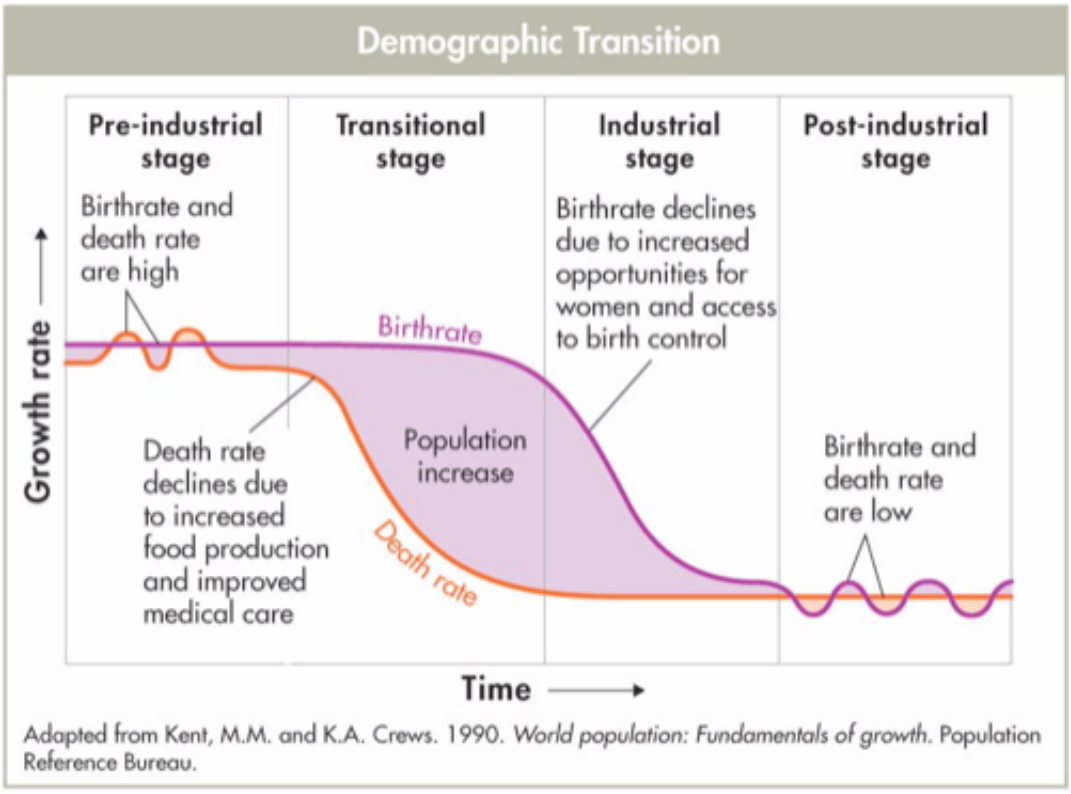

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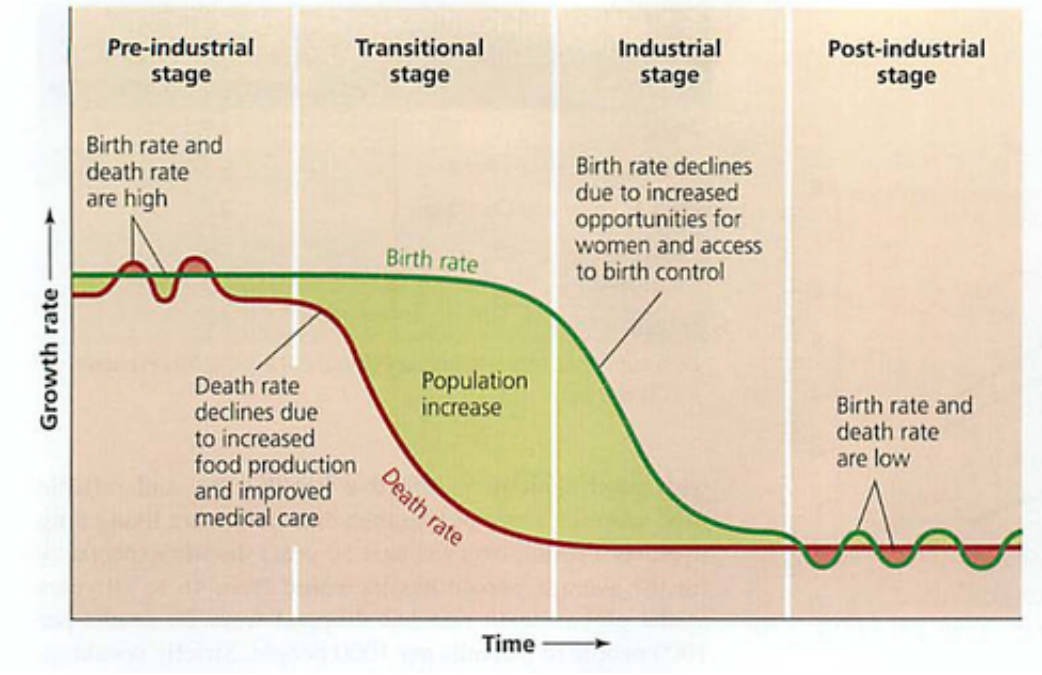
Things to notice:

1. in phase 1, lots of babies, lots of death (infant mortality and short lifespans), so population is low
2. as clean water, sanitation and health care improve, deaths drop, so population rises
3. as women gain reproductive rights and/or education, the birth rate drops (many factors here), while death rate stays low, so the population growth curve flattens a bit (hard to see on this diagram)
4. as industrialization includes more women, esp. as professionals, they may delay pregnancy later in life, so there is actually a population drop. Examples are Italy, Japan and Germany, where the dependency ratio (number of people depending on social retirement divided by number of people in the workforce paying into the system) is greater than 1.0.

Make sure you can cite at least one example country for each...
1. Sub-Saharan Africa, most of the world before the industrial revolution
2. Afghanistan
3. US
4. Japan

Another view:



IPAT formula:

$$\text{impact} = \text{population} \times \text{affluence} \times \text{technology}$$

Imagine two scenarios:
Case 1: A sustainable pacific island community, no phones, internet or electricity. Food sources are local, there is little affluence (tribal community), also less poverty, and a self-limiting population, limited by K, in this case food.
Case 2: Urban community, large population, lots of affluence (think NYC or SF), everyone has an iPhone or similar device, a computer, a car, a refrigerator, TV, and a wide selection of clothing, food and housing.

IPAT: the impact on an ecosystem = population x affluence x technology

Why is Apple using a robot ("Daisy") to take apart iPhones? How does this impact iPAT?
https://www.apple.com/newsroom/2018/04/apple-adds-earth-day-donations-to-trade-in-and-recycling-program/

Which parts of the iPAT formula does this impact, and in which ways?

Think also of electric vehicles: great for the environment, but use materials (Lithium, Neodymium, etc.) that need to be mined. Gasoline/Diesel cars need steel, glass, plastic and some rare materials for electronics, but are much worse for the environment, both in production, use and disposal. More on this later.
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https://www.gapminder.org/tools/#$chart-type=bubbles&url=v1

https://www.ted.com/talks/hans_rosling_on_global_population_growth
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GDP vs. GNP (nationalism, global economy)
GDP is global domestic product, or the sum of all goods and services delivered inside a country
This was the standard growth metric until recently...
GNP is the same thing, but includes multinational companies, or companies "off shore"

Urban areas, UGB (Portland)

TABLE 23.1 The largest 20 urban areas in the world

Rank	City, Country	Population (millions)
1	Tokyo, Japan	38.1
2	Delhi, India	26.5
3	Shanghai, China	24.5
4	Mumbai, India	21.4
5	São Paulo, Brazil	21.3
6	Beijing, China	21.2
7	Mexico City, Mexico	21.2
8	Osaka-Kobe, Japan	20.3
9	Cairo, Egypt	19.1
10	New York-Newark, United States	18.6
11	Dhaka, Bangladesh	18.2
12	Karachi, Pakistan	17.1
13	Buenos Aires, Argentina	15.3
14	Kolkata, India	15.0
15	Istanbul, Turkey	14.4
16	Chongqing, China	13.7
17	Lagos, Nigeria	13.7
18	Manila, Philippines	13.1

19	Guangzhou, Guangdong, China	13.1
20	Rio de Janeiro, Brazil	13.0

Source: Data from United Nations Population Division.
Note: Data are from 2016 and contain the areas defined by the United Nations as "urban agglomerations." Other agencies agglomerate urban areas differently and obtain slightly different results.

See also Ecological Footprint Calculator:

http://www.footprintnetwork.org/resources/footprint-calculator/

https://www.ted.com/talks/hans_rosling_shows_the_best_stats_you_ve_ever_seen
(9 minutes)

Play with these:

https://www.gapminder.org/
https://www.gapminder.org/tools/#$chart-type=bubbles&url=v1

Rule of 70, er 69.3...The TRUTH!
We know that Nt =Noe^rt
When Nt/No = 2, this is the doubling time
ln (Nt/No) = ln (e^rt)
ln(e^x) = x just like square root of x squared is x. They are reverse of each other...
ln (2) = 0.693 = rt
So...
0.693/r = t2, the "doubling time"
But wait! we saw 70, not .693...
Growth rates are in percent (part/100) so the percents cancel out, meaning you can just use percent as a number, like 14%.
You will certainly see this on an AP exam, usually as a multiple or fraction of 70: 14, 28, 35, 7, 3.5...

Rule of 70 rules! (or actually the rule of 69.3)....

Next: earth and soils:
https://www.youtube.com/watch?v=xzAOhyOtfqc