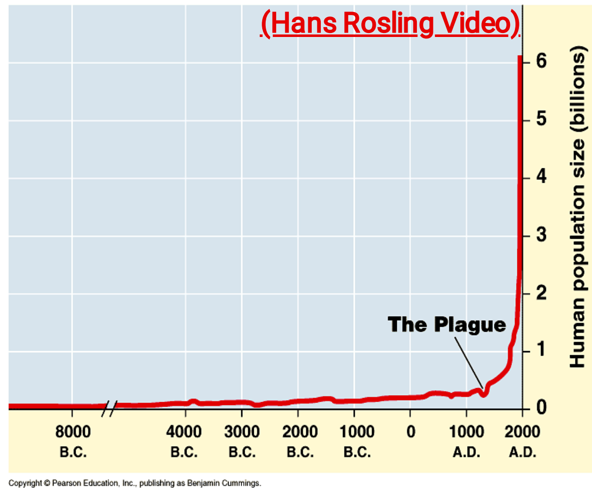
(p.1164)**13.** Identify factors that regulate population size.

Factors that regulate population size are called limiting factors. Limiting factors include: predation - sickness (viruses and bacteria) - food - water - temperature - sunlight.

(Video: How Did We Get So Big So Fast?)

(p.1168)**14.** Look at the growth curve of the human population. How does it compare to the growth curves mentioned in question 9?

The human population growth curve to the right is an example of logistic growth from 8000 B.C. until the Bubonic (Black) Plague in 1347. Since the Industrial Revolution in the 1800's, human population growth has experienced exponential growth since 1960 since the is linear and characteristic of logistic growth.



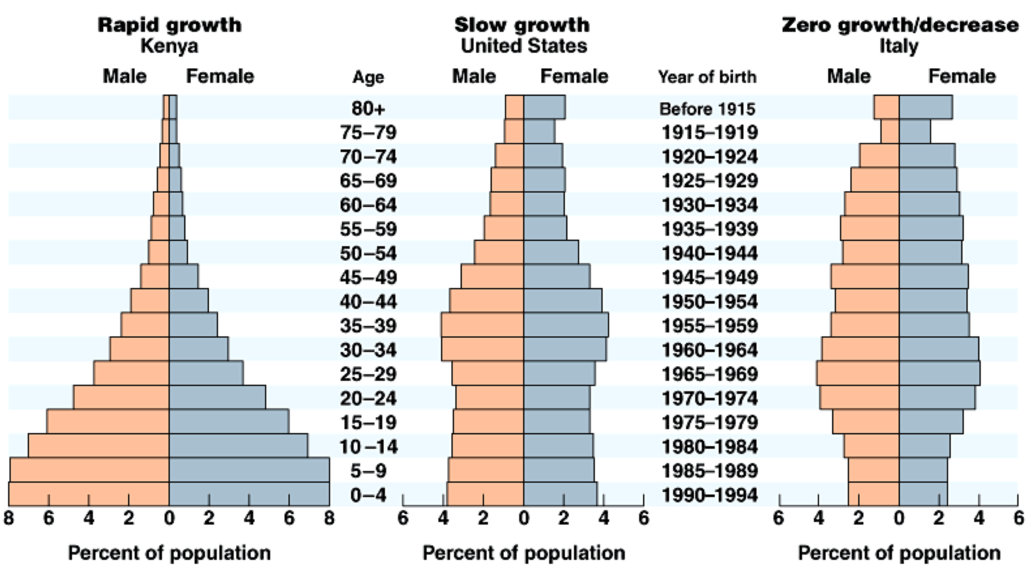
(Video: Human Population Through Time)

15. Have humans reached **K**? What factors are significant when explaining our growth curve?

According to Hans Rosling, the carrying capacity of *Homo sapiens* for planet Earth is 11 billion. Significant factors in explaining our growth curve include:

(Video TedEd)

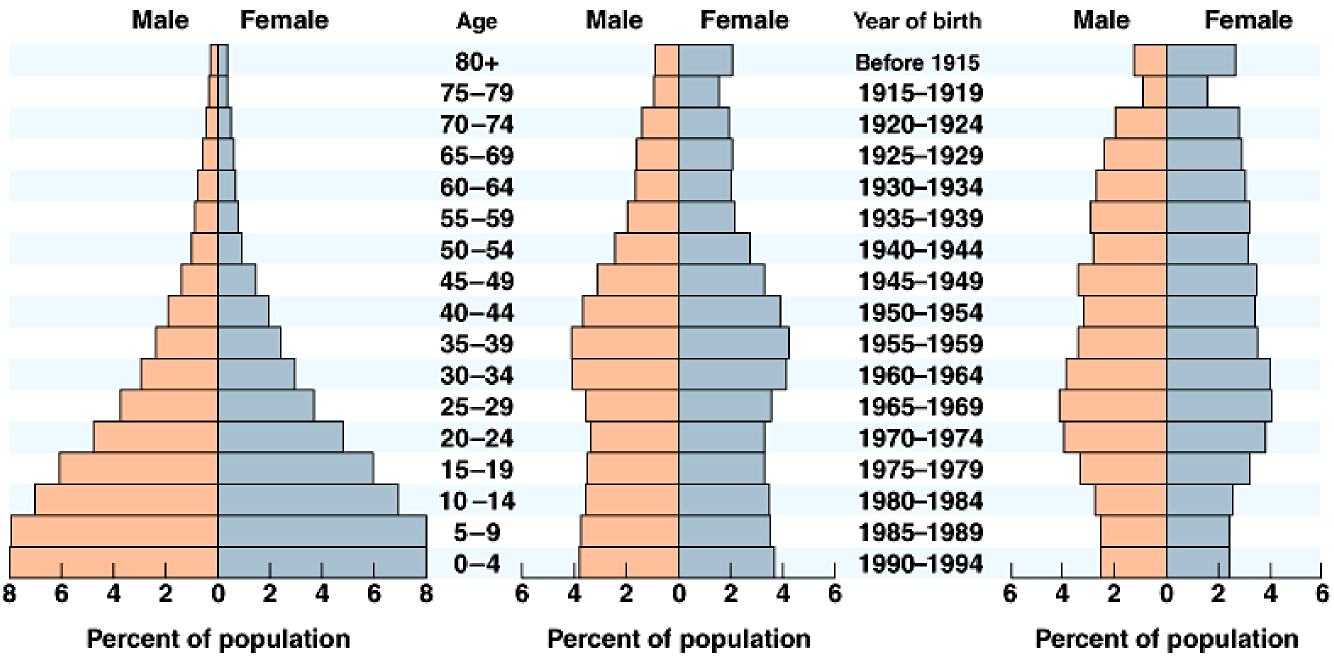
16. Look at the age structure diagrams of different countries. Be prepared to discuss in class how each might influence various personal, governmental and economic policy?



[Video: Hans Rosling's 200 Countries, 200 Years, 4 Minutes](#)

[(Video TedEd)](#)

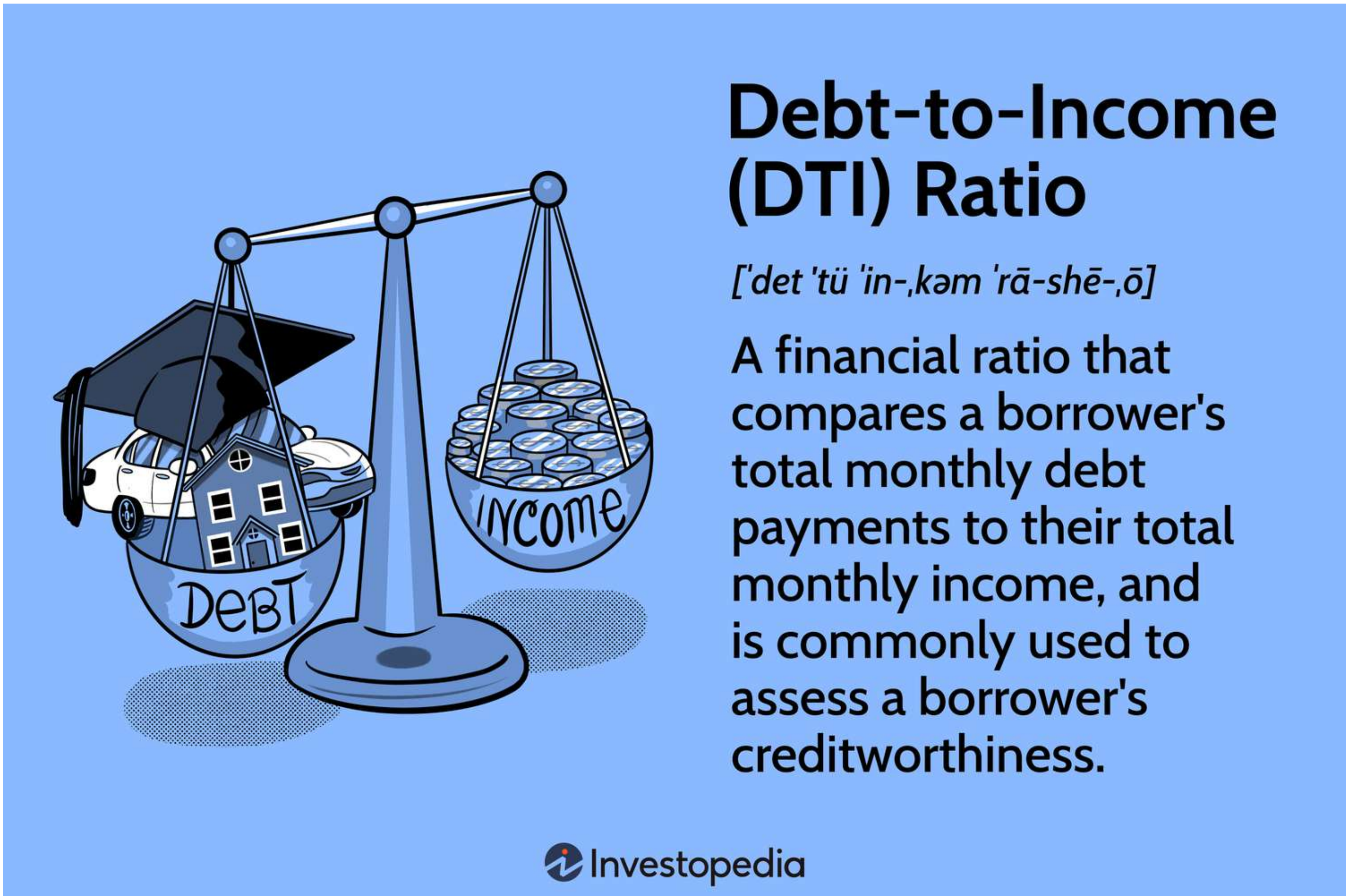
17. Analyzing Age Structure Diagrams



Underdeveloped - youthful	Developed - aging	Developed - aged
Examples: Kenya - India - Rwanda	**Examples:** Canada - England	**Examples:** Japan
	USA	
Characteristics: • high birth rate • high death rate • short life expectancy • large families • increasing growth rate **Issues/Concerns:** • Many workers to support the needs of the elderly **High Demand For:** • schools/education • medical services (pediatric) • high employment	**Characteristics:** • constant birth rate • low death rate • long life expectancy • smaller families • decreasing growth rate **Issues/Concerns:** • Less workers to support the needs of the elderly **High Demand For:** • medical services (geriatric) • high competition for jobs between the young (20-35) and older workers (40-55) (US Debt Clock)	**Characteristics:** • low birth rate • low death rate • long life expectancy • smaller families • decreasing growth rate **Issues/Concerns:** • Few workers to support the needs of the elderly **High Demand For:** • medical services (geriatric) (Japan Article)

(PopulationPyramids.net)

Kahn Academy: Population Growth Rates (PragerU: National Debt) (PragerU: Bankrupting America)
(National Debt reaches $34,000,000,000,000.00) PBS: How the US Debt Reached 34 trillion) (Debt vs. Deficit)



$D = 4/10 = \boxed{0.4}$

Thus, **dN/dt = B – D**
dN/dt = 0.5 – 0.4
dN/dt = $\boxed{0.1}$

Change in population can be calculated by multiplying the growth rate (**dN/dt**) by the original population size (**N**)

Change in Population = (**dN/dt**) **N**

In this example, change in population = (**dN/dt**) **N** = **0.1(10)** = 1,
so the population has increased by one individual in that time period.

To determine the *size of the population at the end of the time period*,
add the population size (**N**) to the change in the population

= **N + (dN/dt) N**
= 10 + (0.1)10
= 10 + 1
= $\boxed{11}$

19. There are **252** deer in a population. There is no net immigration or emigration. If **47** deer die and **32** deer are born in one month, what is the population size at the end of the month?

Round your answer to the nearest whole number.

$$252 - 47 + 32 = \underline{237 \text{ deer}}$$

20. In a population of **600** squirrels, the *birth rate* **(B)** in a particular period is **.06** and the *death rate* **(D)** is **0.12**.

a) What is the *growth rate* of the population (B – D)? *Round your answer to the nearest hundredth.*

$$\frac{dN}{dt} = B - D = 0.06 - 0.12 = \underline{-0.06}$$

b) What is the actual number of squirrels that were born during this particular period? *Round your answer to the nearest whole number.*

$$600 \times 0.06 = \underline{36 \text{ squirrels born}}$$

c) What is the actual number of squirrels that died during this period? *Round your answer to the nearest whole number.*

$$600 \times 0.12 = \underline{72 \text{ squirrels died}}$$

21. In a population of **750** fish, **25** die on a particular day while **12** were born.

a) What is the *death rate* **(D)** for the day? *Round your answer to the nearest hundredth.*

$$\frac{25}{750} = 0.033 = \underline{0.03}$$

b) What is the *birth rate* **(B)** for the day? *Round your answer to the nearest hundredth.*

$$\frac{12}{750} = 0.016 = \underline{0.02}$$

c) What is the *growth rate* of the population (B – D)? *Round your answer to the nearest hundredth.*

$$\frac{dN}{dt} = B - D$$

$$= 0.02 - 0.03 = \underline{-0.01}$$

22. In a population of **125** foxes, **10** die on a particular day and **22** were born on that day.

a) What is the *death rate* **(D)** for the day? *Round your answer to the nearest hundredth.*

$$\frac{10}{125} = \underline{0.08}$$

b) What is the *birth rate* **(B)** for the day? *Round your answer to the nearest hundredth.*

$$\frac{22}{125} = 0.176 = \underline{0.18}$$

c) What is the *growth rate* of the population (B – D)? *Round your answer to the nearest hundredth.*

$$\frac{dN}{dt} = B - D \quad = 0.18 - 0.08 = \underline{0.10}$$

23. The doubling time of a population of plants is **12** years. Assuming that the initial population is **300** and that the rate of increase remains constant, how large will the population be in **36** years?

Round your answer to the nearest whole number.

300 x 2 = 600 plants (after 12 years)

600 x 2 = 1200 plants (after 24 years)

1200 x 2 = <u>2400 plants</u> <u>(after 36 years)</u>

24. If **300** robins are found in a 20 hectare plot, what's the density in robins/hectare in that plot?

Round your answer to the nearest whole number.

$$\frac{300 \text{ robins}}{20 \text{ hectare}} = \frac{15 \text{ robins}}{\text{hectare}}$$

25. If **3400** maple trees are counted on a 3km x 4km rectangular piece of land, what is the density of the maple trees per square kilometer (km)? *Round your answer to the nearest tenth.*

$$\frac{3400 \text{ maple trees}}{12 \text{ km}^2} = \frac{283.3 \text{ maple trees}}{\text{km}^2}$$