Name: _____

Date: _____

Class: _____

IB ESS

8.1 Human population dynamics

Significant ideas:

A variety of models and indicators are employed to quantify human population dynamics.

Human population growth rates are impacted by a complex range of changing factors.

Quantifying Population Dynamics

1. Define the following terms:

Crude Birth Rate (CBR)

The number of births per 1000 people over a year.
= (birth/population) x 1000

Crude Death Rate (CDR)

The number of deaths per 1000 people over a year
= (deaths/population) x 1000

Natural Increase Rate (NIR)

The rate of human growth (% change) per year
= (CBR - CDR) / 10 - divided by 10 to get %

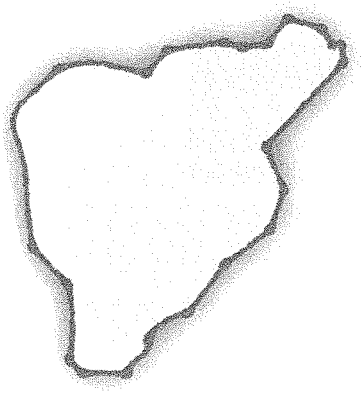
Total Fertility Rate (TFR)

The average number of births a woman has in her lifetime
A TFR of 2 is replacement rate

Doubling Time (DT)

The time, in years, it takes a population to double
DT = 70/NIR. Expressed as a number

2. Look at the data for the nation below and answer the questions. Assume that there is no immigration or emigration.



Country Profile – 2010 data	
Population	5 000 000
Births per year	30 000
Deaths per year	10 000

Calculate the following and show your working where appropriate:

i) The crude birth rate (CBR).

CBR = (births/population) x 1000

= (30 000/5 000 000) x 1000

= 6

CBR= 6 births per 1000

ii) The crude death rate (CDR).

CDR = (death/population) x 1000

= (10 000 / 5 000 000) x 1000

= 2

CDR= 2 deaths per 1000

iii) The natural increase rate (NIR).

NIR = (CBR - CDR)/10

= (6 - 2) / 10

= 0.4

NIR= 0.4% per annum

iv) In which year will the population be 10 000 000? (Think about "doubling time")

DT = 70/NIR

= 70 / 0.4

= 175

Year: 175 years to double population size

3.

a) Explain the term "replacement fertility"

Total fertility rate at which a population exactly replaces itself from one generation to the next, without migration

This rate is roughly 2.1 children per woman for most countries

b) Replacement fertility is higher than 2. State why this is.

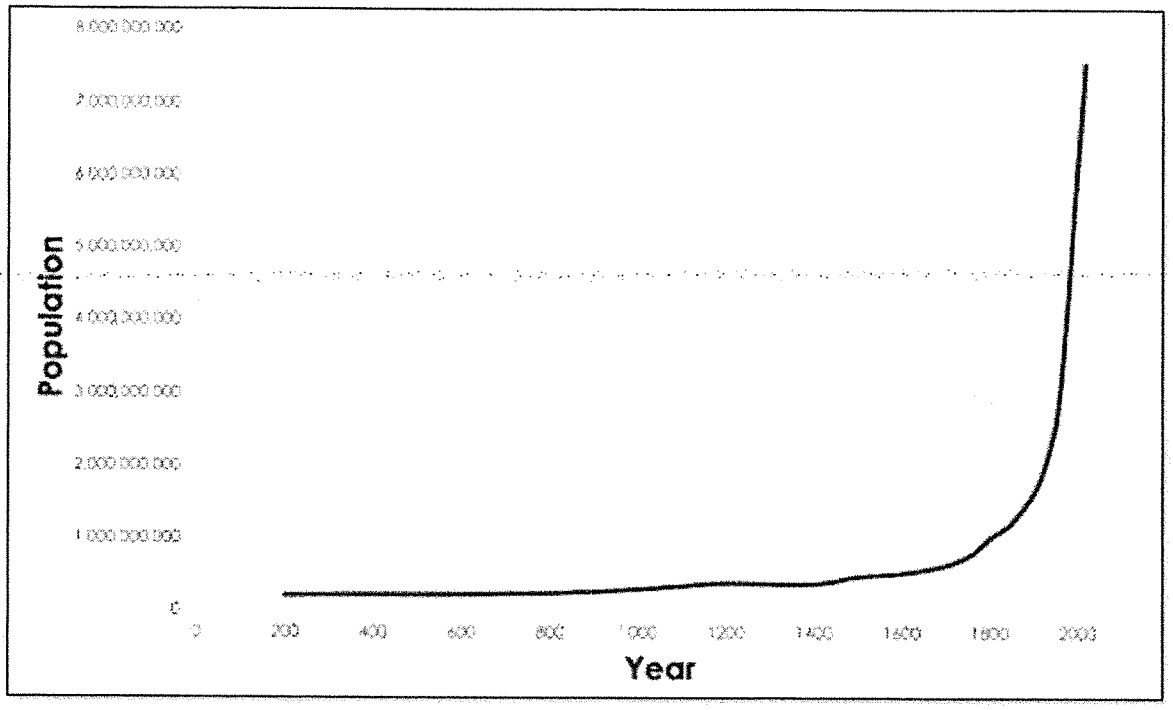
Not all children survive and not all adults reproduce

c) Replacement fertility is about 2.16 in LEDCs, but only 2.03 in MEDCs. Explain this difference.

In MEDCs a child is more likely to survive to adulthood due to better access to health care, food and education. By comparison, more children die in LEDCs and do not make it to adulthood so the number of children born must be higher to achieve replacement fertility rate

Population Growth

1. The diagram below shows the change in world population over about the past 2000 years



Graph 1.1

World population growth 200AD to 2017 (Source: Worldometers)

a) Describe the data

The total human population has stayed below 1 billion for most of its history. From the 1800s to 2020 the population has grown exponentially from 1 billion to 7.4 billion people.

b) Thomas Malthus (1766 – 1834) believed that food production only increased at a linear rate, but human population can increase faster than this. Explain the consequences on the future of the human population if Malthusian theory is accurate.

As the demand for food increases we will be forced to farm more intensely and in marginal lands. Even with technocentric farming solutions, there comes a point where no more food can be produced this limits/caps human population. Carrying capacity for food production limits growth

c) Esther Boserup (1910-1999) believed that an increase in population would result in an increase in food production, because we humans would recognize the necessity to provide more, and use new technologies to meet the demand. Explain the consequences on the future of the human population if Boserup's theory is accurate.

There is no limit/cap set by food production. As we reach carrying capacity technology will find new ways to find food and the population will continue to grow.

d) In your opinion, how will the human population change in the future? Justify your response and try to be specific

The population growth rate will plateau. The total fertility rate in most countries has dropped from 5 to 2 in 50 years. The percentage of people living in extreme poverty is decreasing so as more countries transition from LEDCs to MEDCs this trend of decreasing TFR continues. We are also hitting more planetary boundaries and limiting factors which will cause the population growth to plateau. Even with advances in technology there are limits to some resource e.g. fresh water, fertile soil

2. Describe the consequences of exponential population growth. Use the headings to guide your answer.

Resource requirements

- will increase exponentially
- these include water, food, land (housing + agriculture)

Waste

- will increase exponentially
- we will produce more waste and increase water and air pollution

Living standard expectations

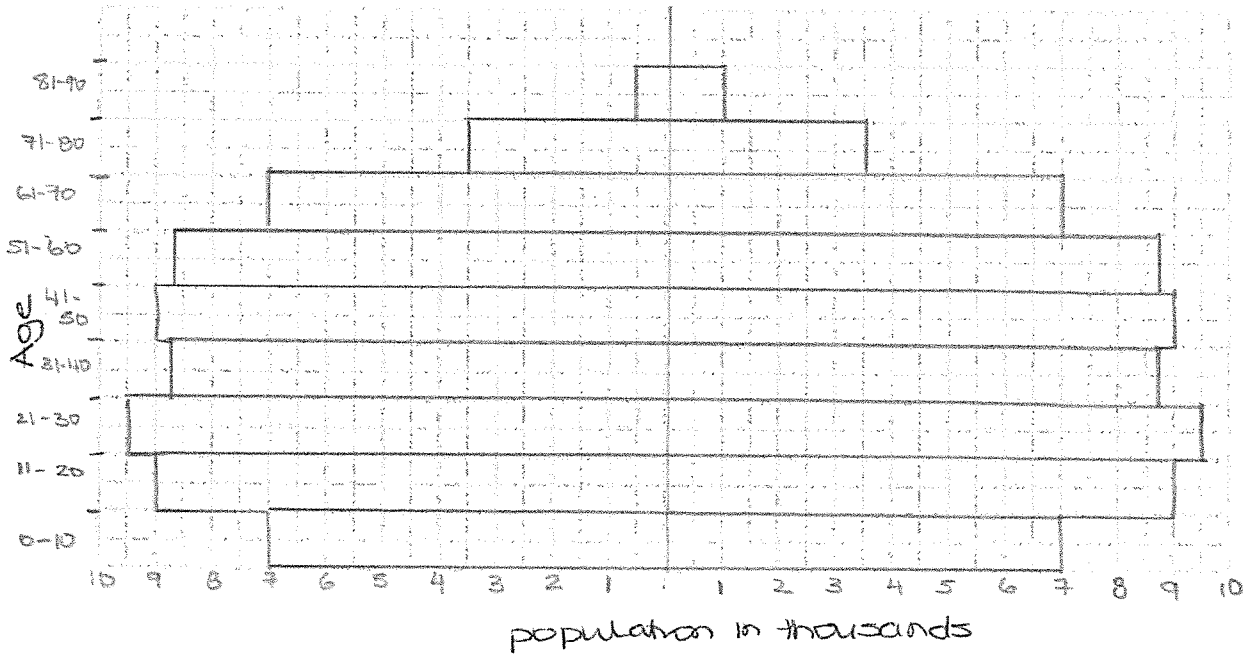
- more countries are transitioning from LEDCs to MEDCs so living standard expectations are increasing

Population Pyramids

1. The data in the table below shows the population with respect to age and gender for a nation in a given year.

Age	Female	Male
81 to 90	500	500
71 to 80	3500	3500
61 to 70	7000	7000
51 to 60	8700	8700
41 to 50	9000	9000
31 to 40	8700	8700
21 to 30	9500	9500
11 to 20	9000	9000
0 to 10	7000	7000

a) Present this information on population pyramid below.



b) Based on the graph, what can you conclude about this population's...

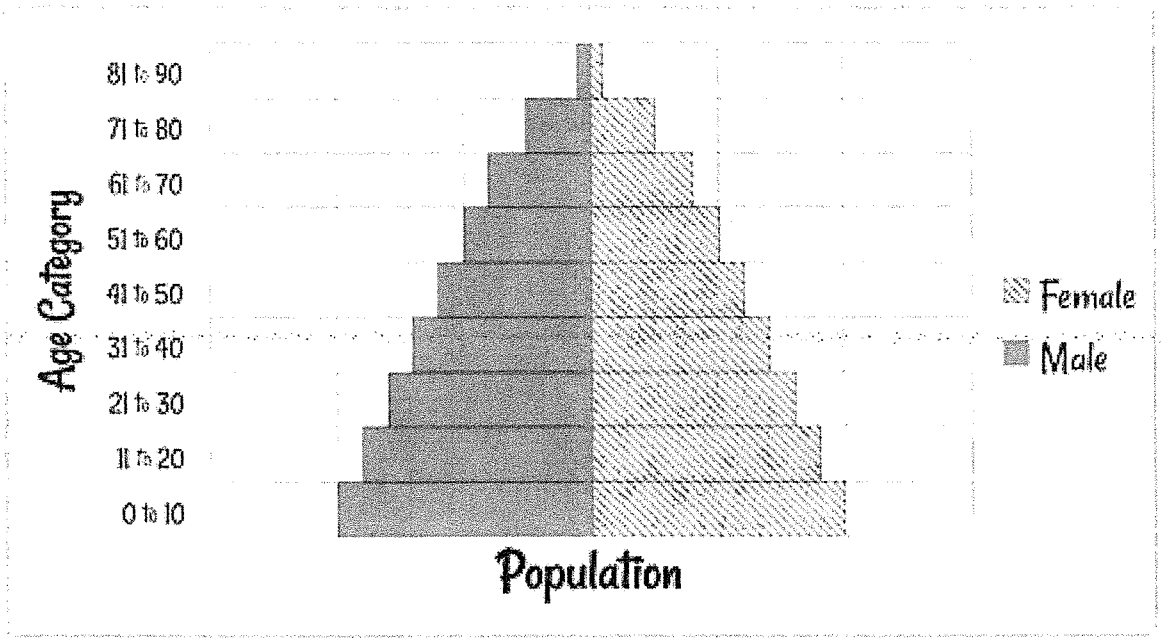
i) birth rate?

Decreasing 0-10 age group smaller than others

ii) death rate?

Low - near vertical sides

Look at the population pyramid below for a different population.



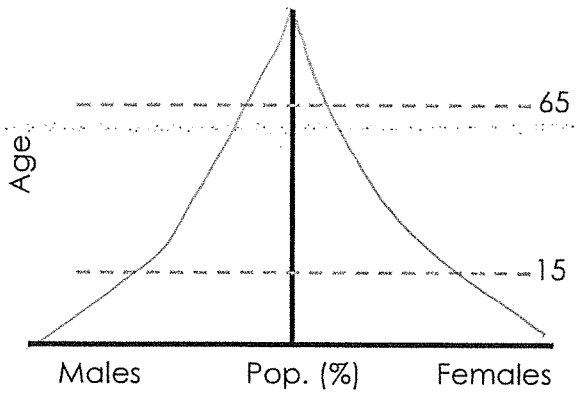
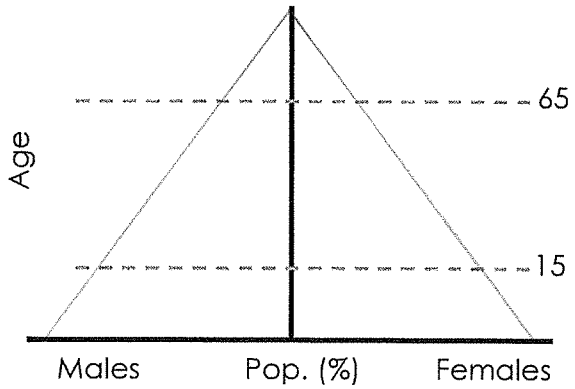
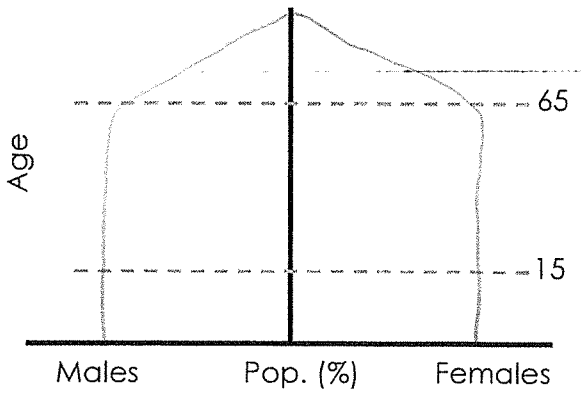
c) Compare this population with the one presented in question 1 a)

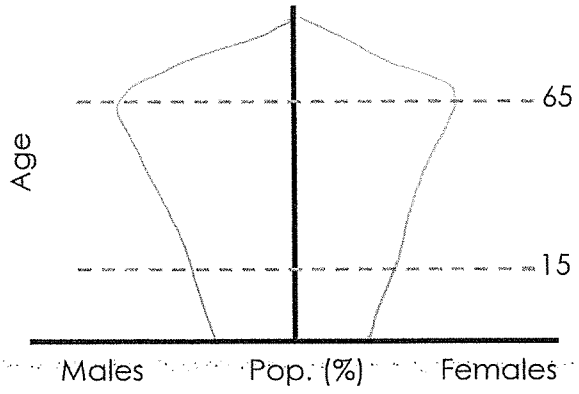
Previous one MEDC - low birth rate, low death rate, a declining population in stage 4-5 of DTM.

This pyramid represents a LEDC, higher birth rate and higher death rate (steep sides of pyramid). Stage 2-3 of DTM.

The Demographic Transition Model and Age/Sex Pyramids

1. Complete table below to summarize the demographic transition model. **Briefly explain** the changes in birth rate, death rate, and population:

Stage 1: High stationary Birth rate: High Death rate High Population change: stable	Population pyramid: 
Stage 2: Early expanding Birth rate: high Death rate medium Population change: Increasing	Population pyramid: 
Stage 3: Late Expanding Birth rate: high Death rate low Population change: increasing	Population pyramid: 

Stage 4: Low stationary	Population pyramid:
Birth rate: lower Death rate lower Population change: stable	

2. The original demographic transition model had only four stages more recently a fifth stage has been proposed.

Summarise the fifth stage of the demographic transition model.

Note: there is more than one possible answer as different suggestions exist as to what the fifth stage is. If you use further research, remember to cite your source.

Declining (MEDCs) - population may not be replaced as fertility rate is low. Problem of aging work force

3. Discuss the limitations and criticisms of the demographic transition model.

As a model the DTM explains change in some countries but not others.
China and Brazil have passed through the stages very quickly
Some sub-saharan countries or those affected by war or civil unrest do not follow the model.
It has been criticized as extrapolating the European model world wide
Useful diagram as it displays visually the complex pattern of changes in birth rate, death rate, natural increase, natural decrease and population growth rates.

Factors influencing population changes

1. Explain how the following factors influence the average family size of a nation:

Infant/childhood mortality rates

high infant/childhood mortality rates will cause people to have more children to ensure they can survive to adulthood.

The need for care-giving in old age

If parents need to be cared for by family members they will have more children as an insurance policy for their old age.

Children as workers

In agricultural societies people will have more children to provide the manual labour needed.

Status of women

Fertility rates remain high when women's status is low. When women have access to education family size decreases

Availabililty and cost of contraception

If contraception is available and affordable women will have fewer children

2. Explain how the following measures can act to reduce family size:

Education

If women go to high school or university they often delay having children until 20s or even 30s

Make contraceptives available

If contraception is made available couples can choose to stop having children after a certain number.

Improved health care

If children are more likely to reach adulthood (due to better medical care) couples will decide to have fewer children.

3. Using the bubble diagrams below, summarise the national and international policies that can be used to reduce and increase population growth rates.