



HUMAN POPULATION WORKSHEET

Estimated Human Population Size

Year	Population in Millions
1	170
400	190
800	220
1000	265
1200	360
1400	350
1600	545
1800	900
1850	1210
1900	1625
1950	2556
2000	6060
2009	6787
2025*	7957

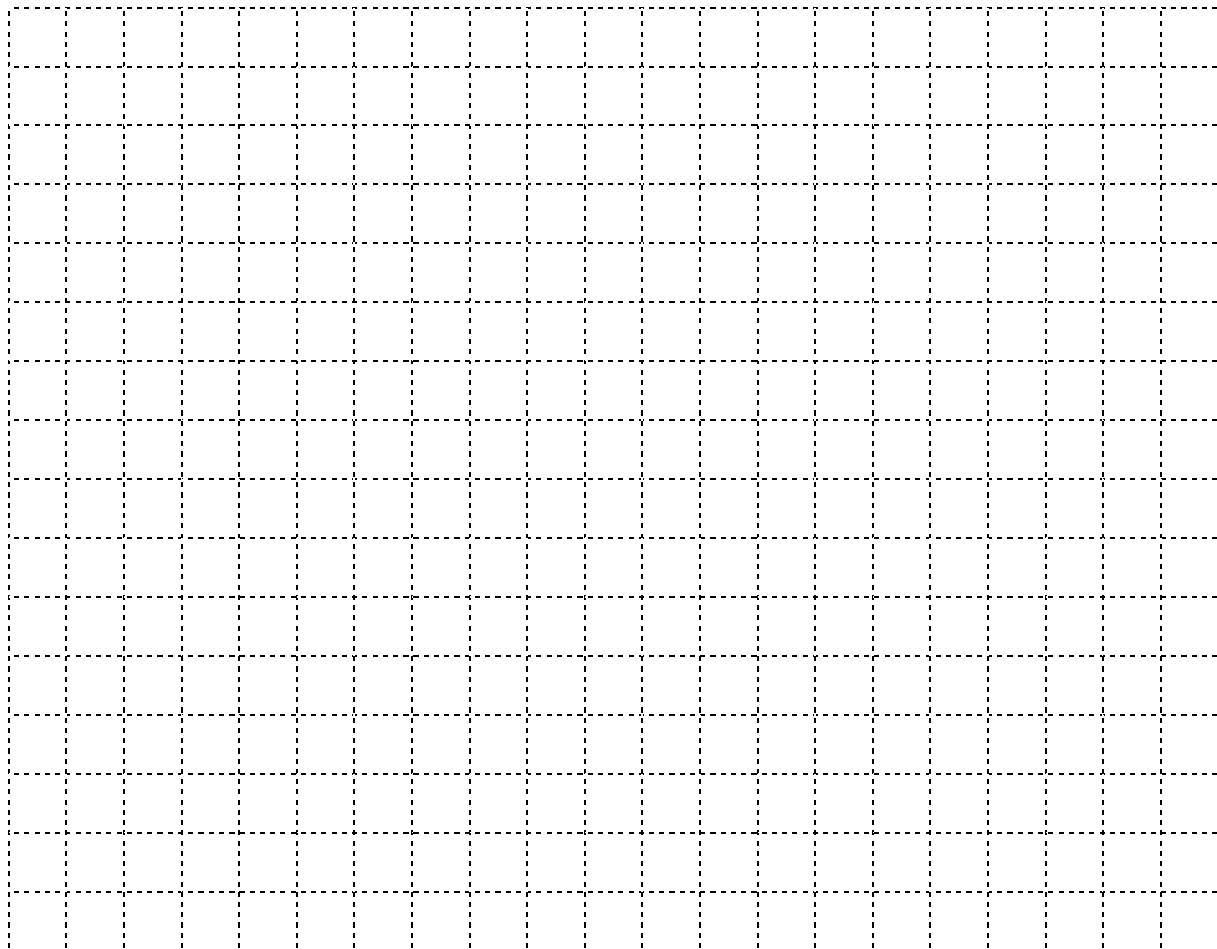
1. In the space at the bottom of this page graph the Human Population (in millions) over Time (Year).

2. Add a dashed line of your projection for the size of the human population through the year 2100.

3. What reasons do you have for your projection?

* Projected by the Population Reference Bureau

8000



0

0

2100

Logarithmic Graph of Human Population Growth History

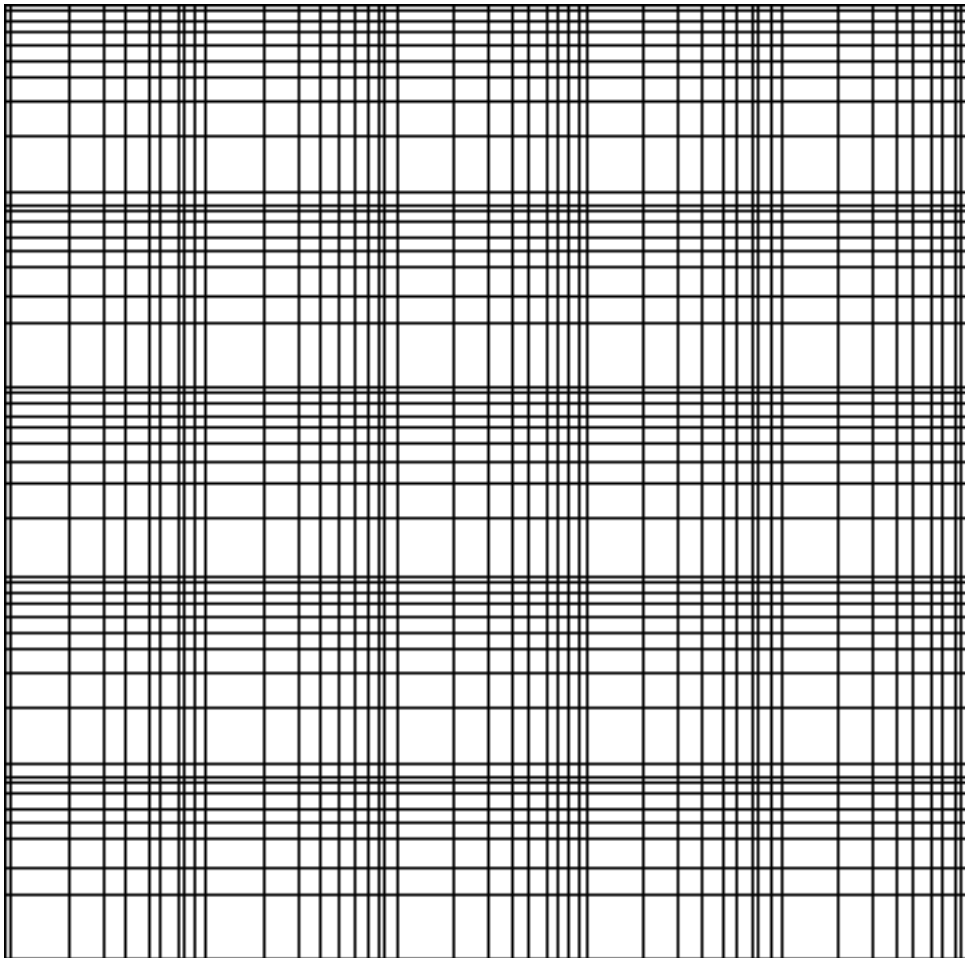
Years Before Present	Population in Millions
100,000	0.2
70,000	1
50,000	1.3
25,000	1.8
12,000	2
10,000	5
4000	27
3000	50
2000	170
1500	190
1010	265
510	500
360	600
210	900
110	1625
60	2556
10	6060
1	6787

1. In the space at the bottom of this page graph the Human Population (in millions) over Time (Year before present).

2. Select a color to highlight on your graph between 10,000 and 100,000 years ago. Label this tool-making.

3. Select a color to highlight on your graph between 200 and 10,000 years ago. Label this agriculture.

4. Select a color to highlight on your graph between 1 and 200 years ago. Label this industrialization.



Human Population Growth: Doubling Time

Introduction:

Birth and death rates determine the rate of population growth. If the birth and death rates are similar, a population experiences little or no growth. When the birth rate far exceeds the death rate, the population soars. These rates are expressed as the number of births or deaths for every 1,000 people in a given year. For instance, in 2007 the world's birth rate was 21 per 1,000 and the death rate was 9 per 1,000. Using the formulas below, one can determine the world's annual growth rate and the number of years it will take the population to double if the growth rate remains constant.

$$\text{Intrinsic rate of natural increase} = (\text{birth rate} - \text{death rate}) / 10 = (21 - 9) / 10 = 1.2\%$$

$$\text{Doubling Time (in years)} = 70 / (\text{rate of increase}) = 70 / 1.2 = 58.3 \text{ years}$$

(NOTE: 70 is the approximate equivalent of 100 times the natural log of 2.)

Using the table below, determine the percentage of annual increase and the population doubling times for each country.

$$\text{Percent annual natural increase} = \frac{(\text{birth rate}) - (\text{death rate})}{10}$$

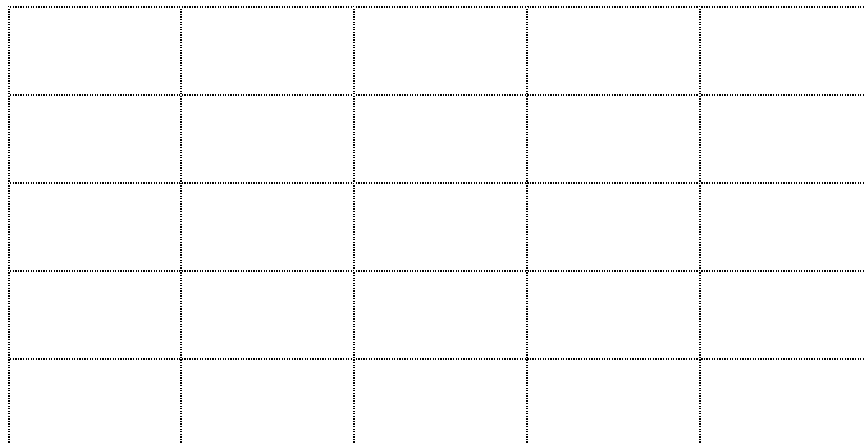
$$\text{Doubling time (in years)} = \frac{70}{\text{rate of increase}}$$

Country	Birth Rate (2007)	Death Rate (2007)	Doubling Time
United States	14 per 1000	8 per 1000	
Kenya	40 per 1000	12 per 1000	
Mexico	21 per 1000	5 per 1000	
India	24 per 1000	8 per 1000	
China	12 per 1000	7 per 1000	
Japan	9 per 1000	9 per 1000	
Germany	8 per 1000	10 per 1000	
Russia	10 per 1000	15 per 1000	
World	21 per 1000	9 per 1000	

Women's Empowerment and Fertility Rates (data from nationmaster.com)

Construct a Scatter Plot of the data below. Use as much as the graph as possible.

Country	Women's average age at first marriage	Total fertility rate
Argentina	23.3	2.4
Brazil	26.0	1.9
Dominican Republic	19.0	2.9
Ethiopia	16.5	5.4
Norway	28.9	1.8
Indonesia	19.5	2.4
Iraq	20.0	4.3
Japan	27.3	1.2
Mali	16.5	6.6
Australia	28	1.8
Niger	15.6	7.1
Pakistan	21.6	3.5
Greece	28.6	1.4
United States	25.1	2.1



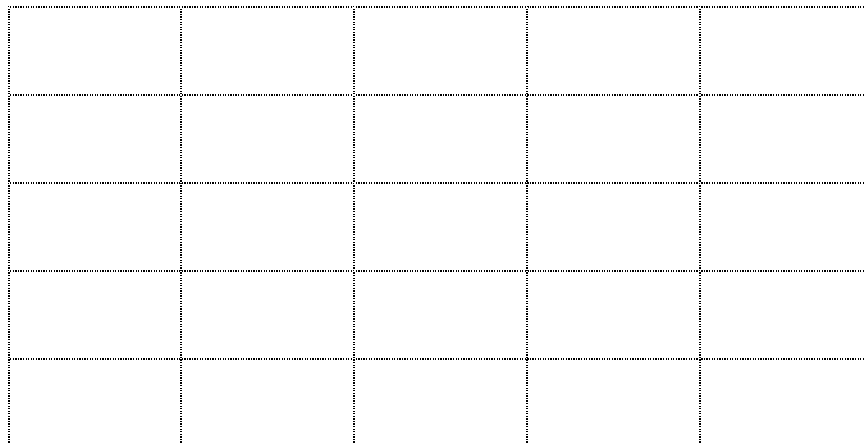
- 1. What is the effect of age of marriage on fertility rate?**

- 2. What could this mean if we want to decrease human population?**

Women's Empowerment and Fertility Rates (data from nationmaster.com)

Construct a Scatter Plot of the data below. Use as much as the graph as possible.

Country	Women's literacy rate	Total fertility rate
Argentina	97.1	2.4
Brazil	88.8	1.9
Dominican Republic	84.8	2.9
Ethiopia	35.1	5.4
Norway	99	1.8
Indonesia	86.8	2.4
Iraq	24.4	4.3
Japan	99	1.2
Mali	39.6	6.6
Australia	99	1.8
Niger	15.1	7.1
Pakistan	36	3.5
Greece	96.5	1.4
United States	99	2.1



1. What is the effect of women's literacy rates on fertility rate?

2. Why do think this correlation exists?

Per Capita Income and Fertility Rates (data from nationmaster.com)

Construct a Scatter Plot of the data below. Use as much as the graph as possible.

Country	Per Capita GNI PPP (U.S. \$)	Total fertility rate
Argentina	4,567	2.4
Brazil	8,230	1.9
Dominican Republic	3,110	2.9
Ethiopia	156	5.4
Norway	64,270	1.8
Indonesia	1,261	2.4
Iraq	2,628	4.3
Japan	36,325	1.2
Mali	375	6.6
Australia	34,671	1.8
Niger	242	7.1
Pakistan	695	3.5
Greece	19,907	1.4
United States	41,997	2.1



1. What is the effect of poverty on fertility rate?

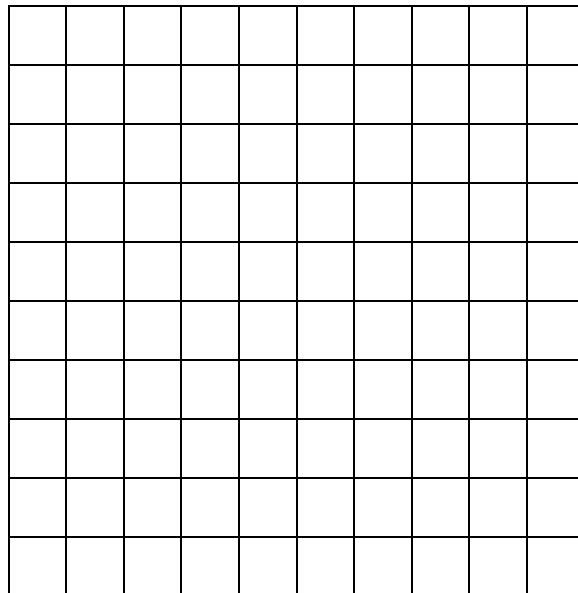
2. Why do think this correlation exists?

Ecological Footprints (data from nationmaster.com)

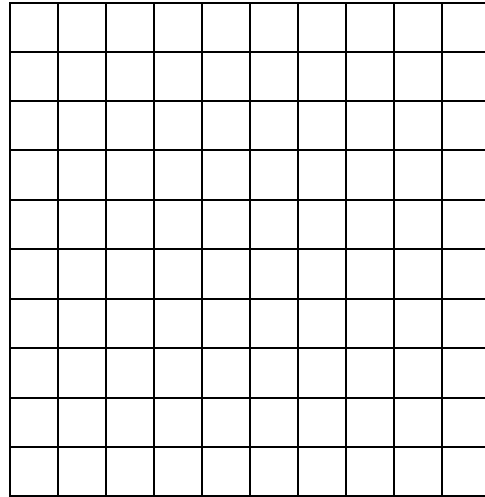
1. Calculate the total impact (national ecological footprint) for each country.

Nation	Population (millions of people)	Affluence (per capita income, in GNI PPP)	Personal Impact (per capita footprint, in ha/person)	Total Impact (national footprint, in millions of ha)
Brazil	186.8	8,230	2.1	392.3
Mali	12.3	375	0.9	
Japan	127.8	36,325	4.4	
Australia	21.0	34,671	8.5	
Greece	10.7	19,907	5.6	
Iraq	28.2	2,628	1.7	
United States	303.8	41,997	12.22	3,712.4

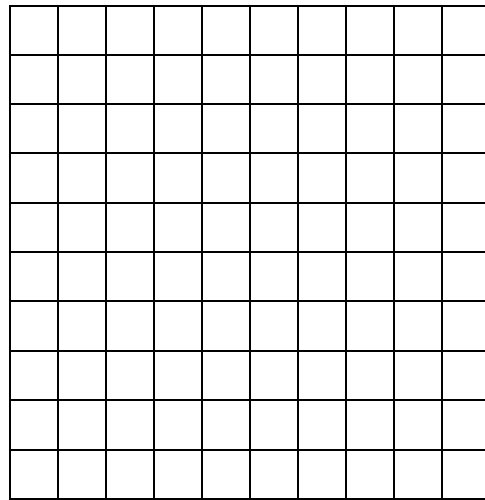
2. Draw a graph illustrating per capita impact (on the y axis) vs. affluence (on the x axis). What do the results show? Explain why the data look the way they do.



3. Draw a graph illustrating total impact in relation to population. What do the results suggest to you?



4. Draw a graph illustrating total impact in relation to affluence. What do the results suggest to you?



5. You have just used three of the four variables in the IPAT equation. Can you give one example of how the T (technology) variable might increase the total impact of the United States, and one example of how it might decrease the U.S. impact?

Human Population Growth: Power of the Pyramids

1. The table below represents the population in thousands of each age group within each gender for the United States in 2007. In order to construct a population pyramid you must first calculate the percentage of the population in each subgroup. For example, the United States's total population in 2007 was 301,140,000. The population of males up to age four was 10,635,000.

$$\frac{10,635,000}{301,140,000} = 0.035 \text{ or } 3.5\%$$

2. Complete these calculations for each age group in the table below.

Age Group	Male Population	Male Population %	Female Population	Female Population %
0-4	10,635		10,181	
5-9	10,156		9,718	
10-14	10,360		9,880	
15-19	11,115		10,551	
20-24	10,794		10,241	
25-29	10,570		10,242	
30-34	9,786		9,596	
35-39	10,558		10,491	
40-44	10,878		11,003	
45-49	11,280		11,567	
50-54	10,272		10,721	
55-59	8,855		9,424	
60-64	6,889		7,531	
65-69	5,027		5,758	
70-74	3,857		4,727	
75-79	3,084		4,208	
80+	3,891		7,298	

Using the U.S. population pyramid you constructed answer the following questions.

4. Is there a relatively large or a relatively small gender difference in the youngest age groups? Why is this the case?

5. Is there a relatively large or a relatively small gender difference in the oldest age groups? Why is this the case?

6. What is the cause of the bulge in the middle of the pyramid?

7. Go to the following website:

<http://www.census.gov/ipc/www/idb/pyramids.html>

Select the United States.

Select the Summary (2000, 2025, 2050) button.

Select the Medium graph size.

Click the "Submit Query" button.

Using these graphs answer the following questions.

8. What is the biggest change in the population comparing 2000 and 2050? Why is this?

9. Click the back button and select the country Kenya. Under "Type of output" select "select years". Medium graph size. Click the "Submit Query" button. Select the year 2007. Make a simple illustration of the shape of this graph below.

10. How does the population pyramid of Kenya compare to that of the United States in 2007 (your graph)?

11. Kenya is a developing country as is India. Find what the pyramid looks like for India in the year 2007. Sketch the shape of this graph of India below.

12. All developing countries share this shape of their population pyramid. Why is this?

13. As you have seen Germany and Russia are experiencing negative growth. Find what their graphs look like and sketch a representative graph below.

14. The United States, Japan, and China are experience growth but it is slow growth. Find what their graphs look like and sketch a representative graph below.

15. Make a hypothesis on what the World's population pyramid looks like by sketching it below. How did you come to this hypothesis?

In the hour and a half it has taken you to complete this worksheet 22,772 people have been born and 9,483 people have passed away.