2. A certain fictional country called Industria is tracking its population data. In 1855, the first year vital statistics were reported for the country, the population was 1.6 million, with a crude birth rate of 43 per 1,000. At that time the population of Industria was growing quite slowly, because of the high death rate of 41 per 1,000. In 1875 the population began to grow very rapidly as the birth rate remained at its 1855 level, while the crude death rate dropped dramatically to 20 per 1,000. Population growth continued to increase in the small country into the late 1800’s, even though birth rates began to decline slowly.

In 1895 the crude birth rate had dropped to 37, and the death rate to 12 per 1,000. In that year (1895) a complete census revealed that the population of Industria had grown to 2.5 million. By 1950 population growth gradually began to decline as the death rate remained at its 1895 level, while the birth rate continued to decline to 22 per 1,000. In 1977 vital statistics revealed that the death rate was 10 per 1,000, and that population growth had slowed even more to an annual rate of 0.4%. By 1990 Industria had reduced its birth rate to that of its now constant, low death rate, and the population transition was complete.

(a) On the axes below, plot the crude birth-rate data from 1855 to 1990. Now plot the crude death-rate data on the same axes. Clearly label the axes and the curves.

(b) What was the annual growth rate of Industria in 1950? What was the birth rate in Industria in 1977?

(c) Indicate TWO factors that might have accounted for the rapid decline in the death rate in Industria between 1855 and 1895. Indicate one specific reason why the birth rate might have been so high in 1855 and was so slow to decrease between 1855 and 1950.

(d) Determine what the population size of Industria would have been in 1951 if the population had continued to grow at the annual rate of growth recorded for Industria in 1895.

GO ON TO THE NEXT PAGE.
B) Assuming no immigration or emigration occurred, pop. growth rate would be \( \frac{\text{births - deaths}}{1000 \text{ people}} \times 100 \) (so it is expressed as a percent).

\[
\frac{22 \text{ people} - 12 \text{ people}}{1000 \text{ people}} \times 100 = \frac{10}{1000} \times 100 = \frac{10}{10} = 1\%
\]

The birth rate in 1977 was \( \frac{14 \text{ babies}}{1000 \text{ people}} \times 100 = 1.4 \).

Multiplying both sides by 10, \( X - \text{deaths} = 4 \). The number of deaths in 1977 was 10, so \( X = 4 + 10 = 14 \). The birth rate was 14 babies / 1000 people.

c) One factor that could have accounted for the rapid decline in death rates would be an agricultural increase (something akin to a Green Revolution) that alleviated malnutrition and undernourishment. Another would be medical advances. Sterilizing or disinfecting hospitals, new medications, or new cures for old diseases would all reduce the death rate. The reason why birth rates are so high in 1850 is probably a high infant mortality rate. This meant women had to have lots of children just to insure survival.

The slow decline of birth rates can be attributed to this cultural mindset (have lots of babies), which isn’t easy to reject offhand (a demographic transition - death rates before birth).

d) The growth rate of 1895 (\( \frac{37 \text{ people} - 12 \text{ people}}{1000 \text{ people}} \times 100 = \frac{25}{10} = 2.5\% \) growth).

If the population was growing this rapidly, it would have doubled in less than 30 years (\( \frac{70}{2.5} = 28 \) years). During the period of 1951 - 1895 (56 years), the population would have doubled twice (\( \frac{56 \text{ years}}{28 \text{ years}} = 2 \)). The population increased from 2.5 million to 5 million and again to 10 million.

\[
2.5 \text{ million} \times 2 \times 2 = 10 \text{ million}
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(d) Determine what the population size of Industria would have been in 1951 if the population had continued to grow at the annual rate of growth recorded for Industria in 1985.

1895 = 2.5 million
1951 = 2.5 million

\[ n = \frac{2.5 \text{ million} \times 1.025^{55}}{2.5 \text{ million} + x} \]

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Visit apcentral.collegeboard.com (for AP professionals) and www.collegeboard.com/apstudents (for AP students and parents).
The annual growth rate of Indonesia in 1950 was 1.07%. The birth rate in Indonesia in 1977 was 3.0%. One factor that might have led to a dramatic decrease in death rates between 1955 and 1995 could have been increases in medical technology and distribution. For example, a vaccine for a harmful disease would dramatically reduce the mortality rate of that disease. Also, many countries can experience decreases in death rates if already known medical technology is successfully distributed to the population. Another factor that could have led to decreases in death rate could be an increase in crop yield. If Indonesia had a high mortality rate due to malnutrition, advances in agriculture would help feed all the countries hungry. This can be seen and applied today when compared the South Asian Green Revolution. Where advances in high-yield crops were developed to feed a growing and malnourished population.

One reason why the birth rate could have been so high in 1955 could be due to Indonesia's reliance on agricultural industry. If this were the case, as is in many developing countries, there would be a strong dependence on many children. In this type of country, it is often the mentality that the more hands that are available the more work that can be done in the fields. Because of this mentality, this mentality is often very strong in many countries and is part of tradition, therefore, it would take several decades to educate people.
of the benefits of having less children. Also as long as Industry is an agricultural country the people would have several children. It wouldn't be until a transition in industry until families reduced their number of kids. The time for an Industrial Revolution to take place can take several decades to occur which is one reason why Industry's birth rates took so long to level off.

If Industry were to continue growing at its 1845 rate until 1921 its population would be approximately 4 million people.
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(d) Determine what the population size of Industria would have been in 1951 if the population had continued to grow at the annual rate of growth recorded for Industria in 1895.

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GO ON TO THE NEXT PAGE.
(b) The annual growth rate of Industria in 1950 was 2.2 people per 1,000 people (2.2/1000). The birth rate was 0.4%. (c) Two factors that might have accounted for the rapid decline in death rate between 1855 and 1895 are that food production may have become more efficient, thus more people were able to be fed and remain healthy. The other factor could be new advancements in healthcare/medicine, because if the people are able to build up resistance/prevent diseases then they can survive and maintain their population. The birth rate might have been so high in 1855, because since Industria was just developing they may not have had contraceptives, thus many of the younger population was having kids, but as time passed new advancements came along and slowed down birth rates. (d) If the population had continued to grow at the annual rate of growth recorded for 1895, then the population would be 4-5 times larger, because the population slowly decreased from 1895 on, but if it stayed the same population numbers would have dramatically increased.