



TEACHING HUMAN DIGNITY

Exploring China's One-Child Policy

with Exponential and Logarithmic Functions

TEACHER PACKET

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Developed in collaboration with John Brahier.

Limited Review of Exponential Functions and Equations

Preliminary Problem

There are 103 students in the senior high school class. They are planning a class trip to the zoo. Only 25 students can fit on a bus. How many buses does the principal need to arrange to get all of the students to the zoo?

- a) 3.12
- b) 4
- c) 4.12
- d) 5

correct answer: **5 (d)**

Fractions of buses do not have any contextual meaning. The purpose of this problem is to encourage students to consider the context of their computation before arriving at an answer.

PBS RetroReport: “The Population Bomb”

- ◆ What is the new kind of fear that began to spread in the 1960s?

Rampant population growth which will lead to mass starvation, mass pollution, social conflicts, crime, etc.

- ◆ Describe the sources of this new fear?

Paul Ehrlich and his book *Population Bomb* published in 1968

- ◆ What is zero population growth (ZPG)?

Zero population growth refers to a time at which the birth rate is equal to the death rate for a particular population such that the total population remains constant.

- ◆ What techniques did advocates push in order to decrease the birth rate?

Couples voluntarily reducing the number of children in a given marriage, compulsion from the government including taxes on people who have more children, blacklisting people, companies, and organizations impeding population control, responsibility prizes for childless marriages, luxury taxes on cribs, diapers, expensive toys, etc., sterility drugs put in water sources.

“Population Bomb: The Overpopulation Theory That Fell Flat” by Kit R. Roane and Sarah Weiser *Retro Report on PBS*, October 22, 2019, <https://www.retroreport.org/video/the-population-bomb/>

PBS RetroReport: “The Population Bomb” cont.

- ◆ Why did India’s elite think the poor were poor? What other reason does the speaker give that might be why the poor are poor?

India’s elite thought the poor were poor because they had too many children. The speaker suggests that the poor were poor because of an unfair and unequal economic system.

- ◆ According to the video, why aren’t insect models appropriate for modeling human populations?

Human beings are conscious beings and do all kinds of things to change our destiny.

- ◆ How has the shift towards urbanization and the rise of the green revolution impacted family size?

As families move into urban areas and away from farming, parents don’t need as many children to help with a farm. Focus has shifted to the education of children, and many families are naturally choosing to have fewer children. With advances in farming there is also more food available for children.

Review Problems

- Without a calculator, evaluate the following expressions.

a) $3^2 = 9$

c) $(1+3)^2$
 $(4)^2 = 16$

b) $2^4 = 16$

d) $2(1+1)^3$
 $2(2)^3$
 $2(8) = 16$

- With a calculator, evaluate the following expressions.

a) $2.51^3 = 15.8$

c) $563(1+0.015)^{2020-1979}$
 $536(1.015)^{2020-1979}$
 $563(1.015)^{41} = 1,036.6$

b) $(1+0.02)^{23}$
 $(1.02)^{23} = 16$

- ◆ What rounding would be expected if these were monetary units?

nearest hundredth

- ◆ What rounding would be expected if these were humans?

nearest integer

What is exponential growth?

Exponential growth is a type of growth in which the increase in size is directly proportional to the size of the current quantity.

- ◆ What is the structure of an exponential function?

$$y = a(b)^x$$

- ◆ What is a simple exponential function that can be used to model population growth?

$$P(t) = P_0(1+r)^{t-t_0}$$

Practice Problems

3. Without a calculator, evaluate the following expressions.

a) $4^3 = 64$

b) $2(3+1)^{5-3}$

$$2(4)^{5-3}$$

$$2(4)^2$$

$$2(16) = 32$$

4. The exponential population model for Anytown, USA is $P(t)=200(1+0.032)^{t-1947}$. Without performing any calculations, answer the following questions.

- a) Written as a percentage, what is the growth rate?

$$3.2\%$$

- b) What does the number 200 represent?

It was the population of Anytown, USA in 1947.

- c) What would $P(1975)$ represent?

It would represent the population of Anytown, USA in 1975.

5. In 1990, Whoville had a population of 2,000,000 residents. Its population growth rate was 0.45%.

a) Create an exponential function to model the population of Whoville.

$$P(2010) = 2,000,000(1 + 0.0045)^{2010 - 1990}$$

$$P(2010) = 2,000,000(1.0045)^{2010 - 1990}$$

$$P(2010) = 2,000,000(1.0045)^{20}$$

$$P(2010) = 2,187,907$$

b) Use your model to predict the population of Whoville in 2010.

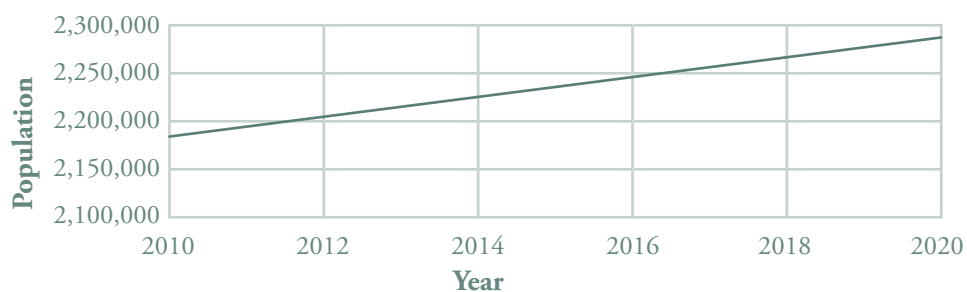
$$P(2010) = 2,187,907$$

c) If Whoville sustained this population growth rate, in what year would Whoville reach 2,250,000?

How did you find your answer?

Whoville's population would reach 2,250,000 in 2016. There are many ways to solve this problem, including with a graph, through algebra, and with a table.

Population vs. Year



Year	Population
2010	2,187,907
2011	2,197,752
2012	2,207,642
2013	2,217,577
2014	2,227,556
2015	2,237,580
2016	2,247,649
2017	2,257,763
2018	2,267,923
2019	2,278,129
2020	2,288,380

Review of Logarithmic Functions and Equations

- ◆ How do you undo the operation of addition?

subtraction

- ◆ What is a logarithm?

Simply put, a logarithm operates as the inverse operation of exponentiating.

A logarithm answers a simple question: What exponent (x) must I use with base b in order to produce y?

If $y=b^x$, then

$$x=\log_b(y)$$

6. Rewrite the following exponential equations as logarithmic equations.

a) $6=3.2 \quad x=\log_{3.2}(6)$

b) $14=5^x \quad x=\log_5(14)$

- ◆ How are logarithms used?

For the purposes of this exploration, logarithms will be used to algebraically solve exponential equations whose solutions are not apparent.

7. Solve the following equations for x. Round to the nearest tenth.

a) $56=4^x$

$$x=\log_4(56)$$

x=2.9

b) $31=4(5.1)^x$

$$\frac{31}{4} = (5.1)^x$$

$$x=\log_{5.1}\left(\frac{31}{4}\right)$$

x=1.3

c) $50=27(1.27)^{x-3}$

$$\frac{50}{27} = (1.27)^{x-3}$$

$$x-3=\log_{1.27}\left(\frac{50}{27}\right)$$

$$x=3+\log_{1.27}\left(\frac{50}{27}\right)$$

x=5.6

8. Go back to #5c, and solve it algebraically (using a logarithm).

a) $P(t)=2,000,000(1+0.0045)^{t-1990}$

$$2,250,000=2,000,000(1+0.0045)^{t-1990}$$

$$\frac{2,250,000}{2,000,000} = (1+0.0045)^{t-1990}$$

$$t-1990=\log_{1.0045}\left(\frac{2,250,000}{2,000,000}\right)$$

$$t=1990+\log_{1.0045}\left(\frac{2,250,000}{2,000,000}\right)$$

t= 2,016.23

◆ If your computation had yielded 2,019.84, how would you have reported your answer?

Any value between 2019 and 2020 simply refers to a time during that particular calendar year.

Therefore, a computed value of 2,019.84 would simply mean that the desired population (in this case, 2.25 million) was reached 84% of the way into the year 2019.

b) Hometown is a small town with a population of 3,500 in 2000. In that year, the growth rate was measured to be 2.4%. If that growth rate remains consistent, when would the population reach 10,000?

$$P(t)=3,500(1+0.024)^{t-2000}$$

$$10,000=3,500(1+0.024)^{t-2000}$$

$$\frac{10,000}{3,500} = (1+0.024)^{t-2000}$$

$$t-2000=\log_{1.024}\left(\frac{10,000}{3,500}\right)$$

$$t=2000+\log_{1.024}\left(\frac{10,000}{3,500}\right)$$

t= 2044.265

c) Explain how you arrived at your answer to 8b. This “explanation” can include an explanation of your computation as well as any rounding that may have happened.

A strict calculation will yield 2044.265. Students need to consider that the population will reach the specified level (10,000) about ¼ of the way into the year 2044. Any value between 2044 and 2045 simply refers to a time during that particular calendar year.

Here's How China's One-Child Policy Started in the First Place

- ◆ When did China implement the one-child policy?
officially in 1980
- ◆ What was China's one-child policy?
Couples of the ethnic Han majority could only have one child.
- ◆ What was the goal of China's one-child policy?
to bring the nation's total population below 1.2 billion by the end of the 20th century
- ◆ Why did China implement the one-child policy?
fear of food shortages and famine
- ◆ Give at least three examples of how the Chinese government enforced the one-child policy?
Couples could be fined for having more children without a permit; single-child homes received longer maternity leaves and other benefits; couples who complied were awarded a "Certificate of Honor for Single-Child Parents"; some women were forced to have abortions and/or forcibly sterilized.
- ◆ According to the article, was the one-child policy successful?
Yes, it seems that the policy was a success in that it helped turn China's economy into the second largest economy in the world.

Development of the One-Child Policy

The year is 1979, and you are a data analyst preparing a report regarding future projections of the Chinese population using an exponential model. Solve the following equations for x . Round to the nearest tenth.

9. You are using data from the previous year (1978) to make your projections. This data is found below.

Year	Population (total)	Population growth (annual %)	Birth rate, crude (per 1,000 people)	Fertility rate, total (births per woman)	Death rate, crude (per 1,000 people)
1978	956,165,000	1.34	18.25	2.94	6.25

Build an exponential model based on this data for China's population (P) as a function of the year (t).

$$P(t) = 956,165,000(1 + 0.0134)^{t-1978}$$

10. Use your model to estimate China's population in the following years:

a) 2000

$$P(2000) = 956,165,000(1 + 0.0134)^{2000-1978}$$

$$P(2000) = 956,165,000(1.0134)^{2000-1978}$$

$$P(2000) = 956,165,000(1.0134)^{22}$$

$$P(2000) = 1,281,482,387$$

b) 2040

$$P(2040) = 956,165,000(1 + 0.0134)^{2040-1978}$$

$$P(2040) = 956,165,000(1.0134)^{2040-1978}$$

$$P(2040) = 956,165,000(1.0134)^{62}$$

$$P(2040) = 2,182,471,794$$

c) 2080

$$P(2080) = 956,165,000(1 + 0.0134)^{2080-1978}$$

$$P(2080) = 956,165,000(1.0134)^{2080-1978}$$

$$P(2080) = 956,165,000(1.0134)^{102}$$

$$P(2080) = 3,716,932,188$$

11. The team of scientists and other analysts claimed that the population of China needed to be kept under 1.2 billion in order to avoid mass starvation and country-wide disaster. Use your model to predict the year in which the Chinese population would reach 1.2 billion.

$$1,200,000,000 = 956,165,000 (1 + 0.0134)^{t-1978}$$

$$\frac{1,200,000,000}{956,165,000} = (1.0134)^{t-1978}$$

$$t-1978 = \log_{1.0134} \left(\frac{1,200,000,000}{956,165,000} \right)$$

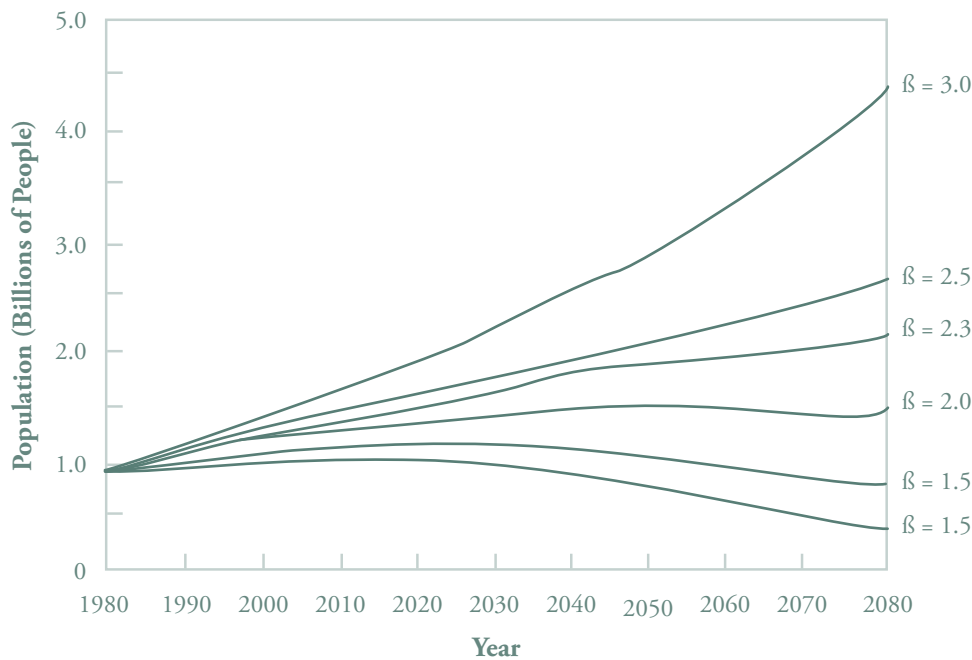
$$t = 1978 + \log_{1.0134} \left(\frac{1,200,000,000}{956,165,000} \right)$$

$$t = 1995.06$$

According to this model, the population would reach 1.2 billion in 1995.

12. Chinese scientists built complex models to make the same types of projections. Below is a graph of one of the projections used by the Chinese government before instituting its one-child policy.

In this graph, β represents the total fertility rate (number of births per woman).



Source: Song Jian Li
Guangyuan, "Renko fazhan
weni dingliang yanju"
("Quantitative research on
the problem of population
development") *Jingji yanjiu*
(*Economy Research*), No.
2, pp 60-67. Reproduced
in Greenhalgh, "Science,
Modernity, p.180.

a) Which of the values of β found on the graph most closely matches the total fertility rate from 1978?

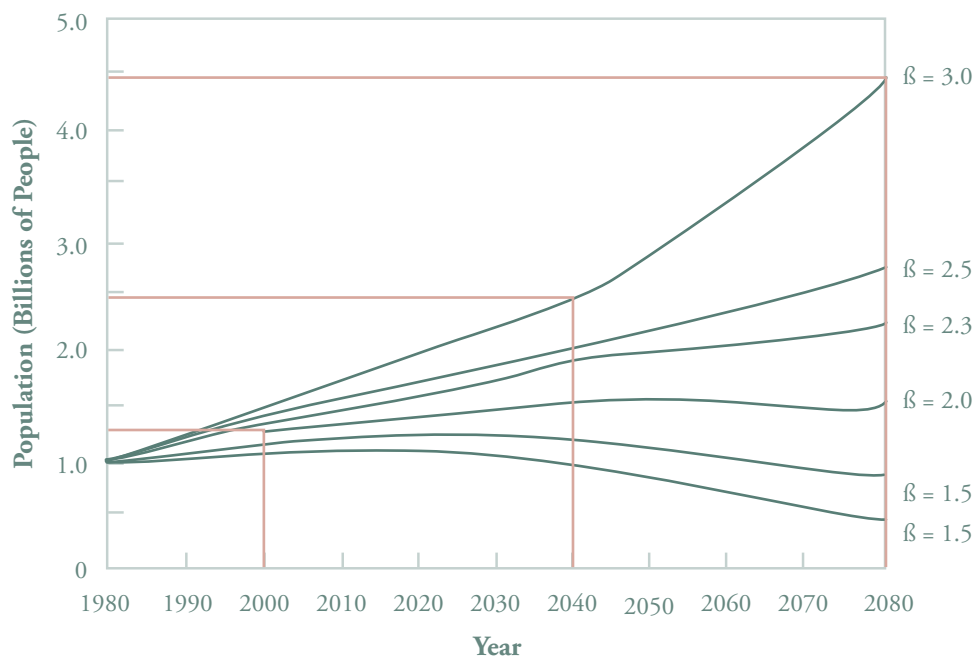
3.0 (In 1978, it was 2.94.) *This number can be found in the data table.*

b) Use the graph's projection for this β -value to make estimates of China's population in the following years:

1. 2000 **1.3 billion**

2. 2040 **2.4 billion**

3. 2080 **4.3 billion**



c) How close are the above estimates to your calculations from #10?

The estimates from #10 were very close but were slightly lower because the fertility rate in 1978 was slightly below 3.0 and the model used in the chart above does not appear to be a perfectly exponential curve.

13. The group of researchers that created the graph above believed the “ideal” population size of China in 2080 was between 650 million and 700 million people. Based on the projection in the graph shown above, what would the total fertility rate (number of births per woman) need to be in order to achieve this target population?

It would need to be between 1.0 and 1.5.

Moral Considerations of the One-Child Policy

Role of the Government

“In the Catholic tradition, government has a positive role because of its responsibility to serve the common good, provide a safety net for the vulnerable, and help overcome discrimination and ensure equal opportunity for all. Government has inescapable responsibilities toward those who are poor and vulnerable, to ensure their rights and defend their dignity. Government action is necessary to help overcome structures of injustice and misuse of power and to address problems beyond the reach of individual and community efforts. Government must act when these other institutions fall short in defending the weak and protecting human life and human rights.”

- ◆ How does this quote describe the role of the government?
- ◆ What are some keywords the bishops use to describe the role of the government?
- ◆ Based on this quote, can you brainstorm some concrete examples of things a government might be expected to do or not to do?

The teacher should highlight that the government has a positive role to play in society. At a minimum, students should identify the following Governments have a responsibility to:

Serve the common good (the flourishing of all people!)

- Protect basic rights such as access to education, food, water, housing, healthcare, freedom of religion, dignified work, a living wage, etc.
- Governments cannot promote the good of most individuals by sacrificing the good of others.

Care for the poor and vulnerable

Overcome structures of injustice

- Governments have the responsibility to protect people from injustices, discrimination, and abuse of powers.

Ensure equal opportunity for human flourishing

- The government has a responsibility to address problems that cannot be addressed by individuals or communities. Notice that this means the government does not control everything, but it does have the important role of maintaining the conditions for all human beings to flourish.

Protect human life and defend human dignity of all

Human Dignity

“Man [all human beings] alone is called to share, by knowledge and love, in God’s own life . . . This is the fundamental reason for his dignity. Being in the image of God, the human individual possesses the dignity of a person, who is not just something, but someone. . . He is capable of self-knowledge, of self-possession and of freely giving himself and entering into communion with other persons. Further, he is called by grace to a covenant with his Creator, to offer him a response of faith and love that no other creature can give in his stead.”

- ◆ What words or phrases catch your attention?

Give students an opportunity to sit a bit with the text and offer their thoughts

- ◆ How does this quote describe human beings?

There are many different points students may raise from reading the text. All of these points speak to the uniqueness of the human person, from the rest of the created world, and thus the dignity of the human person.

This quote starts off saying that “man” is called to share in God’s life. This sharing in God’s life is a sharing in the knowledge of God and a sharing of love between God and the human person.

The quote says that the human person is created in the image of God. We believe that God is one God and also is a communion of persons, Father, Son, and Holy Spirit. This is what we mean when we say we believe in the Trinity. As human persons created in the image of God, we are created to be in loving communion with one another and with God.

The human person is capable of self-knowledge, of knowing himself or herself. Humans can reflect on their actions, feelings, motivations, choices, etc. Given this unique ability to reflect on and know oneself, the human person is thus able to freely enter into relationship with other persons.

As the students start to name what it means to be a human person, the teacher should naturally lead to the next question that asks what it means to be a human person as compared to the rest of the created world (i.e., someone rather than something).

- ◆ What does it mean to be a *someone* rather than a *something*?

The teacher will want to guide students to the conclusion that human beings, no matter who they are, are never simply objects that can be used or disposed of – they are not things (like the chair students are sitting on or the desk they’re working on). They are distinct from mere objects and can never be used as means to an end.

- ◆ With whom are we called to be in relationship? What does this quote imply about what our relationships should look like?

The quote specifically names God and others. The teacher might ask students to offer suggestions about types of relationships they have (siblings, parents, friends, etc.). The quote doesn’t explicitly say what our relationships should look like. This gives students the opportunity to think critically about what is implied in the text. The teacher will want to lead students to recognize the following features of human relationships: love, self-gift, commitment, communion, respect, honor, care, etc.)

What Human Dignity Requires of Us

“If we really believe that we are temples of the Holy Spirit, that we are vessels of the Divine, and icons of the Trinity, that, when God the Father looks at us, he sees the face of his Son, Jesus, can you imagine how differently we would treat ourselves and other people? That is morality, is it not?”

These quotes transition from human dignity broadly to the ethical commitments that human dignity requires of us.

- ◆ What words or phrases catch your attention?

“**temples of the Holy Spirit**”

“**vessels of the Divine**”

“**Icons of the Trinity**”

“**Reflections of God**”

“**Created in the image and likeness of God**”

The teacher emphasizes that we have a unique value or worth as human beings because we are created in the image of God and called to share in God’s own life. Not only can we know and love God, BUT God loves each and every person and wants to bring every person to the fullness of life.

- ◆ What does this quote say about morality?

“**How we treat ourselves and other people.**”

“**It’s what we ought to do based on the truth about the human person (i.e., what is).**”

The teacher will want to emphasize that morality isn’t just a list of dos and don’ts, but is most fundamentally about our relationship with God, others, and ourselves. The teacher should conclude by saying something like:

If we really believe that the Holy Spirit dwells within us (and all human beings) and that we are vessels of the Divine, this will have important implications for how we treat ourselves and others. Related to the topic we’re studying, we can say that “if the pre-born baby in the womb, from the earliest moments of his or her conception, is a human person—an is that comes, not from the Catechism but from the biology textbook used by any sophomore in high school—then that baby’s life ought to be cherished and protected.”

“Whatever is opposed to life itself, such as any type of murder, genocide, abortion, euthanasia or wilful self-destruction, whatever violates the integrity of the human person, such as mutilation, torments inflicted on body or mind, attempts to coerce the will itself; whatever insults human dignity, such as subhuman living conditions, arbitrary imprisonment, deportation, slavery, prostitution, the selling of women and children; as well as disgraceful working conditions, where men are treated as mere tools for profit, rather than as free and responsible persons; all these things and others of their like are infamies indeed. They poison human society, but they do more harm to those who practice them than those who suffer from the injury. Moreover, they are supreme dishonor to the Creator.”

“The Dignity of a Human Person: A Catholic Doctrine” by Cardinal Timothy M. Dolan, April 4, 2016
<https://churchlifejournal.nd.edu/articles/the-dignity-of-a-human-person-a-catholic-doctrine/>

Gaudium et Spes 27

The ghost children: In the wake of China's one-child policy, a generation is lost

- ◆ According to this article, was China's one-child policy successful?

The authors claim that China's one-child policy was not successful because it did little to alter birth rates. Some 70 percent of the decrease in China's child-bearing rates actually came in the years before the one-child policy was launched, under previous efforts at curbing family size through less-severe restrictions, such as delaying marriage and second children. In addition, the article says that the economic benefit that was supposed to arise from women joining the workforce instead of having multiple children has been offset by other problems.

- ◆ What does it mean to be a ghost in China?

A ghost in China is a person who is not able to obtain a hukou, the Chinese registration document. With it, a person can secure a national-identification card, attend school, access basic medical services, find a place to live, board a bus or train, open a bank account, get a job, and secure a passport. Without it, each of those things becomes difficult and, for those with too little money or too few connections, often impossible. Usually any child after the first child is denied a hukou unless their parents can pay a very large fee.

- ◆ Name three things that happened to Mr. Feng and his family after his wife became pregnant with their second child.

Mr. Feng was harassed by coworkers about whether or not his wife was pregnant. He was asked to pledge in writing that his wife was not pregnant.

He was pressed by colleagues to have his wife tested at a hospital and if she was found pregnant she then would have been forced to have an abortion.

He was forced to sign a resignation letter from work.

Neighborhood authorities visited daily, pressing for Ms. Feng to obtain an abortion.

When their second child was born, Mr. Feng was fined 370,000 yuan – \$75,000 – to buy his son proper registration.

- ◆ By the time the article was written:

How many births did China claim the one-child policy avoided? 400 million

How many total abortions have happened? 336 million

How many total sterilizations have been completed? 196 million

How many children have been termed as "ghosts"? 13 million

"The ghost children: In the wake of China's one-child policy, a generation is lost" by Nathan Vanderklippe, *The Globe and Mail*, March 31, 2015, <https://www.theglobeandmail.com/news/world/the-ghost-children-in-the-wake-of-chinas-one-child-policy-a-generation-is-lost/article23454402/>.

TEACHING HUMAN DIGNITY

- ◆ Name two other benefits the article mentions about China's one-child policy.

The smaller population has been a positive factor in contributing to the well-being of the environment.

Economists claim the one-child policy has contributed greatly to the immense wealth of China.

- ◆ Why does Ms. Li, a ghost of China, not have friends?

Ms. Li's lack of status as a person in Chinese society has meant that parents don't want their kids who are educated to associate with her. In addition, the local neighborhood committee has kept Ms. Li under surveillance and made her appear as a troublemaker, which means that others don't want to associate with her.

The Teaching of the Church on Population

- ◆ On the global scene, how did nations view the Catholic Church and its role in the world population?

The world viewed the Catholic Church as a cause of increasing world population because the Church opposed contraception, sterilization, and abortion.

- ◆ What is the difference between population control and birth control?

The difference between the two lies at the level of control. A couple practices birth control while a country's government and international agencies practice population control.

- ◆ According to the developmentalist approach, what can the government do in terms of population? What decisions should be left to the family?

The government can propose legislation and programs that help families. The decision about the number of children and frequency of births should be left to the parents to decide.

- ◆ The document lists ten points. Pick one and explain why you think it is important.

"The ghost children: In the wake of China's one-child policy, a generation is lost" by Nathan Vanderklippe, *The Globe and Mail*, March 31, 2015, <https://www.theglobeandmail.com/news/world/the-ghost-children-in-the-wake-of-chinas-one-child-policy-a-generation-is-lost/article23454402/>.

Evaluating the One-Child Policy

14. One of the original goals of the scientists and data analysts was to keep China's population below 1.2 billion. They did not meet this goal. According to the table below, in what year did the Chinese population actually reach 1.2 billion?

During 1994

Year	Population (total)	Population growth (annual %)	Birth rate, crude (per 1,000 people)	Fertility rate, total (births per woman)	Death rate, crude (per 1,000 people)
1990	1,135,185,000	1.47	21.06	2.31	6.67
1991	1,150,780,000	1.36	19.68	2.14	6.70
1992	1,164,970,000	1.23	18.27	1.98	6.64
1993	1,178,440,000	1.15	18.09	1.84	6.64
1994	1,191,835,000	1.13	17.70	1.73	6.49
1995	1,204,855,000	1.09	17.12	1.66	6.57
1996	1,217,550,000	1.05	16.98	1.62	6.56
1997	1,230,075,000	1.02	16.57	1.61	6.51
1998	1,241,935,000	0.96	15.64	1.60	6.50
1999	1,252,735,000	0.87	14.64	1.60	6.46

Use this table for the next two questions

Year	Population growth (annual %)	Year	Population growth (annual %)	Year	Population growth (annual %)	Year	Population growth (annual %)	Year	Population growth (annual %)	Year	Population growth (annual %)
1960	1.83	1970	2.76	1980	1.47	1990	1.25	2000	0.79	2010	0.48
1961	-1.02	1971	2.75	1981	1.36	1991	1.28	2001	0.73	2011	0.48
1962	0.82	1972	2.46	1982	1.23	1992	1.47	2002	0.67	2012	0.49
1963	2.46	1973	2.28	1983	1.15	1993	1.44	2003	0.62	2013	0.49
1964	2.32	1974	2.07	1984	1.13	1994	1.31	2004	0.59	2014	0.51
1965	2.38	1975	1.77	1985	1.09	1995	1.36	2005	0.59	2015	0.51
1966	2.79	1976	1.55	1986	1.05	1996	1.49	2006	0.56	2016	0.54
1967	2.57	1977	1.36	1987	1.02	1997	1.60	2007	0.52	2017	0.56
1968	2.61	1978	1.34	1988	0.96	1998	1.61	2008	0.51	2018	0.46
1969	2.74	1979	1.33	1989	0.87	1999	1.53	2009	0.51		

15. How close was your prediction in #11 based on the 1978-data-informed model? What does this tell you about the average population growth rate between 1978 and the year in which the population reached 1.2 billion? Confirm this using the data from the table above.

The prediction was very close. This tells me that the average population growth rate between 1978 and 1994 was very similar to the population growth rate in 1978 (1.34). Finding a mean average of these growth rates confirms this.

16. China's population growth rate is in decline.

- a) Using “year” as the x-value and “population growth” as the y-value, create a linear function to model the population growth rate. You will need to use an external tool (Excel, Desmos, graphing calculator, etc.) to find a line of best fit to use for the linear model.

A trendline was created using all data from 1960 to 2018 in Excel. This trendline leads to the following model: $r(t) = -0.0325t + 65.939$

- b) Using this model, estimate the year in which China's growth rate will reach 0%.

The population growth rate will be zero in 2028. Indeed, most public models estimate that China will reach zero population growth in around 2030.

17. From what you have learned, did the one-child policy significantly limit the growth of Chinese population? Why or why not? You may use the table below to inform your response.

Year	Population (total)	Population growth (annual %)	Birth rate, crude (per 1,000 people)	Fertility rate, total (births per woman)	Death rate, crude (per 1,000 people)
1960	667,070,000	1.83	20.86	5.76	25.43
1965	715,185,000	2.38	37.88	6.39	9.50
1970	818,315,000	2.76	33.43	5.73	7.60
1975	916,395,000	1.77	23.01	3.56	7.32
1980	981,235,000	1.25	18.21	2.61	6.34
1985	1,051,040,000	1.36	21.04	2.65	6.78
1990	1,135,185,000	1.47	21.06	2.31	6.67
1995	1,204,855,000	1.09	17.12	1.66	6.57
2000	1,262,645,000	0.79	14.03	1.60	6.45
2005	1,303,720,000	0.59	12.40	1.61	6.51
2010	1,337,705,000	0.48	11.90	1.63	7.11
2015	1,371,220,000	0.51	12.07	1.67	7.11

A variety of answers may be appropriate here. It is important for the teacher to encourage students to simply consider the mathematical realities here. The horrors of the enforcement of the one-child policy will continue to be considered in the next question and the summative task. For this question, encourage students to consider the fact that population growth, birth rates, and fertility rates had already slowed significantly by the time the policy was instituted, suggesting that the policy may not have had a significant impact. (This is one possible theory.) Regardless, as students will note, the disastrous implications of the policy for so many Chinese citizens are clear.

Summative Task

Explain the following to someone who is not familiar with China's one-child policy.

- ◆ What the one-child policy was
- ◆ When and why the one-child policy was instituted (including the mathematical models)
- ◆ Why from a moral standpoint the one-child policy was highly problematic

Your creative explanation should take one of the following formats:

- ◆ Newspaper article
- ◆ Video of a “news report”
- ◆ A short podcast episode or YouTube video
- ◆ Any other format approved by your teacher

TEACHING HUMAN DIGNITY

This summative task is worth 30 points and will be graded as follows:

	Excellent	Good	Average	Poor	Missing	Total
Explanation	The explanation and historical context of the policy were accurately and clearly stated.	The explanation and historical context of the policy were accurate but not clearly stated.		The explanation and historical context of the policy were incorrectly stated.	The explanation and historical context of the policy were not addressed.	/2
Mathematics	The description of the mathematical models... <ul style="list-style-type: none"> demonstrated an understanding of the exponential model for population growth demonstrated an understanding of the relevant charts and tables was clearly stated was clearly explained All four of these were met.	The description of the mathematical models... <ul style="list-style-type: none"> demonstrated an understanding of the exponential model for population growth demonstrated an understanding of the relevant charts and tables was clearly stated was clearly explained Three of these four were met.	The description of the mathematical models... <ul style="list-style-type: none"> demonstrated an understanding of the exponential model for population growth demonstrated an understanding of the relevant charts and tables was clearly stated was clearly explained Two of these four were met.	The description of the mathematical models... <ul style="list-style-type: none"> demonstrated an understanding of the exponential model for population growth demonstrated an understanding of the relevant charts and tables was clearly stated was clearly explained One of these four was met.	No description of the relevant mathematical models was present.	/20
Theology	The description of the morally problematic nature of the one-child policy was... <ul style="list-style-type: none"> clearly stated accurate informed by Catholic Church teaching All three of these were met.	The description of the morally problematic nature of the one-child policy was... <ul style="list-style-type: none"> clearly stated accurate informed by Catholic Church teaching Two of these were met.	The description of the morally problematic nature of the one-child policy was... <ul style="list-style-type: none"> clearly stated accurate informed by Catholic Church teaching One of these three was met.	The description of the morally problematic nature of the one-child policy was... <ul style="list-style-type: none"> clearly stated accurate informed by Catholic Church teaching None of these three were met.	This submission did not address the morally problematic nature of the one-child policy.	/5
Presentation	The submission was a polished final product that utilized one of the creative formats and avoided significant grammatical errors.	The submission utilized one of the creative formats and avoided significant grammatical errors.	The submission utilized one of the creative formats but contained some significant grammatical errors.	The submission did not utilize one of the creative formats but avoided significant grammatical errors.	The submission did not utilize one of the creative formats and contained significant grammatical errors.	/3
						/30