

Name _____

Population Math Formulas with some Example Problems:

Formulas:

Population Density: Total Population/total Area

Birth Rate (as a %): Total births/total population X 100

Death Rate (as a %): Total deaths/total population X 100

Crude Birth Rate (CBR): Total births/total population X 1000

Crude Death Rate (CDR): Total deaths/total population X 1000

Crude Growth Rate: CBR - CDR

Population Change: Births – Deaths + Immigration – Emigration

Pop. Growth Rate(r%): Births – Deaths + Immigration – Emigration/population X 100

Doubling Time: 70/ % Growth rate = years to double

Percent change: new-old/old X 100

Natural Rate of Population Increase: births - deaths

POPULATION DENSITY

$$\left(\frac{\text{population}}{\text{area}} \right) = \text{Population Density}$$

for example: $\left(\frac{270,000,000 \text{ people}}{9,166,605 \text{ sq. km.}} \right) = 29 \text{ people per square kilometer}$

BIRTH OR DEATH RATES:

$$\left(\frac{\# \text{ of births or deaths per year}}{\text{Total population}} \right) = \text{Birth or Death Rate}$$

NOTE: to find Crude Birth/Death Rates, multiply the rate by 1,000

for example: $\left(\frac{23,452 \text{ births}}{942,721 \text{ people}} \right) = 0.025 = 2.5\% \text{ birth rate}$
25 = Crude Birth Rate

FINDING POPULATION GROWTH RATE (r):

(This does not include immigration or emigration)

$$\left(\frac{\text{crude births} - \text{crude deaths}}{10} \right) = r \%$$

for example: $\left(\frac{40 - 30}{10} \right) = 1.0\%$

OR

$$\left(\frac{\text{Population change}}{\text{Total population}} \right) \times 100 = r \%$$

FINDING THE DOUBLING TIME OF A POPULATION: THE RULE OF 70!!!

(This only applies if the population is growing exponentially)

Why 70? It is $100 \times \ln(2)$. What does that mean? Who cares...the math works!

$$\left(\frac{70\%}{r \text{ (in percent form)}} \right) \text{ or } \left(\frac{0.7}{r \text{ (in decimal form)}} \right) = \text{Doubling Time (dt) in years}$$

for example: $\left(\frac{70\%}{7\%} \right) \text{ or } \left(\frac{0.7}{0.07} \right) = 10 \text{ years}$

FINDING FUTURE POPULATION FROM GROWTH RATE:

$$\left(\text{initial population} \right) \times \left(\text{growth rate} \right)^{\text{years}} = \text{Final Population}$$

NOTE: a growth rate of 3% is expressed as 1.03; a growth rate of 0.25% is 1.0025

for example: $\left(468,843 \text{ people} \right) \times \left(1.03 \right)^{10 \text{ years}} = 630,085 \text{ people}$

Practice

1. One thousand two hundred deer are living on an island that is eight hundred square kilometers in size. What is the population density of the deer per square kilometer?

2. A city with 53,000 people has 900 births. What is the birth rate (as a percentage and per thousand)?

3. Another city experiences 12 deaths for each thousand people. What is the death rate (as a percentage and per thousand)?

4. A village of 23,000 people has 2,370 births and 370 deaths. What is the growth rate for this village?

5. A small country of 744,000 people has 44,000 immigrants and 12,000 emigrants. They also experience 15,000 deaths and 35,000 births. What is the growth rate of this small country?

6. How many years will it take for this country to double its population?

7. If a country were doubling its population every 35 years, what would its growth rate be?