MATHEMATICS · GRADES 10-12

Applications involving population and finance

Difficulty level: Advanced

Mathematics: Grades 10-12

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Overview of the concept

This is how you predict real growth, like a town's population over ten years or the balance of an investment. When an amount grows by a percentage each year, the growth itself keeps growing, so the total climbs faster than a straight line. That is why a small yearly rise can turn into a big change over a decade, whether it is people or money.



Rule

Compound growth: the amount after t years is $A = P \times (1 + r)^t$, where P is the starting amount and r is the growth rate as a decimal.

For decay, $A = P \times (1 - r)^t$.

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Worked examples

EXAMPLE 1

Q A population of 1000 grows by 3 percent each year. How many after 2 years?

SOLUTION

3 percent as a decimal is 0.03, so each year the population is multiplied by $1 + 0.03 = 1.03$

Write the model: 1000×1.03^t

Substitute $t = 2$: 1000×1.0609

So the population is 1060.9, about 1061

EXAMPLE 2

Q An investment of 2000 dollars grows at 5 percent compound interest for 3 years. What is the amount?

SOLUTION

5 percent as a decimal is 0.05, so each year the amount is multiplied by $1 + 0.05 = 1.05$

Write the model: 2000×1.05^t

Substitute $t = 3$: 2000×1.157625

So the amount is 2315.25 dollars

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Practice questions

1. A town of 1000 people grows by 10 percent each year. How many people live there after 2 years?

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2. A forest of 5000 trees loses 2 percent of its trees each year. How many trees are left after 2 years?

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3. You invest 1000 dollars at 4 percent compound interest. What is it worth after 2 years?

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4 A population grows by 6 percent each year. By what factor is it multiplied each year?

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5 A colony of 2000 bacteria grows by 5 percent each hour. How many bacteria are there after 1 hour?

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6 The same colony of 2000 bacteria grows by 5 percent each hour. About how many are there after 3 hours?

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7 You invest 10000 dollars at 3 percent compound interest for 1 year. What is it worth?

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8 A town of 4000 people loses 5 percent of its population in one year. How many people leave?

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9 An investment of 200 dollars earns 20 percent compound interest. What is it worth after 3 years?

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10 A city of 5000 people grows by 20 percent each year. After how many years will it first be over 8000?

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ANSWER KEY

1. 1210

2. 4802

3. 1081.60 dollars

4. 1.06

5. 2100

6. About 2315

7. 10300 dollars

8. 200

9. 345.60 dollars

10. 3

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