MATHEMATICS · GRADES 10-12

Exponential growth

Difficulty level: Advanced

Mathematics: Grades 10-12

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Overview of the concept

This is how something grows by a steady percentage (see Percentage change). Savings earning interest grow by the same share each year, and bacteria in a dish double again and again. The growth starts slow and then takes off, which is why it surprises people. Knowing the pattern lets you see where it is heading before it gets there.



Rule

Exponential growth: the amount after t steps is A = starting amount × (growth factor)^t, where the growth factor is 1 plus the percentage gained each step.

So 100 growing by 5 percent each year is 100×1.05^t.

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Worked examples

EXAMPLE 1

Q A population of 100 grows by 5 percent each year. How many after 2 years?

SOLUTION

Write the model: 100×1.05^t

Substitute t = 2: $100 \times 1.05^2 = 100 \times 1.1025$

So the population is 110.25, about 110

EXAMPLE 2

Q A population of 500 grows by 10 percent each year. How many after 2 years?

SOLUTION

Write the model: 500×1.10^t

Substitute t = 2: $500 \times 1.10^2 = 500 \times 1.21 = 605$

So the population is 605

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Practice questions

1. A town of 200 people grows by 10 percent each year. How many people are there after 1 year?

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2. A town of 200 people grows by 10 percent each year. How many are there after 2 years?

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3. You put 100 dollars in a savings account that grows by 20 percent each year. What is the growth factor?

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4 A city has 1000 people. Each year the population grows by 5 percent. How many more people are there after 1 year?

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5 A city grows by 5 percent each year. After 2 years there are 1102.5 people. How many people were there at the start?

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6 You invest 500 dollars at 4 percent interest each year. How much interest is earned in the second year?

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7 A village grows by a factor of 1.25 each year. By what percentage does the population grow each year?

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8 A village has 400 people, and the population grows by 25 percent each year. After how many years will there be 625 people?

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9 **Which is worth more after 2 years: 800 dollars growing by 10 percent each year, or 1000 dollars growing by 5 percent each year?**

A 1000 dollars at 5 percent

B 800 dollars at 10 percent

C They are worth the same

D Cannot tell

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10 **A town of 250 people grows by 20 percent each year. How many people are added in the second year?**

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ANSWER KEY

1. 220

2. 242

3. 1.2

4. 50

5. 1000

6. 20.8

7. 25

8. 2

9. 1000 dollars at 5 percent

10. 60

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