

Exponential functions and the number e (informal)

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Practice problems

1. A population of cells starts with 20 cells and doubles every hour. Write the function $f(x)$ for the population after x hours and find the population after 5 hours.
2. If a value grows continuously at a rate of 100% per period, starting from 1 unit, what is the approximate value after 3 periods? Use $e \approx 2.718$.
3. Compare the values of $g(x) = x^3$ and $h(x) = 3^x$ when $x = 4$. Which one is larger and by how much?

Solutions

1. A population of cells starts with 20 cells and doubles every hour. Write the function $f(x)$ for the population after x hours and find the population after 5 hours.

- The starting amount is 20 and the growth factor is 2, so the function is $f(x) = 20 \times 2^x$.
- Substitute $x = 5$ into the function: $f(5) = 20 \times 2^5$.
- Calculate $2^5 = 32$.
- Multiply $20 \times 32 = 640$.

Answer: 640

2. If a value grows continuously at a rate of 100% per period, starting from 1 unit, what is the approximate value after 3 periods? Use $e \approx 2.718$.

- Continuous growth at 100% is modeled by the base e .
- The function is $f(t) = 1 \times e^t$.
- Substitute $t = 3$: $f(3) = e^3$.
- Calculate $2.718 \times 2.718 \times 2.718 \approx 20.079$.

Answer: 20.079

3. Compare the values of $g(x) = x^3$ and $h(x) = 3^x$ when $x = 4$. Which one is larger and by how much?

- Evaluate $g(4) = 4^3 = 4 \times 4 \times 4 = 64$.
- Evaluate $h(4) = 3^4 = 3 \times 3 \times 3 \times 3 = 81$.
- Compare the two: $81 > 64$.
- Find the difference: $81 - 64 = 17$.

Answer: $h(x)$ is larger by 17