ALBERT

Name _____ Date _____

Comparing Growth Worksheet

Algebra 1 · Common Core HSF-LE.A.3

> Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.

Practice

Builds the skill step by step.

1. At $x = 10$, which is greater: 2^x or $50x$?

   A. $50x$

   B. 2^x

   C. They are equal.

   D. You can't tell.

2. $f(x) = 3x + 10$ and $g(x) = 2^x$. At $x = 5$, how much greater is $g(x)$ than $f(x)$?

3. Which is greater for very large x: x^2 or 2^x?

   A. x^2

   B. They stay equal.

   C. 2^x

   D. It depends on the units.

4. What is $2^x - x^2$ at $x = 4$?

5. At $x = 5$, what is the greater of x^2 and 2^x?

6. Plan A pays 1,000 dollars a day. Plan B pays 1 cent on day 1 and doubles each day. Which pays more per day eventually?

   A. Plan A

   B. They pay the same forever.

   C. Neither

   D. Plan B

7. $f(x) = 100x$ and $g(x) = 2^x$. At $x = 10$, how much greater is $g(x)$?

8. "An exponential function eventually exceeds a linear one" means what?

   A. For all large enough x, the exponential function is greater.

   B. The exponential is always greater.

   C. They cross only at $x = 0$.

   D. The linear function is never greater.

9. What is the smallest positive whole number x for which 2^x is greater than $10x$?

10. What is the smallest whole number x greater than 3 for which 3^x is greater than x^3?

ALBERT

Name _____ Date _____

Comparing Growth Worksheet

Algebra 1 · Common Core HSF-LE.A.3

On Level

Grade-level practice.

1. What is the smallest whole number x greater than 4 for which 2^x is greater than x^2?

2. Use $1.1^{100} \approx 13{,}780.6$. At x = 100, which is greater: 1.1^x or 10x?

   A. 10x

   B. 1.1^x

   C. They are equal.

   D. You can't tell.

3. A penny-doubling plan pays 2^{n-1} cents on day n. On what day does the payment first exceed 1,000 cents?

4. Plan B pays $0.01 \cdot 2^{n-1}$ dollars on day n. Use $2^{19} = 524{,}288$. How much does it pay on day 20?

5. Explain why an exponentially increasing quantity eventually exceeds a linearly increasing one.

6. For how many of the whole numbers x = 0, 1, 2, 3, 4, 5, 6 is 2^x greater than x^2?

7. Which grows fastest for very large x?

   A. 1,000x

   B. x^5

   C. 1.01^x

   D. $x^2 + 1{,}000$

8. f(x) = 50x + 200 and g(x) = 3^x. What is the smallest whole number x for which g(x) is greater than f(x)?

9. How do the differences in a table of x^2 compare with those of 2^x?

   A. Both grow by 2.

   B. Both double.

   C. Neither changes.

   D. The differences of x^2 grow by 2 each time; the differences of 2^x double.

10. What is the smallest whole number $x \geq 2$ for which 2^x is greater than x^3?

Comparing Growth Worksheet

Algebra 1 · Common Core HSF-LE.A.3

Challenge

Multi-step and word problems that stretch it.

1. $2^{16} = 16^4 = 65{,}536$. What is the smallest whole number x greater than 16 for which 2^x is greater than x^4?

2. A linear plan pays $1000 + 500n$ dollars and an exponential plan pays $10 \cdot 2^n$ dollars. What is the smallest whole number n for which the exponential plan pays more?

3. Which is greater for extremely large x: x^{100} or 1.001^x?

   A. 1.001^x

   B. x^{100}

   C. They stay equal.

   D. You can't tell.

4. Plan A: $500 + 100t$ dollars. Plan B: $100(1.2)^t$ dollars. Use $1.2^{12} \approx 8.92$, $1.2^{14} \approx 12.84$, $1.2^{16} \approx 18.49$ and $1.2^{18} \approx 26.62$. Of t = 12, 14, 16 and 18, which is the first where Plan B is greater?

5. Use a table of x^2 and 2^x to explain which eventually grows larger and about where it passes.

6. Use $1.5^{20} \approx 3{,}325$. At $x = 20$, which is greater: x^2 or 1.5^x?

   A. x^2

   B. 1.5^x

   C. They are equal.

   D. You can't tell.

7. $a_n = 3n + 100$ and $b_n = 2^n$. What is the smallest whole number n for which b_n is greater than a_n?

8. What happens to $2^x \div x$ as x gets very large?

   A. It approaches 0.

   B. It approaches 2.

   C. It grows without bound.

   D. It stays at 1.

9. What is the smallest positive whole number x for which 3^x is greater than $100x^2$?

10. Which statement is true?

    A. A polynomial always beats an exponential.

    B. Linear functions eventually beat exponential ones.

    C. Exponential and quadratic functions grow at the same rate.

    D. An increasing exponential function eventually exceeds any polynomial function.