

Unit 2 (1.1) Alg2 – Bacteria and Exponential Growth – Student Notes

Key

Suppose we have a bacteria colony that starts with 1 bacterium, and the population of bacteria doubles every day.

Days	Bacteria
0	1
1	2
2	4
3	8
4	16
5	32
6	64

- How many days will it take for the bacteria population to reach 8?
3 days
- How many days will it take for the bacteria population to reach 256?
8 days
- How many days will it take for the bacteria population to reach 300?
between 8 and 9 days

Approximate the solution to the following equations.

1. $2^x = 100$

between
6 & 7

2. $3^x = 600$

between
5 & 6

3. $5^x = 500,000$

between
8 & 9

4. $7^x = 300$

between
2 & 3

5. $8^x = 100,000$

between
5 & 6

6. $10^x = 1,000$

3

7. Why do you suppose the NCAA chooses 64 teams for its annual basketball tournament?

Multiple / base of 2

8. How would you set up the tournament if only 48 teams were allowed to participate?

certain number of byes

Rules of Exponents Reminders (bases must be the same):

$$x^5 * x^7 = x^{5+7} = x^{12}$$

Add exponents when multiplying

$$\frac{x^{14}}{x^{10}} = x^{14-10} = x^4$$

Subtract exponents when dividing

$$x^0 = 1$$

Any base to the power of zero is equal to 1

When bases are the same, you can solve by using the exponents.

Examples:

1. $2^x = 32$

$$2^x = 2^5$$

$$x = 5$$

2. $2^{x-3} = 2^{2x+5}$

$$x-3 = 2x+5$$

$$-8 = x$$

3. $2^{x^2-3x} = 2^{-2}$

$$x^2 - 3x = -2$$

$$x^2 - 3x + 2 = 0$$

$$(x-2)(x-1) = 0$$

$$x=2, x=1$$

4. $2^{3x} \cdot 2^5 = 2^7$

$$3x+5 = 7$$

$$3x = 2$$

$$x = \frac{2}{3}$$

5. $2^{x^2-16} = 1$

$$2^{x^2-16} = 2^0$$

$$x^2 - 16 = 0$$

$$(x+4)(x-4) = 0$$

$$x=4, x=-4$$

6. $2^{x^2} = 2^{-2}$

$$x^2 = -2$$

$$x = \pm\sqrt{-2}$$

$$x = \pm i\sqrt{2}$$

7. $3^{2x} = 27$

$$3^{2x} = 3^3$$

$$2x = 3$$

$$x = \frac{3}{2}$$

8. $\frac{3^{x^2}}{3^{5x}} = 3^6$

$$x^2 - 5x = 6$$

$$x^2 - 5x - 6 = 0$$

$$(x-6)(x+1) = 0$$

$$x=6, x=-1$$

9. $\frac{2^{2x}}{2^{x+5}} = 1 = 2^0$

$$2x - (x+5) = 0$$

$$2x - x - 5 = 0$$

$$x = 5$$

10. $149^{x^2+3x} = 149^{28}$

$$x^2 + 3x = 28$$

$$x^2 + 3x - 28 = 0$$

$$(x+7)(x-4) = 0$$

$$x=-7, x=4$$

11. $7^{-28} = 2401^{x^2+2}$

$$7^{-28} = 7^{4(x^2+2)}$$

$$-28 = 4x^2 + 8$$

$$-36 = 4x^2$$

$$-9 = x^2$$

$$x = \pm 3i$$

12. $2^{7x-4} \cdot 2^{-2x} = 4^{4x-5}$

$$2^{7x-4} \cdot 2^{-2x} = 2^{2(4x-5)}$$

$$7x-4-2x = 8x-10$$

$$5x-4 = 8x-10$$

$$-3x = -6$$

$$x = 2$$

13. $15^{x^2} \cdot 15^{-50} = 1 = 15^0$

$$x^2 - 50 = 0$$

$$x^2 = 50$$

$$x = \pm\sqrt{50}$$

$$x = \pm 5\sqrt{2}$$

14. $256^x = 64^{x+5}$

$$4^{4x} = 4^{3(x+5)}$$

$$4x = 3x+15$$

$$x = 15$$

15. $\frac{11^{x^2}}{11^{2x+1}} = 11^7$

$$x^2 - 2x - 1 = 7$$

$$x^2 - 2x - 8 = 0$$

$$(x-4)(x+2) = 0$$

$$x=4, x=-2$$