Solving Exponential Equations

SAT Question:

Name:	Date:
Topic:	Class:

Main Ideas/Questions	Notes/Examples	
SOLVING EXPONENTIAL EQUATIONS	①	Use the properties of exponents to **SIMPLIFY** each side of the equation.
	②	Rewrite the equation so both sides have the **SAME BASE.**
	③	Drop the bases and **SET THE EXPONENTS EQUAL TO EACH OTHER.**

Type 1 – Equations with a Common Base

1. $2^{x+1} = 2^9$	**2.** $5^{4n+5} = 5^{n-7}$
3. $3^k \cdot 3^{k+2} = 3^{5k-1}$	**4.** $10^{-4} \cdot 10^9 = 10^{v+4} \cdot 10^{2v-11}$

Type 2 – Equations without a Common Base

5. $6^{2x-10} = 36$	**6.** $2^{p-7} = 8$
7. $7^{4x+11} = \frac{1}{7}$	**8.** $32 = 2^{2m-9}$
9. $27^{2x+6} = 3^{2x}$	**10.** $4^{y+2} = 16^{y-3}$

11. $125^{y} = 25$	**12.** $16^{3x} = 8^{x+2}$
13. $4^{3x} = 8^{x-1}$	**14.** $81^{2x+5} = \left(\frac{1}{3}\right)^{2x}$
15. $8^{2a-1} = 32^{2a+1}$	**16.** $27^{2x} = 243^{x-2}$
17. $64 = 4 \cdot 4^{4x}$	**18.** $9^{2x+4} \cdot 9^{2x} = \frac{1}{81}$
19. $\frac{1}{7} = 49^{x-5} \cdot 7^{x-9}$	**20.** $4^{2x} \cdot \frac{1}{16} = 4^{6x+18}$

Name: _____ **Unit 7:** Exponential & Logarithmic Functions

Date: _____ **Bell:** _____ **Homework 2:** Solving Exponential Equations

**** This is a 2-page document! ****

Directions: Solve each equation using a common base.

1. $9^{3x-7} = 9^{5-x}$	**2.** $2^{w+4} \cdot 2^{4w+6} = 2^{2w+1}$
3. $8^{6y+4} = 64$	**4.** $\frac{1}{5} = 5^{2c+3}$
5. $\frac{1}{27} = 3^{4m-1}$	**6.** $216 = 6^{2r-11}$
7. $2^{3k-1} \cdot 2^{5k-7} = 16$	**8.** $4^{n} \cdot 4^{2n-9} = 64$

9. $8^{x+2} = 4$	**10.** $125 = 25^{2h+1}$
11. $49^{p+1} = 343^{2p}$	**12.** $16^{r-2} = 64^{r+2}$
12. $27^{3n} = 81^{2n+1}$	**14.** $\left(\frac{1}{4}\right)^{2x} = 32^{4x-2}$
15. $16 \cdot 2^{6m} = 2^{3m-8}$	**16.** $\left(\frac{1}{9}\right)^{a} \cdot \left(\frac{1}{3}\right)^{a} = 3^{16-a}$
17. $256^{y} \cdot 16^{y-1} = 4^{2y-22}$	**18.** $36^{n-3} \cdot 216^{n} = 216^{2n+1}$

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Main Ideas/Questions	Notes/Examples
SOLVING EXPONENTIAL EQUATIONS	① Use the properties of exponents to **SIMPLIFY** each side of the equation.
	② Rewrite the equation so both sides have the **SAME BASE.**
	③ Drop the bases and **SET THE EXPONENTS EQUAL TO EACH OTHER.**

Type 1 – Equations with a Common Base

1. $2^{x+1} = 2^9$

$x+1=9$

$\boxed{x=8}$

2. $5^{4n+5} = 5^{n-7}$

$4n+5 = n-7$

$3n+5=-7$

$3n=-12$ $\boxed{n=-4}$

3. $3^k \cdot 3^{k+2} = 3^{5k-1}$

$k+k+2 = 5k-1$

$2k+2=5k-1$

$3=3k$ $\boxed{1=k}$

4. $10^{-4} \cdot 10^9 = 10^{v+4} \cdot 10^{2v-11}$

$-4+9 = v+4+2v-11$

$5 = 3v-7$

$12 = 3v$

$\boxed{4=v}$

Type 2 – Equations without a Common Base

5. $6^{2x-10} = 36$

$6^{2x-10} = 6^2$

$2x-10=2$

$2x=12$ $\boxed{x=6}$

6. $2^{p-7} = 8$

$2^{p-7} = 2^3$

$p-7=3$

$\boxed{p=10}$

7. $7^{4x+11} = \frac{1}{7}$

$7^{4x+11} = 7^{-1}$

$4x+11=-1$

$4x=-12$ $\boxed{x=-3}$

8. $32 = 2^{2m-9}$

$2^5 = 2^{2m-9}$

$5=2m-9$

$14=2m$ $\boxed{7=m}$

9. $27^{2x+6} = 3^{2x}$

$(3^3)^{2x+6} = 3^{2x}$

$6x+18 = 2x$

$18=-4x$

$\boxed{-9/2=x}$

10. $4^{y+2} = 16^{y-3}$

$4^{y+2} = (4^2)^{y-3}$

$y+2 = 2y-6$

$y+8=2y$ $\boxed{8=y}$

11. $125^{y} = 25$

$(5^3)^y = 5^2$

$3y = 2$

$\boxed{y = 2/3}$

12. $16^{3x} = 8^{x+2}$

$(2^4)^{3x} = (2^3)^{x+2}$

$12x = 3x + 6$

$9x = 6$

$\boxed{x = 2/3}$

13. $4^{3x} = 8^{x-1}$

$(2^2)^{3x} = (2^3)^{x-1}$

$6x = 3x - 3$

$3x = -3$

$\boxed{x = -1}$

14. $81^{2x+5} = \left(\frac{1}{3}\right)^{2x}$

$(3^4)^{2x+5} = (3^{-1})^{2x}$

$8x + 20 = -2x$

$20 = -10x$

$\boxed{-2 = x}$

15. $8^{2a-1} = 32^{2a+1}$

$(2^3)^{2a-1} = (2^5)^{2a+1}$

$6a - 3 = 10a + 5$

$-4a - 3 = 5$

$-4a = 8$

$\boxed{a = -2}$

16. $27^{2x} = 243^{x-2}$

$(3^3)^{2x} = (3^5)^{x-2}$

$6x = 5x - 10$

$\boxed{x = -10}$

17. $64 = 4 \cdot 4^{4x}$

$4^3 = 4^1 \cdot 4^{4x}$

$3 = 1 + 4x$

$2 = 4x$

$\boxed{1/2 = x}$

18. $9^{2x+4} \cdot 9^{2x} = \frac{1}{81}$

$9^{2x+4} \cdot 9^{2x} = 9^{-2}$

$2x + 4 + 2x = -2$

$4x = -6$

$\boxed{x = -3/2}$

19. $\frac{1}{7} = 49^{x-5} \cdot 7^{x-9}$

$7^{-1} = (7^2)^{x-5} \cdot 7^{x-9}$

$-1 = 2x - 10 + x - 9$

$-1 = 3x - 19$

$18 = 3x$

$\boxed{6 = x}$

20. $4^{2x} \cdot \frac{1}{16} = 4^{6x+18}$

$4^{2x} \cdot 4^{-2} = 4^{6x+18}$

$2x - 2 = 6x + 18$

$-4x - 2 = 18$

$-4x = 20$

$\boxed{x = -5}$

Name: _____ **Unit 7:** Exponential & Logarithmic Functions

Date: _____ **Bell:** _____ **Homework 2:** Solving Exponential Equations

**** This is a 2-page document! ****

Directions: Solve each equation using a common base.

1. $9^{3x-7} = 9^{5-x}$

$3x-7 = 5-x$

$4x-7=5$

$4x=12$

$\boxed{x=3}$

2. $2^{w+4} \cdot 2^{4w+6} = 2^{2w+1}$

$w+4+4w+6 = 2w+1$

$5w+10 = 2w+1$

$3w = -9$

$\boxed{w=-3}$

3. $8^{6y+4} = 64$

$8^{6y+4} = 8^2$

$6y+4=2$

$6y=-2$

$\boxed{y=-1/3}$

4. $\frac{1}{5} = 5^{2c+3}$

$5^{-1} = 5^{2c+3}$

$-1=2c+3$

$-4=2c$

$\boxed{-2=c}$

5. $\frac{1}{27} = 3^{4m-1}$

$3^{-3} = 3^{4m-1}$

$-3 = 4m-1$

$-2=4m$

$\boxed{-1/2=m}$

6. $216 = 6^{2r-11}$

$6^3 = 6^{2r-11}$

$3 = 2r-11$

$14=2r$

$\boxed{7=r}$

7. $2^{3k-1} \cdot 2^{5k-7} = 16$

$2^{3k-1} \cdot 2^{5k-7} = 2^4$

$3k-1+5k-7=4$

$8k-8=4$

$8k=12$

$\boxed{k=3/2}$

8. $4^n \cdot 4^{2n-9} = 64$

$4^n \cdot 4^{2n-9} = 4^3$

$n+2n-9 = 3$

$3n-9=3$

$3n=12$

$\boxed{n=4}$

9. $8^{x+2} = 4$

$(2^3)^{x+2} = 2^2$

$3x+6 = 2$

$3x = -4$

$\boxed{x = -4/3}$

10. $125 = 25^{2h+1}$

$5^3 = (5^2)^{2h+1}$

$3 = 4h+2$

$1 = 4h$

$\boxed{1/4 = h}$

11. $49^{p+1} = 343^{2p}$

$(7^2)^{p+1} = (7^3)^{2p}$

$2p+2 = 6p$

$2 = 4p$

$\boxed{1/2 = p}$

12. $16^{r-2} = 64^{r+2}$

$(4^2)^{r-2} = (4^3)^{r+2}$

$2r-4 = 3r+6$

$-4 = r+6$

$\boxed{-10 = r}$

12. $27^{3n} = 81^{2n+1}$

$(3^3)^{3n} = (3^4)^{2n+1}$

$9n = 8n+4$

$\boxed{n = 4}$

14. $\left(\frac{1}{4}\right)^{2x} = 32^{4x-2}$

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

$-4x = 20x-10$

$-24x = -10$

$\boxed{x = 5/12}$

15. $16 \cdot 2^{6m} = 2^{3m-8}$

$2^4 \cdot 2^{6m} = 2^{3m-8}$

$4+6m = 3m-8$

$3m = -12$

$\boxed{m = -4}$

16. $\left(\frac{1}{9}\right)^a \cdot \left(\frac{1}{3}\right)^a = 3^{16-a}$

$(3^{-2})^a \cdot (3^{-1})^a = 3^{16-a}$

$-2a - a = 16-a$

$-2a = 16$

$\boxed{a = -8}$

17. $256^y \cdot 16^{y-1} = 4^{2y-22}$

$(4^4)^y \cdot (4^2)^{y-1} = 4^{2y-22}$

$4y + 2y - 2 = 2y - 22$

$6y - 2 = 2y - 22$

$4y = -20$ $\boxed{y = -5}$

18. $36^{n-3} \cdot 216^n = 216^{2n+1}$

$(6^2)^{n-3} \cdot (6^3)^n = (6^3)^{2n+1}$

$2n - 6 + 3n = 6n+3$

$5n - 6 = 6n+3$

$\boxed{-9 = n}$