

## Solving Exponential Functions

Solve each equation:

1.  $4^x + 5 = 21$

$4^x = 16$

$4^x = 4^2$

$x = 2$

2.  $5^{x+1} = 25^{x-9}$

$5^{x+1} = (5^2)^{x-9}$

$x+1 = 2(x-9)$

$x+1 = 2x-18$

$1 = x-18$

$19 = x$

3.  $12^{2x-12} = 144$

$12^{2x-12} = 12^2$

$2x-12 = 2$

$2x = 14$

$x = 7$

4.  $3^{x-14} = \left(\frac{1}{3}\right)^{2x-1}$

$3^{x-14} = (3^{-1})^{2x-1}$

$x-14 = -2x+1$

$3x-14 = 1$

$3x = 15$

$x = 5$

5.  $4^{x+2} > 32^x$

$(2^2)^{x+2} > (2^5)^x$

$2(x+2) > 5(x)$

$2x+4 > 5x$

$4 > 3x$

$\frac{4}{3} > x$

$(-\infty, \frac{4}{3})$

6.  $81^{x-11} = 9^x$

$(9^2)^{x-11} = 9^x$

$2(x-11) = x$

$2x-22 = x$

$-22 = -x$

$22 = x$

7.  $4^{3x} = 8^{x+1}$

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

$2(3x) = 3(x+1)$

$6x = 3x+3$

$3x = 3$

$x = 1$

8.  $9^{x-5} = 27$

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

$2(x-5) = 3$

$2x-10 = 3$

$2x = 13$

$x = \frac{13}{2}$

9.  $100^{7x+1} < 10^{3x-2}$

$(10^2)^{7x+1} < 10^{3x-2}$

$2(7x+1) < 3x-2$

$14x+2 < 3x-2$

$11x+2 < -2$

$11x < -4$

$x < -4/11$

$(-\infty, -4/11)$

10.  $81^{3-x} = \left(\frac{1}{27}\right)^{5x-6}$

$(3^4)^{3-x} = (3^{-3})^{5x-6}$

$4(3-x) = -3(5x-6)$

$12-4x = -15x+18$

$12+11x = 18$

$11x = 6$

$x = \frac{6}{11}$

11.  $\left(\frac{1}{3}\right)^x - 9 = 18$

$\left(\frac{1}{3}\right)^x = 27$

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

$-1x = 3$

$x = -3$

12.  $27^{2x} \geq 3^{x-7}$

$(3^3)^{2x} \geq 3^{x-7}$

$6x \geq x-7$

$5x \geq -7$

$x \geq -7/5$

$[-7/5, \infty)$

13.  $16^{2x+4} = \left(\frac{1}{8}\right)^{x-8}$

$(2^4)^{2x+4} = (2^{-3})^{x-8}$

$4(2x+4) = -3(x-8)$

$8x+16 = -3x+24$

$11x+16 = 24$

$11x = 8$

$x = \frac{8}{11}$

14.  $7^{x+5} - 8 = 41$

$7^{x+5} = 49$

$7^{x+5} = 7^2$

$x+5 = 2$

$x = -3$

15.  $81^{2x} \leq 27^{x+5}$

$(3^4)^{2x} \leq (3^3)^{x+5}$

$4(2x) \leq 3(x+5)$

$8x \leq 3x+15$

$5x \leq 15$

$x \leq 3$

$(-\infty, 3]$