Homework 7.1

Rewrite each of the following expressions as a single base raised to a single power. Show your work.

1. $(5^2)^{x-3} \cdot 5^{3x-4}$

$= 5^{2x-6} \cdot 5^{3x-4}$

$= 5^{5x-10}$

2. $4^{2x-3} \cdot (2^3)^{2x+4}$

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

$= 2^{4x-6} \cdot 2^{6x+12}$

$= 2^{10x+6}$

3. $\frac{(3^3)^{x+2}}{9^{x-5}}$

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

$= \frac{3^{3x+6}}{3^{2x-10}}$

$= 3^{x+16}$

4. $\frac{4^{x-5} \cdot 8^{2x-4}}{2^{x+6}}$

$= \frac{2^{2(x-5)} \cdot 2^{3(2x-4)}}{2^{x+6}}$

$= \frac{2^{2x-10} \cdot 2^{6x-12}}{2^{x+6}}$

$= \frac{2^{8x-22}}{2^{x+6}}$

$= 2^{7x-28}$

5. $5^{12-2x} \cdot 25^{x-6}$

$= 5^{12-2x} \cdot (5^2)^{(x-6)}$

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

$= 5^0$

$= 1$

6. $\sqrt{125^{4-2x} \cdot 5^{2x+2}}$

$= \left[(5^3)^{4-2x} \cdot 5^{2x+2}\right]^{1/2}$

$= \left[5^{12-6x} \cdot 5^{2x+2}\right]^{1/2}$

$= \left[5^{-4x+14}\right]^{1/2}$

$= 5^{\frac{1}{2}(-4x+14)}$

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

Solve each of the following equations by first, rewriting each side of the equation as a single base raised to a single power. Then, set the exponents equal to each other and solving the equation for *x*. Remember, if this is not possible, you will need to solve the equation graphically on the calculator.

7. $9^{2x-4} = 27^{x-3}$

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

$3^{4x-8} = 3^{3x-9}$

$4x - 8 = 3x - 9$

$x - 8 = -9$

$x = -1$

8. $\frac{8^{2x+4}}{4^{x-3}} = 4^{x+5}$

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

$\frac{2^{6x+12}}{2^{2x-6}} = 2^{2x+10}$

$2^{4x+18} = 2^{2x+10}$

$4x + 18 = 2x + 10$

$2x + 18 = 10$

$2x = -8$

$x = -4$

For exercises 9 – 14, solve the exponential equations by rewriting each side of the equation as a power of the same base, if possible. If it is not possible to rewrite each side as a power of the same base, solve the equation using the graphing calculator.

9. $5^{4x+2} = 25^{x-8}$

$5^{4x+2} = (5^2)^{x-8}$

$5^{4x+2} = 5^{2x-16}$

$4x+2 = 2x-16$

$2x+2 = -16$

$2x = -18$

$x = -9$

10. $16^{3x-2} = 8^{5x}$

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

$2^{12x-8} = 2^{15x}$

$12x-8 = 15x$

$-8 = 3x$

$-\frac{8}{3} = x$

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

$(8^{-1})^{x+2} = (2^4)^{2-x}$

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

$2^{-3x-6} = 2^{8-4x}$

$-3x-6 = 8-4x$

$x-6 = 8$

$x = 14$

12. $\sqrt{\frac{8^{x-1}}{2^x}} = 32^{x+3}$

$\left[\frac{(2^3)^{x-1}}{2^x}\right]^{1/2} = (2^5)^{x+3}$

$\left[\frac{2^{3x-3}}{2^x}\right]^{1/2} = 2^{5x+15}$

$\left[2^{2x-3}\right]^{1/2} = 2^{5x+15}$

$2^{x-\frac{3}{2}} = 2^{5x+15}$

$x-\frac{3}{2} = 5x+15$

$2x-3 = 10x+30$

$-3 = 8x+30$

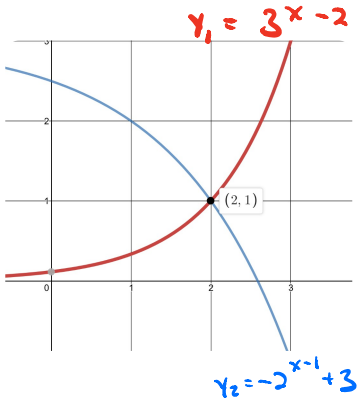
$-33 = 8x$

$\frac{-33}{8} = x$

13. $3^{x-2} = -2^{x-1} + 3$

Bases can't be equal integers

∴ Graph it.



$x = 2$

14. $3^x \cdot 9^{2x-3} = 27^{x+9}$

$3^x \cdot (3^2)^{2x-3} = (3^3)^{x+9}$

$3^x \cdot 3^{4x-6} = 3^{3x+27}$

$3^{5x-6} = 3^{3x+27}$

$5x-6 = 3x+27$

$2x-6 = 27$

$2x = 33$

$x = 33/2$