1. 2^{-1}

$$\frac{1}{2^1} = \frac{1}{2}$$

3. $(2)^{-3}$

$$\frac{1}{(2)^3} = \frac{1}{(2)(2)(2)} = \frac{1}{(4)(2)} = \frac{1}{8}$$

5. $(-2)^{-5}$

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

$$\frac{1}{(16)(-2)} = -\frac{1}{32}$$

7. $(-3)^{-2}$

$$\frac{1}{(-3)^2} = \frac{1}{(-3)(-3)} = \frac{1}{9}$$

9. $(-3)^{-4}$

$$\frac{1}{(-3)^4} = \frac{1}{(-3)(-3)(-3)(-3)} = \frac{1}{(9)(9)} = \frac{1}{81}$$

11. 2^{-2}

$$\frac{1}{2^2} = \frac{1}{(2)(2)} = \frac{1}{4}$$

13. -2^{-4}

$$\frac{1}{-2^4} = \frac{1}{(-2)(-2)(-2)(-2)} = \frac{1}{(4)(4)} = \frac{1}{16}$$

15. -3^{-1}

$$\frac{1}{-3^1} = -\frac{1}{3}$$

17. -3^{-3}

$$\frac{1}{-3^3} = \frac{1}{(-3)(-3)(-3)} = \frac{1}{(9)(-3)} = -\frac{1}{27}$$

19. $-2z^{-3}$

$$\frac{-2}{z^3} = -\frac{2}{z^3}$$

21. $-3x^{-2}$

$$-\frac{3}{x^2}$$

23. $-5x^{-3}$

$$-\frac{5}{x^3}$$

25.

$$(5x)^{-3} = \frac{1}{(5x)^3} = \frac{1}{(5)^3(x)^3} = \frac{1}{125x^3}$$

27. $(-7a)^{-2}$

$$\frac{1}{(-7a)^2} = \frac{1}{(-7)^2(a)^2} = \frac{1}{49a^2}$$

29. $(-4y)^{-3}$

$$\frac{1}{(-4y)^3} = \frac{1}{(-4)^3(y)^3} = -\frac{1}{64y^3}$$

31. $3^{-3} - 2^{-2}$

$$\frac{1}{3^3} - \frac{1}{2^2} = \frac{1}{(3)(3)(3)} - \frac{1}{(2)(2)} =$$

$$\frac{1}{(9)(3)} - \frac{1}{4} = \frac{1}{27} - \frac{1}{4}$$

$$\frac{1}{27} \cdot \frac{4}{4} - \frac{1}{4} \cdot \frac{27}{27} = \frac{4}{108} - \frac{27}{108}$$

$$-\frac{23}{108}$$

33. $(xy)^{-2}$

$$= \frac{1}{(xy)^2} = \frac{1}{(xy)(xy)} = \frac{1}{(x)(x)(y)(y)}$$

$$= \frac{1}{x^2y^2}$$

35.

$$\frac{20a^{-9}b^{-2}}{5a^{-3}b^4}$$

$$= \frac{20}{5} \cdot \frac{a^{-9}}{a^{-3}} \cdot \frac{b^{-2}}{b^4}$$

$$= 4 \cdot \frac{1}{a^9a^{-3}} \cdot \frac{1}{b^2b^4}$$

$$= 4 \cdot \frac{a^3}{a^9} \cdot \frac{1}{b^6} \quad = 4 \cdot \frac{1}{a^6} \cdot \frac{1}{b^6}$$

$$= \frac{4}{a^6b^6}$$

37. $\left(\frac{b}{a}\right)^{-1}$

$$\frac{b^{-1}}{a^{-1}} = \frac{1}{b \cdot a^{-1}} = \frac{a}{b}$$

39. $\left(\frac{3}{x}\right)^{-1}$

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

41. $\left(\frac{2a^{-3}c^{-4}}{b^{-5}c}\right)^{-3}$

$= \left(\frac{2^{-3}a^{9}c^{12}}{b^{15}c^{-3}}\right)$

$= \left(\frac{a^{9}c^{12}c^{3}}{2^{3}b^{15}}\right) = \left(\frac{a^{9}c^{15}}{8b^{15}}\right)$

43.

$\left(\frac{3x^{-7}y^{-2}}{9x^{-6}y^{-7}}\right)^{-3}$

$= \left(\frac{3^{-3}x^{21}y^{6}}{9^{-3}x^{18}y^{21}}\right)$

$= \left(\frac{(3 \cdot 3)^{3}x^{21}y^{6}}{3^{3}x^{18}y^{21}}\right)$

$= \left(\frac{3^{3}3^{3}x^{3}}{3^{3}y^{15}}\right) = \left(\frac{3^{3}x^{3}}{y^{15}}\right) = \left(\frac{27x^{3}}{y^{15}}\right)$

45. To make the statement true, we must add a negative sign to 2^{-2}, which is 1/4.

$-2^{-2} = -\frac{1}{2^{2}} = -\frac{1}{4}$

47. The important thing here, is that the parentheses make a big difference!
The statement would be true if there were no parentheses; that is, if we had $5t^{-1}$, then that would equal $\frac{5}{t}$!

Since we have $(5t)^{-1}$, this is really equal to $5^{-1}t^{-1}$, which is equal to $\frac{1}{5t}$.

49. Since x = -2, then

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

$= 4 - \frac{1}{4} = \frac{4}{1} \cdot \frac{4}{4} - \frac{1}{4} \cdot \frac{1}{1}$

$= \frac{16}{4} - \frac{1}{4} = \frac{15}{4}$

51.

$3^{2} = (3)(3) = 9$

$3^{-2} = \frac{1}{3^{2}} = \frac{1}{9}$

Since $3^{2} = 9$ and $3^{-2} = 1/9$, they are not the same value.

53. $a^{-3}a^{-7}$

$$\frac{1}{a^3}\cdot\frac{1}{a^7}=\frac{1}{a^3\cdot a^7}=\frac{1}{a^{3+7}}=\frac{1}{a^{10}}$$

55. $y^{-3}y^{3}$

$$= y^{(-3+3)} = y^0 = 1$$

or

$$y^{-3}y^{3} = \frac{1}{y^3}\cdot\frac{y^3}{1}=\frac{y^3}{y^3} = 1$$

57. $x^{-1}x^{-4}$

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

or

$$x^{-1}x^{-4} = \frac{1}{x^1}\cdot\frac{1}{x^4}=\frac{1}{x^{1+4}}=\frac{1}{x^5}$$

59. $d^{-1}d = \frac{1}{d}\cdot d = \frac{d}{d} = 1$

61.

$$\frac{-12x^7x^{-9}}{-6y^{-9}y^{-8}}$$

$$=\frac{-12}{-6}\cdot\frac{x^7x^{-9}}{y^{-9}y^{-8}}=\frac{2}{1}\cdot\frac{x^{7-9}}{y^{-9-8}}$$

$$=\frac{2x^{-2}}{y^{-17}}=\frac{2y^{17}}{x^2}$$

63.

$$-\frac{16c^{-8}c^{-1}}{-48d^5d^{-4}}=-\frac{16c^{-8}c^{-1}}{-(16\cdot 3)d^5d^{-4}}$$

$$=-\frac{1c^{-8}c^{-1}}{-3d^5d^{-4}}=-\frac{d^4}{-3d^5c^8c^1}=-\frac{1}{-3dc^8c^1}$$

$$-\frac{1}{-3dc^{8+1}}=-\frac{1}{-3dc9}$$

$$=\frac{1}{3c^9d}$$

65. Find 2 to the negative fourth power.

$$\Rightarrow 2^{-4} = \frac{1}{2^4} = \frac{1}{2 \cdot 2 \cdot 2 \cdot 2} = \frac{1}{4 \cdot 4} = \frac{1}{16}$$

67. Find 3 to the negative fourth power.

$$\Rightarrow 3^{-4} = \frac{1}{3^4} = \frac{1}{3 \cdot 3 \cdot 3 \cdot 3} = \frac{1}{9 \cdot 9} = \frac{1}{81}$$

69. Find 4 to the negative second power.

$$\Rightarrow 4^{-2} = \frac{1}{4^2} = \frac{1}{4 \cdot 4} = \frac{1}{16}$$