Solutions

1. Write as a single power. Express your answers with positive exponents.

a) $5(5^4)$ $= 5^{1+4} = 5^5$

b) $\dfrac{(-8)^4}{(-8)^5}$ $= (-8)^{4-5} = (-8)^{-1} = \left(-\frac{1}{8}\right)$

c) $(9^3)^6$ $= 9^{3(6)} = 9^{18}$

d) $\dfrac{3(3)^6}{3^5}$ $= 3^{1+6-5} = 3^2$

e) $\left(\frac{1}{10}\right)^6\left(\frac{1}{10}\right)^{-4}$ $= \left(\frac{1}{10}\right)^{6+(-4)} = \left(\frac{1}{10}\right)^2$

f) $\left(\dfrac{(7)^2}{(7)^4}\right)^{-1}$ $= \left(\dfrac{7^4}{7^2}\right)^1 = 7^{4-2} = 7^2$

2. Evaluate. Express answers in rational form.

a) $4^{-2} - 8^{-1}$

$= \left(\frac{1}{4}\right)^2 - \left(\frac{1}{8}\right)$

$= \frac{1}{16} - \frac{1}{8}$

$= \frac{1}{16} - \frac{2}{16} = -\frac{1}{16}$

c) $25^{-1} + 3(5^{-1})^2$

$= \frac{1}{25} + 3\left(\frac{1}{5}\right)^2$

$= \frac{1}{25} + 3\left(\frac{1}{25}\right)$

$= \frac{1}{25} + \frac{3}{25} = \frac{4}{25}$

b) $(4 + 8)^0 - 5^{-2}$

$= (12)^0 - \left(\frac{1}{5}\right)^2$

$= 1 - \frac{1}{25}$

$= \frac{25}{25} - \frac{1}{25} = \frac{24}{25}$

d) $\left(-\frac{1}{2}\right)^3 + 4^{-3}$

$= \left(-\frac{1}{8}\right) + \left(\frac{1}{4}\right)^3$

$= -\frac{1}{8} + \frac{1}{64}$

$= \frac{-8}{64} + \frac{1}{64} = \frac{-7}{64}$

3. Evaluate. Express answers in rational form.

a) $\left(\frac{4}{7}\right)^2$

$= \frac{4^2}{7^2}$

$= \frac{16}{49}$

c) $\left(\frac{-2}{3}\right)^{-3}$

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

$= \frac{(-3)^3}{(2)^3} = \frac{-27}{8}$

b) $\left(-\frac{2}{5}\right)^3$

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

$= \frac{-8}{125}$

d) $\frac{(-3)^{-2}}{(-3)^{-5}}$

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

$= (-3)^3$

$= -27$

4. What restrictions are there on the value of x in $x^{-\frac{1}{2}}$?
Are these restrictions different for $x^{\frac{1}{2}}$? Explain.

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

Restrictions are $x > 0$
If $= 0 \Rightarrow$ undefined
If $< 0 \Rightarrow$ cannot find $\sqrt{}$ of a negative

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

Restrictions are $x \geq 0$
we can include zero this time because
we can find $\sqrt{0}$.

5. Evaluate. Express answers in rational form.

a) $\left(\frac{49}{81}\right)^{\frac{1}{2}} = \frac{\sqrt{49}}{\sqrt{81}} = \frac{7}{9}$

b) $\sqrt{\frac{100}{121}} = \frac{\sqrt{100}}{\sqrt{121}} = \frac{10}{11}$

c) $\left(\frac{16}{9}\right)^{-0.5} = \left(\frac{9}{16}\right)^{0.5} = \frac{\sqrt{9}}{\sqrt{16}} = \frac{3}{4}$

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

e) $\sqrt[4]{(-9)^{-2}} = \left(\left(-\frac{1}{9}\right)^2\right)^{1/4} = \left(\frac{1}{81}\right)^{1/4} = \frac{1}{3}$

f) $\frac{-\sqrt[3]{512}}{\sqrt[5]{-1024}} = \frac{-8}{-4} = 2$

6. Copy and complete the table. Express values in the last column in rational form.

	Exponential Form	Radical Form	Evaluation of Expression
a)	$100^{\frac{1}{2}}$	$\sqrt{100}$	10
b)	$16^{0.25}$	$\sqrt[4]{16}$	2
c)	$121^{0.5}$	$\sqrt{121}$	11
d)	$(-27)^{\frac{5}{3}}$	$(\sqrt[3]{(-27)})^5$	-243
e)	$49^{2.5}$	$(\sqrt{49})^5$	16807
f)	$1024^{0.1}$	$\sqrt[10]{1024}$	2

7. Evaluate. Express answers to three decimals.

a) $-456^{\frac{4}{7}}$ $= -33.068$

c) $\left(\frac{5}{8}\right)^{\frac{5}{8}}$ $= 0.745$

b) $98^{0.75}$ $= 31.147$

d) $(\sqrt[5]{-1000})^3$ $= -63.096$

8. Evaluate $-8^{\frac{4}{3}}$ and $(-8)^{\frac{4}{3}}$. Explain the difference between the two.

$-8^{4/3} \Rightarrow -(\sqrt[3]{8})^4$ [Follow BEDMAS]

$= -(2)^4$ x by -1 is the LAST operation.

$= -16$

$(-8)^{4/3} \Rightarrow (\sqrt[3]{-8})^4$ The negative is PART of the base.

$= (-2)^4$

$= 16$

9. Simplify. Express answers with positive exponents.

a) $\dfrac{(x^{-3})x^5}{x^7}$ $= x^{-3+5-7} = x^{-5} = \dfrac{1}{x^5}$

b) $\dfrac{(n^{-4})n^{-6}}{(n^{-2})^7}$ $= n^{-4+(-6)-[(-2)(7)]} = n^{-10-(-14)} = n^4$

c) $\left(\dfrac{(y^2)^6}{y^9}\right)^{-2}$ $= y^{(2(6)-9)(-2)} = y^{(3)(-2)} = y^{-6} = \dfrac{1}{y^6}$

d) $\dfrac{(-2x^5)^3}{8x^{10}}$ $= \dfrac{(-2)^3}{8}x^{5(3)-10} = -x^5$

e) $(3a^2)^{-3}(9a^{-1})^2$ $= \left(\dfrac{1}{3^3}\right)\left(a^{2(-3)}\right)\left(9^2\right)\left(a^{-1(2)}\right) = \dfrac{81}{27}a^{-8} = \dfrac{3}{a^8}$

f) $\dfrac{(4r^{-6})(-2r^2)^5}{(-2r)^4}$

$= \dfrac{(4)(r^{-6})(-2)^5(r^{2(5)})}{(-2)^4(r^4)} = \dfrac{-8r^4}{r^4} = -8$

10. Simplify. Express answers with positive exponents.

a) $\dfrac{x^{0.5}y^{1.8}}{x^{0.3}y^{2.5}}$ $= x^{0.2}y^{-0.7} = \dfrac{x^{0.2}}{y^{0.7}}$

b) $\dfrac{(mn^3)^{-\frac{1}{2}}}{m^{\frac{1}{2}}n^{-\frac{5}{2}}}$ $= m^{-1/2}n^{-3/2}m^{-1/2}n^{5/2} = m^{-1}n^{1} = \dfrac{n}{m}$

c) $\dfrac{\sqrt{x^2y^4}}{(x^{-2}y^3)^{-1}}$ $= (x^2)^{1/2}(y^4)^{1/2}(x^{-2})(y^3) = x^{-1}y^5 = \dfrac{y^5}{x}$

d) $\left(\dfrac{2abc^3}{(2a^2b^3c)^2}\right)^{-2} = \left(\dfrac{4a^4b^6c^2}{2abc^3}\right)^2 = \dfrac{16a^8b^{12}c^4}{4a^2b^2c^6} = \dfrac{4a^6b^{10}}{c^2}$

e) $\dfrac{\sqrt[4]{81p^8}}{\sqrt{9p^4}}$ $= (81^{1/4})(p^{8(1/4)}) \div (9^{1/2})(p^{4(1/2)}) = \dfrac{3p^2}{3p^2} = 1$

f) $\dfrac{\sqrt[6]{(8x^6)^2}}{\sqrt[4]{625x^8}}$ $= \dfrac{(64x^{12})^{1/6}}{5x^{8(1/4)}} = \dfrac{2x^2}{5x^2} = \dfrac{2}{5}$

11. Evaluate each expression for $a = 2$ and $b = 3$. Express values in rational form.

a) $\left(\dfrac{b^3}{a^{\frac{5}{2}}}\right)^2\left(\dfrac{2a^4}{b^5}\right)$ b) $\sqrt{\dfrac{9b^3(ab)^2}{(a^2b^3)^3}}$

$= \left(\dfrac{b^6}{a^5}\right)\left(\dfrac{2a^4}{b^5}\right)$ $= \sqrt{\dfrac{9b^3a^2b^2}{a^6b^9}}$

$= \dfrac{2b}{a}$ $= \sqrt{\dfrac{9a^2b^5}{a^6b^9}}$

$= \dfrac{2(3)}{2}$ $= \sqrt{\dfrac{9}{a^4b^4}}$

$= 3$ $= \dfrac{\sqrt{9}}{(a^4)^{1/2}(b^4)^{1/2}}$ $= \dfrac{3}{a^2b^2} = \dfrac{3}{(2^2)(3^2)}$

$= \dfrac{3}{36}$

$= \dfrac{1}{12}$

12. Simplify.

a) $(a^{10+2p})(a^{-p-8})$

$= a^{10+2p-p-8}$

$= a^{p+2}$

b) $(2x^2)^{3-2m}\left(\frac{1}{x}\right)^{2m}$

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

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

$= 2^{3-2m}x^{6-6m}$

c) $[(c)^{2n-3m}](c^3)^m \div (c^2)^n$

$= c^{2n-3m+3m-2n}$

$= c^{0n+0m}$

$= c^0$

$= 1$

d) $(x^{4n-m})\left(\frac{1}{x^3}\right)^{m+n}$

$= x^{4n-m}x^{-3(m+n)}$

$= x^{4n-m-3m-3n}$

$= x^{n-4m}$

1. Use differences to identify the type of function represented by the table of values.

a) Quadratic

x	y	
−4	5	
−3	8	>3
−2	13	>5 >2
−1	20	>7 >2
0	29	>9 >2
1	40	>11 >2

c) [Tricky because x not increasing by 1 each time]

x	y	
−2	−2.75	
0	−2	>0.75
2	1	>3 >×4
4	13	>12 >×4
6	61	>48 >×4
8	253	>192 >×4

Exponential

b) Exponential

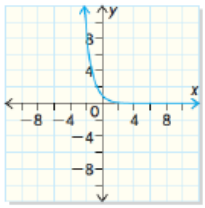
x	y	
−5	32	>×½
−4	16	>×½
−3	8	>×½
−2	4	>×½
−1	2	>×½
0	1	>×½

d) Linear

x	y	
0.5	0.9	>0.2
0.75	1.1	>0.2
1	1.3	>0.2
1.25	1.5	>0.2
1.5	1.7	>0.2
1.75	1.9	

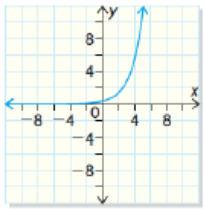
2. What type of function is represented in each graph? Explain how you know.

a)



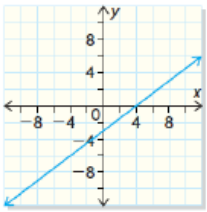
Exponential
y decreases at a decreasing rate

b)



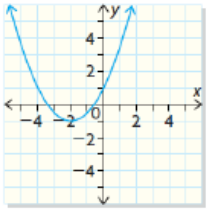
Exponential
y increases at an increasing rate

c)



Linear
y increases at a constant rate (straight line graph)

d)



Quadratic
y decreases and then increases (parabolic shape)