

## Tutorial 1

~~Exercises~~

$$i \quad x^6 \times x^7 = x^{13}$$

$$ii \quad b^2 \times b^4 \times b^3 = b^{19}$$

$$iii \quad x^{\frac{1}{2}} \times x^{\frac{2}{3}} = \frac{1 \times 2}{2 \times 3} = \frac{2}{6} = \frac{1}{3} = x^{\frac{1}{3}}$$

$$iv \quad a^{-8} \times a^{-2} = a^{-10} = \frac{1}{a^{10}}$$

$$v \quad a^{-8} \times a^3 = a^{-5} = \frac{1}{a^5}$$

$$vi \quad a^{-8} \times a^3 = a^{-5} = \frac{1}{a^5}$$

$$vii \quad x^{\frac{1}{2}} \times x^{\frac{2}{3}} = x^{\frac{7}{6}}$$

$$viii \quad x^5 \times x^{-4} \times x^6 \times x^3 = x^{11} \times x^7 = x^{18}$$

$$ix \quad \frac{x^8}{x^3} = x^5 //$$

$$x \quad \frac{x^{-7}}{x^{-2}} = x^{-5} = \frac{1}{x^5}$$

$$xi \quad \frac{a^{-5}}{a^{-2}} = \frac{a^2}{a^5} = \frac{1}{a^3} //$$

$$xii \quad \frac{a^{\frac{1}{2}}}{a^{\frac{1}{3}}} = \frac{1}{3} - \frac{1}{2} = \frac{2}{6} - \frac{3}{6} = -\frac{1}{6} = \frac{1}{a^{\frac{1}{6}}} = a^{\frac{1}{6}} //$$

$$xiii \quad \frac{2^8}{2^3} = 2^5 //$$

$$xiv \quad (x^4)^2 = x^8$$

$$xv \quad (a^5)^7 = a^{35}$$

$$xvi \quad (a^{-2})^3 = a^{-6}$$

$$xvii \quad (x^{-5})^{-3} = x^{15}$$

$$xviii \quad (x^{\frac{3}{2}})^{\frac{1}{4}} = \frac{3}{2} \times \frac{1}{4} = \frac{3}{8} = x^{\frac{3}{8}} //$$

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$$\times viii \quad (x^{-5/1})^8 = x^{-\frac{5}{1} \times 8} = x^{-40} = x^{-20} = \frac{1}{x^{20}}$$

$$\times ix \quad (3^6)^4 = 3^{20}$$

$$\times x \quad \sqrt[3]{x^5} = x^{5/3}$$

$$\times xi \quad 5\sqrt{x^{-2}} = x^{-\frac{2}{5}} = \frac{1}{x^{\frac{2}{5}}}$$

$$\times xii \quad \sqrt{x^{-3}} = x^{-\frac{3}{2}} = \frac{1}{x^{\frac{3}{2}}}$$

$$\times xiii \quad \sqrt[4]{x^{10}} = ((x^4)^4)^{1/4} x^{3/2}$$

$$\times xiv \quad \sqrt{x} = x^{1/2}$$

$$\times xv \quad \sqrt[3]{5^3} = 5$$

$$\times xvi \quad a^{-8} = \frac{1}{a^8}$$

$$\times xvii \quad a^{-1/4} = \frac{1}{a^{1/4}} \left(\frac{1}{a^2}\right)^4$$

$$\times xviii \quad 2^{-3} = \frac{1}{2^3}$$

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## Tutorial

Express with positive indices.

$$29. \quad x^{-4} y^8 = \frac{y^8}{x^4}$$

$$30. \quad a^5 b^{-2/3} = \frac{a^5}{b^{2/3}}$$

$$31. \quad \frac{x^5 y^{-2}}{a^3 b^7} = \frac{x^5 a^3}{b^7 y^2}$$

$$32. \quad 8 a^{-7} = \frac{8}{a^7}$$

$$33. \quad \frac{5 a^{-1} b^3 c^{-4}}{2 x^5 y^{-8}} = \frac{5 b^3 y^8}{a c^4 2 x^5}$$

$$= \frac{5 b^3 y^8}{2 a c^4 x^5}$$

$$34. \quad 2^{-3} a^{-6} b^{-6} = \frac{1}{2^3 a^6 b^6}$$

35a.

$$\underbrace{(\log_b a)(\log_a b)}_{L.H.S.} = \underbrace{1}_{R.H.S.}$$

$$L.H.S. \equiv \log_b a \times \log_a b$$

$$L.H.S. \equiv \frac{\log_a a \times \log_a b}{\log_a b}$$

$$L.H.S. \equiv \underline{\underline{1}}$$

$$L.H.S. \equiv R.H.S.$$

36.  $\log_b a = 4$   
 $\log_b b = 3$

37.  $\log_a 45 + 4 \log_a 2 - \frac{1}{2} \log_a 81 - \log_a 10 = \frac{3}{2}$

$$\log_a 45 + \log_a 16 - \log_a 9 - \log_a 10 = \frac{3}{2}$$

$$\log_a \left( \frac{45 \times 16}{9 \times 10} \right) = \frac{3}{2}$$

$$\log_a \left( \frac{45 \times 16}{9 \times 10} \right) = \frac{3}{2}$$

$$\log_a 8 = \frac{3}{2}$$

$$a^{\frac{3}{2}} = 8$$

$$a^{\frac{3}{2}} = 2^3$$

$$a^{\frac{3}{2}} = \left( (2^2)^{\frac{1}{2}} \right)^3$$

$$a^{\frac{3}{2}} = 4^{\frac{3}{2}}$$

$$a = \underline{\underline{4}}$$

Atlas



36.  $\log_b a = 4 \quad \text{--- (1)}$   
 $\log_c b = 3 \quad \text{--- (2)}$   
 $a = 32c^2$

$\textcircled{1} \times \textcircled{2}$   
 $\log_b a \times \log_c b = 4 \times 3$

$\frac{\log_c b}{\log_c b} \times \frac{\log_c a}{\log_c b}$

$\log_c a = 12$

Since  $a = 32c^2$

$c^{12} = a \quad \text{--- (3)}$

$\frac{c^{12}}{c^2} = \frac{32c^2}{c^2}$

${}^{10}\sqrt{c^{10}} = {}^{10}\sqrt{32}$

$c = 32^{\frac{1}{10}}$

$c = (2^5)^{\frac{1}{10}} = 2^{\frac{1}{2}}$

$c = \sqrt{2}$

$(\sqrt{2})^{12} = a$

$(2^{\frac{1}{2}})^{12} = a$   
 $2^6 = a$   
 $64 = a$

$8^{\frac{3}{2}} = \frac{8 \times 3}{2}$   
 $a^{\frac{3}{2}} = 8$   
 $a^{\frac{3}{2}} = 2^3$   
 $a^{\frac{1}{2}} = \left(2^{\frac{2}{3}}\right)^{\frac{1}{2}}$   
 $a^{\frac{1}{2}} = 2^{\frac{1}{3}}$

$$(28) \quad \frac{\log 15 + 2 \log 6 - \log 5 - 4 \log 2 - \log 3}{\log 3 - \log 2}$$

$$\frac{\log 15 + \log 6^2 - \log 5 - \log 2^4 - \log 3}{\log 3 - \log 2}$$

$$\frac{\log \frac{15 \times 6^2}{5 \times 2^4 \times 3}}{\log 3 - \log 2}$$

$$\log \frac{3}{2}$$

$$\log \frac{36}{16 \times 4}$$

$$\log \frac{3}{2}$$

$$\log \frac{9}{4}$$

$$\log \frac{3}{2}$$

$$\log \frac{3^2}{2^2}$$

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

$$\log \frac{3}{2}$$

$$2 \log \frac{3}{2}$$

$$\log \frac{3}{2}$$

$$\underline{\underline{2}}$$

$$39. \log_2 x + \log_x 8 = 4$$

$$\log_2 x + \log_x 2^3 = 4$$

$$\log_2 x + 3 \log_x 2 = 4$$

$$\log_2 x + 3 \frac{\log_2 2}{\log_2 x} = 4$$

$$\log_2 x + \frac{3}{\log_2 x} = 4$$

$$\frac{(\log_2 x)^2 + 3}{\log_2 x} = 4$$

$$(\log_2 x)^2 + 3 = 4 \log_2 x$$

$$(\log_2 x)^2 - 4 \log_2 x + 3 = 0$$

$$(\log_2 x)^2 - \log_2 x - 3 \log_2 x + 3 = 0$$

$$(\log_2 x) [\log_2 x + 4] = -3$$

$$x^2 - 4x + 3 = 0$$

$$x^2 - 3x - x + 3 = 0$$

$$x(x-3) - 1(x-3) = 0$$

$$(x-3)(x-1) = 0$$

$$x = 3 \text{ or } x = 1$$

$$\log_2 x = 3 \text{ or } \log_2 x = 1$$

$$2^3 = x$$

$$2 = x$$

$$x = 8$$

$$\text{or}$$

$$2^1 = x$$

$$x = 2$$

$$x^2 = 4x + 3$$



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$$\underbrace{\log_{ab}(x)}_{\text{L.H.S.}} = \underbrace{\frac{\log_b x}{1 + \log_b a}}_{\text{R.H.S.}}$$

$$\text{L.H.S.} \equiv \log_{ab}(x)$$

$$\text{L.H.S.} \equiv \frac{\log_b x}{\log_b ab}$$

$$\text{L.H.S.} \equiv \frac{\log_b x}{\log_b a + \log_b b}$$

$$\text{L.H.S.} \equiv \frac{\log_b x}{\log_b a + 1}$$

$$\text{L.H.S.} \equiv \frac{\log_b x}{1 + \log_b a}$$

$$\text{L.H.S.} \equiv \text{R.H.S.}$$

$$1 = \underbrace{(\log_{ab} a)}_{\text{L.H.S.}} \underbrace{(\log_{ab} b)}_{\text{R.H.S.}}$$

$$\log_{ab} a \times \log_{ab} b = \text{R.H.S.}$$

$$\log_{ab} a \times \log_{ab} b = \text{R.H.S.}$$

$$1 = \text{R.H.S.}$$

$$\text{L.H.S.} \equiv \text{R.H.S.}$$

$$a = \log_{ab} a$$

$$b = \log_{ab} b$$

$$E = 01 \log_{ab} a - 13 \log_{ab} b - 5 \log_{ab} a + 22 \log_{ab} b$$

$$E = 01 \log_{ab} a - 13 \log_{ab} b - 5 \log_{ab} a + 22 \log_{ab} b$$

$$E = \begin{pmatrix} 01 \times 22 \\ 13 \times 01 \end{pmatrix} \log_{ab}$$

$$E = \begin{pmatrix} 01 \times 22 \\ 13 \times 01 \end{pmatrix} \log_{ab}$$

$$E = 8 \log_{ab}$$

$$E = 8$$

$$E = 8$$