AL121.1b .Examples for AL121.1a_Bài tập Hàm số mũ

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AL121.1b .Examples for AL121.1a_Bài t□□p hàm s□□ mũ

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We present some examples about graphing and identifying properties of the exponential equation .

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AL121.1b .Examples for AL121.1a_Bài tập hàm số mũ

We present some examples about graphing and identifying properties of the exponential equation .
Trình bày các ví dụ về vẽ đồ thị và nhận xét các tính chất của hàm số mũ .

1.Calculating the exponential expressions .
2. Simplifying the exponential expressions with some bases given .
3. Comparing two exponents without calculator .
4. Graphing the exponential functions to predict the zeros of exponential equations .

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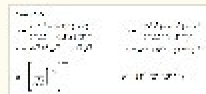

Ex1 .
Click the image to see example 1 .

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Solution 1 .

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Ex2 .

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Calculate

$$A = \frac{2 : 4^{-2} + (-3)^2 . (1/9)^{-3}}{5^{-3} . 25^2 + 0.5^0 . (1/2)^{-2}}$$

$$B = \frac{4.(5^2)^5 . (-20)^3 . (-8)^{-6}}{5^{-3} . 25^3 . ((-5)^{-2})^{-4}}$$

$$C = 2^{(\sqrt{3}-1)^2} . 4^{\sqrt{3}} + (2^{-\sqrt[5]{8}})^{\sqrt[5]{4}}$$

$$D = 4^{3/2} + 8^{2/3} + (32^{3/2})^{-2/5}$$

$$E = \left[\left(\frac{1}{\sqrt{2}} \right)^{-\frac{1}{\sqrt{2}}} \right]^{\frac{1}{\sqrt{2}}}$$

$$F = 24^{\sqrt{3}} (2^{\sqrt{27}} . 3^{1-\sqrt{3}})$$

$$* A = \frac{2:4^{-2}+(-3)^2.(1/9)^{-3}}{5^{-3}.25^2+0.5^0.(1/2)^{-2}} = \frac{2:2^{-4}+3^2.(1/3^2)^{-3}}{5^{-3}.5^4+(1/2)^{-2}} = \frac{2^{1-(-4)}+3^2.1/3^{-6}}{5^{-3+4}+1/2^{-2}} = \frac{2^5+3^2 3^6}{5^1+2^2} = \frac{32+3^{2+6}}{5+4}$$

$$= 6593/9$$

$$* B = \frac{4.(5^2)^5.(-20)^3.(-8)^{-6}}{5^{-3}.25^3.((-5)^{-2})^{-4}} = \frac{4.5^{2\times 5}.(-20^3).2^{3\times(-6)}}{5^{-3}.5^{2\times 3}.(5^{-2})^{-4}} = \frac{-2^2.5^{10}.(2^2.5)^3.2^{-18}}{5^{-3}.5^6.5^8}$$

$$= \frac{-2^2.5^{10}.2^6.5^3.2^{-18}}{5^{-3+6+8}} = \frac{-2^{2+6-18}.5^{10+3}}{5^{11}} = -2^{-10}.5^2 = -25/1024$$

$$* C = 2^{(\sqrt{3}-1)^2}.4^{\sqrt{3}} + (2^{-\sqrt[5]{8}})^{\sqrt[5]{4}} = 2^{(\sqrt{3}-1)^2}.2^{2\sqrt{3}} + 2^{-\sqrt[5]{8}\times\sqrt[5]{4}} = 2^{(\sqrt{3}-1)^2+2\sqrt{3}} + 2^{-\sqrt[5]{32}} = 2^{3+1} + 2^{-2} = 65/4$$

$$* D = 4^{3/2} + 8^{2/3} + (32^{3/2})^{-2/5} = [2^2]^{3/2} + [2^3]^{2/3} + [2^5]^{3/2\times(-2/5)} = 2^3 + 2^2 + [2^5]^{-6/10} = 97/8$$

$$* E = \left[\left(\frac{1}{\sqrt{2}}\right)^{-\frac{1}{\sqrt{2}}}\right]^{\frac{1}{\sqrt{2}}} = \left(\frac{1}{\sqrt{2}}\right)^{-\frac{1}{\sqrt{2}}\times\frac{1}{\sqrt{2}}} = \left(\frac{1}{\sqrt{2}}\right)^{-\frac{1}{2}} = \frac{1}{(\sqrt{2})^{-\frac{1}{2}}} = \sqrt{2}^{\frac{1}{2}} = \left(2^{\frac{1}{2}}\right)^{\frac{1}{2}} = 2^{\frac{1}{4}} = \sqrt[4]{2}$$

$$* F = 24^{\sqrt{3}}(2^{\sqrt{27}}.3^{1-\sqrt{3}}) = (2^3.3)^{\sqrt{3}}.(2^{3\sqrt{3}}.3^{1-\sqrt{3}}) = 2^{3\sqrt{3}}3^{\sqrt{3}}.2^{3\sqrt{3}}.3^{1-\sqrt{3}} = 2^{6\sqrt{3}}3^{\sqrt{3}+1-\sqrt{3}} = 2^{6\sqrt{3}}.3$$

Simplify $\forall a,b>0$

$$* \; A=\frac{a^{1/3}.\sqrt{a}}{a^{4/3}.\sqrt[3]{a}}$$

$$B=\frac{\sqrt[3]{b}:\sqrt[6]{b}}{b^{1/3}.b^{1/2}.(b^{2})^{1/12}}$$

$$C=\frac{a^{1/4}-a^{9/4}}{a^{1/4}-a^{5/4}}-\frac{b^{-1/2}-b^{3/2}}{b^{1/2}+b^{-1/2}}$$

$$D=\frac{a^{\sqrt{5}}-b^{\sqrt{7}}}{a^{2\sqrt{5}/3}+a^{\sqrt{5}/3}.b^{\sqrt{7}/3}+b^{2\sqrt{7}/3}}$$

$$* A=\frac{a^{1/3}.\sqrt{a}}{a^{4/3}:\sqrt[3]{a}}=\frac{a^{1/2+1/3}}{a^{4/3-1/3}}=a^{5/6-1}=a^{-1/6}$$

$$* B=\frac{\sqrt[3]{b}:\sqrt[6]{b}}{b^{1/3}.b^{1/2}.(b^2)^{1/12}}=\frac{b^{1/3-1/6}}{b^{1/3+1/2}.b^{1/6}}=\frac{b^{1/6}}{b^{5/6}.b^{1/6}}=\frac{1}{b^{5/6}}$$

$$* C=\frac{a^{1/4}-a^{9/4}}{a^{1/4}-a^{5/4}}-\frac{b^{-1/2}-b^{3/2}}{b^{1/2}+b^{-1/2}}=\frac{a^{1/4}(1-a^{8/4})}{a^{1/4}(1-a^{4/4})}-\frac{b^{-1/2}(1-b^{4/2})}{b^{-1/2}(b^{2/2}+1)}=\frac{(1-a)(1+a)}{(1-a)}-\frac{(1-b)(1+b)}{(b+1)}$$

$$=(1+a)-(1-b)=a+b$$

$$* D=\frac{a^{\sqrt{5}}-b^{\sqrt{7}}}{a^{2\sqrt{5}/3}+a^{\sqrt{5}/3}.b^{\sqrt{7}/3}+b^{2\sqrt{7}/3}}=\frac{(a^{\sqrt{5}}-b^{\sqrt{7}})(a^{\sqrt{5}/3}-b^{\sqrt{7}/3})}{(a^{2\sqrt{5}/3}+a^{\sqrt{5}/3}.b^{\sqrt{7}/3}+b^{2\sqrt{7}/3})(a^{\sqrt{5}/3}-b^{\sqrt{7}/3})}=$$

$$\frac{(a^{\sqrt{5}}-b^{\sqrt{7}})(a^{\sqrt{5}/3}-b^{\sqrt{7}/3})}{(a^{3\sqrt{5}/3}-b^{3\sqrt{7}/3})}=a^{\sqrt{5}/3}-b^{\sqrt{7}/3}$$

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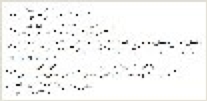

Solution 2 .

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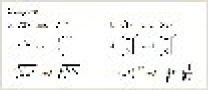

Ex3 .
Click the image to see example 3 .

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Compare

a. $\sqrt[3]{28}$ and $\sqrt{17}$

b. $\sqrt[4]{13}$ and $\sqrt[5]{23}$

c. $2^{-\sqrt{12}}$ and $\left(\frac{1}{2}\right)^{5/2}$

d. $\left(\frac{\pi}{2}\right)^{\sqrt{2}}$ and $\left(\frac{\pi}{5}\right)^{\sqrt{3}}$

e. $\sqrt[5]{\sqrt[4]{\sqrt{2}}}$ and $\sqrt[3]{\sqrt[4]{\sqrt[3]{9}}}$

f. $\left(\sqrt{3}\right)^{-5/6}$ and $\sqrt[3]{3^{-1}.\sqrt[4]{\frac{1}{3}}}$

$* a.$ suppose $\sqrt[3]{28} > \sqrt{17} \Leftrightarrow \left(\sqrt[3]{28}\right)^6 > \left(\sqrt{17}\right)^6 \Leftrightarrow (28)^2 > (17)^3 \Leftrightarrow 784 > 4913$ (false)

Thus $\sqrt[3]{28} < \sqrt{17}$

$*$ b. suppose $\sqrt[4]{13} > \sqrt[5]{23} \Leftrightarrow (\sqrt[4]{13})^{20} > (\sqrt[5]{23})^{20} \Leftrightarrow (13)^5 > (23)^4 \Leftrightarrow 13 > (23/13)^4$

$\Leftrightarrow 13 > (1+10/13)^4$ (true)

$*$ c. suppose $2^{-\sqrt{12}} > \left(\frac{1}{2}\right)^{5/2} \Leftrightarrow 2^{-\sqrt{12}} > \left(2^{-1}\right)^{5/2} \Leftrightarrow 2^{-2\sqrt{3}} > 2^{-5/2} \Leftrightarrow -2\sqrt{3} > -5/2 \Leftrightarrow 5/2 < 2\sqrt{3}$

$\Leftrightarrow 5 < 4\sqrt{3} \Leftrightarrow 5^2 < (4\sqrt{3})^2 \Leftrightarrow 25 < 48$ (true)

$*$ d. suppose $\left(\frac{\pi}{2}\right)^{\sqrt{2}} > \left(\frac{\pi}{5}\right)^{\sqrt{3}} \Leftrightarrow \left[\left(\frac{\pi}{2}\right)^{\sqrt{2}}\right]^{\sqrt{2}} > \left[\left(\frac{\pi}{5}\right)^{\sqrt{3}}\right]^{\sqrt{2}} \Leftrightarrow \left(\frac{\pi}{2}\right)^2 > 1 > \left(\frac{\pi}{5}\right)^{\sqrt{6}}$ (true)

$*$ e. suppose $\sqrt[5]{\sqrt[4]{\sqrt{2}}} > \sqrt[3]{\sqrt[4]{\sqrt[3]{9}}} \Leftrightarrow 2^{1/40} > 3^{2/36} \Leftrightarrow (2^{1/40})^{40} > (3^{2/36})^{40} \Leftrightarrow 2 > 3^{80/36} > 1$ (false)

$*$ f. suppose $\left(\sqrt{3}\right)^{-5/6} > \sqrt[3]{3^{-1}.\sqrt[4]{\frac{1}{3}}} \Leftrightarrow 3^{-5/12} > \sqrt[3]{3^{-1}.3^{-1/4}} \Leftrightarrow 3^{-5/12} > \sqrt[3]{3^{-5/4}} \Leftrightarrow 3^{-5/12} > 3^{-5/12}$ (false)

Thus $\left(\sqrt{3}\right)^{-5/6} = \sqrt[3]{3^{-1}.\sqrt[4]{\frac{1}{3}}}$

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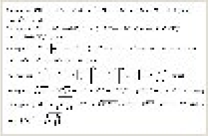

Solution 3 .

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Ex4 .

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Prove that

a. $\mathrm{m}^{\frac{2}{3}} = \mathrm{x}^{\frac{2}{3}} + \mathrm{y}^{\frac{2}{3}}$ if $\mathrm{m} = \sqrt{x^2 + \sqrt[3]{x^4 y^2}} + \sqrt{y^2 + \sqrt[3]{x^2 y^4}}$

b. $\dfrac{1}{1+4^x} + \dfrac{1}{1+4^y} \geq \dfrac{2}{1+2^{x+y}} \quad \forall x, y \ : x + y > 0$

c. $\sqrt[3]{x} + \sqrt[3]{y} > \sqrt[3]{3} \qquad \forall x, y \in R_0^+ \ : x + y = 3$

d. $(x^2 + y^2 - z^2)^3 + 27(xyz)^2 = 0$ if $\sqrt[3]{x^2} + \sqrt[3]{y^2} = \sqrt[3]{z^2}$

*a. $m^{\frac{2}{3}} = x^{\frac{2}{3}} + y^{\frac{2}{3}}$ if $m = \sqrt{x^2+\sqrt[3]{x^4y^2}} + \sqrt{y^2+\sqrt[3]{x^2y^4}}$

from $m = \sqrt{x^2+\sqrt[3]{x^4y^2}} + \sqrt{y^2+\sqrt[3]{x^2y^4}}$ then $m^2 = \left[\sqrt{x^2+\sqrt[3]{x^4y^2}} + \sqrt{y^2+\sqrt[3]{x^2y^4}}\right]^2$

$$m^2 = x^2+y^2+3\sqrt[3]{x^2y^2}\left[\sqrt[3]{x^2}+\sqrt[3]{y^2}\right]+2\sqrt{x^2+\sqrt[3]{x^4y^2}}.\sqrt{y^2+\sqrt[3]{x^2y^4}}$$

$$= (x^{2/3}+y^{2/3})(x^{4/3}+y^{4/3}-x^{2/3}.y^{2/3})+3\sqrt[3]{x^2y^2}\left[\sqrt[3]{x^2}+\sqrt[3]{y^2}\right]+2\sqrt{x^2+\sqrt[3]{x^4y^2}}.\sqrt{y^2+\sqrt[3]{x^2y^4}}$$

$$= (x^{2/3}+y^{2/3})(x^{4/3}+y^{4/3}-x^{2/3}.y^{2/3}+x^{2/3}.y^{2/3})+2\sqrt{x^2y^2+x^2\sqrt[3]{x^2y^4}+y^2\sqrt[3]{x^4y^2}+\sqrt[3]{x^2y^4}\sqrt[3]{x^4y^2}}$$

$$= (x^{2/3}+y^{2/3})(x^{4/3}+y^{4/3})+2\sqrt{2x^2y^2+x^2\sqrt[3]{x^2y^4}+y^2\sqrt[3]{x^4y^2}}$$

$$= (x^{2/3}+y^{2/3})(x^{4/3}+y^{4/3})+2\sqrt{2x^2y^2+x^{8/3}y^{4/3}+x^{4/3}y^{8/3}}$$

$$= (x^{2/3}+y^{2/3})(x^{4/3}+y^{4/3})+2\sqrt{2x^2y^2+(x^{4/3}y^{2/3})^2+(x^{2/3}y^{4/3})^2}$$

$$= (x^{2/3}+y^{2/3})(x^{4/3}+y^{4/3})+2\sqrt{(x^{4/3}y^{2/3}+x^{2/3}y^{4/3})^2}$$

$$= (x^{2/3}+y^{2/3})(x^{4/3}+y^{4/3})+2(x^{4/3}y^{2/3}+x^{2/3}y^{4/3})$$

$$= (x^{2/3}+y^{2/3})(x^{4/3}+y^{4/3})+2x^{2/3}y^{2/3}(x^{2/3}+y^{2/3}) = (x^{2/3}+y^{2/3})\left[x^{4/3}+y^{4/3}+2x^{2/3}y^{2/3}\right]$$

$$= (x^{2/3}+y^{2/3})(x^{2/3}+y^{2/3})^2 = (x^{2/3}+y^{2/3})^3$$

$$m^2 = (x^{2/3}+y^{2/3})^3 \Leftrightarrow \sqrt[3]{m^2} = \sqrt[3]{(x^{2/3}+y^{2/3})^3} \Leftrightarrow m^{\frac{2}{3}} = x^{\frac{2}{3}}+y^{\frac{2}{3}}$$

*b. $\frac{1}{1+4^x}+\frac{1}{1+4^y} \geq \frac{2}{1+2^{x+y}}$ $\forall x, y$: $x+y>0$

Let $a = 2^x$ and $b = 2^y$ because $x+y>0$ then $2^{x+y} > 2^0 = 1$ or $2^x.2^y > 1$

or $ab > 1$

use Cauchy's inequality $2^{2x}+2^{2y} \geq 2(2^x.2^y) \Leftrightarrow 2^{2x}+2^{2y} \geq 2$

$$\frac{1}{1+4^x}+\frac{1}{1+4^y} \geq \frac{2}{1+2^{x+y}} \Leftrightarrow \frac{1}{1+a^2}+\frac{1}{1+b^2} \geq \frac{2}{1+ab} \Leftrightarrow (a^2+b^2+2)(1+ab) \geq 2(1+a^2)(1+b^2)$$

$$a^3b+ab^3-a^2-b^2+2ab-2a^2b^2 \geq 0 \Leftrightarrow ab(a^2+b^2)-(a^2+b^2)+2ab(1-ab) \geq 0$$

$$\Leftrightarrow (a^2+b^2)(ab-1)+2ab(1-ab) \geq 0 \Leftrightarrow (ab-1)\left[(a^2+b^2)-2ab\right] \geq 0 \Leftrightarrow (ab-1)(a-b)^2 \geq 0$$

*c. $\sqrt[3]{x}+\sqrt[3]{y} > \sqrt[3]{3}$ $\forall x, y \in R_0^+$: $x+y=3$

From $x+y=3$ it follows $y = 3-x$

$$\sqrt[3]{x}+\sqrt[3]{y} > \sqrt[3]{3} \Leftrightarrow \sqrt[3]{x}+\sqrt[3]{3-x} > \sqrt[3]{3} \Leftrightarrow \left(\sqrt[3]{x}+\sqrt[3]{3-x}\right)^3 > 3$$

$$\Leftrightarrow x+3\sqrt[3]{x}^2\sqrt[3]{3-x}+3\sqrt[3]{x}\left(\sqrt[3]{3-x}\right)^2+3-x > 3$$

$$\Leftrightarrow 3\sqrt[3]{x}^2\sqrt[3]{3-x}+3\sqrt[3]{x}\left(\sqrt[3]{3-x}\right)^2 > 0 (true)$$

*d. $(x^2+y^2-z^2)^3+27(xyz)^2 = 0$ if $\sqrt[3]{x^2}+\sqrt[3]{y^2} = \sqrt[3]{z^2}$

Because $\sqrt[3]{x^2}+\sqrt[3]{y^2} = \sqrt[3]{z^2}$ then $\left(\sqrt[3]{x^2}+\sqrt[3]{y^2}\right)^3 = z^2 \Leftrightarrow z^2 = x^2+3\sqrt[3]{x^2}^2\sqrt[3]{y^2}+3\sqrt[3]{x^2}\sqrt[3]{y^2}^2+y^2$

$$\Leftrightarrow x^2+y^2-z^2 = -\left(3\sqrt[3]{x^4y^2}+3\sqrt[3]{x^2y^4}\right) = -3\sqrt[3]{x^2y^2}\left(\sqrt[3]{x^2}+\sqrt[3]{y^2}\right) = -3\sqrt[3]{x^2y^2}.\sqrt[3]{z^2}$$

$$(x^2+y^2-z^2)^3 = \left[-3\sqrt[3]{x^2y^2}.\sqrt[3]{z^2}\right]^3 = -27x^2y^2z^2 \Leftrightarrow (x^2+y^2-z^2)^3+27(xyz)^2 = 0 \text{ (true)}$$

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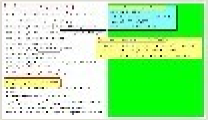

Solution 4 .

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Ex5 .
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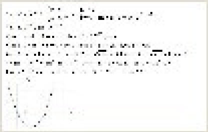

Solution 5 .

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Find m that satisfies the following inequalities .

a. $m^{\pi} < \sqrt[3]{m^{10}}$

b. $(m-1)^{3/4} \geq (m-1)^{x+\sqrt{x+1}}, \forall x \geq 0$

c. $(m^2+3)^{x^2+1} > (2m^2 - m + 1)^{x^2+1}$

d. $\left(\sqrt{m^2 - 3m + 2}\right)^{\sqrt{15}} > \left(m^2 - 3m + 2\right)^{|x+1/x|}, \forall x \neq 0$

$$*\text{a. } m^{\pi} < \sqrt[3]{m^{10}} \Leftrightarrow \begin{cases} m > 0 \\ m^{\pi} < m^{10/3} \end{cases} \Leftrightarrow \begin{cases} m > 0 \\ \pi \approx 3.1415 < 10/3 \Rightarrow m > 1 \end{cases} \Leftrightarrow m > 1$$

$$*\text{b. } (\mathrm{m}-1)^{3/4} \ge (\mathrm{m}-1)^{x+\sqrt{x+1}}$$

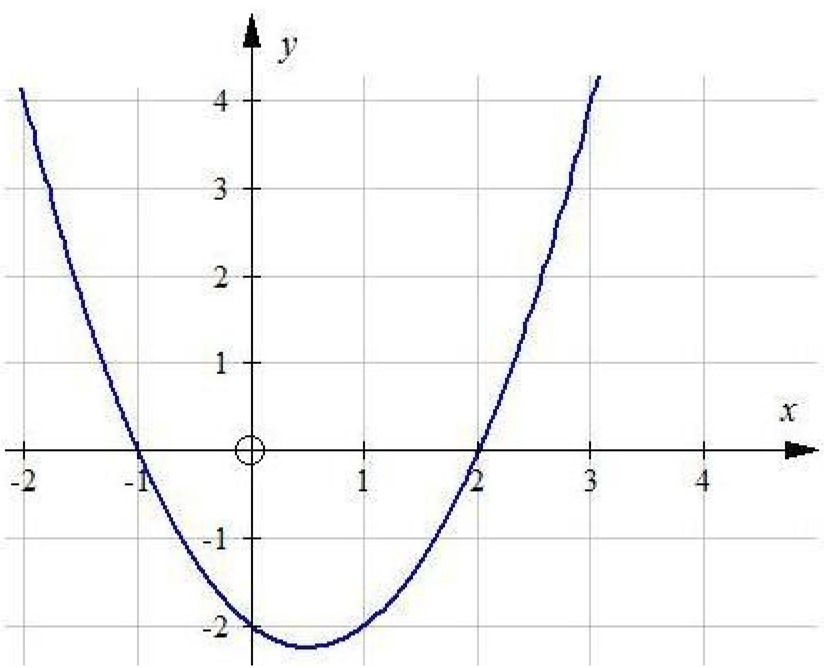
$Case\,1.$ $\mathrm{m}-1 = 0 \Leftrightarrow m = 1$ then $0^{3/4} \ge 0^{x+\sqrt{x+1}}\,(true)$

$Case\,2.$ $0 < \mathrm{m}-1 < 1 \Leftrightarrow 1 < m < 2$ then $3/4 \le x + \sqrt{x+1}, \forall x \ge 0\,(true)$

$Case\,3.$ $\mathrm{m}-1 > 1 \Leftrightarrow m > 2$ then $3/4 \ge x + \sqrt{x+1}, \forall x \ge 0 \Leftrightarrow 3/4 \ge x + \sqrt{x+1} > 1, (false)$

$*c.$ $(\mathrm{m}^2+3)^{x^2+1} > (2\mathrm{m}^2-\mathrm{m}+1)^{x^2+1}$ Note : $\mathrm{m}^2+3 > 0$, $2\mathrm{m}^2-\mathrm{m}+1 > 0$, $x^2+1 > 1$

thus $\mathrm{m}^2+3 > 2\mathrm{m}^2-\mathrm{m}+1 \Leftrightarrow m^2 - m - 2 < 0 \Leftrightarrow -1 < \mathrm{m} < 2$



$$*\text{d. } \left(\sqrt{m^2-3m+2}\right)^{\sqrt{15}} > \left(m^2-3m+2\right)^{|x+1/x|}, \forall x \neq 0$$

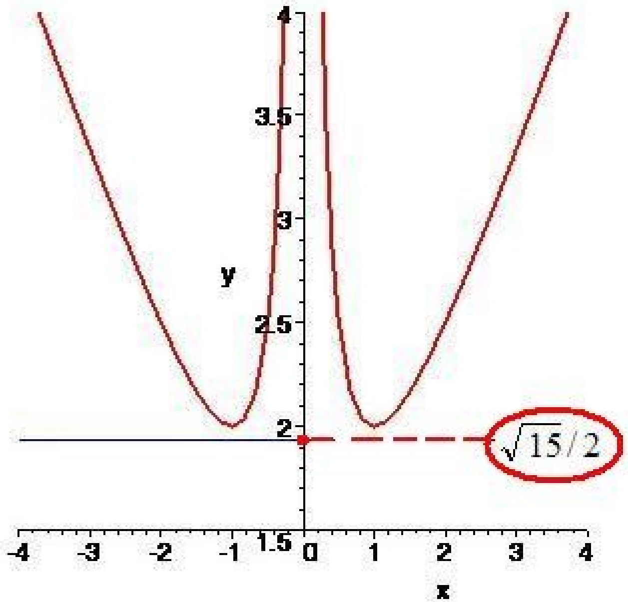
$$\Leftrightarrow \left(m^2-3m+2\right)^{\sqrt{15}/2} > \left(m^2-3m+2\right)^{|x+1/x|}, \forall x \neq 0$$

$$Case\,1.\quad m^2-3m+2 = 0 \Leftrightarrow m = 1,\ m = 2 \quad \text{then } 0 > 0 \ (false)$$

$$Case\,2.\quad 0 < m^2-3m+2 < 1 \Leftrightarrow \sqrt{15}/2 < \left|x+\frac{1}{x}\right| (true)$$

```
> eq1:=abs(x+1/x)>sqrt(15)/2;plot([abs(x+1/x),sqrt(15)/2],x=-4..4,y=1.5..4,thickness=[2,1],color=[red,blue]);
```

$$eq1 := \frac{\sqrt{15}}{2} < \left|x+\frac{1}{x}\right|$$



$$eq2 := \{0 < m^2 - 3\,m + 2,\ m^2 - 3\,m < -1\}$$

$$\left[\begin{array}{l} \left\{m < 1, \frac{3}{2} - \frac{\sqrt{5}}{2} < m\right\} \\ \left\{2 < m, m < \frac{\sqrt{5}}{2} + \frac{3}{2}\right\} \end{array}\right.$$

$$Case\,3.\quad m^2-3m+2 > 1 \Leftrightarrow \sqrt{15}/2 > \left|x+\frac{1}{x}\right| (false)$$

Ex6 .

a. Plot the function

$$y = 3^x + 4^x \quad (1)$$

$$y = 5^x \quad (2)$$

b. Find the intersection point between graphs of (1) and (2)

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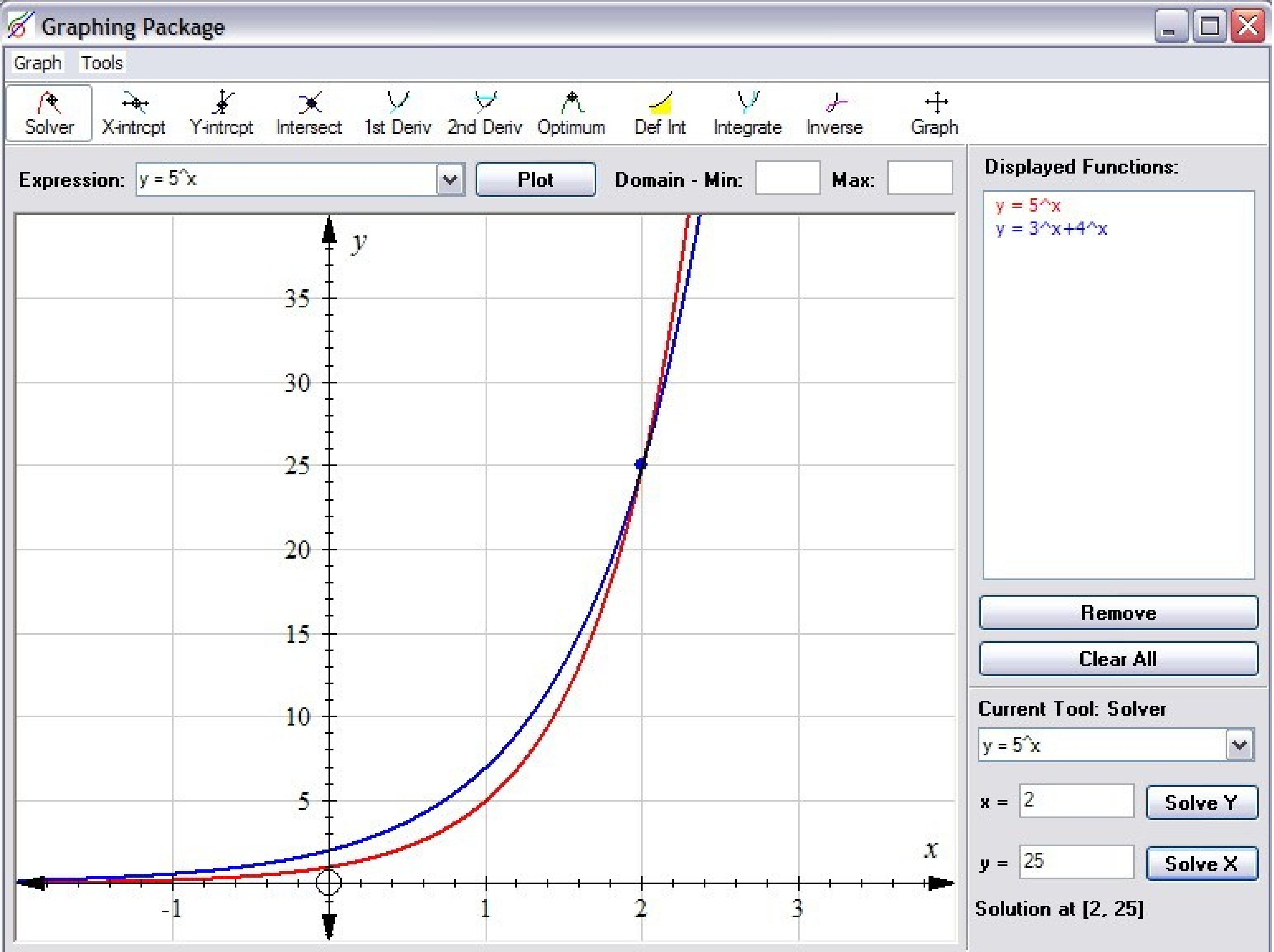
Graphing Package
Graph
Tools
Solver
X-intrcpt
Y-intrcpt
Intersect
1st Deriv
2nd Deriv
Optimum
Def Int
Integrate
Inverse
Graph
Expression:
y = 5^x
Plot
Domain - Min:
Max:
Displayed Functions:
y = 5^x
y = 3^x+4^x
Remove
Clear All
Current Tool: Solver
y = 5^x
x = 2
Solve Y
y = 25
Solve X
Solution at [2, 25]
y
x
35
30
25
20
15
10
5
-1
1
2
3

AL121.1b .Examples for AL121.1a_Bài tập Hàm số mũ

AL121.1b .Examples for AL121.1a_Bài tập hàm số mũ
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