

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

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AL121.1c .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 vẽ đồ thị và xét các tính chất của hàm số mũ .

Author :

Co.H.Tran

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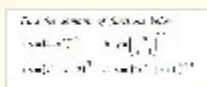


We present some examples about graphing and identifying properties of the exponential equation .

Trình bày các ví dụ về vẽ đồ thị và nhận xét các tính chất của hàm số mũ .

1. Finding the domain of exponential function .
2. Graphing the exponential functions to predict the zeros of exponential equations .
3. Finding the derivatives of exponential functions .
4. Solving the exponential equation by the monotonicity and Rolle's theorem .
5. Proving the inequality based on the monotonicity of exponential function.

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Ex1 .
Click the image to see example 1 .

Find the domains of functions below

a. $y = (4 - x^2)^{-1/4}$

b. $y = \left(\frac{4x}{x-4} \right)^{3/5}$

c. $y = (x^2 - x - 2)^{\sqrt{3}}$

d. $y = (2x^2 - |x+1|)^{-3/4}$

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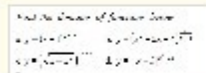
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Solution 1 .
Click the image to see
solution 1 .



Ex2 .
Click the image to see
example 2 .

↻ Repeat

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? keyboard shortcuts

* a. $y = (4 - x^2)^{-1/4} = \frac{1}{\sqrt[4]{(4 - x^2)}}$ reasonably when $4 - x^2 > 0$

$\Leftrightarrow -2 < x < 2$; $D = (-2, 2)$

* b. $y = \left(\frac{4x}{x-4}\right)^{3/5} = \sqrt[5]{\left(\frac{4x}{x-4}\right)^3}$ reasonably when $x - 4 \neq 0 \Leftrightarrow x \neq 4$; $D = \mathbb{R} \setminus \{4\}$

* c. $y = (x^2 - x - 2)^{\sqrt{3}}$; $D = \mathbb{R}$

* d. $y = (2x^2 - |x + 1|)^{-3/4} = \frac{1}{\sqrt[4]{(2x^2 - |x + 1|)^3}}$ reasonably when $(2x^2 - |x + 1|) > 0$

$\Leftrightarrow 2x^2 > |x + 1| \Leftrightarrow (2x^2)^2 > (x + 1)^2 \Leftrightarrow (2x^2)^2 - (x + 1)^2 > 0$

$\Leftrightarrow (2x^2 + x + 1)(2x^2 - x - 1) > 0 \Leftrightarrow 2x^2 - x - 1 > 0 \Leftrightarrow x > 1 \vee x < -1/2$

$D = (-\infty, -1/2) \cup (1, +\infty)$

Find the domains of functions below

a. $y = (x - 1)^{\sqrt{x^2 - 1}}$

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

c. $y = \left(\sqrt{x - x^2}\right)^{x - \sqrt{x}}$

d. $y = |x - 3|^{x^2 - 2x}$

$$* \text{ a. } y = (x-1)^{\sqrt{x^2-1}} \text{ reasonably when } \begin{cases} 0 < x-1 \neq 1 \\ x^2-1 \geq 0 \end{cases} \Leftrightarrow \begin{cases} x > 1 \\ x \neq 2 \\ x \leq -1 \vee x \geq 1 \end{cases} \Leftrightarrow D = (-1, +\infty) \setminus \{2\}$$

$$* \text{ b. } y = (x^2 - 5x + 4)^{\frac{1}{x^2-4}} \text{ reasonably when } \begin{cases} 0 < x^2 - 5x + 4 \neq 1 \\ x^2 - 4 \neq 0 \end{cases} \Leftrightarrow \begin{cases} x^2 - 5x + 4 > 0 \\ x^2 - 5x + 3 \neq 0 \\ x \neq -2 \wedge x \neq 2 \end{cases}$$

$$\Leftrightarrow \begin{cases} x^2 - 5x + 4 > 0 \\ x^2 - 5x + 3 \neq 0 \\ x \neq -2 \wedge x \neq 2 \end{cases} \Leftrightarrow \begin{cases} x \neq -2, x \neq \frac{5-\sqrt{13}}{2}, x < 1 \\ x > 4, x \neq \frac{5+\sqrt{13}}{2} \end{cases} \Leftrightarrow D = (-\infty, 1) \cup (4, +\infty) \setminus \left\{-2, \frac{5 \pm \sqrt{13}}{2}\right\}$$

$$* \text{ c. } y = (\sqrt{x-x^2})^{x-\sqrt{x}} \text{ reasonably when } \begin{cases} 0 < x-x^2 \neq 1 \\ x \geq 0 \end{cases} \Leftrightarrow \begin{cases} x^2 - x < 0 \\ x^2 - x + 1 \neq 0 \\ x \geq 0 \end{cases} \Leftrightarrow D = (0, 1)$$

$$* \text{ d. } y = |x-3|^{x^2-2x} \text{ reasonably when } 0 < x-3 \neq 1 \Leftrightarrow \begin{cases} x > 3 \\ x \neq 4 \end{cases} \Leftrightarrow D = (3, +\infty) \setminus \{4\}$$

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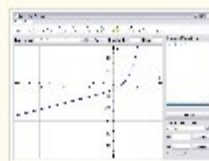
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Solution 2 .
Click the image to see
solution 2 .



Ex3 .

Given $y = 2^x + x - 6$.

- Plot the function .
- Define the x-intercept of the function .

+++++

Solution 3 .

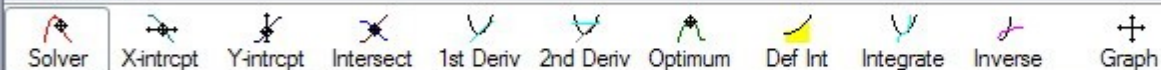
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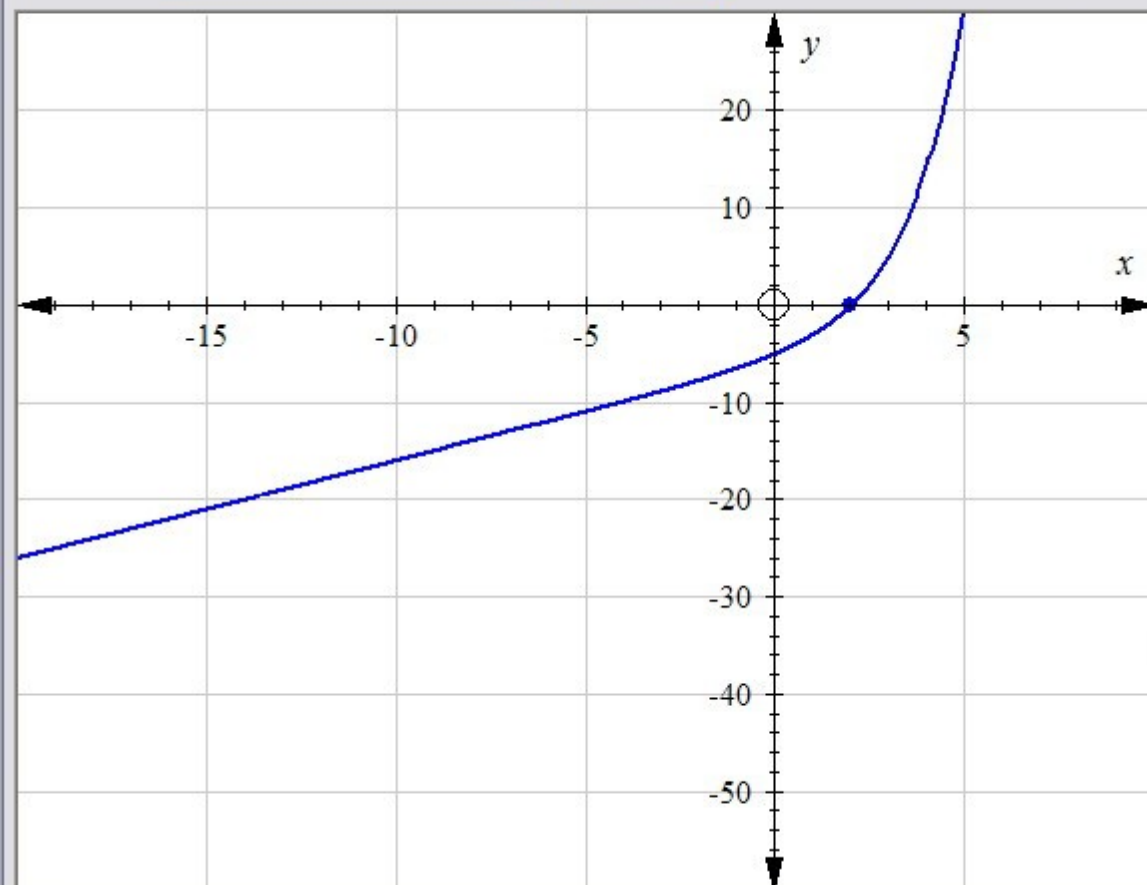
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Graph Tools

Expression: $y = 2^x + x - 6$

Plot

Domain - Min: Max: 

Displayed Functions:

 $y = 2^x + x - 6$

Remove

Clear All

Current Tool: Solver

 $y = 2^x + x - 6$ x =

Solve Y

y =

Solve X

Solution at [2, 0]

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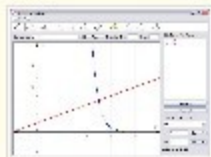
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Ex4 .

Given $y = 7^{6-x}$ (C1)

$y = x + 2$ (C2) .

a. Plot the functions (C1) and (C2) .

b. Infer the zero of the equation

$$7^{6-x} = x + 2$$

from the intersection point of two graphs .

+++++

Solution 4 .

Ex5 .

Click the image to see
example 5 .

Find the derivatives of exponential
functions .

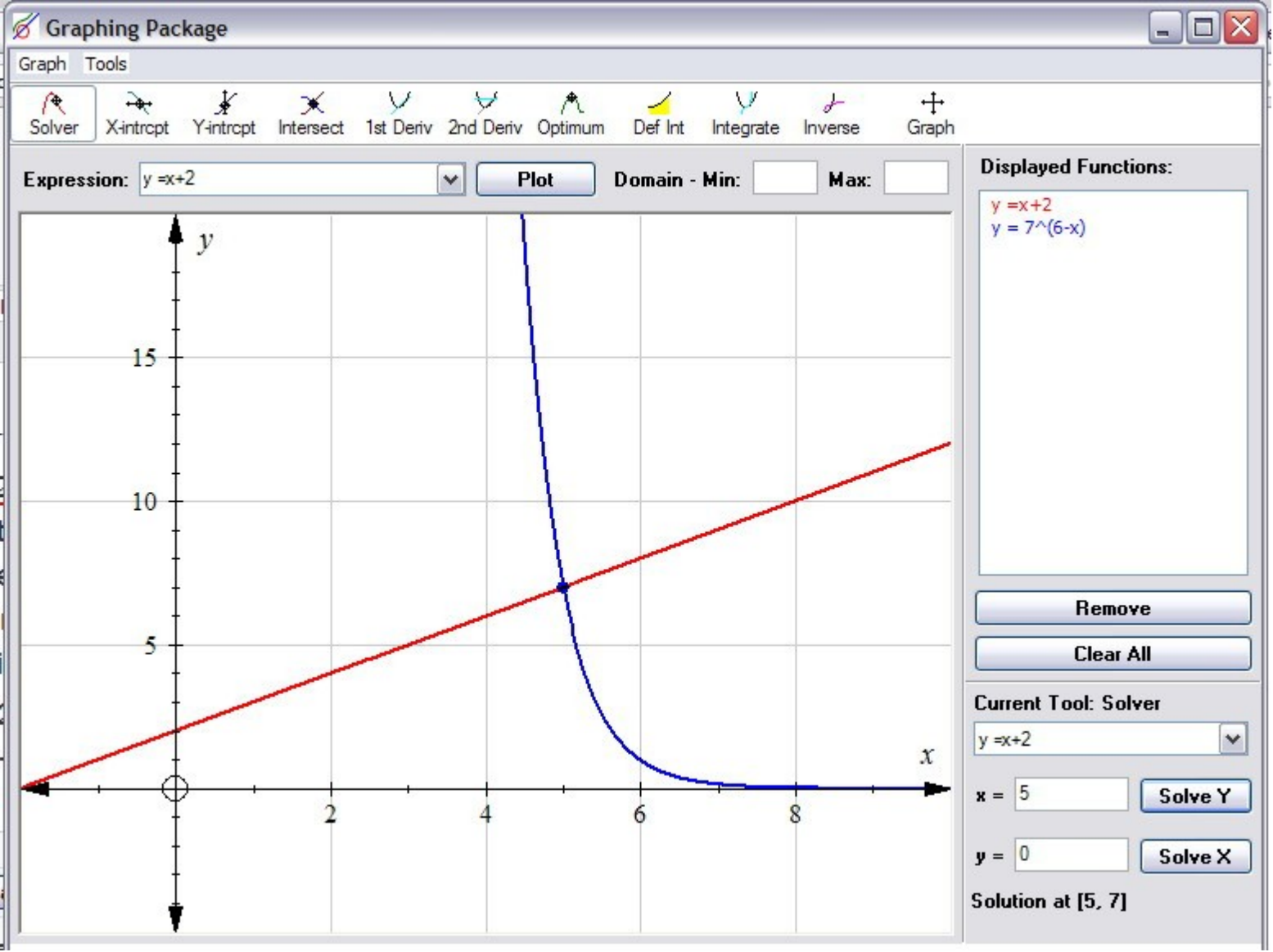
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a. $y = 2^{x^2 - 3x + 5}$

b. $y = \left(\frac{1}{2}\right)^{\sin x + \cos x}$

c. $y = \tan^{\sqrt{3}} 2x$

d. $y = e^{\sqrt{\sin x}}$

$$* a. y = 2^{x^2-3x+5} \Rightarrow y' = (2^{x^2-3x+5})' = 2^{x^2-3x+5} \cdot (x^2 - 3x + 5)' \ln 2 = 2^{x^2-3x+5} \cdot (2x - 3) \ln 2$$

$$* b. y = \left(\frac{1}{2}\right)^{\sin x + \cos x} \Rightarrow y' = \left[\left(\frac{1}{2}\right)^{\sin x + \cos x}\right]' = \left(\frac{1}{2}\right)^{\sin x + \cos x} \cdot (\sin x + \cos x)' \cdot \ln(1/2) =$$

$$= -\left(\frac{1}{2}\right)^{\sin x + \cos x} \cdot (\cos x - \sin x) \cdot \ln 2$$

$$* c. y = \tan^{\sqrt{3}} 2x \Rightarrow y' = [\tan^{\sqrt{3}} 2x]' = \sqrt{3} \cdot \tan^{\sqrt{3}-1} 2x \cdot (\tan 2x)' = \sqrt{3} \cdot \tan^{\sqrt{3}-1} 2x \cdot \frac{1}{\cos^2 2x} \cdot 2$$

$$= 2\sqrt{3} \cdot \frac{\tan^{\sqrt{3}-1} 2x}{\cos^2 2x}$$

$$* d. y = e^{\sqrt{\sin x}} \Rightarrow y' = [e^{\sqrt{\sin x}}]' = e^{\sqrt{\sin x}} \cdot [\sqrt{\sin x}]' = e^{\sqrt{\sin x}} \cdot \frac{1}{2\sqrt{\sin x}} \cdot (\sin x)' = \frac{e^{\sqrt{\sin x}} \cos x}{2\sqrt{\sin x}}$$

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Solution 5 .
Click the image to see
solution 5 .



Ex6 .

Solve the exponential
equation

(i) $2^x = 6^x - 32$

(ii) $1/3^x = 4 + x$

(iii) $7^{6-x} = x + 2$

(iv) $\text{sqrt}(3)^x = 2^x - 1$ for x .

Repeat

Flip

keyboard shortcuts

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Ex6 .

Solve the exponential equation

(i) $2^x = 6^x - 32$

(ii) $1/3^x = 4 + x$

(iii) $7^{6-x} = x + 2$

(iv) $\text{sqrt}(3)^x = 2^x - 1$ for x .

> gptmuDBNB((1/3)^x, 4+x, -1.5, 2, 30); vedt(20);

" Phuong trinh mu co dang ", $\left(\frac{1}{3}\right)^x = 4 + x$ $T_0 = -5.712$

" Xet ham so : $y = f(x) =$ ", $\left(\frac{1}{3}\right)^x$ $T_1 = -1.903$
 $T_2 = -0.6345$

" Dao ham cap 1 $y' =$ ", $-\left(\frac{1}{3}\right)^x \ln(3)$ " Tong T = ", $\Sigma(T_j) = -8.2495$

" Ham so co khuynh huong GLAM \ tren doan ", $[-1.5, 0.5]$

$j = 1.5$, " Dao ham cap 1 ", $\frac{dy(-1.5)}{dx} = -5.712$

" Xet ham so $y = f(x) =$ ", $\left(\frac{1}{3}\right)^x - 4 - x$

$j = 2.5$, " Dao ham cap 1 ", $\frac{dy(-0.5)}{dx} = -1.903$

" Phuong trinh hoành do giao diem : ", $\left(\frac{1}{3}\right)^x = 4 + x$

$j = 3.5$, " Dao ham cap 1 ", $\frac{dy(0.5)}{dx} = -0.6345$

$$X_0 = -1.5$$

" Xet ham so $y = f(x) =$ ", $\left(\frac{1}{3}\right)^x - 4 - x$

$$X_1 = -0.6853050264$$

$$X_2 = -1.202459559$$

$$X_3 = -0.8706044839$$

$$X_{28} = -1.000002052$$

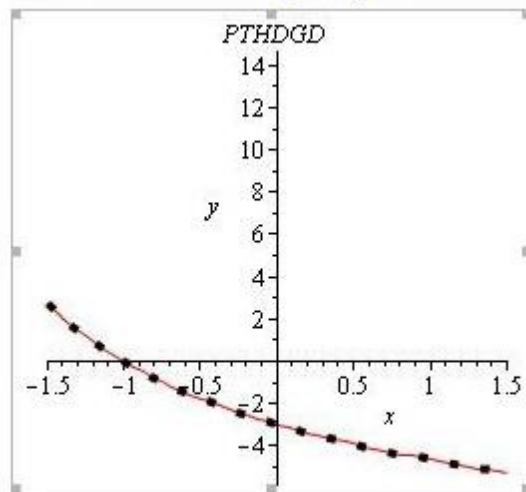
$$X_{29} = -0.9999986812$$

$$X_{30} = -1.000000847$$

" Nghiem cua phuong trinh hoành do giao diem : ",

$$\left(\frac{1}{3}\right)^x = 4 + x,$$

" la giao diem cua ham so $y = f(x)$ va truc hoành "



> gptmuDBNB((1/3)^x, 4+x, -1.5, 2, 30); vedt(20);

" Phuong trinh mu co dang ", $\left(\frac{1}{3}\right)^x = 4 + x$ $T_0 = -5.712$

" Xet ham so : $y = f(x) =$ ", $\left(\frac{1}{3}\right)^x$ $T_1 = -1.903$
 $T_2 = -0.6345$

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" Ham so co khuynh huong GLAM \ tren doan ", $[-1.5, 0.5]$

$j = 1.5$, " Dao ham cap 1 ", $\frac{dy(-1.5)}{dx} = -5.712$

" Xet ham so $y = f(x) =$ ", $\left(\frac{1}{3}\right)^x - 4 - x$

$j = 2.5$, " Dao ham cap 1 ", $\frac{dy(-0.5)}{dx} = -1.903$

" Phuong trinh hoành do giao diem : ", $\left(\frac{1}{3}\right)^x = 4 + x$

$j = 3.5$, " Dao ham cap 1 ", $\frac{dy(0.5)}{dx} = -0.6345$

$$X_0 = -1.5$$

" Xet ham so $y = f(x) =$ ", $\left(\frac{1}{3}\right)^x - 4 - x$

$$X_1 = -0.6853050264$$

" Nghiem cua phuong trinh hoành do giao diem : "

$$X_2 = -1.202459559$$

$$X_3 = -0.8706044839$$

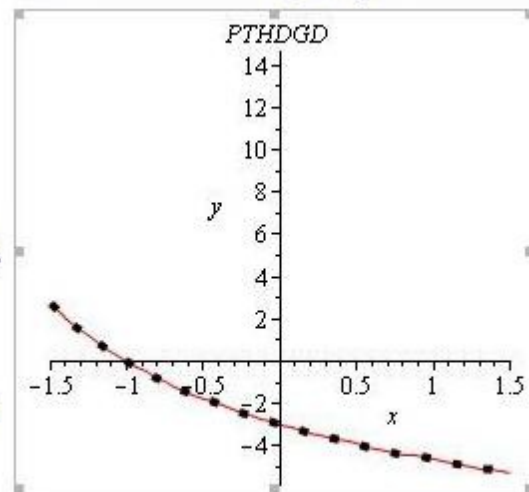
$$\left(\frac{1}{3}\right)^x = 4 + x,$$

$$X_{28} = -1.000002052$$

" la giao diem cua ham so $y = f(x)$ va truc hoành "

$$X_{29} = -0.9999986812$$

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Solution 6 . Cont'
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solution 6 .



$$(iii) 7^{6-x} = x + 2$$
$$(iv) \sqrt{3}^x = 2^x - 1$$

NEXT →

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" Phương trình mũ có dạng ", $7^{6-x} = x + 2$

" Xét hàm số : $y = f(x) =$ ", 7^{6-x}

" Đạo hàm cấp 1 $y' =$ ", $-7^{6-x} \ln(7)$

" Tổng T = ", $\Sigma(T_j) = -2.347079842 \cdot 10^7$

Hàm số có khuynh hướng GIAM \ trên đoạn ", $[-2.3, 4.98]$

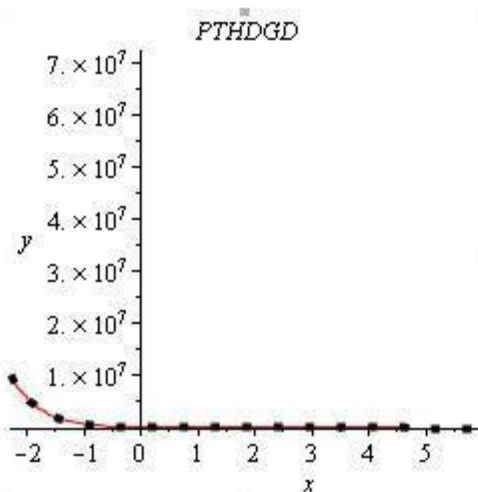
" Xét hàm số $y = f(x) =$ ", $7^{6-x} - x - 2$

$$X_0 = -2.3$$

$$X_4 = 4.999999884$$

$$X_5 = 4.999999998$$

$$X_6 = 5.000000000$$



" Phương trình mũ có dạng ", $(\sqrt{3})^x = 2^x - 1$

" Xét hàm số : $y = f(x) =$ ", $(\sqrt{3})^x$

" Đạo hàm cấp 1 $y' =$ ", $\frac{1}{2} (\sqrt{3})^x \ln(3)$

$j = -1.35$, " Đạo hàm cấp 1 ", $\frac{dy(1.35)}{dx} = 1.154$

$j = -0.35$, " Đạo hàm cấp 1 ", $\frac{dy(2.35)}{dx} = 1.998$

$$T_0 = 1.154$$

$$T_1 = 1.998$$

" Tổng T = ", $\Sigma(T_j) = 3.152$

" Hàm số có khuynh hướng TANG // trên đoạn ",
 $[1.35, 2.35]$

" Xét hàm số $y = f(x) =$ ", $(\sqrt{3})^x - 2^x + 1$

$$X_0 = 1.35$$

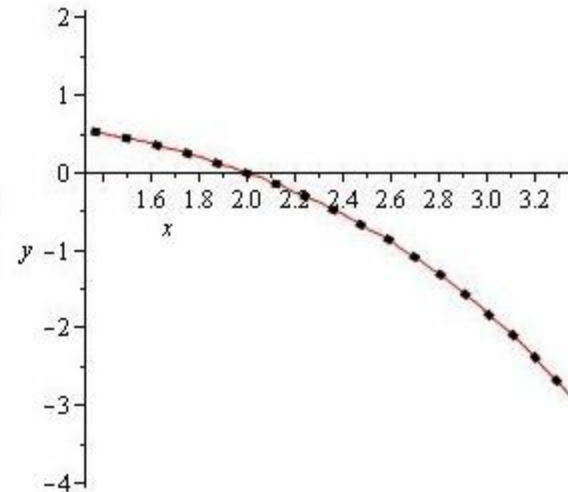
$$X_1 = 1.893361422$$

$$X_2 = 1.983893547$$

$$X_{10} = 1.999999996$$

$$X_{11} = 1.999999999$$

$$X_{12} = 2.000000000$$



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Ex7 .

Prove that

(i) $2^x \geq x + 1$, any $x \geq 1$.

(ii) $\cos x + x + 1 \leq 2^{x+1}$,
any $x \geq 0$.



Solution 7 .
Click the image to see
solution 7 .

↻ Repeat

↻ Flip

? keyboard shortcuts

Ex7 .

Prove that

(i) $2^x \geq x + 1$, any $x \geq 1$.

(ii) $\cos x + x + 1 \leq 2^{x+1}$, any $x \geq 0$.

Close Window

> gbptmuDBNB(2^x, x+1, bang, [1, infinity], 10, 50);

" Bat phuong trinh mu co dang ", $x + 1 \leq 2^x$

" Xet ham so : $y = f(x) =$ ", $2^x - x - 1$

" Dao ham cap 1 $y' =$ ", $2^x \ln(2) - 1$

" Dieu kien bat phuong trinh mu co dang ", $x < \infty, 1 < x$

" Nghiem cua bat phuong trinh : $f'(x) > 0 \Leftrightarrow$ ", $\{x \leq 0\}, \{1 \leq x\}$

" Tim cuc dai , cuc tieu tren doan : ", $[1, \infty]$

" Dao ham cap 1 : $y' =$ ", $2^x \ln(2) - 1$

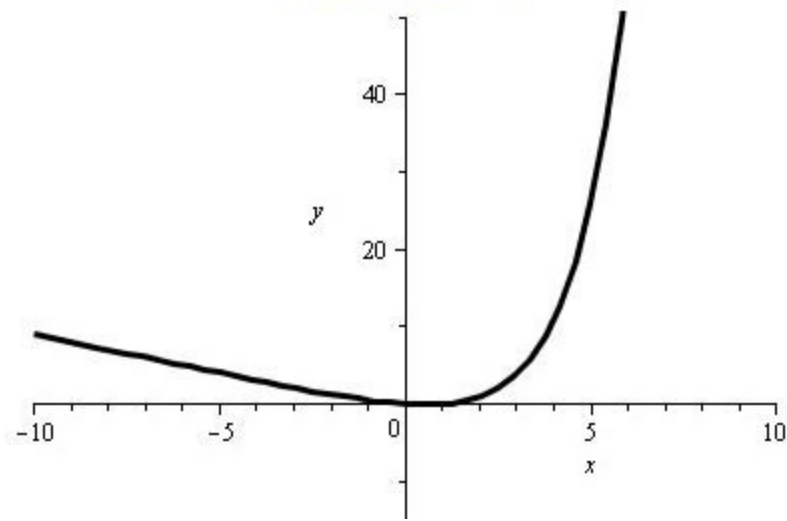
" Giai : $y' = 0$ tim $x \Leftrightarrow$ ", $2^x \ln(2) - 1 = 0$

" Hoanh do cuc tri : $x =$ ", $\left\{ -\frac{\ln(\ln(2))}{\ln(2)} \right\}$

" Lap bang bien thien "

" Cuc dai : $y_{Max} =$ ", ∞

" cuc tieu : $y_{min} =$ ", 0



> gbptmuDBNB(2^(x+1), cos(x)+x+1, bang, [0, infinity], 5, 5);

" Bat phuong trinh mu co dang ", $\cos(x) + x + 1 \leq 2^{x+1}$

" Xet ham so : $y = f(x) =$ ", $2^{x+1} - \cos(x) - x - 1$

" Dao ham cap 1 $y' =$ ", $2^{x+1} \ln(2) + \sin(x) - 1$

" Dieu kien bat phuong trinh mu co dang ", $x < \infty, 0 < x$

" Nghiem cua bat phuong trinh : $f'(x) > 0 \Leftrightarrow$ "

" Tim cuc dai , cuc tieu tren doan : ", $[0, \infty]$

" Dao ham cap 1 : $y' =$ ", $2^{x+1} \ln(2) + \sin(x) - 1$

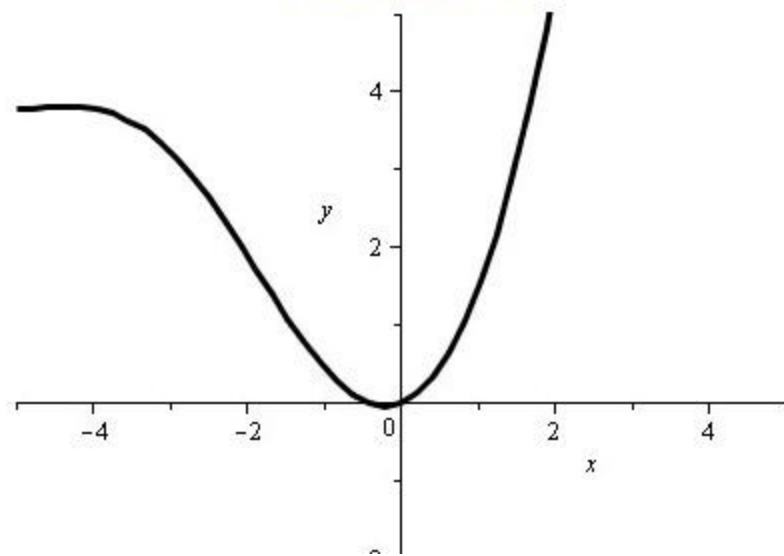
" Giai : $y' = 0$ tim $x \Leftrightarrow$ ", $2^{x+1} \ln(2) + \sin(x) - 1 = 0$

" Hoanh do cuc tri : $x =$ ", $\{RootOf(_Z \ln(2) + \ln(2) + \ln(\ln(2)) - \ln(-\sin(_Z) + 1))\}$

" Lap bang bien thien "

" Cuc dai : $y_{Max} =$ ", ∞

" cuc tieu : $y_{min} =$ ", 0



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**LOOKING FORWARD
TO YOUR VISIT .**

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