Logarithms

Question1

$\cosh(\log 4)$ **is equal to**

AP EAPCET 2024 - 23th May Morning Shift

Options:

A. $\frac{8}{17}$

B. $\frac{17}{8}$

C. 0

D. $\frac{9}{8}$

Answer: B

Solution:

To find $\cosh(\log 4)$, we start by using the identity for the hyperbolic cosine function:

$\cosh(x) = \frac{e^x + e^{-x}}{2}$

Substituting $x = \log 4$ into the formula, we have:

$\cosh(\log 4) = \frac{e^{\log 4} + e^{-\log 4}}{2}$

We know that:

$e^{\log 4} = 4 \quad \text{and} \quad e^{-\log 4} = \frac{1}{4}$

Substitute these values back into the equation:

$\cosh(\log 4) = \frac{4 + \frac{1}{4}}{2} = \frac{\frac{16}{4} + \frac{1}{4}}{2}$

Simplify the expression:

$= \frac{\frac{17}{4}}{2} = \frac{17}{8}$

Therefore, $\cosh(\log 4) = \frac{17}{8}$.

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Question2

$\cosh 1+2=$

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Options:

A. $\log(2+\sqrt{3})$

B. $\log(2+\sqrt{5})$

C. $\log(2-\sqrt{5})$

D. $\log(2+\sqrt{2})$

Answer: A

Solution:

To solve this problem, let's use the relationship for the inverse hyperbolic cosine function:

$\cosh^{-1} x=\log\left(x+\sqrt{x^2-1}\right)$

Applying this to $\cosh^{-1} 2$, we get:

$\cosh^{-1} 2=\log\left(2+\sqrt{2^2-1}\right)$

Simplifying under the square root:

$\sqrt{2^2-1}=\sqrt{4-1}=\sqrt{3}$

So, the expression becomes:

$\cosh^{-1} 2=\log(2+\sqrt{3})$

Question3

$4^x-3^{x-\frac{1}{2}}=3^{x+\frac{1}{2}}-2^{2x-1} \Rightarrow x=$

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Options:

A. $\frac{5}{2}$

B. $\frac{1}{2}$

C. $\frac{3}{2}$

D. $\frac{7}{2}$

Answer: C

Solution:

Given,

$$4^x - 3^{x-\frac{1}{2}} = 3^{x+\frac{1}{2}} - 2^{2x-1}$$
$$\Rightarrow (2)^{2x} + 2^{2x-1} = 3^{x+\frac{1}{2}} + 3^{x-\frac{1}{2}}$$
$$\Rightarrow 2^{2x} + \frac{2^{2x}}{2} = 3^x \cdot \sqrt{3} + \frac{3^x}{\sqrt{3}}$$
$$\Rightarrow 2^{2x}\left[1 + \frac{1}{2}\right] = 3^x\left[\sqrt{3} + \frac{1}{\sqrt{3}}\right]$$
$$\Rightarrow 2^{2x} \times \frac{3}{2} = 3^x \times \frac{4}{\sqrt{3}}$$
$$\Rightarrow 2^{2x}(3\sqrt{3}) = 3^x(8)$$
$$\Rightarrow 2^{2x}(3)^{\frac{3}{2}} = 3^x \times (2)^3$$

Comparing power of 2, $2x = 3$

and comparing power of 3, $x = \frac{3}{2}$

Both equations given us $x = \frac{3}{2}$.

Question4

$\left\{x \in R / \frac{\sqrt{|x|^2 - 2|x| - 8}}{\log(2 - x - x^2)}\right.$ **is a real number** $\}=$

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Options:

A. $(-\infty,-4]\cup[4,\infty)$

B. ϕ

C. $(-1,2)$

D. $(-\infty,-4]\cup(-1,2)\cup[4,\infty)$

Answer: B

Solution:

$$\left\{x\in R/\frac{\sqrt{|x|^2-2|x|-8}}{\log\left(2-x-x^2\right)}\text{ is a real number }\right\}$$
$$\left\{x\in R/\frac{\sqrt{x^2-2x-8}}{\log(2+x)(1-x)}\text{ is a real number }\right\}$$
$$=\left\{x\in R/\frac{\sqrt{(x-4)(x+2)}}{\log\{(2+x)(1-x)\}}\text{ is a real number }\right\}$$
$$=\phi$$

Question5

If $4+6\left(e^{2x}+1\right)\tanh x=11\cosh x+11\sinh x$ **then** $x=$

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Options:

A. $\log_{10}$

B. $\log 4$

C. $\log 5$

D. $\log 2$

Answer: D

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Solution:

Given,

$4+6\left(e^{2x}+1\right)\tanh x=11\cosh x+11\sinh x$

$\Rightarrow \quad 4+6\left(e^{2x}+1\right)\cdot\frac{\left(e^{2x}-1\right)}{\left(e^{2x}+1\right)}$

$=11\left\{\frac{e^{2x}+1}{2e^{x}}+\frac{e^{2x}-1}{2e^{x}}\right\}$

$=11\left\{\frac{2e^{2x}}{2e^{x}}\right\}=11e^{x}$

$\Rightarrow \quad 4+6\left(e^{2x}-1\right)=11e^{x}$

Let $e^{x}=P$

$\Rightarrow \quad 4+6\left(P^{2}-1\right)=11P$

$\Rightarrow \quad 6P^{2}-11P-2=0$

$\Rightarrow \quad 6P^{2}-12P+P-2=0$

$\Rightarrow \quad (P-2)(6P+1)=0$

$\Rightarrow \quad P=2 \text{ and } \frac{-1}{6}$

Thus, $e^{x}=2$

$\Rightarrow \quad x=\log_{e}2$

Question6

If $4^{x}-3^{x-1/2}=3^{x+1/2}-2^{2x-1}$, then the value of x is

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Options:

A. $7/2$

B. $5/2$

C. $1/2$

D. $3/2$

Answer: D

Solution:

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$$
\begin{aligned}
& 4^x - 3^{x-\frac{1}{2}} = 3^{x+\frac{1}{2}} - 2^{2x-1} \\
\Rightarrow \quad & 4^x - 3^x \cdot 3^{-\frac{1}{2}} = 3^x \cdot 3^{\frac{1}{2}} - 2^{2x} \cdot 2^{-1} \\
\Rightarrow \quad & 4^x - 3^x \cdot \frac{1}{\sqrt{3}} = \sqrt{3} \cdot 3^x - \frac{4^x}{2} \\
\Rightarrow \quad & 4^x + \frac{4^x}{2} = \sqrt{3} \cdot 3^x + \frac{1}{\sqrt{3}} \cdot 3^x \\
\Rightarrow \quad & 4^x \left(1 + \frac{1}{2}\right) = 3^x \left(\sqrt{3} + \frac{1}{\sqrt{3}}\right) \\
\Rightarrow \quad & \frac{3}{2} \cdot 4^x = \frac{4}{\sqrt{3}} \cdot 3^x \\
\Rightarrow \quad & \frac{4^x}{3^x} = \frac{2 \cdot 4}{3\sqrt{3}} \\
\Rightarrow \quad & \left(\frac{4}{3}\right)^x = \frac{4^{\frac{1}{2}} \cdot 4^1}{3^{1\frac{1}{3^2}}} = \left(\frac{4}{3}\right)^{\frac{1}{2}+1} = \left(\frac{4}{3}\right)^{\frac{3}{2}} \\
\Rightarrow \quad & x = \frac{3}{2}
\end{aligned}
$$

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