**Chapter # 05 (Exponential and Logarithmic Function) Page-30**

**5.6 Logarithmic and Exponential Equations:**

**Objectives:** 1 Solve Logarithmic Equations

2 Solve Exponential Equations

3 Solve Logarithmic and Exponential Equations Using a Graphing Utility

**Solve Logarithmic Equations:** In Section 5.4 we solved logarithmic equations by changing a logarithmic expression to an exponential expression. That is, we used the definition of a logarithm:

is equivalent to

**Question:** Solve the following equation:

**Solution:** Given,

Ans.

**Note:** If , then *M* = *N* *M*, *N*, and *a* are positive and

**Example1:** Solve:

**Solution:** The domain of the variable in this equation is . Note that each logarithm has the same base, 5. Then find the exact solution as follows:

Now,

But

Therefore the only solution is Ans.

**Example2:** Solve: .

**Solution:** The domain of the variable requires that As a result, the domain of the variable here is .

Now,

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But . Therefore the only solution is Ans.

**Solve Exponential Equations:**  In Sections 5.3 and 5.4, we solved exponential equations algebraically by expressing each side of the equation using the same base. That is, we used the one-to-one property of the exponential function:

If , then here .

**Example 3:** Solve the following exponential equation: (a) (b) 8.

**Solution:** (a) Given,

(Because 5 cannot be written as an integer power of 2, write the exponential equation as the equivalent logarithmic equation).

(Use change of base rule)

Ans.

**Example 4:** Solve the following exponential equation:

**Solution:** Given,

((take the natural logarithm of each side)

Ans.

**Example 5:** Solve the following exponential equation: .

**Solution:** Note that, , so the equation is quadratic in form and can be written as

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But in the second solution has no solution because for all x.

Therefore, Ans.

**Home Work: Exercise 5.6: Problem No. 5 - 32, 41-64 and 83 - 96**

**Exercise 5.6:**

**Question no. 5 - 32 are same:**

**Question 16:** Solve the following logarithmic equation:

**Solution:** Here,

Now,

For all real x, , Ans.

**Question 28:** Solve the following logarithmic equation:

**Solution:** The domain of the variable requires that, As a result, the domain of the variable here is .

Now,

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. But domain is

Therefore the only solution is (approximate) Ans.

**Question no. 41- 64 are same:**

**Question 52:** Solve following exponential equation. Express irrational solutions in exact form and as a decimal rounded to three decimal places:

**Solution:**

(Taking *ln* both the sides)

⇒ (Approximate) Ans.

**Question 56:** Solve following exponential equation. Express irrational solutions in exact form and as a decimal rounded to three decimal places:

**Solution:**

(Taking *ln* both the sides)

(Approximate) Ans.

**Question 64:** Solve following exponential equation. Express irrational solutions in exact form and as a decimal rounded to three decimal places:

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**Solution:**

Let,

Therefore,

(Taking *ln* both the sides)

(Approximate) Ans.