**Chapter # 05 (Exponential and Logarithmic Function)**

**Introduction:** In this chapter, we study two transcendental functions; the exponential function and the logarithmic function. These functions occur frequently in a wide variety of applications, such as biology, chemistry, economics and psychology. This chapter begins with a discussion of composite, one-to-one, and inverse functions- concepts that are needed to explain the relationship between exponential and logarithmic functions.

**5.1 Composite Functions:** Given two functions *f* and *g*, the composite function, denoted by is defined by

The domain of is the set of all numbers *x* in the domain of *g* such the *g*(*x*) is in the domain of *f*.

**Example1.** Suppose and . Find

(a) (b) (c) (d)

**Solution. (a)** Given and

؞

=

؞ Ans.

**(c)**

⇒ Ans.

**Example2.** Suppose that and .

Find (a) (b) . Then find the domain of each composite function.

**Solution.** (a)

Ans.

Since the domains of both *f* and *g* are the set of all real numbers, the domain of is the set of all real numbers.

**Example3.** Find the domain of if and

**Solution.** For , first note that the domain of *g* is , so exclude 1 from the domain of .

Next note that the domain of f is

The domain of is Ans.

**Example4.** Suppose that and . Find (a) , (b) . Then find the domain of each composite function.

**Solution.** The domain of is and the domain of *g* is .

**(a)**

؞ The domain of is Ans. (Ref. example 3)

**(b)**

⇒

Now the domain of consists of those *x* in the domain of *f* is for which

⇒, ؞

؞ The domain of is Ans.

**Example5.** If , show that , for every x in the domain of .

**Solution.** Given,

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And

Hence, proved

**H. W: Exercise 5.1: Problem No. 13 - 46 and 53 - 58**

**Exercise 5.1:**

**Question no. 13 - 22 are same:**

**Question 22**. Given, . Find

**(a)** , (b) , (c) , (d)

Solution. (a) Given, .

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؞ Ans.

**(c)** Given,

Now,

؞ Ans.

**Question no. 23 - 38 are same:**

**Question 38.** Given, .

Find, (a) , (b) , (c) , (d) and then state the domain of each composite function.

**Solution. (a)** Given,

؞ Ans.

For the domain of :

Note that the domain of *g* is , so we exclude 3 from the domain of . Next, note that the domain of *f* is

So,

The domain of is Ans.

**(c)** Ans.

Note that the domain of .

Next, the domain of *f* is

So,

The domain of is Ans.

**Question no. 39 - 46 are same:**

**Question 44.** If , show that , for every x in the domain of .

**Solution:** Given,

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And

Hence, proved

**Question no. 53 - 58 are same:**

**Question 56.** If , find the value of '*a*' so that the graph crosses the *y*-axis at 68.

**Solution:** Given,

Since crosses the *y*-axis at 68

Ans.