

2.  $x - 6 > 0$

Since the logarithmic function is one-to-one,  $\log_{10}(x^2 - 9x + 10) = \log_{10}(x - 6)$  if and only if  $x^2 - 9x + 10 = x - 6$ .

Solving the last equation, we get two solutions:  $x = 8$  or  $x = 2$ .

Now, we check whether these values satisfy inequalities 1 and 2 above.

Substituting  $x = 8$  in these inequalities, we get:

$$8^2 - 9 \cdot 8 + 10 = 2 > 0$$

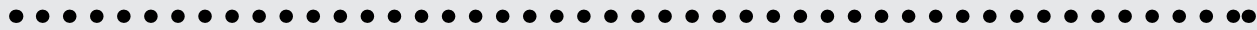
$$8 - 6 = 2 > 0$$

$x = 8$  satisfies conditions 1 and 2, and hence it is a solution.

Substituting  $x = 2$  in inequality 1, we get  $2^2 - 9 \cdot 2 + 10 = -4 < 0$

Since  $x = 2$  does not satisfy at least one of conditions 1 and 2, it is not a solution.

**EXAMPLE 6.3c:** Solve the equation  $\log_3 x + \log_3(x + 8) = 2$ .



**SOLUTION:**  $\log_3 x + \log_3(x + 8) = 2$

**Condition:**

1.  $x > 0$

2.  $x + 8 > 0$

$$\log_3 x(x + 8) = 2 \quad \text{By Property 6}$$

$$x(x + 8) = 3^2$$

$$x^2 + 8x = 9$$

$$x^2 + 8x - 9 = 0$$

$$x = \frac{-8 \pm \sqrt{64 + 36}}{2}$$

$$x = \frac{-8 \pm 10}{2}$$

$$x = -9, x = 1$$

Since  $x = -9$  violates condition 1, the only solution our equation has is  $x = 1$ .

