### **TALENT & OLYMPIAD**

Linear Equation in One Variable

#### Introduction of Linear Equation

An algebraic equation is an equality involving one or more variables. It has equality sign in between. The expression on the left is called LHS and the expression on the right is called RHS. An expression in one variable having degree one is called linear equation in one variable. In a linear equation the value of the expression on LHS and RHS are all equal. The value of the variable which satisfies the given expression is called solution of the linear equation. We can find the solution of the linear equation either by hit and trial method or by solving the given equation for the required variables.

#### How to solve Linear Equation in One Variable

There are some set of rules to solve linear equation in one variable:

- We can add the same number on both sides of the equation.
- We can subtract the same number from both sides of the equation.
- We can multiply both sides of the equation by the same number.
- We can divide both sides of the equation by some none zero numbers.

• If 
$$\frac{ax+by}{cx+dy} = \frac{p}{q}$$
 then  $q(ax+b) = p(cx+d)$ .

- This process is called cross multiplication.
- Any term of the equation can be transferred to any side of the equation by changing the sign of the term. This is called transposition.

#### Properties of Equality

Let us consider an algebraic expression as A, B and C.

Property 1: Addition Property of Equality. If A = B then A + C = B + C

**Property 2:** Subtraction Property of Equality. If A = B then A - C = B - C

Property 3: Multiplication Property of Equality. If A = B and  $C \neq 0$  then CA = CB.

Property 4: Division Property of Equality.

If A = B and  $C \neq 0$  then  $\frac{A}{C} = \frac{B}{C}$ 

**Note:** Multiplying or dividing both sides of an equation by zero is carefully avoided. Dividing by zero is undefined and multiplying both sides by zero will result in an equation 0=0.



- A linear equation can be used to solve the word problems related to day to day situations.
- A linear equation cannot have more than one solution.
- A linear equation in two variables always represents a straight line on the graph.
- The solution of the linear equation is that number which satisfies the given equations.
- There can be infinite number of solutions of the linear equation of two variables.

### **SUMMARY**



- An algebraic expression is an equality involving one or more variables.
- The solution of the linear equation is the value of the variable which is obtained by solving the given equation.
- ✤ A linear equation may have a rational solution.
- In a linear equation variable can also be transposed.
- Linear equation can be used for the purpose of problem solving.

## Commonly Asked

| - | Find the solution of the given linear  | r equation      | $\frac{6m+7}{3m+2} =$ | $\frac{4m+5}{2m+3}$ |
|---|--|-----------------|-----------------------|---------------------|
|   | (a) $-\frac{11}{9}$ (b)  | $\frac{11}{9}$  |                       |                     |
|   | (c) $\frac{9}{11}$ (d)   | $-\frac{9}{11}$ |                       |                     |
|   | (e) None of these  |                 |                       |                     |
|   | Answer: (a)<br>Exploration   |                 |                       |                     |
|   | $=\frac{6m+7}{3m+2}=\frac{4m+5}{2m+3}$   |                 |                       |                     |
|   | $\Rightarrow (6m+7)(2m+3) = (4m+5)(3m+3) = (4m+5)(3m+5) = (4$ | 2)              |                       |                     |
|   | $\Rightarrow 12m + 18m + 14m + 21 = 21m + 8m$ $\Rightarrow 32m + 21 = 23m + 10$  | +15m+10         |                       |                     |
|   | $\Rightarrow m = -\frac{11}{9}$  |                 |                       |                     |

Find the solution of 
$$\frac{4y+1}{3} + \frac{2y-1}{2} - \frac{3y-7}{5} = 6$$
  
(a) 1  
(b)  $-2\frac{11}{4}$   
(c)  $-\frac{11}{4}$   
(d)  $2\frac{3}{4}$   
(e) None of these  
Answer: (d)  
Explanation  
We have,  
 $\Rightarrow \frac{4y+1}{3} + \frac{2y-1}{2} - \frac{3y-7}{5} = 6$ 

$$\Rightarrow \frac{\frac{3}{40y+10+30y-15-18y+42}}{30} = 6$$

$$\Rightarrow 52y + 37 = 180$$
$$\Rightarrow 52y = 180 - 37$$
$$\Rightarrow y = \frac{143}{52} = \frac{11}{4}$$

Find the value of n such that  $\frac{2}{3}(4n-1) - (2n - \frac{1+n}{3}) = \frac{1}{3}n + \frac{4}{3}$ . (a)  $-\frac{5}{4}$  (b)  $\frac{5}{4}$ (c)  $-\frac{5}{2}$  (d)  $\frac{5}{2}$ (e) None of these

Answer: (d)

Solve the equation  $\frac{0.5(z-0.4)}{3.5} - \frac{0.6(z-2.7)}{4.2} = z+6.1$ (a)  $-\frac{202}{35}$  (b)  $\frac{202}{35}$ (c)  $\frac{35}{202}$  (d)  $-\frac{35}{202}$ (e) None of these Answer: (a) Explanation  $\Rightarrow \frac{5(z-0.4)}{35} - \frac{6(z-2.7)}{42} = z+6.1$  $\Rightarrow \frac{30z-12-30z+81}{210} = z+6.1$  $\Rightarrow \frac{69}{210} = z+6.1$  $\Rightarrow z = -\frac{202}{35}$ 

# Self Evaluation



| 1. | David cuts a bread into<br>small pieces is twenty gr<br>original cake.<br>(a) 120 gm<br>(c) 300 gm<br>(e) None of these   | two equal pieces and cuts one half into smaller pieces of equal size. Each of the<br>rams in weight. If he has seven pieces of the bread all with him, how heavy is the<br>(b) 180 gm<br>(d) 240 gm           |
|----|---|---|
| 2. | Find the number of 8's in<br>exactly divisible by imme<br>(a) 2<br>(c) 4<br>(e) None of these                             | n the given series which is exactly divisible by its immediately preceding and also<br>ediately succeeding numbers? The number is 824517284842282698454832843182.<br>(b) 3<br>(d) 5                           |
| 3. | Mary was counting down<br>from 1 and he was calling<br>time if they were calling<br>(a) 20<br>(c) 22<br>(e) None of these | n from 34 and Thomas was counting upwards simultaneously, the number starting<br>g out only the odd numbers. Which common number will they call out at the same<br>out at the same speed?<br>(b) 21<br>(d) 23 |
| 4. | Solve the given equation<br>(a) $\frac{43}{13}$<br>(c) $\frac{43}{11}$<br>(e) None of these                               | and find the value of y if, $\frac{7y-1}{4} - \frac{1}{3}(2y - \frac{1-y}{2}) = \frac{10}{3}$<br>(b) $\frac{41}{15}$<br>(d) $\frac{43}{17}$   |
| 5. | Find the value of 'm' from<br>(a) -1<br>(b) 1<br>(c) 0<br>(d) 10<br>(e) None of these                                     | n the expression $\frac{6m^2 + 13m - 4}{2m + 5} = \frac{12m^2 + 5m - 2}{4m + 3}.$   |

| 6.  | If $6.5n + \frac{19.5n - 32.5}{2} = 6.5n - 32.5$<br>(a) 0  | $-13 - \left(\frac{13n - 26}{2}\right)$ then find the value of n.<br>(b) 5 |  |  |  |  |  |  |  |  |  |
|-----|--|--|--|--|--|--|--|--|--|--|--|
|     | (e) None of these  | (u) 1  |  |  |  |  |  |  |  |  |  |
| 7.  | The distance between two mile stones is 230 km and two cars start simultaneously from the milestones in opposite directions and the distance between them after three hours is 20 km. If the speed of one car is less than that of other by 10 km/h, find the speed of each car.<br>(a) 25 km/h, 40 km/h (b) 40 km/h, 50 km/h<br>(c) 20 km (b) 40 km/h (c) 20 km (b) 40 km/h |  |  |  |  |  |  |  |  |  |  |
|     | (e) None of these  | (u) 50 km/m, 40 km/m   |  |  |  |  |  |  |  |  |  |
| 8.  | A store has provision which would last for a certain number of men for 21 days. For one seventh of the men it will last for how many days?   |  |  |  |  |  |  |  |  |  |  |
|     | (a) 147  | (b) 158  |  |  |  |  |  |  |  |  |  |
|     | (c) 129<br>(e) None of these   | (d) 174  |  |  |  |  |  |  |  |  |  |
| 9.  | An MNC company employed 25 men to do the official work in 32 days. After 16 days, it employed 5 more men and work was finished one day earlier. If it had not employed additional men, it would have been behind by how many days?   |  |  |  |  |  |  |  |  |  |  |
|     | (a) 1 day  | (b) 2 days   |  |  |  |  |  |  |  |  |  |
|     | (c) 3 days   | (d) 2.5 days   |  |  |  |  |  |  |  |  |  |
|     | (e) None of these  |  |  |  |  |  |  |  |  |  |  |
| 10. | A Bullet train left for the New York at time y minutes after x hours and reached Canada z minutes after y hour on the same day, after travelling z hrs and x minutes. How many possible values of x are there?   |  |  |  |  |  |  |  |  |  |  |
|     | (a) 1  | (b) 2  |  |  |  |  |  |  |  |  |  |
|     | (c) 3  | (d) 4  |  |  |  |  |  |  |  |  |  |
|     | (e) None of these  |  |  |  |  |  |  |  |  |  |  |
|     |  |  |  |  |  |  |  |  |  |  |  |

| Answers – Self Evaluation Test |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |    |   |              |
|--------------------------------|---|----|---|----|---|----|---|----|---|----|---|----|---|----|---|----|---|--------------|
| 1.                             | D | 2. | С | 3. | D | 4. | С | 5. | В | 6. | D | 7. | D | 8. | А | 9. | В | <b>10.</b> B |

# Self Evaluation Test SOLUTIONS

**1.** Let the weight of original piece be '*x*'

Then the weight on one half is  $\frac{x}{2}$ 

There are total of seven pieces and number of smaller pieces is six. Weight of each smaller piece is 20 gm Therefore, weight of six such piece is  $6 \times 20 = 120$  gm Hence the total weight of piece  $= 2 \times 120 = 240$  gm

2. There are four such order pairs such as 284, 484, 282, 284. Hence the number of such 8 is four.