

CLASS 9 · HOTS · OLYMPIAD PREPARATION · SHORT NOTES

Chapter 2: HOTS: Linear Polynomials (Class 9)

Topic-wise short notes with solved examples

Higher order thinking questions on linear polynomials for Class 9: finding a polynomial from two values, zeroes, comparing two plans, straight-line graphs and matchstick patterns, each with a full solution.

1 Solved HOTS questions

- A linear polynomial $p(x) = ax + b$ has a graph that is a straight line with slope a and cuts the y -axis at b . Its zero is $x = -\frac{b}{a}$. Patterns that grow by a fixed amount are described by linear polynomials.

Example 1.1 A linear polynomial $p(x)$ has $p(2) = 7$ and $p(5) = 16$. Find $p(x)$.

SOLUTION

Let $p(x) = ax + b$. Then $2a + b = 7$ and $5a + b = 16$.

Subtracting: $3a = 9$, so $a = 3$ and $b = 1$.

Check: $p(2) = 7$ and $p(5) = 16$.

$$p(x) = 3x + 1$$

Example 1.2 Find k if $x = 2$ is a zero of $5x + k$. Hence find the zero of $kx + 20$.

SOLUTION

$$5(2) + k = 0, \text{ so } k = -10.$$

The second polynomial is $-10x + 20$, and its zero is $x = \frac{20}{10}$.

$k = -10$ and the zero is 2

Example 1.3 A phone plan A has a fixed charge of Rs 150 and Rs 2 per minute. Plan B has no fixed charge and Rs 5 per minute. For how many minutes do the two plans cost the same?

SOLUTION

Plan A: $150 + 2m$. Plan B: $5m$.

$$150 + 2m = 5m, \text{ so } 3m = 150 \text{ and } m = 50.$$

Check: A costs $150 + 100 = 250$ and B costs 250.

50 minutes (and for more than 50 minutes plan A is cheaper)

Example 1.4 The graph of $y = ax + b$ passes through $(1, 5)$ and $(3, 11)$. Find the equation of the line and the points where it cuts the axes.

SOLUTION

$a + b = 5$ and $3a + b = 11$. Subtracting: $2a = 6$, so $a = 3$ and $b = 2$.

The line is $y = 3x + 2$. It cuts the y-axis at $(0, 2)$.

It cuts the x-axis where $3x + 2 = 0$, that is $x = -\frac{2}{3}$.

$y = 3x + 2$; points $(0, 2)$ and $\left(-\frac{2}{3}, 0\right)$

Example 1.5 A row of triangles is made with matchsticks. One triangle needs 3 sticks, two triangles in a row need 5, three need 7. How many sticks are needed for 25 triangles, and how many triangles can be made with 101 sticks?

SOLUTION

The pattern adds 2 sticks for each new triangle: $p(n) = 2n + 1$.

For 25 triangles: $2 \times 25 + 1 = 51$.

For 101 sticks: $2n + 1 = 101$, so $n = 50$.

51 sticks, and 50 triangles