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TOPIC-WISE ASSIGNMENT

Chapter 2 · Linear Polynomials

Class IX · As per New Curriculum **Ganita Manjari**

Reviewed by Deepika Bhati, Maths Passionate Since 2009
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TOPIC 1

1 Polynomials, Degree and Linear Equations

Terms, variables, coefficients | One-variable polynomials | Degree | Value of a polynomial | Input–output machines | Word problems

QUICK RECAP (from earlier classes)

- In $4x + 5y + 3$, the **terms** are $4x$, $5y$, 3; 4 and 5 are **coefficients**; 3 is the **constant**.
- Solving a linear equation: do the same operation on both sides, e.g., $2x + 10 = 64 \Rightarrow 2x = 54 \Rightarrow x = 27$.
- $x^0 = 1$ for $x \neq 0$, so a constant 8 can be written as $8x^0$.

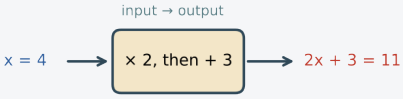
01 ✦ Concept Zone: Theorems & Results

Polynomials and their Degree

- An algebraic expression in **one variable** whose terms are whole-number powers of the variable, e.g., $5y^3 + y^2 + 2y - 1$, is a (univariate) **polynomial**.
- The highest power of the variable is the **degree**: degree 0 — **constant** (8); 1 — **linear** ($3z + 7$); 2 — **quadratic** ($x^2 + 5x + 1$); 3 — **cubic**.
- Expressions such as $\frac{1}{x} = x^{-1}$ or $\sqrt{x}$ are **not** polynomials (the powers are not whole numbers).
- A **linear polynomial** has the form $ax + b$ with $a \neq 0$.

Polynomials as Input–Output Machines

- Putting a number in place of the variable gives the **value** of the polynomial: for $p(x) = 2x + 3$, $p(4) = 11$ and $p(-6) = -9$.
- So a polynomial is like a machine (a **function**): input x, output p(x). $2x + 3$ is a linear function; $10x - x^2$ is a quadratic function.
- Setting a linear polynomial equal to a number gives a **linear equation**, e.g., $x + (x + 10) = 64$.



KEY NOTES

- ✔ Degree = highest power of the variable.
- ✔ Linear: $ax + b$ ($a \neq 0$); constant: degree 0.
- ✔ Value p(k): substitute $x = k$.
- ✔ Word problem → choose a variable → linear equation → solve → check.

NOTE The coefficient of a missing power is 0. In $4z^3 + 5z^2 - 11$, the coefficient of z is 0.

TOPIC 1

02 ✎ Solved Examples

EXAMPLE 1

For $5y^3 + y^2 + 2y - 1$ write the degree, the coefficient of each power and the constant term. Name the type of $3z + 7$, $x^2 + 5x + 1$ and 8.

Solution

- Degree 3; coefficients of y^3, y^2, y: 5, 1, 2; constant −1.
- $3z + 7$: linear; $x^2 + 5x + 1$: quadratic; 8: constant (degree 0).

∴ Cubic polynomial; linear, quadratic, constant

EXAMPLE 2

Find (i) p(0), p(−1), p(2) for $p(x) = 5x - 3$, (ii) q(−3) for $q(s) = 7s^2 - 4s + 6$.

Solution

- (i) $p(0) = -3$; $p(-1) = -5 - 3 = -8$; $p(2) = 10 - 3 = 7$.
- (ii) $q(-3) = 7(9) - 4(-3) + 6 = 63 + 12 + 6$.

∴ (i) −3, −8, 7 (ii) 81

EXAMPLE 3

The sum of two numbers is 64 and one is 10 more than the other. Find them.

Solution

- Let the smaller be x: $x + (x + 10) = 64$.
- $2x + 10 = 64 \Rightarrow x = 27$.

∴ 27 and 37

EXAMPLE 4

Salil's mother is three times as old as Salil. After 5 years their ages will add up to 70. Find their present ages.

Solution

- Salil x, mother 3x: $(x + 5) + (3x + 5) = 70$.
- $4x + 10 = 70 \Rightarrow x = 15$.

∴ Salil 15 years, mother 45 years

EXAMPLE 5

Ruby has 3 times as many ₹2 coins as ₹5 coins, worth ₹88 in all. How many coins of each kind?

Solution

- ₹5 coins: x; ₹2 coins: 3x.
- $5x + 2(3x) = 88 \Rightarrow 11x = 88 \Rightarrow x = 8$.

∴ 8 five-rupee and 24 two-rupee coins

03 ⚡ Practice Zone

Attempt in your notebook. Draw a neat figure wherever needed. ★ = higher-order thinking

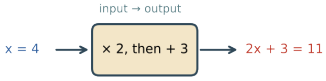
1. Find the degree and name the type: (i) $2x^2 - 5x + 3$, (ii) $y^3 + 2y - 1$, (iii) -9, (iv) $4z - 3$, (v) $7 - x^4 + x$.

2. (i) Give the coefficients of x^2 and x^3 in $x^4 - 3x^3 + 6x^2 - 2x + 7$. (ii) Give the coefficient of z in $4z^3 + 5z^2 - 11$. (iii) Give the constant term of $9x^3 + 5x^2 - 8x - 10$.

3. Which are linear polynomials? $3x + 7$, $x^2 + 1$, $5 - 4y$, $\frac{1}{x}$, $\sqrt{2}x$, 8, $\frac{x}{3} - 1$. Give reasons.

4. (i) Write a cubic polynomial in x with x^2-coefficient -7. (ii) Find the linear polynomial $ax - 4$ whose value at $x = 2$ is 6. (iii) Write a quadratic with constant term 0.

5. Find the value of (i) $5x^2 - 3x + 7$ at $x = 1$, (ii) $4t^3 - t^2 + 6$ at $t = -1$, (iii) the output of the machine "× 2, then + 3" for inputs -6, 0 and $\frac{1}{2}$.



6. (i) A wire of 20 cm is bent into rectangles. Write the area when the length is x cm. (ii) Find the area for $x = 2, 4, 6$. (iii) Is the area a linear polynomial in x? Why?

7. The difference of two positive integers is 63 and they are in the ratio 2 : 5. Find them.

8. (i) A 300 ft fence is cut into two pieces; the longer is 4 times the shorter. Find the pieces. (ii) The length of a rectangle is 3 cm more than twice its width and its perimeter is 24 cm. Find its dimensions.

9. (i) If a number is multiplied by 2 and 3 is added, the result is -11. Find the number. (ii) A positive number is 5 times another. If 21 is added to both, one becomes twice the other. Find the numbers.

10. The digits of a two-digit number differ by 3. The number and the number with digits interchanged add up to 143. Find both numbers. ★

11. Raju buys x boxes of 4 pens and y boxes of 5 pencils and gets 3 pens free. (i) Write the total number of items. (ii) Is this a polynomial in one variable? (iii) If $x = y$, write it as a linear polynomial and find x when the total is 75. ★

MY NOTES ✎

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TOPIC 2

2 Linear Patterns, Linear Growth and Linear Decay

Constant differences | nth term an + b | Growing tile patterns | Linear growth | Linear decay

QUICK RECAP (from earlier classes)

- A **sequence** is a list of numbers in order: 1, 3, 5, 7, ...
- Successive differences: for 4, 7, 10, 13 they are 3, 3, 3.
- Substitution: if t = 100 − 5n, then n = 12 gives t = 40.

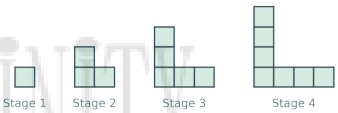
01 ✦ Concept Zone: Theorems & Results

RESULT 1

For a linear polynomial p(n) = an + b, the difference between successive values p(n + 1) − p(n) is always a. Conversely, a pattern with a constant difference a has nth term an + b.

Given: p(n) = an + b, with n = 1, 2, 3, ...

To prove: p(n + 1) − p(n) = a for every n.



Proof:

p(n + 1) = a(n + 1) + b = an + a + b

p(n + 1) − p(n) = (an + a + b) − (an + b)

∴ p(n + 1) − p(n) = a, the same for every n

Conversely, if each term is a more than the previous one and the first term is t_1:

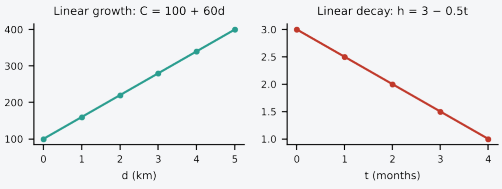
∴ $t_n = t_1 + (n - 1)a = an + (t_1 - a)$, a linear polynomial in n

Hence proved.

Tile pattern: 1, 3, 5, 7, ... has difference 2, so the nth stage has 2n − 1 tiles.

Linear Growth and Linear Decay

- **Linear growth:** a quantity increases by the same amount in equal intervals, e.g., cost C = 100 + 60d (₹60 more per km).
- **Linear decay:** it decreases by the same amount in equal intervals, e.g., water height h = 3 − 0.5t (0.5 m less each month).
- In y = a × (step) + b, the starting value is b and the change per step is a: a > 0 growth, a < 0 decay.
- A rule may hold only from some point on: an auto fare of ₹25 for the first 2 km and ₹15 per km after that is 15n − 5 for n ≥ 2.



TOPIC 2

KEY NOTES

- ✔ Linear pattern ⇔ constant difference.
- ✔ nth term = (difference) × n + (first term − difference).
- ✔ Growth: + a per step; decay: − a per step.
- ✔ To find when a value is reached, set the linear expression equal to it and solve.

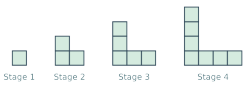
NOTE Check whether the counting starts at n = 0 or n = 1; it changes the constant term of the rule.

02 ✎ Solved Examples

EXAMPLE 1

The tile pattern has 1, 3, 5, 7, ... tiles. (i) Find the rule. (ii) How many tiles at Stage 15? (iii) Which stage has 47 tiles?

Solution



- (i) Difference 2 ⇒ 2n + c; n = 1 gives 1 ⇒ c = −1: rule 2n − 1.
- (ii) 2(15) − 1 = 29.
- (iii) 2n − 1 = 47 ⇒ n = 24.

∴ (i) 2n − 1 (ii) 29 (iii) Stage 24

EXAMPLE 2

Bela has ₹100 and spends ₹5 every day. (i) Write the amount left after n days. (ii) When will ₹40 be left? (iii) When will the money run out?

Solution

- (i) 100 − 5n.
- (ii) 100 − 5n = 40 ⇒ n = 12.
- (iii) 100 − 5n = 0 ⇒ n = 20.

∴ (i) ₹(100 − 5n) (ii) day 12 (iii) day 20

EXAMPLE 3

An auto fare is ₹25 for the first 2 km and ₹15 for each further km. (i) Find the fare for 10 km. (ii) Write the fare for n km (n ≥ 2). (iii) For how many km is the fare ₹130?

Solution

- (i) 25 + 15 × 8 = 145.
- (ii) 25 + 15(n − 2) = 15n − 5.
- (iii) 15n − 5 = 130 ⇒ n = 9.

∴ (i) ₹145 (ii) ₹(15n − 5) (iii) 9 km

EXAMPLE 4

A journey costs C(d) = 100 + 60d rupees for d km. (i) Find the cost for 15 km. (ii) For what distance is the cost ₹700? (iii) Is this growth or decay?

Solution

TOPIC 2

› (i) 100 + 900 = 1000.
› (ii) 100 + 60d = 700 ⇒ d = 10.
› (iii) +₹60 per km ⇒ linear growth.

∴ (i) ₹1000 (ii) 10 km (iii) growth

EXAMPLE 5

The water in a tank is h(t) = 3 − 0.5t metres high after t months. (i) Find the height after 5 months. (ii) When will the tank be empty?

Solution

› (i) 3 − 2.5 = 0.5 m.
› (ii) 3 − 0.5t = 0 ⇒ t = 6.

∴ (i) 0.5 m (ii) after 6 months (linear decay)

03 ⚡ Practice Zone

Attempt in your notebook. Draw a neat figure wherever needed. ★ = higher-order thinking

1. A student has ₹500 in her account and receives ₹150 every month. (i) Write the amount after n months. (ii) Find it after 12 months. (iii) After how many months will she first have at least ₹2000?
2. A rally starts with 120 members and 9 drop out each hour. (i) Write the number after n hours. (ii) How many remain after 5 hours? (iii) After how many hours will fewer than 50 remain?
3. (i) A rectangle has length 13 cm. Find its area for breadths 12, 10, 8 cm and write the pattern. (ii) A box has length 7 cm and breadth 11 cm. Find its volume for heights 5, 9, 13 cm and the rule.
4. Sarita reads 20 pages a day of a 500-page book. (i) Write the pages left after n days. (ii) How many are left after 15 days? (iii) On which day does she finish?
5. A plant 1.75 ft tall grows 0.5 ft each month. (i) Find its height after 7 months. (ii) Make a table for t = 0 to 5. (iii) Write h in terms of t and explain why it is linear growth.
6. A phone bought for ₹10 000 loses ₹800 in value each year. (i) Find its value after 3 years. (ii) Write v in terms of t. (iii) After how many years is it first worth less than ₹5000?
7. A prepaid balance of ₹600 reduces by ₹15 each day. (i) Write the balance b(x) after x days. (ii) After how many days does it run out? (iii) Is this growth or decay?
8. A village has 750 people and 50 move in every year. (i) Find the population after 6 years. (ii) Write P in terms of t. (iii) When will it reach 1500?
9. Hexagons are made from matchsticks; each new hexagon shares one side with the previous one. (i) Draw Stages 4 and 5 and count the matchsticks. (ii) Find the rule for Stage n. (iii) How many are needed for Stage 15? (iv) Can 200 matchsticks make a stage exactly? ★



10. (i) Is 2, 5, 9, 14, … a linear pattern? Why? (ii) Find the nth term of 7, 4, 1, −2, … and the term number of −29. (iii) Is it growth or decay? ★

TOPIC 2

3

TOPIC 3

Linear Relationships and Their Graphs

y = ax + b | Finding a and b from data | Plotting a line | Slope | y-intercept | Parallel lines

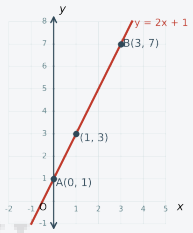
QUICK RECAP (from earlier classes)

- Plotting points (x, y) on the coordinate plane (Chapter 1).
- Solving two simple equations: 350 = 10a + b, 550 = 20a + b ⇒ subtract ⇒ 10a = 200.
- A point lies on a line exactly when its coordinates satisfy the equation.

01 ✦ Concept Zone: Theorems & Results

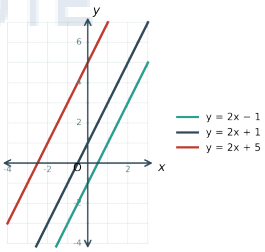
Linear Relationships

- A relationship y = ax + b between two variables is **linear**. Its graph is a **straight line**, so **two points** are enough to draw it.
- To find a and b from two observations, substitute both into y = ax + b and solve. A bill of ₹350 for 10 GB and ₹550 for 20 GB gives y = 20x + 150: ₹20 per GB and a fixed ₹150.
- For y = 2x + 1: x = 0 gives (0, 1), x = 3 gives (3, 7). (7, 15) lies on it since 2(7) + 1 = 15.



RESULT 2

The graph of y = ax + b is a straight line that cuts the y-axis at (0, b) (the y-intercept) and rises by a for every unit increase in x (the slope). Lines with the same slope are parallel.



Given: Lines y = ax + b and y = ax + c.

To prove: y-intercept = b, slope = a, and the two lines are parallel.

Proof:

$x = 0 \Rightarrow y = a \times 0 + b = b$ *[point (0, b) on the y-axis]*

$x \to x + 1 \Rightarrow y$ changes by $a(x + 1) + b - (ax + b) = a$ *[rise per unit run]*

For y = ax + b and y = ax + c, at every x the vertical gap is:

$(ax + c) - (ax + b) = c - b$ *[the same for all x]*

∴ the lines never meet (if b ≠ c): they are parallel

Hence proved.

y = ax passes through O. a > 1: steeper than y = x; 0 < a < 1: less steep; a < 0: the line falls (decay).

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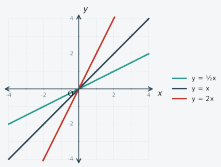
Effect of the Slope

- Positive slope: the line rises from left to right (linear growth). Negative slope: it falls (linear decay).
- The larger |a|, the steeper the line: compare $y = \frac{1}{2}x$, y = x, y = 2x and $y = -\frac{1}{3}x$, y = −x, y = −3x.



KEY NOTES

- ✔ y = ax + b: slope a, y-intercept b (line meets the y-axis at (0, b)).
- ✔ Two points fix a line.
- ✔ Same slope, different intercepts ⇒ parallel lines.
- ✔ Rewrite 2y = 4x + 7 as y = 2x + 3.5 before reading slope and intercept.

NOTE The slope of a linear pattern equals its constant difference: the tile pattern y = 2x − 1 has slope 2.

02 ✎ Solved Examples

EXAMPLE 1

A phone bill is y = ax + b for x GB of data. 10 GB costs ₹350 and 20 GB costs ₹550. Find a and b and explain them.

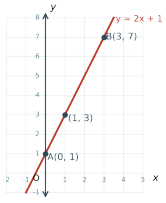
Solution

- 350 = 10a + b and 550 = 20a + b.
- Subtracting: 10a = 200 ⇒ a = 20; b = 350 − 200 = 150.

∴ y = 20x + 150: ₹20 per GB plus a fixed ₹150

EXAMPLE 2

Plot y = 2x + 1. Check whether (7, 15) and (5, 10) lie on it.



Solution

- x = 0 ⇒ y = 1; x = 3 ⇒ y = 7: plot (0, 1), (3, 7) and join.
- (7, 15): 2(7) + 1 = 15 ✓. (5, 10): 2(5) + 1 = 11 ≠ 10.

∴ (7, 15) lies on the line; (5, 10) does not

EXAMPLE 3

The points (−1, −3), (0, 0), (1, 3), (3, 9) lie on a line. Find its equation. Do (−3, 6), (1, −2), (2, −4) lie on y = −2x?

Solution

- Each y is 3 times x ⇒ y = 3x.
- −2(−3) = 6 ✓; −2(1) = −2 ✓; −2(2) = −4 ✓.

TOPIC 3

∴ y = 3x; yes, all three lie on y = −2x

EXAMPLE 4

Find the slope and y-intercept of (i) y = −3x + 4, (ii) 2y = 4x + 7. Which line is parallel to y = 2x − 1?

Solution

- (i) slope −3, intercept 4.
- (ii) y = 2x + 3.5: slope 2, intercept 3.5.

∴ Line (ii) is parallel to y = 2x − 1

EXAMPLE 5

°C = a°F + b. Ice melts at 0 °C = 32 °F and water boils at 100 °C = 212 °F. Find a and b.

Solution

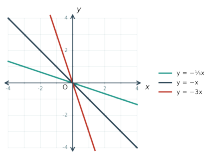
- 0 = 32a + b and 100 = 212a + b.
- Subtracting: $180a = 100 \Rightarrow a = \frac{5}{9}$; $b = -32 \times \frac{5}{9} = -\frac{160}{9}$.

∴ °C = $\frac{5}{9}$(°F − 32)

03 ⚡ Practice Zone

Attempt in your notebook. Draw a neat figure wherever needed. ★ = higher-order thinking

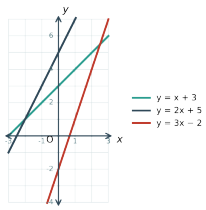
1. (i) A learning platform charges y = ax + b for x modules: 10 modules cost ₹400 and 14 cost ₹500. Find a and b. (ii) A gym charges ₹800 for 10 hours and ₹1100 for 15 hours of court use. Find the rule.
2. Find the slope and y-intercept of (i) y = −3x + 4, (ii) 2y = 4x + 7, (iii) 5y = 6x − 10, (iv) 3y = 6x − 11. Which lines are parallel? Where does each cut the y-axis?
3. The graph of a linear polynomial p(x) passes through (1, 5) and (3, 11). (i) Find p(x). (ii) Find where it cuts the axes. (iii) Draw the graph and verify.
4. Which of the points (2, 1), (0, −3), (−1, −4), (4, 5) lie on y = 2x − 3? Plot the line and the points.
5. Draw on the same axes (i) y = 4x, y = 2x, y = x; (ii) y = −6x, y = −3x, y = −x; (iii) y = 3x − 1, y = 3x, y = 3x + 1. What is the role of a and of b in each set?



6. Temperature in kelvin x K and Fahrenheit y °F are related by y = $\frac{9}{5}$(x − 273) + 32. (i) Convert 313 K to °F. (ii) Convert 158 °F to K.
7. Work done w = force × distance d. Take the force as 3 units. (i) Write w in terms of d. (ii) Draw its graph. (iii) Read off the work for d = 2 and verify.

TOPIC 3

8 The lines $y = x + 3$, $y = 2x + 5$ and $y = 3x - 2$ are drawn. (i) Where does each cut the y-axis? (ii) Which is the steepest? (iii) Does any pair look parallel?



9 $p(x) = ax + b$ and $q(x) = cx + d$ with $p(0) = 5$, $p(x) + q(x) = 6x + 4$ for all x, and the graph of $p(x) - q(x)$ cuts the x-axis at $(3, 0)$. Find $p(x)$ and $q(x)$. ★

10 The graph of $p(x)$ passes through $(2, 3)$ and $(6, 11)$; the graph of $q(x)$ is parallel to it and passes through $(4, -1)$. Find $p(x)$, $q(x)$ and where each meets the x-axis. ★

11 What do all lines $f(x) = ax + a$ $(a > 0)$ have in common? Draw three of them to check. ★

MY NOTES ✎

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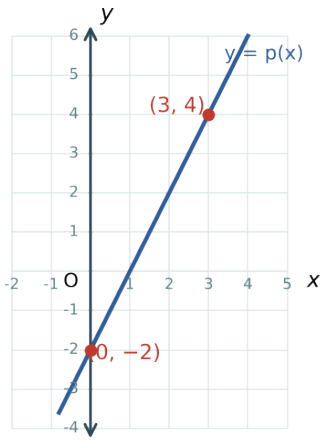
TOPIC 3

+ Miscellaneous Questions

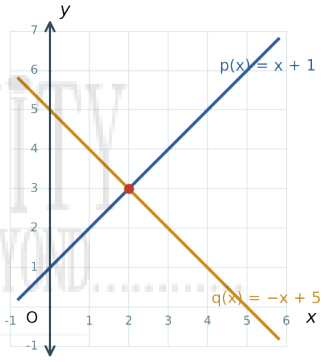
11 mixed questions from all topics of this chapter and earlier Ganita Manjari chapters

Attempt in your notebook. Draw a neat figure wherever needed. ★ = higher-order thinking

1 The graph of a linear polynomial p(x) is shown. (i) Find p(x). (ii) Find p(5) and p(−1). (iii) Find the zero of p(x). (iv) Write its slope and y-intercept.



2 The graphs of p(x) = x + 1 and q(x) = −x + 5 are shown. (i) Where do they meet? (ii) For which x is p(x) > q(x)? (iii) Find the area of the triangle formed by the two lines and the x-axis.



3 Squares are made in a row with matchsticks. (i) Write the number of sticks for stage n. (ii) How many sticks are needed for 20 squares? (iii) How many squares can be made with 100 sticks? (iv) A row of triangles needs 3 sticks for the first and 2 more for each new one. Write the number of sticks for n triangles.



4 The points (−1, k), (2, 5) and (4, 9) lie on the line y = ax + b. (i) Find a and b. (ii) Find k. (iii) Find m if (m, 7) is on the same line. (iv) Find the distance between (2, 5) and (4, 9).

5 A 30 cm candle burns 2.5 cm every hour. (i) Write its height h(t) after t hours. (ii) Find its height after 4 hours. (iii) When does it burn out? (iv) Is this linear growth or linear decay? Draw the graph.

6 A taxi fare is y = 12x + 40 rupees for x km. (i) Find the fare for 15 km. (ii) How far can you go for ₹400? (iii) What do 12 and 40 mean? (iv) Another taxi charges y = 14x + 20. For what distance are the fares equal?

7 Which are linear patterns? For those that are, find the nth term. (i) 5, 9, 13, 17, … (find the 50th term); (ii) 20, 17, 14, … (is −40 a term?); (iii) 1, 4, 9, 16, …; (iv) 2.5, 4, 5.5, 7, …

8 The line y = −2x + 6 meets the axes at A and B. (i) Find A and B. (ii) Find the area of ΔOAB. (iii) Find AB. (iv) Repeat for y = 3x − 6.

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9 A rectangle has breadth x cm and length (x + 3) cm. (i) Write its perimeter and area as polynomials and give their degrees. (ii) Which is linear? (iii) Find x if the perimeter is 46 cm.

10 p(x) is linear with p(1) = 4 and p(3) = 10. (i) Find p(x). (ii) Find p(p(0)). (iii) Find x if p(x) = x. ★

11 For the lines y = ax + 3 and y = 2x + b, find a and b if they (i) are the same line, (ii) are parallel and distinct, (iii) meet on the y-axis at (0, 3) but are not parallel. ★

MY NOTES ✎

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★ Competency Based Question Bank

30 MCQs and 6 Assertion–Reason questions from the whole chapter and linked topics

1 The degree of $5y^3 + y^2 + 2y - 1$ is

(a) 1 (b) 2 (c) 3 (d) 5

2 Which is a linear polynomial?

(a) $x^2 + 1$ (b) $5 - 4y$ (c) $\frac{1}{x} + 2$ (d) x^3

3 The degree of the constant polynomial -9 is

(a) -9 (b) 1 (c) 0 (d) not defined

4 The coefficient of z in $4z^3 + 5z^2 - 11$ is

(a) 4 (b) 5 (c) 0 (d) -11

5 The constant term of $9x^3 + 5x^2 - 8x - 10$ is

(a) 9 (b) -8 (c) -10 (d) 10

6 If $p(x) = 5x - 3$, then $p(-1)$ is

(a) 2 (b) -8 (c) 8 (d) -2

7 For $q(s) = 7s^2 - 4s + 6$, $q(0)$ is

(a) 0 (b) 6 (c) 7 (d) 9

8 Which is not a polynomial?

(a) $3x + 2$ (b) $x^2 - 1$ (c) $\frac{1}{x}$ (d) 7

9 Two numbers add to 64 and differ by 10. The smaller is

(a) 27 (b) 32 (c) 37 (d) 22

10 Integers in ratio 2 : 5 differing by 63 are

(a) 42, 105 (b) 21, 84 (c) 30, 93 (d) 18, 81

11 The nth term of 1, 3, 5, 7, ... is

(a) $2n + 1$ (b) $2n - 1$ (c) $n + 2$ (d) $2n$

12 Bela has ₹100 and spends ₹5 a day. Money left after n days is

(a) $100 + 5n$ (b) $100 - 5n$ (c) $5n - 100$ (d) $95n$

13 Fare: ₹25 for 2 km, then ₹15 per km. Fare for 10 km:

(a) ₹150 (b) ₹145 (c) ₹175 (d) ₹160

14 Which shows linear decay?

(a) $C = 100 + 60d$ (b) $h = 3 - 0.5t$ (c) $y = x^2$ (d) $P = 750 + 50t$

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15 A pattern is linear when its successive differences are
(a) increasing (b) constant (c) doubling (d) zero only

16 Matchstick hexagons sharing a side need 6, 11, 16, … sticks. The rule is
(a) 6n (b) 5n + 1 (c) 6n − 1 (d) 5n

17 The line y = 2x + 1 passes through
(a) (1, 2) (b) (3, 7) (c) (2, 4) (d) (0, 2)

18 The slope of y = −3x + 4 is
(a) 4 (b) 3 (c) −3 (d) −4

19 The y-intercept of 2y = 4x + 7 is
(a) 7 (b) 2 (c) 3.5 (d) 4

20 Which line is parallel to y = 2x − 1?
(a) y = −2x + 1 (b) y = 2x + 5 (c) y = x − 1 (d) $y = \frac{1}{2}x$

21 The line y = ax always passes through
(a) (1, 0) (b) (0, 1) (c) (0, 0) (d) (a, 0)

22 Which line is steepest?
(a) $y = \frac{1}{2}x$ (b) y = x (c) y = 2x (d) y = 3x

23 If 10 GB costs ₹350 and 20 GB costs ₹550 (y = ax + b), then a =
(a) 20 (b) 35 (c) 150 (d) 55

24 Points (−1, −3), (0, 0), (1, 3) lie on
(a) y = x (b) y = 3x (c) y = −3x (d) y = x + 3

25 Lines y = 3x − 1, y = 3x, y = 3x + 1 are
(a) intersecting at O (b) parallel
(c) perpendicular (d) the same line

26 The line y = 3x − 2 cuts the y-axis at
(a) (0, 3) (b) (0, −2) (c) (−2, 0) (d) (2, 0)

27 °C = a°F + b with 0 °C = 32 °F and 100 °C = 212 °F gives a =
(a) $\frac{9}{5}$ (b) $\frac{5}{9}$ (c) 32 (d) 1.8

28 A line with negative slope represents
(a) linear growth (b) linear decay (c) no change (d) a constant

29 All lines f(x) = ax + a (a > 0) pass through
(a) (0, 0) (b) (1, 0) (c) (−1, 0) (d) (0, 1)

QUESTION BANK

30 The value of $ax - 4$ at $x = 2$ is 6. Then $a =$

(a) 2 (b) 5 (c) 3 (d) 1

⚖ Assertion – Reason

Directions: (a) Both A and R are true and R is the correct explanation of A. (b) Both A and R are true but R is not the correct explanation of A. (c) A is true but R is false. (d) A is false but R is true.

31 Assertion (A): $3x + 7$ is a linear polynomial.
Reason (R): Its highest power of x is 1.

32 Assertion (A): The sequence 1, 3, 5, 7, ... is a linear pattern.
Reason (R): Its successive differences are constant.

33 Assertion (A): The lines $y = 2x + 1$ and $y = 2x + 5$ meet at one point.
Reason (R): Lines with the same slope are parallel.

34 Assertion (A): $\frac{1}{x} + 1$ is a polynomial of degree -1.

Reason (R): In a polynomial, the powers of the variable are whole numbers.

35 Assertion (A): The line $y = 3x - 2$ cuts the y-axis at $(0, -2)$.
Reason (R): $y = ax + b$ meets the y-axis at $(0, b)$.

36 Assertion (A): $h = 3 - 0.5t$ represents linear growth.
Reason (R): In linear decay, a quantity decreases by a fixed amount in equal intervals.

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MY NOTES ✎

QUESTION BANK

Story Time: Case Studies & Twisters

Real-life stories, linked chapters and tricky twists. Read carefully, think, then answer.

Case 1 · The Chess Club

LINEAR PATTERN

A chess club charges a joining fee of ₹200 plus ₹50 per match played.

(i) Write the amount for 1, 2, 3 matches.

(ii) Write the amount for m matches.

(iii) How many matches for ₹750?

(iv) Is this growth or decay? What is the slope?

Case 2 · Mobile Data Plan

LINEAR RELATIONSHIP

A plan charges y = ax + b rupees for x GB. A user pays ₹350 for 10 GB and ₹550 for 20 GB.

(i) Form two equations in a and b.

(ii) Find a and b.

(iii) What does each number mean?

(iv) How much data can be used for ₹750?

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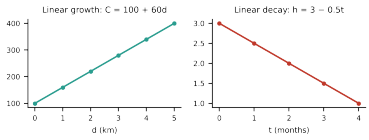
Case 3 · The Water Tank

LINEAR DECAY

A tank holds water 3 m high at the start of summer; the level falls by 0.5 m each month.



(i) Write h in terms of the month t.

(ii) Find h after 4 months.

(iii) When will the tank be empty?

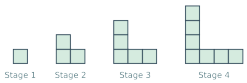
(iv) What is the slope of the graph and what does its sign mean?

STORY TIME

Case 4 · Growing Tiles

PATTERN

An L-shaped tile pattern has 1, 3, 5, 7, ... tiles at Stages 1, 2, 3, 4, ...



(i) Write the rule for Stage n.

(ii) How many tiles at Stage 26?

(iii) Which stage has 21 tiles?

(iv) Can a stage have 100 tiles? Why?

Case 5 · Auto-Rickshaw Fares

TWISTED

Fare: ₹25 for the first 2 km and ₹15 for every additional km.

(i) Find the fares for 3, 4, 5 km.

(ii) Write the fare for n km (n ≥ 2).

(iii) How far can you go for ₹220?

(iv) Why does the rule not work for n = 1?

Case 6 · Savings Plan

LINEAR GROWTH

Meena has ₹800 and saves ₹250 every month.

(i) Find her savings after 6 months.

(ii) Find her savings after 2 years.

(iii) Write S in terms of months n.

(iv) When will she reach ₹5300?

Case 7 · Temperature Scales

GRAPH

°F and °C are related by $F = \frac{9}{5}C + 32$.

(i) Convert 25 °C to °F.

(ii) Convert 98.6 °F to °C.

(iii) What are the slope and y-intercept of the graph of F against C?

(iv) At what temperature are the two readings equal?

STORY TIME

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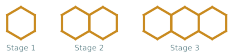
Case 8 · Matchstick Hexagons

PATTERN

Hexagons are joined in a row, each new one sharing a side with the previous one.



(i) Count the sticks for Stages 1–3.

(ii) Write the rule for Stage n.

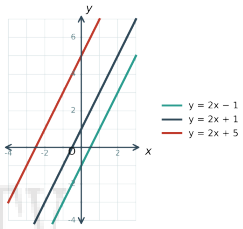
(iii) How many sticks for Stage 20?

(iv) Which stage uses 101 sticks?

Case 9 · Parallel Roads

SLOPE

On a map, three straight roads have equations $y = 2x - 1$, $y = 2x + 1$ and $y = 2x + 5$.



(i) What is the slope of each road?

(ii) Where does each cross the y-axis?

(iii) Will any two roads meet? Why?

(iv) Write the equation of another road parallel to these through (0, −4).

Case 10 · Phone Depreciation

LINEAR DECAY

A phone bought for ₹10 000 loses ₹800 in value every year.

(i) Find its value after 3 years.

(ii) Write v in terms of t.

(iii) In which year will its value first fall below ₹5000?

(iv) Is the slope of the graph positive or negative?

STORY TIME

MY NOTES ✎

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STORY TIME

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