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ANSWER KEY

Chapter 2 · Linear Polynomials

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

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Topic 1: Polynomials, Degree and Linear Equations

1. (i) 2 — quadratic (ii) 3 — cubic (iii) 0 — constant *[highest power]*
(iv) 1 — linear (v) 4

Answer: 2, 3, 0, 1, 4

2. (i) x^2: 6; x^3: −3
(ii) no z term ⇒ 0
(iii) −10

Answer: 6, −3; 0; −10

3. Linear: 3x + 7, 5 − 4y, $\sqrt{2}x$, $\frac{x}{3} - 1$ (highest power 1)

$x^2 + 1$ has degree 2; $\frac{1}{x} = x^{-1}$ is not a polynomial; 8 has degree 0

Answer: Four linear polynomials

4. (i) e.g., $x^3 - 7x^2 + 2$
(ii) $2a - 4 = 6 \Rightarrow a = 5 \Rightarrow 5x - 4$
(iii) e.g., $x^2 + 3x$

Answer: (ii) 5x − 4

5. (i) 5 − 3 + 7 = 9
(ii) −4 − 1 + 6 = 1
(iii) −9, 3, 4 *[2x + 3]*



Answer: 9; 1; −9, 3, 4

6. (i) width = 10 − x ⇒ area = $x(10 - x) = 10x - x^2$ *[half-perimeter 10]*
(ii) 16, 24, 24 cm^2
(iii) No: it has degree 2 and the differences are not constant.

Answer: Quadratic, not linear

7. 2k and 5k: 5k − 2k = 63 ⇒ k = 21

Answer: 42 and 105

8. (i) x + 4x = 300 ⇒ x = 60
(ii) 2(w + 2w + 3) = 24 ⇒ 6w + 6 = 24 ⇒ w = 3

Answer: (i) 60 ft, 240 ft (ii) 3 cm × 9 cm

9. (i) $2x + 3 = -11 \Rightarrow x = -7$

(ii) $5x + 21 = 2(x + 21) \Rightarrow 3x = 21 \Rightarrow x = 7$ *[the larger becomes twice the smaller]*

Answer: (i) −7 (ii) 7 and 35

10. Digits a, b: $(10a + b) + (10b + a) = 11(a + b) = 143 \Rightarrow a + b = 13$

$a - b = 3 \Rightarrow a = 8, b = 5$

Answer: 85 and 58

11. (i) $4x + 5y + 3$

(ii) No — it has two variables.

(iii) $9x + 3 = 75 \Rightarrow x = 8$

Answer: (iii) x = 8

Topic 2: Linear Patterns, Linear Growth and Linear Decay

1. (i) $500 + 150n$

(ii) $500 + 1800 = 2300$

(iii) $500 + 150n \geq 2000 \Rightarrow n \geq 10$

Answer: (i) ₹(500 + 150n) (ii) ₹2300 (iii) 10 months

2. (i) $120 - 9n$

(ii) $120 - 45 = 75$

(iii) $120 - 9n < 50 \Rightarrow n > 7.8 \Rightarrow 8$ hours

Answer: (i) 120 − 9n (ii) 75 (iii) after 8 hours

3. (i) 156, 130, 104 cm^2; area = 13b *[falls by 26 for every 2 cm]*

(ii) 385, 693, 1001 cm^3; volume = 77h *[rises by 308 for every 4 cm]*

Answer: 13b and 77h

4. (i) $500 - 20n$

(ii) $500 - 300 = 200$

(iii) $500 - 20n = 0 \Rightarrow n = 25$

Answer: (ii) 200 pages (iii) day 25

5. (i) 1.75 + 3.5 = 5.25 ft

(ii) 1.75, 2.25, 2.75, 3.25, 3.75, 4.25

(iii) h = 1.75 + 0.5t; rises 0.5 ft every month

Answer: (i) 5.25 ft (iii) linear growth

6. (i) 10 000 − 2400 = 7600

(ii) v = 10 000 − 800t

(iii) t = 6: 5200; t = 7: 4400

Answer: (i) ₹7600 (iii) after 7 years

7. (i) b(x) = 600 − 15x

(ii) 600 − 15x = 0 ⇒ x = 40

Answer: (ii) 40 days (iii) linear decay

8. (i) 750 + 300 = 1050

(ii) P = 750 + 50t

(iii) 50t = 750 ⇒ t = 15

Answer: (i) 1050 (iii) 15 years

9. (i) Stage 4: 21, Stage 5: 26 *[each new hexagon adds 5 sticks]*



(ii) 5n + 1

(iii) 76

(iv) 5n + 1 = 200 ⇒ n = 39.8, not a whole number

Answer: No stage uses exactly 200 sticks

10. (i) Differences 3, 4, 5 — not constant ⇒ not linear

(ii) Difference −3 ⇒ 10 − 3n; 10 − 3n = −29 ⇒ n = 13

Answer: (ii) 10 − 3n; 13th term (iii) decay

Topic 3: Linear Relationships and Their Graphs

1. (i) 400 = 10a + b, 500 = 14a + b ⇒ 4a = 100 ⇒ a = 25, b = 150

(ii) 800 = 10a + b, 1100 = 15a + b ⇒ a = 60, b = 200

Answer: (i) y = 25x + 150 (ii) y = 60x + 200

2. (i) slope −3, intercept 4

(ii) y = 2x + 3.5: slope 2, intercept 3.5

(iii) $y = 1.2x - 2$: slope $\frac{6}{5}$, intercept -2

(iv) $y = 2x - \frac{11}{3}$: slope 2, intercept $-\frac{11}{3}$

Answer: (ii) and (iv) are parallel; they cut the y-axis at (0, 4), (0, 3.5), (0, −2), (0, $-\frac{11}{3}$)

3. $5 = a + b$, $11 = 3a + b \Rightarrow a = 3, b = 2$

y-axis: (0, 2); x-axis: $3x + 2 = 0 \Rightarrow x = -\frac{2}{3}$

Answer: $p(x) = 3x + 2$; (0, 2) and $(-\frac{2}{3}, 0)$

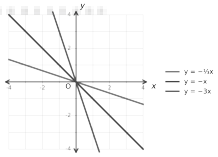
4. (2, 1): $4 - 3 = 1$ ✓; (0, −3) ✓

(−1, −4): $-2 - 3 = -5 \neq -4$ ✗; (4, 5): $8 - 3 = 5$ ✓

Answer: (2, 1), (0, −3), (4, 5)

5. (i), (ii): all pass through O; a larger |a| gives a steeper line; negative a makes the line fall.

(iii): the same slope 3; b moves the line up or down, keeping it parallel.



Answer: a decides steepness and direction; b decides where the line meets the y-axis.

6. (i) $\frac{9}{5}(40) + 32 = 104$ °F

(ii) $158 - 32 = 126 = \frac{9}{5}(x - 273) \Rightarrow x - 273 = 70$

Answer: (i) 104 °F (ii) 343 K

7. (i) $w = 3d$

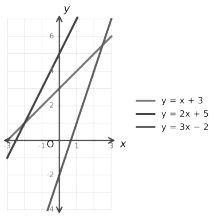
(iii) $d = 2 \Rightarrow w = 6$

Answer: A line through O with slope 3; w = 6 units

8. (i) (0, 3), (0, 5), (0, −2)

(ii) y = 3x − 2 (slope 3)

(iii) No — the slopes 1, 2, 3 are all different.



Answer: As above

9. p(0) = 5 ⇒ b = 5; a + c = 6 and b + d = 4 ⇒ d = −1

p − q = (a − c)x + 6 is 0 at x = 3 ⇒ a − c = −2

a = 2, c = 4

Answer: p(x) = 2x + 5, q(x) = 4x − 1

10. p: slope $\frac{11-3}{6-2} = 2$; 3 = 4 + b ⇒ b = −1 ⇒ p(x) = 2x − 1

q parallel: q(x) = 2x + d; −1 = 8 + d ⇒ d = −9

x-axis: p at $(\frac{1}{2}, 0)$, q at (4.5, 0)

Answer: p(x) = 2x − 1, q(x) = 2x − 9

11. f(x) = a(x + 1) ⇒ f(−1) = 0 for every a

Answer: All pass through (−1, 0); each has slope = y-intercept = a

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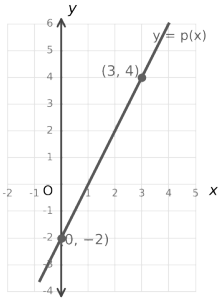
Miscellaneous Questions

1. Slope = $\frac{4-(-2)}{3-0} = 2$, y-intercept −2 ⇒ p(x) = 2x − 2

p(5) = 8; p(−1) = −4

2x − 2 = 0 ⇒ x = 1

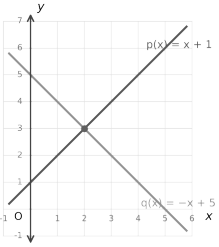


Answer: p(x) = 2x − 2; slope 2, y-intercept −2

2. x + 1 = −x + 5 ⇒ x = 2 ⇒ (2, 3)

p(x) > q(x) when x > 2

x-intercepts −1 and 5: base 6, height 3 ⇒ area 9



Answer: (2, 3); x > 2; 9 sq. units

3. 4, 7, 10, … ⇒ 3n + 1 *[each new square adds 3 sticks]*



3 × 20 + 1 = 61

3n + 1 ≤ 100 ⇒ n = 33 (one stick left over)

Triangles in a row: 3, 5, 7, … ⇒ 2n + 1

Answer: 3n + 1; 61; 33; 2n + 1

4. $a = \frac{9-5}{4-2} = 2$, b = 5 − 4 = 1 ⇒ y = 2x + 1

k = 2(−1) + 1 = −1; 7 = 2m + 1 ⇒ m = 3

Distance = $\sqrt{2^2 + 4^2} = 2\sqrt{5}$

Answer: a = 2, b = 1, k = −1, m = 3, $2\sqrt{5}$

5. h(t) = 30 − 2.5t

h(4) = 20 cm; 30 − 2.5t = 0 ⇒ t = 12 h

Answer: Linear decay; graph meets the axes at (0, 30) and (12, 0)

6. 12 × 15 + 40 = ₹220

12x + 40 = 400 ⇒ x = 30 km

12 = rate per km (slope); 40 = fixed charge (intercept).

12x + 40 = 14x + 20 ⇒ x = 10 km

Answer: ₹220; 30 km; 10 km

7. (i) 4n + 1; 50th term 201

(ii) 23 − 3n; 23 − 3n = −40 ⇒ n = 21 ⇒ yes, the 21st term

(iii) differences 3, 5, 7 — not linear

(iv) 1.5n + 1

Answer: (i), (ii), (iv) are linear

8. A(3, 0), B(0, 6)

Area = $\frac{1}{2} \times 3 \times 6 = 9$; AB = $\sqrt{45} = 3\sqrt{5}$

y = 3x − 6: (2, 0), (0, −6) ⇒ area 6, AB = $2\sqrt{10}$

Answer: 9, $3\sqrt{5}$; 6, $2\sqrt{10}$

9. Perimeter 4x + 6 (degree 1); area $x^2 + 3x$ (degree 2)

$4x + 6 = 46 \Rightarrow x = 10$

Answer: Perimeter is linear; x = 10 cm

10. $a = \frac{10-4}{3-1} = 3$, $b = 1 \Rightarrow p(x) = 3x + 1$

$p(0) = 1 \Rightarrow p(p(0)) = p(1) = 4$

$3x + 1 = x \Rightarrow x = -\frac{1}{2}$

Answer: $3x + 1$; 4; $-\frac{1}{2}$

11. (i) a = 2, b = 3

(ii) a = 2, b ≠ 3 *[same slope, different intercepts]*

(iii) b = 3, a ≠ 2

Answer: As above

Competency Based Question Bank

1. Highest power 3.

Answer: (c) 3

2. Power 1.

Answer: (b) 5 − 4y

3. $-9 = -9x^0$.

Answer: (c) 0

4. No z term.

Answer: (c) 0

5. −10.

Answer: (c) −10

6. $-5 - 3 = -8$

Answer: (b) −8

7. 6.

Answer: (b) 6

8. $\frac{1}{x}$ has power -1.

Answer: (c) $\frac{1}{x}$

9. $2x + 10 = 64 \Rightarrow 27$

Answer: (a) 27

10. $3k = 63 \Rightarrow 42, 105$

Answer: (a) 42, 105

11. $2n - 1$.

Answer: (b) $2n - 1$

12. $100 - 5n$.

Answer: (b) $100 - 5n$

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13. $25 + 15 \times 8 = 145$

Answer: (b) ₹145

14. Decreases by 0.5 per month.

Answer: (b) $h = 3 - 0.5t$

15. Constant difference.

Answer: (b) constant

16. $5n + 1$.

Answer: (b) $5n + 1$

17. $2(3) + 1 = 7$

Answer: (b) (3, 7)

18. $a = -3$.

Answer: (c) -3

19. $y = 2x + 3.5$.

Answer: (c) 3.5

20. Same slope 2.

Answer: (b) $y = 2x + 5$

21. $x = 0 \Rightarrow y = 0$.

Answer: (c) (0, 0)

22. Largest $a = 3$.

Answer: (d) $y = 3x$

23. $10a = 200 \Rightarrow a = 20$

Answer: (a) 20

24. $y = 3x$.

Answer: (b) $y = 3x$

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25. Same slope.

Answer: (b) parallel

26. $(0, b) = (0, -2)$.

Answer: (b) $(0, -2)$

27. $180a = 100 \Rightarrow a = \frac{5}{9}$

Answer: (b) $\frac{5}{9}$

28. Falls ⇒ decay.

Answer: (b) linear decay

29. $f(-1) = 0$.

Answer: (c) $(-1, 0)$

30. $2a - 4 = 6 \Rightarrow a = 5$

Answer: (b) 5

31. A: true.
R: true and explains A.

Answer: (a)

32. A: true (difference 2).
R: true and explains A.

Answer: (a)

33. A: false — they are parallel.
R: true.

Answer: (d)

34. A: false — it is not a polynomial.
R: true.

Answer: (d)

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35. A: true.
R: true and explains A.

Answer: (a)

36. A: false — it is decay.
R: true.

Answer: (d)

Story Time: Case Studies

Case 1 · The Chess Club

(i) ₹250, ₹300, ₹350.

(ii) ₹(200 + 50m).

(iii) 200 + 50m = 750 ⇒ m = 11.

(iv) Growth; slope 50.

Case 2 · Mobile Data Plan

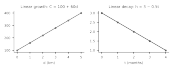
(i) 350 = 10a + b; 550 = 20a + b.

(ii) a = 20, b = 150.

(iii) ₹20 per GB; fixed charge ₹150.

(iv) 20x + 150 = 750 ⇒ 30 GB.

Case 3 · The Water Tank



(i) h = 3 − 0.5t.

(ii) 1 m.

(iii) t = 6 months.

(iv) −0.5; negative ⇒ decay.

Case 4 · Growing Tiles



(i) 2n − 1.

(ii) 51.

(iii) 2n − 1 = 21 ⇒ Stage 11.

(iv) No: 2n − 1 is always odd.

Case 5 · Auto-Rickshaw Fares

(i) ₹40, ₹55, ₹70.

(ii) ₹(15n − 5).

(iii) 15n − 5 = 220 ⇒ 15 km.

(iv) For 1 km the fare is still ₹25, but 15(1) − 5 = 10.

Case 6 · Savings Plan

(i) 800 + 1500 = ₹2300.

(ii) 800 + 6000 = ₹6800.

(iii) S = 800 + 250n.

(iv) 250n = 4500 ⇒ 18 months.

Case 7 · Temperature Scales

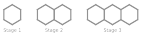
(i) $\frac{9}{5} \times 25 + 32 = 77\ °F$.

(ii) $\frac{5}{9}(98.6 - 32) = 37\ °C$.

(iii) Slope $\frac{9}{5}$, intercept 32.

(iv) x = 1.8x + 32 ⇒ x = −40.

Case 8 · Matchstick Hexagons



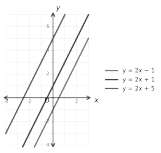
(i) 6, 11, 16.

(ii) 5n + 1.

(iii) 101.

(iv) 5n + 1 = 101 ⇒ Stage 20.

Case 9 · Parallel Roads



(i) 2 each.

(ii) (0, −1), (0, 1), (0, 5).

(iii) No — equal slopes, so they are parallel.

(iv) y = 2x − 4.

Case 10 · Phone Depreciation

(i) ₹7600.

(ii) v = 10 000 − 800t.

(iii) 7th year (₹4400).

(iv) Negative.

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