

Notes for valuers

- Give full marks for any correct alternative method. For 4- and 8-mark questions, award step marks as shown in brackets.
- If a student makes an arithmetic slip but the method is correct, deduct only the marks for that step.

SECTION – I

12 × 1 = 12

1. A) 4 ($96 = 2^5 \times 3$, $404 = 2^2 \times 101 \rightarrow \text{HCF} = 2^2 = 4$)
2. C) 6 ($p(2) = 4 - 10 + k = 0 \rightarrow k = 6$)
3. $x^2 - 3x - 4$ (or any $k(x^2 - 3x - 4)$, $k \neq 0$)
4. C) infinitely many ($2/4 = 3/6 = 7/14$)
5. A) Both A and R are true and R is the correct explanation of A. ($D = 0 - 16 = -16 < 0$)
6. 39 ($a_{10} = 3 + 9 \times 4$)
7. equilateral
8. 10 units ($\sqrt{36 + 64} = \sqrt{100}$)
9. 1
10. False (the shadow becomes shorter).
11. Mode = 3 Median – 2 Mean = $66 - 40 = 26$
12. B) 0

SECTION – II

8 × 2 = 16

13. $156 = 2 \times 78 = 2 \times 2 \times 39 = 2 \times 2 \times 3 \times 13$ [factor tree 1, answer 1]
 $\therefore 156 = 2^2 \times 3 \times 13$
14. $x^2 - 2x - 8 = (x - 4)(x + 2) \rightarrow$ zeroes 4 and -2. [1 + 1]
Sum = $4 + (-2) = 2 = -b/a = -(-2)/1 \checkmark$; Product = $4 \times (-2) = -8 = c/a \checkmark$
15. No solution when $a_1/a_2 = b_1/b_2 \neq c_1/c_2 \rightarrow k/12 = 3/k \neq 3/6$. [1 + 1]
 $k^2 = 36 \rightarrow k = \pm 6$. For $k = 6$, $3/k = 1/2 = 3/6$ (not allowed). $\therefore k = -6$
16. $2x^2 - 5x + 3 = 2x^2 - 2x - 3x + 3 = 2x(x - 1) - 3(x - 1) = (2x - 3)(x - 1)$ [1 + 1]
Roots: $x = 3/2$ and $x = 1$
17. If a line is drawn parallel to one side of a triangle to intersect the other two sides in distinct points, the other two sides are divided in the same ratio. (In $\triangle ABC$, if $DE \parallel BC$, then $AD/DB = AE/EC$.)
18. Mid-point = $((2 + (-6))/2, (-3 + 7)/2) = (-4/2, 4/2) = (-2, 2)$
19. $\sin A = 3/5 \rightarrow$ opposite 3, hypotenuse 5, adjacent = $\sqrt{25 - 9} = 4$. [1 + 1]
 $\cos A = 4/5$, $\tan A = 3/4$
20. Prime numbers on a die: 2, 3, 5 $\rightarrow P = 3/6 = 1/2$

SECTION – III

8 × 4 = 32

21. $6 = 2 \times 3$; $72 = 2^3 \times 3^2$; $120 = 2^3 \times 3 \times 5$

[factorisation 2, HCF 1, LCM 1]

HCF = $2^1 \times 3^1 = 6$

LCM = $2^3 \times 3^2 \times 5 = 360$

22. $a = 1$, $d = 3$, $n = 20$

[formula 1, substitution 2, answer 1]

$S_{20} = n/2 [2a + (n - 1)d] = 20/2 [2 + 19 \times 3] = 10 \times 59 = 590$

23. Let the ratio be $k : 1$. On the y-axis, $x = 0$.

[ratio 2, point 2]

$x = (k(-1) + 1(5))/(k + 1) = 0 \rightarrow -k + 5 = 0 \rightarrow k = 5$. Ratio = $5 : 1$

$y = (5(-4) + 1(-6))/6 = -26/6 = -13/3$

Point of intersection = $(0, -13/3)$

24. LHS = $(1 + \tan^2 A)/(1 + \cot^2 A) = \sec^2 A / \operatorname{cosec}^2 A$

= $(1/\cos^2 A) \times \sin^2 A = \sin^2 A / \cos^2 A = \tan^2 A = \text{RHS}$

25. Rough figure: right triangle with ladder (hypotenuse) = 15 m, angle with ground 60° , height h on the wall.

[figure 1, ratio 1, answer 2]

$\sin 60^\circ = h/15 \rightarrow h = 15 \times \sqrt{3}/2 = 7.5 \times 1.732 = 12.99 \text{ m } (\approx 13 \text{ m})$

26. Direct method:

Class	x_i	f_i	$f_i x_i$
0–10	5	5	25
10–20	15	8	120
20–30	25	15	375
30–40	35	12	420
40–50	45	10	450
Total		50	1390

Mean = $\Sigma f_i x_i / \Sigma f_i = 1390 / 50 = 27.8$

27. Total balls = $5 + 8 + 7 = 20$

[1 each]

(i) $P(\text{red}) = 5/20 = 1/4$ (ii) $P(\text{white}) = 8/20 = 2/5$

(iii) $P(\text{not black}) = 13/20$ (iv) $P(\text{neither red nor white}) = P(\text{black}) = 7/20$

28. By BPT, $AD/DB = AE/EC \rightarrow x/(x - 2) = (x + 2)/(x - 1)$

$x(x - 1) = (x + 2)(x - 2) \rightarrow x^2 - x = x^2 - 4 \rightarrow x = 4$

(Check: $AD = 4$, $DB = 2$, $AE = 6$, $EC = 3 \rightarrow 4/2 = 6/3 \checkmark$)

SECTION – IV

5 × 8 = 40

29. a) Assume $\sqrt{5}$ is rational: $\sqrt{5} = a/b$, where a, b are co-prime integers, $b \neq 0$. [assumption 2, steps 4, conclusion 2]

Then $5b^2 = a^2 \rightarrow 5$ divides $a^2 \rightarrow 5$ divides a (5 is prime). Let $a = 5c$.

$5b^2 = 25c^2 \rightarrow b^2 = 5c^2 \rightarrow 5$ divides b^2 , so 5 divides b .

So 5 is a common factor of a and b — contradiction to a, b being co-prime.

$\therefore$ Our assumption is wrong; $\sqrt{5}$ is irrational.

29. b) $6x^2 - 7x - 3 = 6x^2 - 9x + 2x - 3 = 3x(2x - 3) + 1(2x - 3) = (3x + 1)(2x - 3)$

[zeroes 4, verification 4]

Zeroes: $x = -1/3$ and $x = 3/2$

Sum = $-1/3 + 3/2 = 7/6$; $-b/a = -(-7)/6 = 7/6 \checkmark$

Product = $(-1/3)(3/2) = -1/2$; $c/a = -3/6 = -1/2 \checkmark$

30. a) Tables of values:

$x + y = 5$	$x: 0, 1, 5$	$y: 5, 4, 0$
$2x - y = 4$	$x: 0, 2, 3$	$y: -4, 0, 2$

Plot both lines; they intersect at (3, 2).

Solution: $x = 3$, $y = 2$.

Marks: tables 2, graph 4, solution 2.

30. b) Let the digits be x (tens) and y (units). Number = $10x + y$, reversed = $10y + x$.

$$(10x + y) + (10y + x) = 66 \rightarrow 11(x + y) = 66 \rightarrow x + y = 6$$

Digits differ by 2: $x - y = 2$ or $y - x = 2$

Case 1: $x - y = 2 \rightarrow x = 4$, $y = 2 \rightarrow$ number 42

Case 2: $y - x = 2 \rightarrow x = 2$, $y = 4 \rightarrow$ number 24

There are two such numbers: 42 and 24.

31. a) Let speed = x km/h. Time = $360/x$.

[equation 3, solving 3, answer 2]

$$360/x - 360/(x + 5) = 1 \rightarrow 360 \times 5 = x(x + 5) \rightarrow x^2 + 5x - 1800 = 0$$

$$(x + 45)(x - 40) = 0 \rightarrow x = 40 \text{ (speed cannot be negative)}$$

Speed of the train = 40 km/h

31. b) $a = 3$, $d = 12$

$$a_n - a_{54} = 132 \rightarrow [a + (n - 1)d] - [a + 53d] = 132 \rightarrow (n - 54) \times 12 = 132$$

$$n - 54 = 11 \rightarrow n = 65$$

The 65th term is 132 more than the 54th term. ($a_{54} = 639$, $a_{65} = 771$)

32. a) Statement (as in Q 17). Given: $\triangle ABC$, $DE \parallel BC$, D on AB , E on AC . To prove: $AD/DB = AE/EC$. [given/figure 2, proof 6]

Construction: join BE and CD ; draw $DM \perp AC$ and $EN \perp AB$.

$$\ar(ADE) = \frac{1}{2} \cdot AD \cdot EN, \ar(BDE) = \frac{1}{2} \cdot DB \cdot EN \rightarrow \ar(ADE)/\ar(BDE) = AD/DB \dots (1)$$

$$\ar(ADE) = \frac{1}{2} \cdot AE \cdot DM, \ar(DEC) = \frac{1}{2} \cdot EC \cdot DM \rightarrow \ar(ADE)/\ar(DEC) = AE/EC \dots (2)$$

$\triangle BDE$ and $\triangle DEC$ are on the same base DE and between the same parallels DE and $BC \rightarrow \ar(BDE) = \ar(DEC) \dots (3)$

From (1), (2), (3): $AD/DB = AE/EC$. Hence proved.

32. b) Let AB = building (7 m), CD = tower, E on CD with $BE \parallel AC$ (horizontal from top of building). [figure 2, steps 4, answer 2]

$$\text{Angle of depression of foot} = 45^\circ \rightarrow \tan 45^\circ = AB/AC \rightarrow AC = 7 \text{ m} = BE.$$

$$\text{Angle of elevation of top} = 60^\circ \rightarrow \tan 60^\circ = DE/BE \rightarrow DE = 7\sqrt{3} \text{ m}.$$

$$\text{Height of tower} = CE + DE = 7 + 7\sqrt{3} = 7(1 + \sqrt{3}) \text{ m} \approx 7 \times 2.732 = 19.12 \text{ m}$$

33. a) Cumulative frequency table:

Class	0–10	10–20	20–30	30–40	40–50	50–60
f	5	8	20	15	7	5
cf	5	13	33	48	55	60

$$n = 60, n/2 = 30 \rightarrow \text{median class } 20\text{--}30.$$

$$l = 20, cf = 13, f = 20, h = 10$$

$$\text{Median} = l + [(n/2 - cf)/f] \times h = 20 + (17/20) \times 10 = 20 + 8.5 = 28.5$$

33. b) Modal class = 60–80 (highest frequency 12).

$$l = 60, f_1 = 12, f_0 = 10, f_2 = 6, h = 20$$

$$\text{Mode} = l + [(f_1 - f_0)/(2f_1 - f_0 - f_2)] \times h = 60 + [2/(24 - 16)] \times 20 = 60 + 5 = 65$$

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