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Answers Key:

Case Study Questions

1. **(i) (b):** Here $\sqrt{8} = 2\sqrt{2}$ = product of rational and irrational numbers = irrational number
   (ii) (c): Here, $\sqrt{9} = 3$ So, $2 + 2\sqrt{9} = 2 + 6 = 8$, which is not irrational.
   (iii) (b): Here.$\sqrt{15}$ and $\sqrt{10}$ are both irrational and difference of two irrational numbers is also irrational.
   (iv) (c): As $\sqrt{5}$ is irrational, so its reciprocal is also irrational.
   (v) (d): We know that $\sqrt{6}$ is irrational. So, $15 + 3.\sqrt{6}$ is irrational.
   Similarly, $\sqrt{24} - 9 = 2.\sqrt{6} - 9$ is irrational.
   And $5\sqrt{150} = 5 \times 5.\sqrt{6} = 25\sqrt{6}$ is irrational.
2. **(i) (a):** For student Anu: Fixed charge + cost of food for 25 days = Rs 4500
   i.e., x + 25y = 4500 For student Bindu:
   Fixed charges + cost of food for 30 days = Rs 5200
   i.e., x + 30y = 5200
   (ii) (b): From above, we have $a_1 = 1$, b_1, = 25
   $c_1 = -4500$ and $a_2 = 1, b_2 = 30, c_2 = -5200$
   $\therefore \frac{a_1}{a_2} = 1, \frac{b_1}{b_2} = \frac{25}{30} = \frac{5}{6}, \frac{c_1}{c_2} = \frac{-4500}{-5200} = \frac{45}{52}$
   $\Rightarrow \frac{a_1}{a_2} \neq \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$
   Thus, system of linear equations has unique solution
   (iii) (c) : We have x + 25y = 4500 .....(i)
   and x + 30y = 5200 .....(ii)
   Subtracting (i) from (ii), we get
   5y=700 $\Rightarrow$ y=140
   $\therefore$ Cost of food per day is Rs 140
   (iv) (c): We have, x + 25y = 4500
   $\Rightarrow$ x = 4500 - 25 x 140
   $\Rightarrow$ x = 4500 - 3500 = 1000
   $\therefore$ Fixed charges per month for the hostel is Rs 1000
   (v) (d): We have, x = 1000, Y = 140 and Bindu takes food for 20 days.
   $\therefore$ Amount that Bindu has to pay = Rs (1000 + 20 x 140) = Rs 3800
3. (i) (c)

Weekly consumption	Number of families (f_1)	Cumulative frequency (cf)
0-10	16	16
10-20	12	28
20-30	18	46
30-40	6	52
40-50	4	56
50-60	0	56
Total	N = 56	

Here, N = 56
$\therefore \quad \frac{N}{2} = \frac{56}{2} = 28$
$\because$ Median class = 20-30
$\therefore$ l = 20, cf = 28, h = 10 and f = 18
Now, median weekly consumption
$= l + \frac{(\frac{N}{2} - cf)}{f} \times h = 20 + \left(\frac{28-28}{18}\right) \times 10$
= 20 + 0 = 20 units
(ii) (a)

Class	x_i	f_i	$f_i x_i$
0-10	5	16	80
10-20	15	12	180
20-30	25	18	450
30-40	35	6	210
40-50	45	4	180
50-60	55	0	0
Total		$\Sigma f = 56$	$\Sigma fx = 1100$

$\therefore$ Mean $= \frac{\Sigma f_i x_i}{\Sigma f_i} = \frac{1100}{56} = 19.64$ units

(iii) (c) Here, maximum frequency is 18 and the class corresponding to this frequency is 20-30.
So, modal class is 20-30.
(iv) (b) Here maximum frequency is 40 and class corresponding to this frequency is 40-50.
So, modal class is 40-50.

Weekly consumption (in units)	0-10	10-20	20-30	30-40	40-50	50-60
Number of families	0	5	10	20	40=f_1	5

$\therefore$ l = 40, f_1 = 40, f_0 = 20, f_2 = 5 and h= 10
Now, modal weekly consumption

$$= l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) \times h$$

$$= 40 + \left(\frac{40 - 20}{80 - 20 - 5}\right) \times 10$$

$$= 40 + \frac{20}{55} \times 10$$

= 40 + 3.6
= 43.6 units
(v) (c)

Class	x_i	f_i	f_ix_i
0-10	5	0	0
10-20	15	5	75
20-30	25	10	250
30-40	35	20	700
40-50	45	40	1800
50-60	55	5	275
		$\Sigma f_i = 80$	$\Sigma f_i x_i = 3100$

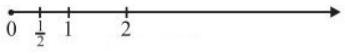
$\therefore$ Mean consumption $= \frac{3100}{80} = 38.75$ units

Assertion and reason

4. (d) If Assertion is incorrect but Reason is correct.
5. (c) Total possible outcomes are 20 as there as 20 numbers from the numbers 1 to 20 and favourable outcome is 1.
   $\therefore$ Required probability = $\frac{1}{20}$
6. (c) **Assertion (A)** Simplifying the expression $\sqrt{2}(5 - \sqrt{2}) = 5\sqrt{2} - (\sqrt{2})^2 = 5\sqrt{2} - 2$. It is known that $\sqrt{2}$ is an irrational number and multiplying an irrational number by a rational number (here, 5) results in an irrational number. Subtracting a rational number (2) from an irrational number still gives us an irrational number.
   Thus, $\sqrt{2}(5 - \sqrt{2})$ is an irrational number.
   Hence, Assertion (A) is true.
   Reason (R) It is known that $\sqrt{2}$ is an irrational number. Product of $\sqrt{2}$ and $\sqrt{2}$ is equal to 2, which is a rational number.
   Therefore, product of two irrational numbers is always an irrational number is false.
   Hence, Reason (R) is false.
7. (c) Assertion is correct but Reason is incorrect.

5 Marks

8. Here the possible outcomes are all the numbers between 0 and 2. This is the portion of the number line from 0 to 2.



   Let E be the event that 'the music is stopped within the first half-minute'.
   The outcomes favourable to E are points on the number line from 0 to $\frac{1}{2}$.
   The distance from 0 to 2 is 2, while the distance from 0 to $\frac{1}{2}$ is $\frac{1}{2}$.
   Since all the outcomes are equally likely, we can argue that, of the total distance of 2, the distance favourable to the event E is $\frac{1}{2}$.
   So, $P(E) = \frac{\text{Distance favourable to the event E}}{\text{Total distance in which outcomes can lie}} = \frac{\frac{1}{2}}{2} = \frac{1}{4}$
9. Let the breadth of the plot be x m.
   Then, the length of the plot be (2x+1)m.
   [by given condition]
   $\therefore$ Area of the rectangular plot=Length x breadth
   $\therefore$ 528 = (2x + 1)x [given]
   $\Rightarrow$ 528=$2x^2$+x
   $\Rightarrow$ $2x^2$ + x - 528 = 0,
   which is the required quadratic equation.
10. $6x^2 - 3 - 7x = 6x^2 - 7x - 3$
    $=6x^2 - 9x + 2x - 3$
    $=3x(2x - 3) + 1(2x - 3)$
    $=(2x - 3)(3x + 1)$
    $= 2\left(x - \frac{3}{2}\right)3\left(x + \frac{1}{2}\right)$
    $= 6\left(x - \frac{3}{2}\right)\left(x + \frac{1}{3}\right)$
    The zeroes of the polynomial are {3/2, -1/3}
    Relationship between the zeroes and the coeffieicients of the polynomial

Also sum of the zeroes = $\frac{3}{2} - \frac{1}{3} = \frac{9-2}{6} = \frac{7}{6}$
Also product of the zeroes = $\frac{3}{2} \times -\frac{1}{3} = -\frac{1}{2}$
Hence Verified.

11. It can be observed that the numbers of logs in rows are in an A.P.
20, 19, 18...
For this A.P.,
a = 20
d = $a_2 - a_1$ = 19 - 20 = -1
Let a total of 200 logs be placed in n rows.
S_n = 200
$S_n = \frac{n}{2}[2a + (n-1)d]$
$200 = \frac{n}{2}[2(20) + (n-1)(-1)]$
400 = n (40 - n + 1)
400 = n (41 - n)
400 = 41n - n^2
n^2 - 41n + 400 = 0
n^2 - 16n - 25n + 400 = 0
n (n - 16) -25 (n - 16) = 0
(n - 16) (n - 25) = 0
Either (n - 16) = 0 or n - 25 = 0
n = 16 or n = 25
a_n = a + (n - 1)d
a_{16} = 20 + (16 - 1) (-1)
a_{16} = 20 - 15
a_{16} = 5
Similarly,
a_{25} = 20 + (25 - 1) (-1)
a_{25} = 20 - 24
= -4
Clearly, the number of logs in 16th row is 5. However, the number of logs in 25th row is negative, which is not possible.
Therefore, 200 logs can be placed in 16 rows and the number of logs in the 16th row is 5.

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3 Marks

12. Let the amount of instalments are a, a + d, a+2d, .
Then, according to given condition, we have,
$S_{40} = 3600$ and $S_{30} = 3600 - \frac{1}{3} \times 3600 = 2400$
$\Rightarrow$ 2a+ 39d = 180 and 2a+ 29d = 160
Now, find a and d and then find a_8.
a_8 = Rs. 65
13. $\frac{1}{6}$
14. Let us the data in ascending order of x_i and make a cumulative frequency table.

Marks Obtained (x_i)	Number of students (f_i)	(cf)
19	9	9
20	3	9+3=12
28	5	12+5=17
29	4	17+4=21
35	2	21+2=23
42	7	23+7=30
51	3	303+=33

Here, n=33 [odd]
Median=Value of $\left(\frac{n+1}{2}\right)$ th observation
=Value of $\left(\frac{33+1}{2}\right)$ th observation
=Value of 17th observation
Corresponding value of 17th observation of cumulative frequency in x_i is 28.
Hece, Median is 28.

15. Let {(x) = $x^3 + 2x^2 + kx + 3$.
It is given that {(x), when divided by x- 3 gives 21 as remainder, f(3) = 21;
$\therefore$ k =-9
Now, divide {(x) by (x- 3), to find the quotient.
$\therefore$ Quotient = $x^2 + 5x + 6$
Thus, when {(x) is divided by x- 3, the quotient and remainder are $x^2 + 5x + 6$ and 21.
$\therefore$ f(x) = (x^2 + 5x+ 6)(x- 3) + 21
$x^3 + 2x^2$-9x-18= (x-2)(x+ 3)(x-3)
Ans. k =-9
Hence, the zeroes of $x^3 + 2x^2$ - 9x -18 are -2, - 3 and 3.

16. x = 1,y = 1

17. Hint When mistake was committed by first one in writing constant term. So, coefficient of x was written correctly and he got roots as 6 and 8 .
$\therefore$ Sum of roots =6+8=14
The other person did mistake in writing coefficient of x. So, constant term was written correctly and he got roots as 3 and 14 .
$\therefore$ Product of roots $= 3 \times 14 = 42$
$\therefore$ Required quadratic equation $= x^2 - 14x + 42 = 0$

2 Marks

18. $\frac{\alpha+\beta}{2} = A \Rightarrow \alpha + \beta = 2A$ and $\alpha\beta = G^2$
Equation is $x^2 - (\alpha + \beta)x + \alpha\beta = 0 \Rightarrow x^2 - 2Ax + G^2 = 0$

19. k=7

20. Let x = 571
$\Rightarrow \quad \sqrt{x} = \sqrt{571}$
Now 571 lies between the perfect squares of $(23)^2$ and $(24)^2$
Prime numbers less than 24 are 2, 3, 5, 7, 11, 13, 17, 19 ,23.
Since 571 is not divisible by any of the above numbers. So, 571 is a prime number.

21. Prime numbers are = 2,3,5,7, 11, 13,]7, 19, 23, 29 = 10
No. of possible outcomes = 30
P(prime no.) = $\frac{10}{30} = \frac{1}{3}$

22. Given, a = 1,a_{20} = 58 and n = 20
Now, sum of first 20 terms,
$S_{20} = \frac{20}{2}(1 + 58) \qquad \left[\because S_n = \frac{n}{2}(a + a_n)\right]$
= 10 (59) = 590

Multiple Choice Question

23. (c) 7/5
24. (d) 0.1
25. (d) -19
26. (b) 0 < y < x
27. (b) 1
28. (c) 5/12
29. (a) Mean = Median = Mode
30. (c) 30
31. (c) 13
32. (d) $x = 2\frac{1}{8}, y = 1\frac{7}{8}$
33. (c) 7
34. (c) 12.56 sq units
35. (c) Both (a) and (b)
36. (a) only (ii)
37. (a) 3, $\frac{-3}{2}$
38. (d) $\frac{25}{36}$

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