

CBSE CLASS X

Mathematics Standard (041)

ANSWER KEY

From previous CBSE Board Exam questions

Code: PJ1OH2

Questions: 61

Maximum Marks: 165

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SELECTIONS USED

Source	Previous-year board
Subject	Mathematics
Lessons	Statistics
Year	2022-2026
Questions selected	61

Composition — Types: 25 MCQ · 16 Long · 11 Short · 6 Case-based · 2 Very short · 1 Assertion–reason

Q1. § 13.2 Mean of Grouped Data

[1]

For some data $x_1, x_2, \dots, x_n$ with respective frequencies $f_1, f_2, \dots, f_n$, the value of $\sum_1^n f_i(x_i - \bar{x})$ is equal to :

- (a) $n\bar{x}$
- (b) 1
- (c) $\sum f_i$
- (d) 0

Previously asked in: 2024 30/1/1 Q9

◆ Statistics

13.2 Mean of Grouped Data

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Model Answer

(d) 0

Since $\bar{x} = \frac{\sum f_i x_i}{\sum f_i}$, we have $\sum f_i x_i = \bar{x} \cdot \sum f_i$. Therefore, $\sum f_i(x_i - \bar{x}) = \sum f_i x_i - \bar{x} \sum f_i = \bar{x} \sum f_i - \bar{x} \sum f_i = 0$.

Source: Chapter 13, Section 13.2 Mean of Grouped Data

Explanation

This is a standard property of the arithmetic mean: the sum of deviations of observations from their mean is always zero. Expanding $\sum f_i(x_i - \bar{x}) = \sum f_i x_i - \bar{x} \sum f_i$, and substituting the formula for $\bar{x}$, both terms cancel. Examiners expect you to identify option (d) and optionally show the one-step algebraic justification.

Q2. § 13.1 Introduction § 13.2 Mean of Grouped Data § 13.4 Median of Grouped Data

[5]

The mean of the following frequency distribution is 28. If sum of all frequencies is 100, then find the values of p and q :

Previously asked in: 2026 30/5/1 Q34(a) (OR-1)

◆ Statistics

13.2 Mean of Grouped Data

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Model Answer

Given: Mean = 28, $\Sigma f_i = 100$

Step 1: Find p and q using $\Sigma f_i = 100$

$$12 + p + 27 + 20 + q + 6 = 100$$

$$65 + p + q = 100$$

$$p + q = 35 \quad \dots(1)$$

Step 2: Calculate $\Sigma f_i x_i$ using class marks

Class	x_i	f_i	$f_i x_i$
0-10	5	12	60
10-20	15	p	15p
20-30	25	27	675
30-40	35	20	700
40-50	45	q	45q
50-60	55	6	330

$$\Sigma f_i x_i = 1765 + 15p + 45q$$

Step 3: Apply mean formula

$$\bar{x} = \frac{\Sigma f_i x_i}{\Sigma f_i} \Rightarrow 28 = \frac{1765 + 15p + 45q}{100}$$

$$2800 = 1765 + 15p + 45q$$

$$15p + 45q = 1035$$

$$p + 3q = 69 \quad \dots(2)$$

Step 4: Solve equations (1) and (2)

Subtract (1) from (2):

$$2q = 34 \Rightarrow q = 17$$

$$p = 35 - 17 = 18$$

$$p = 18, \quad q = 17$$

Source: Chapter 13, Section 13.2 (Mean of Grouped Data)

Explanation

- **Two conditions** are always needed for two unknowns: (i) sum of frequencies = total, (ii) mean formula.
- Use class marks (midpoints) for x_i in the direct method.
- Set up simultaneous equations and solve — examiners award marks at each step, so show all working clearly.
- Don't skip the table; it earns step marks and keeps calculation organised.

Q3. § 13.5 Summary

[1]

While calculating mean of a grouped frequency distribution, step deviation method was used ($\frac{x-a}{h} = u$). It was found that $\bar{x} = 64$, $h = 5$ and $a = 62.5$. The value of $\bar{u}$ is

- (A) 0.5
- (B) 1.5
- (C) 0.3
- (D) 7.5

Previously asked in: 2026 30/5/1 Q6

◆ Statistics

13.2 Mean of Grouped Data

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Model Answer

(A) 0.3

Using the step-deviation formula: $\bar{x} = a + h\bar{u}$

$$64 = 62.5 + 5 \times \bar{u} \implies 5\bar{u} = 1.5 \implies \bar{u} = 0.3$$

Explanation

The key formula is $\bar{x} = a + h\bar{u}$. Substitute the known values ($\bar{x} = 64$, $a = 62.5$, $h = 5$) and solve for $\bar{u}$. Many students mistakenly choose 0.5 (dividing 1.5 by 3) or 1.5 (forgetting to divide by h). Always isolate $\bar{u}$ by dividing the difference ($\bar{x} - a$) by h .

Q4. § 13.2 Mean of Grouped Data

[3]

Find the mean of the following data using assumed mean method :

Previously asked in: 2022 30/2/1 Q9(b)

◆ Statistics

13.2 Mean of Grouped Data

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Model AnswerLet assumed mean $a = 12.5$

Class	f_i	x_i	$d_i = x_i - 12.5$	$f_i d_i$
0-5	8	2.5	-10	-80
5-10	7	7.5	-5	-35
10-15	10	12.5	0	0
15-20	13	17.5	5	65
20-25	12	22.5	10	120
Total	50			70

Using the formula:

$$\bar{x} = a + \frac{\sum f_i d_i}{\sum f_i} = 12.5 + \frac{70}{50} = 12.5 + 1.4 = \mathbf{13.9}$$

Source: Chapter 13, Section 13.2 (Assumed Mean Method)

Explanation

- **Choose** a as the class mark of the middle class (here 10-15, so $a = 12.5$).
- $d_i = x_i - a$: find deviation of each class mark from assumed mean.
- **Formula:** $\bar{x} = a + \frac{\sum f_i d_i}{\sum f_i}$
- Examiners award marks for: correct table (class marks, d_i , $f_i d_i$), correct $\sum f_i = 50$, $\sum f_i d_i = 70$, and final answer 13.9. Show all table columns clearly.

Q5. § 13.2 Mean of Grouped Data**[3]**

The mean of the following frequency distribution is 25. Find the value of f .

Previously asked in: 2022 30/2/1 Q9(a)

◆ Statistics

13.2 Mean of Grouped Data

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Model Answer**Finding class marks (midpoints):**

Class	f_i	x_i	$f_i x_i$
0-10	5	5	25
10-20	18	15	270
20-30	15	25	375
30-40	f	35	$35f$
40-50	6	45	270
Total	$44 + f$		$940 + 35f$

Using the formula: $\bar{x} = \frac{\sum f_i x_i}{\sum f_i}$

$$25 = \frac{940 + 35f}{44 + f}$$

$$25(44 + f) = 940 + 35f$$

$$1100 + 25f = 940 + 35f$$

$$1100 - 940 = 35f - 25f$$

$$160 = 10f$$

$$\boxed{f = 16}$$

Source: Chapter 13 – Statistics, Section 13.2 Mean of Grouped Data

Explanation

- **Examiner expects:** A complete table with x_i and $f_i x_i$, correct substitution into the mean formula, and clear algebraic steps to isolate f .
- **Key formula:** $\bar{x} = \frac{\sum f_i x_i}{\sum f_i}$ (Direct Method).
- **Common mistake:** Forgetting to include f in $\sum f_i$ (denominator). Both numerator and denominator must contain f .
- For 3 marks: 1 mark for the table, 1 mark for setting up the equation, 1 mark for correct value of f .

Q6. § 13.2 Mean of Grouped Data

[1]

If the value of each observation of a statistical data is increased by 3, then the mean of the data

- A remains unchanged
- B increases by 3
- C increases by 6
- D increases by $3n$

Previously asked in: 2023 30/1/1 Q15

♦ Statistics

13.2 Mean of Grouped Data

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Model Answer

Option B: increases by 3

If each observation x_i is increased by 3, the new mean = $\frac{\Sigma(x_i + 3)}{n} = \frac{\Sigma x_i + 3n}{n} = \bar{x} + 3$.

Explanation

The mean is the sum of all observations divided by n . Adding 3 to every observation adds $3n$ to the total sum; dividing by n gives an increase of exactly 3 in the mean. Options A, C, D are wrong because the mean does change, it changes by 3 (not 6 or $3n$). This is a standard property of mean tested frequently in MCQs.

Q7. § 13.2 Mean of Grouped Data

[5]

The mean of the following frequency distribution is 35. Find the values of x and y , if the sum of frequencies is 25 :

Previously asked in: 2026 30/1/1 Q35

♦ Statistics

13.2 Mean of Grouped Data

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Model Answer

Given: Mean = 35, $\Sigma f_i = 25$

Step 1: From the sum of frequencies:

$$1 + x + 5 + 7 + y + 3 + 1 = 25$$

$$17 + x + y = 25$$

$$\boxed{x + y = 8} \quad \dots(i)$$

Step 2: Find class marks and compute $\Sigma f_i x_i$:

Class	f_i	x_i	$f_i x_i$
0-10	1	5	5
10-20	x	15	$15x$
20-30	5	25	125
30-40	7	35	245
40-50	y	45	$45y$
50-60	3	55	165
60-70	1	65	65

$$\Sigma f_i x_i = 605 + 15x + 45y$$

Step 3: Apply mean formula:

$$\bar{x} = \frac{\Sigma f_i x_i}{\Sigma f_i} \Rightarrow 35 = \frac{605 + 15x + 45y}{25}$$

$$875 = 605 + 15x + 45y$$

$$15x + 45y = 270$$

$$\boxed{x + 3y = 18} \quad \dots(ii)$$

Step 4: Solve equations (i) and (ii):

Subtracting (i) from (ii):

$$2y = 10 \Rightarrow y = 5$$

$$x = 8 - 5 = 3$$

$$\therefore x = 3, \quad y = 5$$

Source: Statistics, Section 13.2 Mean of Grouped Data, Chapter 13

Explanation

- **Two equations, two unknowns** — examiners expect you to set up both equations clearly: one from $\Sigma f_i = 25$ and one from the mean formula.
- Always use **class marks** (midpoints) as x_i for grouped data mean.
- Show the table of $f_i x_i$ neatly — it earns method marks even if arithmetic slips.
- Label your equations (i) and (ii) and show the subtraction step clearly.
- Final answer must state **both** values of x and y explicitly.

Q8. § 13.2 Mean of Grouped Data**[3]**

The weights (in kg) of 50 wild animals of a National Park were recorded and the following data was obtained. Find the mean weight (in kg) of animals, using assumed mean method.

Previously asked in: 2022 30/3/1 Q9

♦ Statistics

13.2 Mean of Grouped Data

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Model Answer

Let assumed mean $a = 125$, class size $h = 10$.

Weight (kg)	f_i	x_i	$d_i = x_i - 125$	$f_i d_i$
100–110	4	105	–20	–80
110–120	12	115	–10	–120
120–130	23	125	0	0
130–140	8	135	10	80
140–150	3	145	20	60
Total	50			–60

$$\bar{x} = a + \frac{\sum f_i d_i}{\sum f_i} = 125 + \frac{-60}{50} = 125 - 1.2 = 123.8 \text{ kg}$$

Mean weight of animals = 123.8 kg

Source: Chapter 13, Section 13.2 (Assumed Mean Method)

Explanation

- Choose assumed mean $a = 125$ (midpoint of the middle class 120–130, which has the highest frequency – a natural central value).
- Calculate **deviations** $d_i = x_i - a$ for each class mark.
- Apply the formula: $\bar{x} = a + \frac{\sum f_i d_i}{\sum f_i}$.
- Examiners award marks for: correct table with $f_i, x_i, d_i, f_i d_i$; correct $\sum f_i = 50$ and $\sum f_i d_i = -60$; and correct final calculation.
- Note the negative sum of $f_i d_i$ – don't drop the minus sign.

Q9. § 13.2 Mean of Grouped Data § 13.4 Median of Grouped Data

[3]

Following is the daily expenditure on lunch by 30 employees of a company. Find the mean daily expenditure of the employees.

Previously asked in: 2022 30/1/1 Q10

◆ Statistics

13.2 Mean of Grouped Data

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Model Answer**Using the Direct Method:**

Daily Expenditure (₹)	f_i	x_i (Class Mark)	$f_i x_i$
100 – 120	8	110	880
120 – 140	3	130	390
140 – 160	8	150	1200
160 – 180	6	170	1020
180 – 200	5	190	950
Total	30		4440

$$\bar{x} = \frac{\sum f_i x_i}{\sum f_i} = \frac{4440}{30} = \text{₹}148$$

The mean daily expenditure of the employees is ₹148.

Source: Chapter 13, Section 13.2 – Mean of Grouped Data (Direct Method)

Explanation

- **Class mark** $x_i = \frac{\text{Upper limit} + \text{Lower limit}}{2}$ is used to represent each class interval.
- The **Direct Method** formula is $\bar{x} = \frac{\sum f_i x_i}{\sum f_i}$.
- Always show the table with all columns – examiners award marks for the working, not just the final answer.
- Verify: $\sum f_i = 30$ ✓ (matches total employees given in the question).

Q10. § 13.1 Introduction § 13.2 Mean of Grouped Data

[3]

Find the mean of the following frequency distribution :

Previously asked in: 2023 30/5/1 Q31; 2022 30/4/1 Q4 – 2×

◆ Statistics

13.2 Mean of Grouped Data

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Model AnswerUsing the **Direct Method**: $\bar{x} = \frac{\sum f_i x_i}{\sum f_i}$

Classes	f_i	x_i (class mark)	$f_i x_i$
25–30	14	27.5	385.0
30–35	22	32.5	715.0
35–40	16	37.5	600.0
40–45	6	42.5	255.0
45–50	5	47.5	237.5
50–55	3	52.5	157.5
55–60	4	57.5	230.0
Total	70		2580.0

$$\bar{x} = \frac{\sum f_i x_i}{\sum f_i} = \frac{2580}{70} = \mathbf{36.86}$$

The mean of the distribution is 36.86 (approx).

Source: Chapter 13, Section 13.2 Mean of Grouped Data

Explanation

- **Class mark** x_i = (lower limit + upper limit) / 2 for each class. Always write this column clearly.
- Use the **Direct Method** here since the values are small and manageable.
- $\sum f_i = 70$ is the total frequency — verify this first to avoid errors.
- Examiner awards marks for: correct class marks, correct $f_i x_i$ products, correct $\sum f_i x_i$, and correct final division. Show each step.

Q11. § 13.2 Mean of Grouped Data**[1]**

If every term of the statistical data consisting of n terms is decreased by 2, then the mean of the data :

- (a) decreases by 2
- (b) remains unchanged
- (c) decreases by $2n$
- (d) decreases by 1

Previously asked in: 2023 30/5/1 Q18

♦ Statistics

13.2 Mean of Grouped Data

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Model Answer**(a) decreases by 2**

When every term is decreased by 2, the new mean = old mean – 2, so the mean also decreases by 2.

Explanation

If original mean is $\bar{x} = \frac{\sum x_i}{n}$, and each term becomes $(x_i - 2)$, new mean = $\frac{\sum (x_i - 2)}{n} = \bar{x} - 2$. The mean shifts by exactly the same constant subtracted from every term. Examiners expect you to state the correct option and give a one-line reason.

Q12. § 13.2 Mean of Grouped Data**[1]**

For the data 2, 9, $x + 6$, $2x + 3$, 5, 10, 5; if the mean is 7, then the value of x is :

- A 9
- B 6
- C 5
- D 3

Previously asked in: 2024 30/5/1 Q6

♦ Statistics

13.2 Mean of Grouped Data

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Model Answer**Option (D) 3**

$$\text{Mean} = \frac{2 + 9 + (x + 6) + (2x + 3) + 5 + 10 + 5}{7} = 7$$

$$\Rightarrow 2x + 40 = 49 \Rightarrow 2x = 9 \dots$$

$$\text{Recalculating: } 2 + 9 + x + 6 + 2x + 3 + 5 + 10 + 5 = 3x + 40$$

$$\frac{3x + 40}{7} = 7 \Rightarrow 3x + 40 = 49 \Rightarrow 3x = 9 \Rightarrow x = 3$$

Answer: D) 3**Explanation**

Sum all terms: $2 + 9 + (x + 6) + (2x + 3) + 5 + 10 + 5 = 3x + 40$. Set $\frac{3x+40}{7} = 7$, solve to get $x = 3$. Watch out for carefully collecting like terms ($x + 2x = 3x$) – a common slip.

Q13. § 13.2 Mean of Grouped Data

[1]

The mean of five observations is 15. If the mean of first three observations is 14 and that of the last three observations is 17, then the third observation is

- A 20
- B 19
- C 18
- D 17

Previously asked in: 2024 30/3/1 Q16

◆ Statistics

13.2 Mean of Grouped Data

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Model Answer

Option (A) 20

Sum of 5 observations = $15 \times 5 = 75$; Sum of first 3 = $14 \times 3 = 42$; Sum of last 3 = $17 \times 3 = 51$.

Third observation = $42 + 51 - 75 = 20$.

Explanation

The third observation is counted in both "first three" and "last three" groups. So: 3rd obs = (Sum of first 3) + (Sum of last 3) - (Total sum) = $42 + 51 - 75 = 20$. This is a standard trick question on means.

Q14. § 13.4 Median of Grouped Data**[3]**

In a test, the marks obtained by 100 students (out of 50) are given below:

Marks obtained	0–10	10–20	20–30	30–40	40–50
Frequency	12	23	34	25	6

Find the mean marks of the students.

Previously asked in: 2024 30/2/1 Q30

◆ Statistics

13.2 Mean of Grouped Data

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Model Answer**Finding class marks and $f_i x_i$:**

Marks (x_i)	No. of students (f_i)	$f_i x_i$
0–10	12	60
10–20	23	230
20–30	34	680
30–40	25	750
40–50	6	270
Total	100	2400

$$\bar{x} = \frac{\sum f_i x_i}{\sum f_i} = \frac{2400}{100} = 24$$

The mean marks of the students is 24.

Source: Chapter 13, Section 13.2 – Mean of Grouped Data (Direct Method)

Explanation

- **Class mark** = (lower limit + upper limit) ÷ 2. For 0–10, class mark = 5; for 10–20, class mark = 15, etc.
- Multiply each class mark by its frequency to get $f_i x_i$, then sum all values.
- Apply the direct method formula: $\bar{x} = \frac{\sum f_i x_i}{\sum f_i}$.
- Since class marks and frequencies are small, the **Direct Method** is the appropriate and simplest choice here.
- Always show the table clearly – examiners award marks for the working, not just the final answer.

Q15. § 13.2 Mean of Grouped Data**[1]**

If the mean of 2, 9, $x + 6$, $2x + 3$, 5, 10, 5 is 7, then the value of x is:

- A 9
- B 6
- C 5
- D 3

Previously asked in: 2025 30/3/1 Q15

♦ Statistics

13.2 Mean of Grouped Data

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Model Answer**Option (D) 3**

$$\text{Mean} = \frac{2 + 9 + (x + 6) + (2x + 3) + 5 + 10 + 5}{7} = 7$$

$$\Rightarrow 2 + 9 + x + 6 + 2x + 3 + 5 + 10 + 5 = 49$$

$$\Rightarrow 3x + 40 = 49 \Rightarrow 3x = 9 \Rightarrow x = 3$$

Explanation

Apply the mean formula: sum of all observations ÷ total number of observations = given mean. Set up the equation, simplify by collecting like terms, and solve for x . There are 7 observations, so multiply mean (7) by 7 to get 49. Watch out for correctly expanding $(x + 6)$ and $(2x + 3)$ before adding.

Q16. § 13.1 Introduction § 13.3 Mode of Grouped Data § 13.5 Summary

[2]

The mode of a grouped frequency distribution is 75 and the modal class is 65-80. The frequency of the class preceding the modal class is 6 and the frequency of the class succeeding the modal class is 8. Find the frequency of the modal class.

Previously asked in: 2022 30/4/1 Q1

♦ Statistics

13.3 Mode of Grouped Data

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Model Answer

Given: Mode = 75, modal class = 65-80, $f_0 = 6$, $f_2 = 8$, $l = 65$, $h = 15$.

Using the formula:

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

$$75 = 65 + \left(\frac{f_1 - 6}{2f_1 - 6 - 8} \right) \times 15$$

$$10 = \frac{15(f_1 - 6)}{2f_1 - 14}$$

$$10(2f_1 - 14) = 15(f_1 - 6)$$

$$20f_1 - 140 = 15f_1 - 90$$

$$5f_1 = 50 \implies f_1 = 10$$

The frequency of the modal class is 10.

Source: Chapter 13, Section 13.3 Mode of Grouped Data

Explanation

- Examiners expect you to write the mode formula, substitute all known values clearly, and solve the linear equation step by step.
- Key variables: l = lower limit of modal class, h = class width, f_1 = modal class frequency (unknown), f_0 = preceding frequency, f_2 = succeeding frequency.
- Don't forget: $h = 80 - 65 = 15$.
- Both marks are awarded for correct substitution and correct final answer; show working to secure full credit.

Q17. § 13.3 Mode of Grouped Data § 13.5 Summary

[2]

If mode of the following frequency distribution is 55, then find the value of x .

Previously asked in: 2022 30/2/1 Q5

◆ Statistics

13.3 Mode of Grouped Data

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Model Answer

Since mode = 55 lies in class **45–60**, this is the modal class.

Here, $l = 45$, $h = 15$, $f_1 = 15$, $f_0 = x$, $f_2 = 10$

Using Mode formula:

$$55 = 45 + \left(\frac{15 - x}{2(15) - x - 10} \right) \times 15$$

$$10 = \frac{(15 - x) \times 15}{20 - x}$$

$$10(20 - x) = 15(15 - x)$$

$$200 - 10x = 225 - 15x$$

$$5x = 25$$

$$\boxed{x = 5}$$

Source: Chapter 13, Section 13.3 – Mode of Grouped Data

Explanation

- Since mode = 55 falls in 45–60, that is the modal class. The class **before** it (30–45) has frequency x , so $f_0 = x$.
- Substitute directly into the mode formula and solve the linear equation.
- Examiners award 1 mark for correct identification of modal class/formula setup and 1 mark for the correct value of $x = 5$.

Q18. § 13.2 Mean of Grouped Data § 13.3 Mode of Grouped Data

[5]

250 apples of a box were weighed and the distribution of masses of the apples is given in the following table:

(i) Find the value of x and the mean mass of the apples. [3]

(ii) Find the modal mass of the apples. [2]

Previously asked in: 2023 30/6/1 Q35

◆ Statistics

13.2 Mean of Grouped Data

13.4 Mode of Grouped Data

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Model Answer**(i) Finding x and the mean mass:**

Total apples = 250

$$20 + 60 + 70 + x + 60 = 250$$

$$210 + x = 250 \implies x = 40$$

Mean by Direct Method:

Mass (g)	f_i	x_i (mid-point)	$f_i x_i$
80–100	20	90	1800
100–120	60	110	6600
120–140	70	130	9100
140–160	40	150	6000
160–180	60	170	10200
Total	250		33700

$$\bar{x} = \frac{\sum f_i x_i}{\sum f_i} = \frac{33700}{250} = 134.8 \text{ g}$$

(ii) Finding the modal mass:

The class **120–140** has the highest frequency (70), so it is the **modal class**.

Here: $l = 120$, $f_1 = 70$, $f_0 = 60$, $f_2 = 40$, $h = 20$

$$\begin{aligned} \text{Mode} &= l + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times h = 120 + \frac{70 - 60}{2(70) - 60 - 40} \times 20 \\ &= 120 + \frac{10}{40} \times 20 = 120 + 5 = 125 \text{ g} \end{aligned}$$

Source: Statistics, Chapter 13, Sections 13.2 and 13.4

Explanation

- **For (i):** Always find the unknown frequency first using $\sum f_i = \text{total}$. Then use mid-points for the direct method. Show the table clearly — examiners award marks step-by-step.

- **For (ii):** Identify the modal class as the one with the highest frequency. Apply the formula correctly: l = lower limit, f_1 = modal class frequency, f_0 = preceding class frequency, f_2 = succeeding class frequency, h = class width. Don't confuse f_0 and f_2 .

Q19. § 13.4 Median of Grouped Data

[1]

The distribution below gives the marks obtained by 80 students on a test. The modal class of this distribution is :

- A 10 – 20
- B 20 – 30
- C 30 – 40
- D 50 – 60

Previously asked in: 2023 30/1/1 Q11

♦ Statistics

Modal Class in Frequency Distribution

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Model Answer

Converting to a frequency table: 0–10: 3, 10–20: 9, 20–30: 15, **30–40: 30**, 40–50: 18, 50–60: 5.

The class with the highest frequency is **30–40**.

Answer: (C) 30 – 40

Explanation

Convert the cumulative frequency table to a regular frequency table by subtracting successive values (e.g., $57 - 27 = 30$ for 30–40). The class with the maximum frequency is the **modal class**. Here, 30–40 has frequency 30, which is the highest — so it is the modal class.

Q20. § 13.4 Median of Grouped Data

[1]

If the maximum number of students has obtained 52 marks out of 80, then

- A 52 is the mean of the data.
- B 52 is the median of the data.
- C 52 is the mode of the data.
- D 52 is the range of the data.

Previously asked in: 2025 30/6/1 Q16

♦ Statistics

Mode of Grouped Data

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Model Answer

Answer: C — 52 is the mode of the data.

Since the maximum number of students obtained 52 marks, 52 is the observation that occurs most frequently, which is the **mode**.

Explanation

Mode is defined as the value that appears most often in a data set. "Maximum number of students obtained 52 marks" directly means 52 has the highest frequency — that is the definition of mode. Mean requires calculation of average; median is the middle value; range is the difference between highest and lowest values.

Q21. § 13.1 Introduction § 13.2 Mean of Grouped Data § 13.3 Mode of Grouped Data

[5]

The following table shows the number of patients of different age group who were discharged from the hospital in a particular month :

Find the 'mean' and the 'mode' of the above data.

Previously asked in: 2025 30/4/1 Q35

◆ Statistics 13.2 Mean of Grouped Data 13.3 Mode of Grouped Data

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Model Answer

Mean:

Age	f_i	x_i (mid-value)	$f_i x_i$
5-15	6	10	60
15-25	11	20	220
25-35	21	30	630
35-45	23	40	920
45-55	14	50	700
55-65	5	60	300
Total	80		2830

$$\bar{x} = \frac{\sum f_i x_i}{\sum f_i} = \frac{2830}{80} = \mathbf{35.375 \text{ years}}$$

Mode:

The class with the highest frequency is **35-45** (frequency = 23).

So, Modal class = 35-45, $l = 35$, $f_1 = 23$, $f_0 = 21$, $f_2 = 14$, $h = 10$

$$\begin{aligned} \text{Mode} &= l + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times h \\ &= 35 + \frac{23 - 21}{2(23) - 21 - 14} \times 10 = 35 + \frac{2}{11} \times 10 = 35 + 1.82 = \mathbf{36.82 \text{ years}} \end{aligned}$$

Source: Exercise 13.2, Q.1; Chapter 13

Explanation

- **Mean:** Use Direct Method — find mid-value (x_i) of each class, multiply by frequency, sum up, then divide by total frequency (80).
- **Mode:** Identify the modal class (highest frequency = 23, class 35-45). Apply the formula with l = lower limit, f_1 = modal class frequency, f_0 = preceding class frequency, f_2 = succeeding class frequency, h = class width.
- Examiners expect the full table for mean (awarded ~2 marks) and correct substitution in mode formula (~2 marks) + final answers (~1 mark). Never skip the formula step.

Q22. § 13.3 Mode of Grouped Data

[2]

Find the mode of the given frequency distribution:

Previously asked in: 2022 30/3/1 Q3

◆ Statistics

13.3 Mode of Grouped Data

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Model AnswerThe highest frequency is 23, so the **modal class** = 45–55.Here, $l = 45$, $f_1 = 23$, $f_0 = 22$, $f_2 = 14$, $h = 10$

$$\begin{aligned}\text{Mode} &= l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right) \times h \\ &= 45 + \left(\frac{23 - 22}{2(23) - 22 - 14} \right) \times 10 = 45 + \frac{1}{10} \times 10 = 45 + 1 = \mathbf{46}\end{aligned}$$

Source: Chapter 13, Section 13.3

Explanation

- **Modal class** is the class with the highest frequency ($23 \rightarrow 45-55$).
- Identify f_0 (preceding class frequency = 22) and f_2 (succeeding class frequency = 14) carefully — a common error is swapping these.
- Examiner awards 1 mark for correct identification of modal class/values and 1 mark for correct substitution and final answer.

Q23. § 13.3 Mode of Grouped Data**[2]**

Find the mode of the following frequency distribution:

Previously asked in: 2022 30/1/1 Q4

◆ Statistics

13.3 Mode of Grouped Data

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Model AnswerThe class with the highest frequency is **40–50** (frequency = 17), so the **modal class = 40–50**.Here, $l = 40$, $f_1 = 17$, $f_0 = 12$, $f_2 = 4$, $h = 10$

$$\begin{aligned}\text{Mode} &= l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right) \times h = 40 + \left(\frac{17 - 12}{34 - 12 - 4} \right) \times 10 \\ &= 40 + \frac{5}{18} \times 10 = 40 + 2.78 = \mathbf{42.78}\end{aligned}$$

Source: Chapter 13, Section 13.3

Explanation

- Examiners award 1 mark for correctly identifying the modal class and writing the values of l , f_1 , f_0 , f_2 , h , and 1 mark for correct substitution and final answer.
- The modal class is always the one with the **highest frequency** (here 40–50, $f = 17$), not the first class.
- f_0 is the frequency of the class **before** the modal class (30–40 = 12) and f_2 is the class **after** (50–60 = 4). Getting these mixed up is a common error.

Q24. § 13.2 Mean of Grouped Data § 13.3 Mode of Grouped Data § 13.5 Summary

[5]

The following table shows the ages of the patients admitted in a hospital during a year. Find the mode and mean of the data given above.

Previously asked in: 2024 30/4/1 Q35

◆ Statistics

13.2 Mean of Grouped Data

13.3 Mode of Grouped Data

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Model Answer**Mode:**

The class with the highest frequency is **35–45** ($f = 23$).

So, Modal class = 35–45, $l = 35$, $f_1 = 23$, $f_0 = 21$, $f_2 = 14$, $h = 10$.

$$\begin{aligned}\text{Mode} &= l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right) \times h = 35 + \left(\frac{23 - 21}{2(23) - 21 - 14} \right) \times 10 \\ &= 35 + \frac{2}{11} \times 10 = 35 + 1.8 = \mathbf{36.8 \text{ years}}\end{aligned}$$

Mean (Direct Method): Taking class marks x_i :

Age	f_i	x_i	$f_i x_i$
5–15	6	10	60
15–25	11	20	220
25–35	21	30	630
35–45	23	40	920
45–55	14	50	700
55–65	5	60	300
Total	80		2830

$$\bar{x} = \frac{\sum f_i x_i}{\sum f_i} = \frac{2830}{80} = \mathbf{35.375 \text{ years}}$$

Interpretation: The mode (36.8 years) is the age group most common among patients. The mean (35.375 years) is the average age of all patients admitted.

Source: Chapter 13, Exercise 13.2, Q.1

Explanation

- **Modal class** = class with highest frequency (23), not just the highest frequency value.
- Apply the standard mode formula; examiners check correct substitution of f_0 (preceding class freq.) and f_2 (succeeding class freq.).
- For **mean**, the direct method is simplest here since x_i values are manageable. Use class marks (midpoints) as representatives.
- The **interpretation line** is required by the question ("Compare and interpret") — don't skip it even in a 5-mark answer.
- Σf must equal total patients = 80; verify this before computing mean.

Q25. § 13.4 Median of Grouped Data**[1]**

After an examination, a teacher wants to know the marks obtained by maximum number of the students in her class. She requires to calculate _____ of marks.

- (A) median
- (B) mode
- (C) mean
- (D) range

Previously asked in: 2024 30/2/1 Q18

◆ Statistics

Mode

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Model Answer**(B) mode**

The mode gives the value that occurs most frequently. To know the marks obtained by the **maximum number** of students, the teacher needs the mode.

Explanation

Mode = value with the highest frequency. The textbook states: "In situations which require establishing the most frequent value or most popular item, the mode is the best choice." Here, "marks obtained by maximum number of students" directly means the most frequently occurring marks, so mode is the correct measure — not mean (average of all) or median (middle value).

Q26. § 13.1 Introduction § 13.3 Mode of Grouped Data § 13.5 Summary

[5]

Find the Mean and Mode of the following frequency distribution :

Previously asked in: 2025 30/2/1 Q35

◆ Statistics

13.2 Mean of Grouped Data

13.3 Mode of Grouped Data

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Model Answer**Mean Calculation (Direct Method):**

Class	f_i	x_i	$f_i x_i$
0-10	8	5	40
10-20	7	15	105
20-30	15	25	375
30-40	20	35	700
40-50	12	45	540
50-60	8	55	440
60-70	10	65	650
Total	$\Sigma f_i = 80$		$\Sigma f_i x_i = 2850$

$$\bar{x} = \frac{\Sigma f_i x_i}{\Sigma f_i} = \frac{2850}{80} = \mathbf{35.625}$$

Mode Calculation:The highest frequency is **20**, corresponding to class **30-40** → Modal class = 30-40.Here, $l = 30$, $f_1 = 20$, $f_0 = 15$, $f_2 = 12$, $h = 10$

$$\begin{aligned} \text{Mode} &= l + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times h = 30 + \frac{20 - 15}{40 - 15 - 12} \times 10 \\ &= 30 + \frac{5}{13} \times 10 = 30 + 3.846 \approx \mathbf{33.85} \end{aligned}$$

Source: Chapter 13, Sections 13.2 and 13.3

Explanation

- **Mean:** Use mid-points (x_i) of each class; apply $\bar{x} = \frac{\Sigma f_i x_i}{\Sigma f_i}$.
- **Modal class:** The class with the **highest frequency** (20 here, i.e., 30-40).
- In the mode formula, f_0 = frequency of class *before* modal class, f_2 = frequency of class *after* modal class. Don't mix these up.
- Show the full table for Mean — examiners award step marks for correct x_i and $f_i x_i$ columns.
- Round mode to 2 decimal places unless told otherwise.

Q27. § 13.2 Mean of Grouped Data § 13.3 Mode of Grouped Data § 13.5 Summary

[5]

Find the missing frequency f in the following table, if the mean of the given data is 18. Hence find the mode.

Previously asked in: 2025 30/1/1 Q35

◆ Statistics

13.2 Mean of Grouped Data

13.3 Mode of Grouped Data

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Model Answer**Finding the missing frequency f :**

Class	x_i	f_i	$f_i x_i$
11–13	12	7	84
13–15	14	6	84
15–17	16	9	144
17–19	18	13	234
19–21	20	f	$20f$
21–23	22	5	110
23–25	24	4	96
Total		$44 + f$	$752 + 20f$

Given $\bar{x} = 18$:

$$18 = \frac{752 + 20f}{44 + f}$$

$$18(44 + f) = 752 + 20f$$

$$792 + 18f = 752 + 20f$$

$$40 = 2f \implies \boxed{f = 20}$$

Finding the Mode:The highest frequency is 20, so the **modal class is 19–21**.Here, $l = 19$, $h = 2$, $f_1 = 20$, $f_0 = 13$, $f_2 = 5$

$$\begin{aligned} \text{Mode} &= l + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times h = 19 + \frac{20 - 13}{40 - 13 - 5} \times 2 \\ &= 19 + \frac{7}{22} \times 2 = 19 + \frac{7}{11} = 19 + 0.636 \approx \boxed{19.64} \end{aligned}$$

Source: Chapter 13, Sections 13.2 and 13.3

Explanation

- **Finding f :** Use the direct method formula $\bar{x} = \frac{\sum f_i x_i}{\sum f_i}$. Set it equal to 18 and solve the linear equation for f .
- **Modal class:** The class with the highest frequency (here, 19–21 with $f = 20$) is the modal class.
- **Mode formula:** Examiners expect you to correctly identify f_0 (preceding class frequency = 13) and f_2 (succeeding class frequency = 5). Show substitution clearly for full marks.
- Write the table neatly — it earns method marks even if arithmetic slips occur.

Q28. § 13.1 Introduction § 13.3 Mode of Grouped Data § 13.5 Summary

[5]

Find mean and mode of the following distribution:

Previously asked in: 2026 30/4/1 Q35 (OR-2); 2026 30/3/1 Q32(b) – 2×

◆ Statistics

13.2 Mean of Grouped Data

13.3 Mode of Grouped Data

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Model Answer**Mean** (using assumed mean method, $a = 52.5$, $h = 15$):

Class	f_i	x_i	$u_i = \frac{x_i - 52.5}{15}$	$f_i u_i$
0–15	4	7.5	–3	–12
15–30	8	22.5	–2	–16
30–45	11	37.5	–1	–11
45–60	14	52.5	0	0
60–75	10	67.5	1	10
75–90	7	82.5	2	14
90–105	6	97.5	3	18
Total	60			3

$$\bar{x} = a + \frac{\sum f_i u_i}{\sum f_i} \times h = 52.5 + \frac{3}{60} \times 15 = 52.5 + 0.75 = \mathbf{53.25}$$

Mode:The highest frequency is 14, so the **modal class = 45–60**. $l = 45$, $f_1 = 14$, $f_0 = 11$, $f_2 = 10$, $h = 15$

$$\text{Mode} = l + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times h = 45 + \frac{14 - 11}{28 - 11 - 10} \times 15 = 45 + \frac{3}{7} \times 15 = 45 + 6.43 = \mathbf{51.43}$$

Mean = 53.25, Mode = 51.43

Source: Chapter 13, Section 13.2 (Mean) and Section 13.3 (Mode)

Explanation

- **Mean:** The step-deviation (assumed mean) method is most efficient here since all class widths are equal ($h = 15$). Take $a = 52.5$ (midpoint of middle class). Calculate u_i and $f_i u_i$, sum them, and apply the formula.
- **Mode:** Identify the modal class as the one with the highest frequency ($14 \rightarrow$ class 45–60). Then substitute l , f_1 , f_0 , f_2 , h into the mode formula. Examiners award marks for correctly identifying the modal class, writing the formula with correct substitution, and the final answer.
- Show the table neatly — 1–2 marks are often for working, not just the final answer.

Q29. § 13.1 Introduction § 13.5 Summary

[1]

Mean and Median of a frequency distribution are 43 and 40 respectively. The value of mode is

- A 34
- B 43
- C 38.5
- D 41.5

Previously asked in: 2026 30/4/1 Q18

♦ Statistics

13.3 Mode of Grouped Data

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Model Answer

Using the empirical relationship: **Mode = 3 Median – 2 Mean**

$$\text{Mode} = 3 \times 40 - 2 \times 43 = 120 - 86 = \mathbf{34}$$

The correct option is **A) 34**.

Explanation

The empirical relationship between the three measures of central tendency is:

$$\mathbf{\text{Mode} = 3 \text{ Median} - 2 \text{ Mean}}$$

This formula is stated in Chapter 13. Always substitute Median first, then Mean. Here: $3(40) - 2(43) = 120 - 86 = 34$. This is a standard 1-mark application question in board exams.

Q30. § 13.4 Median of Grouped Data

[4]

BINGO is game of chance. The host has 75 balls numbered 1 through 75. Each player has a BINGO card with some numbers written on it. The participant cancels the number on the card when called out a number written on the ball selected at random. Whosoever cancels all the numbers on his/her card, says BINGO and wins the game. The table given below, shows the data of one such game where 48 balls were used before Tara said 'BINGO'.

Based on the above information, answer the following :

- (i) Write the median class. [1]
- (ii) When first ball was picked up, what was the probability of calling out an even number ? [1]
- (iii) Find median of the given data. [2]

Previously asked in: 2024 30/1/1 Q37

◆ Statistics

13.4 Median of Grouped Data

14.1 Probability — A Theoretical Approach

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Model Answer

(i) Median Class:

Cumulative frequencies: 8, 17, 27, 39, 48.

$n = 48$, $n/2 = 24$. The cumulative frequency just exceeding 24 is 27 (class 30–45).

Median class = 30–45

(ii) Probability of calling an even number (first ball):

Even numbers from 1 to 75: 2, 4, 6, ... 74 → **37 even numbers**

Total balls = 75

$$P(\text{even}) = \frac{37}{75}$$

(iii) Median:

Median class = 30–45, $l = 30$, $f = 10$, $cf = 17$, $h = 15$, $n/2 = 24$

$$\begin{aligned} \text{Median} &= l + \frac{\frac{n}{2} - cf}{f} \times h = 30 + \frac{24 - 17}{10} \times 15 \\ &= 30 + \frac{7 \times 15}{10} = 30 + 10.5 = \mathbf{40.5} \end{aligned}$$

Source: Statistics, Median of Grouped Data

Explanation

- **Part (i):** Build the cumulative frequency table; the class where cumulative frequency first reaches or exceeds $n/2 = 24$ is the median class.
- **Part (ii):** Balls are 1–75; even numbers are 2, 4, ..., 74 = 37 numbers. Total = 75. Many students mistakenly write 38 — remember 75 is odd so evens = 37.
- **Part (iii):** Apply the standard median formula. Carry cf of the class *before* the median class (17, not 27). This is a common error to avoid.

Q31. § 13.1 Introduction § 13.3 Mode of Grouped Data § 13.4 Median of Grouped Data**[1]**

The middle most observation of every data arranged in order is called :

- (a) mode
- (b) median
- (c) mean
- (d) deviation

Previously asked in: 2024 30/1/1 Q14

♦ **Statistics** 13.4 Median of Grouped Data

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Model Answer

(b) median

The middle-most observation of data arranged in order is called the **median**.

Source: Statistics, Section 13.4 (Median of Grouped Data), Chapter 13

Explanation

The textbook explicitly defines median as "a measure of central tendency which gives the value of the middle-most observation in the data." Mode is the most frequent value, mean is the average, and deviation is not a measure of central tendency. For a 1-mark MCQ, just writing the option letter and the term is sufficient.

Q32. § 13.1 Introduction § 13.3 Mode of Grouped Data § 13.4 Median of Grouped Data

[5]

Find median and mode of the following distribution:

Previously asked in: 2026 30/5/1 Q34(b) (OR-2)

◆ Statistics

13.3 Mode of Grouped Data

13.4 Median of Grouped Data

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Model Answer**Frequency Distribution Table with Cumulative Frequency:**

Class	Frequency (f)	cf
0-15	15	15
15-30	10	25
30-45	12	37
45-60	9	46
60-75	8	54
75-90	10	64
90-105	6	70

Total n = 70

Median:

$$\frac{n}{2} = 35$$

Cumulative frequency just greater than 35 is 37 (class 30-45).

∴ Median class = **30-45**, $l = 30$, $cf = 25$, $f = 12$, $h = 15$

$$\begin{aligned}\text{Median} &= l + \left(\frac{\frac{n}{2} - cf}{f} \right) \times h = 30 + \left(\frac{35 - 25}{12} \right) \times 15 \\ &= 30 + \frac{150}{12} = 30 + 12.5 = \mathbf{42.5}\end{aligned}$$

Mode:Maximum frequency = 15 → Modal class = **0-15** $l = 0$, $f_1 = 15$, $f_0 = 0$ (no preceding class), $f_2 = 10$, $h = 15$

$$\text{Mode} = 0 + \left(\frac{15 - 0}{2(15) - 0 - 10} \right) \times 15 = \frac{15}{20} \times 15 = \mathbf{11.25}$$

Source: Chapter 13, Sections 13.3 and 13.4

Explanation

- **Median:** Find $n/2$, locate the class whose *cumulative frequency* first exceeds $n/2$ — that is the median class. Then apply the formula. Here $cf = 25$ (class before 30-45) and $f = 12$.
- **Mode:** The modal class has the *highest frequency* (15 for 0-15). Since it is the first class, $f_0 = 0$. Substitute carefully in the mode formula.

- Common mistakes: using wrong cf (must be of the class *preceding* median class), and forgetting $f_0 = 0$ when modal class is the first interval.

Q33.

[4]

Yoga is an ancient practice which is a form of meditation and exercise. By practising yoga, we not even make our body healthy but also achieve inner peace and calmness. The International Yoga Day is celebrated on 21st of June every year since 2015.

To promote Yoga, Green park society in Pune organised a 7-day Yoga camp in their society. The number of people of different age groups who enrolled for this camp is given as follows :

Based on the above, find the following :

- (a) Find the median age of people enrolled for the camp. [2]
 (b) If x more people of age group 65 – 75 had enrolled for the camp, the mean age would have been 58. Find the value of x . [2]

Previously asked in: 2022 30/4/1 Q13

◆ Statistics

13.2 Mean of Grouped Data

13.4 Median of Grouped Data

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Model Answer

(a) Median Age:

Age Group	Frequency	Cumulative Frequency
15-25	8	8
25-35	10	18
35-45	15	33
45-55	25	58
55-65	40	98
65-75	24	122
75-85	18	140

Total $N = 140$, so $N/2 = 70$.

Median class = **55-65** ($cf = 58$, $f = 40$, $l = 55$, $h = 10$)

$$\text{Median} = 55 + \frac{70 - 58}{40} \times 10 = 55 + 3 = \mathbf{58}$$

(b) Finding x :

Original $\Sigma fi \cdot xi$ (midpoints: 20, 30, 40, 50, 60, 70, 80):

$$\Sigma fi \cdot xi = 8(20) + 10(30) + 15(40) + 25(50) + 40(60) + 24(70) + 18(80)$$

$$= 160 + 300 + 600 + 1250 + 2400 + 1680 + 1440 = \mathbf{7830}$$

New total frequency = $140 + x$; New $\Sigma fi \cdot xi = 7830 + 70x$

$$58 = \frac{7830 + 70x}{140 + x}$$

$$8120 + 58x = 7830 + 70x \implies 290 = 12x \implies \boxed{x = \frac{290}{12} \approx 24.17}$$

Since x must be a whole number, $x \approx \mathbf{24}$ (or exact value $x = \frac{145}{6}$, accept as per calculation).

Explanation

- **Part (a):** Always build cumulative frequency, identify median class where cf first exceeds $N/2$, then apply the formula correctly. Here median = 58.
- **Part (b):** Use midpoints for mean calculation. Set up the equation with $(140 + x)$ in denominator and solve. If the answer is non-integer, present the exact fraction — CBSE accepts it. Show all steps clearly for full marks.

Q34. § 13.4 Median of Grouped Data

[3]

Heights of 50 students of class X of a school are recorded and following data is obtained : Find the median height of the students.

Previously asked in: 2022 30/2/1 Q10

◆ Statistics

13.4 Median of Grouped Data

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Model Answer**Cumulative Frequency Table:**

Height (cm)	Frequency (f)	Cumulative Frequency (cf)
130–135	4	4
135–140	11	15
140–145	12	27
145–150	7	34
150–155	10	44
155–160	6	50

Here, $n = 50$, so $\frac{n}{2} = 25$.

The cumulative frequency just greater than 25 is 27, which belongs to class **140–145**.

∴ Median class = 140–145

$l = 140$, $cf = 15$, $f = 12$, $h = 5$

$$\begin{aligned}\text{Median} &= l + \left(\frac{\frac{n}{2} - cf}{f} \right) \times h = 140 + \left(\frac{25 - 15}{12} \right) \times 5 \\ &= 140 + \frac{50}{12} = 140 + 4.17 = \mathbf{144.17 \text{ cm}}\end{aligned}$$

Source: Chapter 13, Section 13.4

Explanation

- Always build the **cumulative frequency (cf) column** first.
- Locate the median class: the class whose cf first exceeds $n/2$.
- Substitute carefully into the formula; examiners award marks for the table (1 mark), identifying the median class with correct values of l , cf , f , h (1 mark), and the final calculation (1 mark).
- Round to 2 decimal places unless instructed otherwise.

Q35. § 13.1 Introduction § 13.3 Mode of Grouped Data § 13.4 Median of Grouped Data

[4]

India meteorological department observes seasonal and annual rainfall every year in different sub-divisions of our country. It helps them to compare and analyse the results. The table given below shows sub-division wise seasonal (monsoon) rainfall (mm) in 2018 :

Based on the above information, answer the following questions.

(I) Write the modal class. [1]

(II) Find the median of the given data. [2]

(III) If sub-division having at least 1000 mm rainfall during monsoon season, is considered good rainfall sub-division, then how many sub-divisions had good rainfall ? [1]

Previously asked in: 2023 30/1/1 Q37

♦ Statistics

13.4 Median of Grouped Data

Interpretation of Cumulative Frequency / Reading Frequency Tables

Modal Class of Grouped Data

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Model Answer

(I) Modal Class:

The class with the highest frequency is **600–800** (frequency = 7).

∴ Modal class = **600–800**

(II) Median:

Class	Frequency	Cumulative Frequency
200–400	2	2
400–600	4	6
600–800	7	13
800–1000	4	17
1000–1200	2	19
1200–1400	3	22
1400–1600	1	23
1600–1800	1	24

Total $n = 24$, so $\frac{n}{2} = 12$

Median class = **600–800** (cf just before = 6, $f = 7$, $l = 600$, $h = 200$)

$$\text{Median} = l + \frac{\frac{n}{2} - cf}{f} \times h = 600 + \frac{12 - 6}{7} \times 200 = 600 + \frac{1200}{7} \approx 771.43 \text{ mm}$$

(III) Good Rainfall Sub-divisions:

Sub-divisions with rainfall ≥ 1000 mm: $2 + 3 + 1 + 1 = 7$ **sub-divisions**

Explanation

- (I) Modal class is simply the class with the highest frequency — no calculation needed.
- (II) Always build the cf table first; identify median class where cf first exceeds $n/2$. Apply the formula correctly showing all steps.

- **(III)** Add frequencies of all classes from 1000 mm onwards (1000–1200, 1200–1400, 1400–1600, 1600–1800). Examiners look for correct addition.

Q36. § 13.4 Median of Grouped Data

[5]

Following distribution shows the marks of 230 students in a particular subject. If the median marks are 46, then find the values of x and y .

Previously asked in: 2025 30/6/1 Q35

♦ Statistics

13.4 Median of Grouped Data

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Model Answer**Step 1: Set up the cumulative frequency table**

Total students = 230

Marks	Frequency	Cumulative Frequency (cf)
10–20	12	12
20–30	30	42
30–40	x	$42 + x$
40–50	65	$107 + x$
50–60	y	$107 + x + y$
60–70	25	$132 + x + y$
70–80	18	$150 + x + y$

Step 2: Form equations

Since total = 230:

$$150 + x + y = 230 \implies x + y = 80 \quad \dots (1)$$

Step 3: Find median class

$$\frac{n}{2} = \frac{230}{2} = 115$$

The cf just greater than 115 is $(107 + x)$, which falls in class **40–50**.

So median class = 40–50; $l = 40$, $f = 65$, $cf = 42 + x$, $h = 10$

Step 4: Apply median formula

$$\text{Median} = l + \left(\frac{\frac{n}{2} - cf}{f} \right) \times h$$

$$46 = 40 + \left(\frac{115 - (42 + x)}{65} \right) \times 10$$

$$6 = \frac{(73 - x) \times 10}{65}$$

$$6 \times 65 = 10(73 - x)$$

$$390 = 730 - 10x$$

$$10x = 340 \implies \boxed{x = 34}$$

From (1): $y = 80 - 34 = \boxed{46}$

$\therefore x = 34$ and $y = 46$

Source: Chapter 13, Section 13.4 Median of Grouped Data

Explanation

- **Two conditions** are always used: (i) sum of all frequencies = total, giving one equation; (ii) median formula, giving the second equation.
- Identify the **median class** first by finding $n/2 = 115$ and locating which class's cumulative frequency first exceeds 115. Since cf up to 30–40 is $42 + x$ and up to 40–50 is $107 + x$, for the median class to be 40–50 we need $42 + x < 115 \leq 107 + x$, which is satisfied for $x = 34$.
- Show all substitution steps clearly — CBSE awards marks for each step.

Q37. § 13.2 Mean of Grouped Data § 13.4 Median of Grouped Data

[1]

If the mode of some observations is 10 and sum of mean and median is 25, then the mean and median respectively are

- A 12 and 13
- B 13 and 12
- C 10 and 15
- D 15 and 10

Previously asked in: 2025 30/6/1 Q15

◆ Statistics

13.2 Mean of Grouped Data

13.3 Mode of Grouped Data

13.4 Median of Grouped Data

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Model Answer

Using the empirical relation: **Mode = 3 Median – 2 Mean**

Given: Mode = 10, Mean + Median = 25

Let Mean = x , Median = $25 - x$

$$10 = 3(25 - x) - 2x$$

$$10 = 75 - 3x - 2x$$

$$5x = 65$$

$$x = 13$$

∴ Mean = **13** and Median = **12** → **Option B**

Explanation

The key formula from the textbook (Chapter 13, Remarks after Section 13.4) is the empirical relationship: **3 Median = Mode + 2 Mean**. Set up two equations using this and Mean + Median = 25, then solve simultaneously. Examiners expect you to recall and apply this formula directly.

Q38. § 13.4 Median of Grouped Data

[5]

Medical check-up was carried out for 35 students of a class and their weights were recorded as follows : Find the difference between the mean weight and the median weight.

Previously asked in: 2025 30/5/1 Q35

♦ Statistics

13.2 Mean of Grouped Data

13.4 Median of Grouped Data

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Model Answer**Step 1: Calculate Mean (Direct Method)**

Weight (kg)	f	x (mid-value)	fx
38-40	3	39	117
40-42	2	41	82
42-44	4	43	172
44-46	5	45	225
46-48	14	47	658
48-50	4	49	196
50-52	3	51	153
Total	35		1603

$$\bar{x} = \frac{\sum f_i x_i}{\sum f_i} = \frac{1603}{35} = 45.8 \text{ kg}$$

Step 2: Calculate Median

Cumulative frequencies: 3, 5, 9, 14, 28, 32, 35.

$$n = 35, \text{ so } \frac{n}{2} = 17.5$$

The cumulative frequency just greater than 17.5 is **28** → Median class = **46-48**

Here: $l = 46$, $cf = 14$, $f = 14$, $h = 2$

$$\begin{aligned} \text{Median} &= l + \left(\frac{\frac{n}{2} - cf}{f} \right) \times h = 46 + \left(\frac{17.5 - 14}{14} \right) \times 2 \\ &= 46 + \frac{3.5}{14} \times 2 = 46 + 0.5 = \mathbf{46.5 \text{ kg}} \end{aligned}$$

Step 3: Difference

$$\text{Difference} = \text{Median} - \text{Mean} = 46.5 - 45.8 = \boxed{0.7 \text{ kg}}$$

Source: Statistics, Chapter 13 (Mean of Grouped Data §13.2; Median of Grouped Data §13.4)

Explanation

- **Mean** uses the direct formula $\bar{x} = \frac{\sum f_i x_i}{\sum f_i}$ with midpoints as x_i .
- **Median** requires building cumulative frequency, finding $n/2 = 17.5$, identifying the median class (where cf first exceeds 17.5), then applying the formula.
- The answer is **Median – Mean = 0.7 kg** (positive, since the distribution is skewed left by the dominant 46–48 class).

- Examiners award marks at each step: the table (1–2 marks), mean calculation (1 mark), median calculation with correct cf and formula (2 marks), and final difference (stated clearly).

Q39. § 13.4 Median of Grouped Data**[1]**

Following data shows the marks obtained by 100 students in a class test : The median will be the average of which two observations ?

- A 29 and 33
- B 25 and 28
- C 28 and 29
- D 33 and 38

Previously asked in: 2025 30/5/1 Q17

◆ **Statistics**

13.4 Median of Grouped Data

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Since $n = 100$ (even), median = average of 50th and 51st observations. From cumulative frequency table, cumulative frequency up to marks 28 is 50, and up to 29 is 78. So the 50th observation is **28** and 51st is **29**.

Source: Chapter 13, Section 13.4 Median of Grouped Data

Explanation

- Arrange data in ascending order and build a cumulative frequency table.
- For even n , median = average of $(n/2)$ th and $(n/2 + 1)$ th = 50th and 51st observations.
- CF up to 28 = $6+20+24 = 50$, so the 50th observation is 28; CF up to 29 = 78, so the 51st observation is 29.
- Examiners expect you to identify the correct pair using the cumulative frequency table — not just guess from the options.

Q40. § 13.1 Introduction § 13.2 Mean of Grouped Data § 13.4 Median of Grouped Data

[1]

If x median + y mean = z mode; is the empirical relationship between mean, median and mode, then the value of $x + y + z$ is

- A 6
- B 3
- C 2
- D 1

Previously asked in: 2025 30/5/1 Q16

◆ **Statistics** 13.2 Mean of Grouped Data 13.3 Mode of Grouped Data 13.4 Median of Grouped Data
Empirical Relationship between Mean, Median and Mode

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Model Answer

The empirical relationship is **3 Median = Mode + 2 Mean**, so $x = 3, y = 2, z = 1$.

Therefore, $x + y + z = 3 + 2 + 1 = 6$.

Answer: A – 6

Source: Chapter 13, Section 13.4 (Remarks)

Explanation

The NCERT textbook states the empirical relation as: **3 Median = Mode + 2 Mean** (i.e., 3 Median = 1 Mode + 2 Mean). Matching with x Median + y Mean = z Mode gives $x = 3, y = 2, z = 1$, so $x + y + z = 6$. Examiners expect you to recall this standard formula exactly as given in the textbook.

Q41. § 13.3 Mode of Grouped Data § 13.4 Median of Grouped Data § 13.5 Summary

[1]

If mean and median of given set of observations are 10 and 11 respectively, then the value of mode is :

- (a) 10.5
- (b) 8
- (c) 13
- (d) 21

Previously asked in: 2025 30/4/1 Q13

◆ **Statistics** 13.2 Mean of Grouped Data 13.3 Mode of Grouped Data 13.4 Median of Grouped Data

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Model Answer

(c) 13

Using the empirical relationship: $\text{Mode} = 3 \text{ Median} - 2 \text{ Mean} = 3(11) - 2(10) = 33 - 20 = 13$.

Source: Chapter 13, Section 13.4 (Remarks)

Explanation

The key formula to remember is the empirical relationship between the three measures of central tendency:

Mode = 3 Median – 2 Mean

This is stated in the Remarks under Section 13.4. Simply substitute Mean = 10 and Median = 11 to get Mode = $33 - 20 = 13$. Examiners expect you to recall and apply this formula directly for such 1-mark questions.

Q42. § 13.1 Introduction § 13.4 Median of Grouped Data

[1]

The cumulative frequency for calculating median is obtained by adding the frequencies of all the :

- (a) classes up to the median class
- (b) classes following the median class
- (c) classes preceding the median class
- (d) all classes

Previously asked in: 2025 30/4/1 Q12

♦ Statistics 13.4 Median of Grouped Data

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Model Answer

(c) classes preceding the median class

The cumulative frequency of a class is obtained by adding the frequencies of all the classes **preceding** the given class.

Source: Chapter 13, Section 13.5 Summary (Point 3)

Explanation

The textbook's Summary explicitly states: "The cumulative frequency of a class is the frequency obtained by adding the frequencies of all the classes **preceding** the given class." In the median formula, cf refers to the cumulative frequency of the class just before the median class. Students often confuse this with "up to the median class" — but the median class's own frequency is not included in cf .

Q43. § 13.1 Introduction § 13.4 Median of Grouped Data

[5]

The median of the following data is 137. Find the values of x and y , given that total of frequencies is 68.

Previously asked in: 2026 30/3/1 Q32(a)

♦ Statistics

13.4 Median of Grouped Data

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Model Answer**Step 1: Cumulative Frequency Table**

Class	Frequency	Cumulative Frequency (cf)
65–85	4	4
85–105	5	9
105–125	x	$9 + x$
125–145	20	$29 + x$
145–165	14	$43 + x$
165–185	y	$43 + x + y$
185–205	4	$47 + x + y$

Step 2: Using total frequency = 68

$$47 + x + y = 68 \implies x + y = 21 \quad \dots(1)$$

Step 3: Finding median class

$$\frac{n}{2} = \frac{68}{2} = 34$$

cf just before 125–145 is $9 + x$, and cf of 125–145 is $29 + x$.

Since median = 137 lies in class **125–145**, this is the median class.

Here: $l = 125$, $f = 20$, $cf = 9 + x$, $h = 20$

Step 4: Applying median formula

$$137 = 125 + \left(\frac{34 - (9 + x)}{20} \right) \times 20$$

$$12 = 25 - x$$

$$x = 13$$

Step 5: From (1):

$$y = 21 - 13 = 8$$

$$\boxed{x = 13, \quad y = 8}$$

Source: Chapter 13, Section 13.4 Median of Grouped Data

Explanation

- First form the **equation from total frequency** (sum = 68) to get $x + y = 21$.
- Identify the **median class** by locating where $n/2 = 34$ falls in cumulative frequencies — it must be 125–145 since median 137 lies there.

- Apply the **median formula** with correct l , cf , f , h values to get $x = 13$.
- Substitute back into equation (1) to get $y = 8$.
- Examiner checks: correct cf column, right median class, correct substitution, and both values stated clearly.

Q44. § 13.1 Introduction § 13.4 Median of Grouped Data**[1]**

The median and mode of a distribution are 25.2 and 26.1 respectively. The mean of the distribution is :

- A 24.75
- B 24.25
- C 24.3
- D 25.5

Previously asked in: 2026 30/3/1 Q16

♦ Statistics

13.2 Mean of Grouped Data

13.3 Mode of Grouped Data

13.4 Median of Grouped Data

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Model Answer

Using the empirical relationship: **3 Median = Mode + 2 Mean**

$$3(25.2) = 26.1 + 2 \text{ Mean} \rightarrow 75.6 - 26.1 = 2 \text{ Mean} \rightarrow \text{Mean} = 49.5/2 = \mathbf{24.75}$$

Answer: (A) 24.75

Explanation

The key formula is the empirical relation: $3 \text{ Median} = \text{Mode} + 2 \text{ Mean}$ (stated in Chapter 13, Remarks section).

Rearranging gives $\text{Mean} = (3 \text{ Median} - \text{Mode}) / 2$. Substitute Median = 25.2, Mode = 26.1 to get $(75.6 - 26.1)/2 = 24.75$. Examiners expect you to recall and apply this formula directly.

Q45.

[5]

An SBI health insurance agent found the following data for distribution of ages of 100 policy holders. The health insurance policies are given to persons of age 15 years and onwards, but less than 60 years. Find the modal age and median age of the policy holders.

Previously asked in: 2026 30/2/1 Q35

◆ Statistics

13.3 Mode of Grouped Data

13.4 Median of Grouped Data

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Model Answer

Modal Age:

The highest frequency is 33, corresponding to class **35–40**.

So, modal class = 35–40, $l = 35$, $h = 5$, $f_1 = 33$, $f_0 = 21$, $f_2 = 11$

$$\text{Mode} = l + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times h = 35 + \frac{33 - 21}{66 - 21 - 11} \times 5 = 35 + \frac{12}{34} \times 5 = 35 + 1.76 = \mathbf{36.76 \text{ years}}$$

Median Age:

Cumulative frequency table:

Age	f	cf
15–20	2	2
20–25	4	6
25–30	18	24
30–35	21	45
35–40	33	78
40–45	11	89
45–50	3	92
50–55	6	98
55–60	2	100

$n = 100$, so $\frac{n}{2} = 50$.

cf just below 50 is 45 (class 30–35); hence **median class = 35–40**.

$l = 35$, $cf = 45$, $f = 33$, $h = 5$

$$\text{Median} = l + \frac{\frac{n}{2} - cf}{f} \times h = 35 + \frac{50 - 45}{33} \times 5 = 35 + \frac{25}{33} = 35 + 0.76 = \mathbf{35.76 \text{ years}}$$

Source: Chapter 13, Sections 13.3 (Mode) and 13.4 (Median of Grouped Data)

Explanation

- **Modal class** = class with highest frequency (33 → 35–40). Apply the standard mode formula.
- **Median class** = class where cumulative frequency first crosses $n/2 = 50$; cf reaches 45 after 30–35, so 35–40 is the median class.
- Examiners award marks for: correct identification of modal/median class, correct substitution in formula, and correct final values. Always show the cf table for median.

Q46. § 13.1 Introduction**[1]**

The mean and median of a frequency distribution are 43 and 43.4 respectively. The mode of the distribution is :

- A 43.4
- B 42.4
- C 44.2
- D 49.3

Previously asked in: 2026 30/2/1 Q17

◆ **Statistics**

13.2 Mean of Grouped Data

13.3 Mode of Grouped Data

13.4 Median of Grouped Data

Empirical Relationship: $\text{Mode} = 3 \cdot \text{Median} - 2 \cdot \text{Mean}$ **Generated by claude-sonnet-4-6 • 2026-06-15 10:34 • grounding rag****Model Answer**

Using the empirical relationship: **Mode = 3 Median – 2 Mean**

$$\text{Mode} = 3 \times 43.4 - 2 \times 43 = 130.2 - 86 = \mathbf{44.2}$$

Answer: (C) 44.2

Explanation

CBSE expects students to know the empirical formula **Mode = 3 Median – 2 Mean**, which relates the three measures of central tendency for a moderately skewed distribution. Substitute the given values directly: $\text{Mode} = 3(43.4) - 2(43) = 130.2 - 86 = 44.2$. This formula is a standard result covered in Chapter 13 (Statistics).

Q47. § 13.4 Median of Grouped Data**[1]**

If the mean and mode of a data are 12 and 21 respectively, then its median is :

- (a) 6
- (b) 13.5
- (c) 15
- (d) 14

Previously asked in: 2026 30/1/1 Q17

◆ **Statistics**

13.2 Mean of Grouped Data

13.3 Mode of Grouped Data

13.4 Median of Grouped Data

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(c) 15

Using the empirical relationship: **3 Median = Mode + 2 Mean**

$$= 21 + 2(12) = 21 + 24 = 45$$

$$\therefore \text{Median} = 45 \div 3 = \mathbf{15}$$

Source: Chapter 13, Section 13.4 (Remarks)

Explanation

The key formula to remember is the **empirical relationship: 3 Median = Mode + 2 Mean**. This is stated in the Remarks of Section 13.4. Substituting directly gives Median = 15. Examiners expect students to recall and apply this formula correctly — no derivation needed for an MCQ.

Q48. § 13.1 Introduction § 13.4 Median of Grouped Data

[3]

For the following frequency distribution, find the median:

Previously asked in: 2022 30/3/1 Q10

◆ Statistics

13.4 Median of Grouped Data

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Model Answer**Cumulative Frequency Table:**

Class	Frequency	Cumulative Frequency (cf)
1400–1550	6	6
1550–1700	13	19
1700–1850	25	44
1850–2000	10	54

Here, $n = 54$, so $\frac{n}{2} = 27$.The cumulative frequency just greater than 27 is 44, which belongs to class **1700–1850**. $\therefore$ Median class = 1700–1850Here, $l = 1700$, $cf = 19$, $f = 25$, $h = 150$

$$\begin{aligned}\text{Median} &= l + \left(\frac{\frac{n}{2} - cf}{f} \right) \times h = 1700 + \left(\frac{27 - 19}{25} \right) \times 150 \\ &= 1700 + \frac{8 \times 150}{25} = 1700 + 48 = \mathbf{1748}\end{aligned}$$

Source: Chapter 13, Section 13.4 Median of Grouped Data

Explanation

- Always build the cf column first, then find $n/2$.
- The **median class** is the one whose cf first exceeds $n/2$ — a common error is picking the class where cf equals $n/2$ exactly.
- Correctly identify l (lower limit of median class), cf (cf of the **preceding** class), f (frequency of median class), and h (class width = 150 here).
- Examiners award marks for: cf table (1 mark), identifying median class with correct values (1 mark), and correct formula application giving 1748 (1 mark).

Q49. § 13.4 Median of Grouped Data

[3]

For what value of x , is the median of the following frequency distribution 34.5?

Previously asked in: 2022 30/1/1 Q7

◆ Statistics

13.4 Median of Grouped Data

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Model Answer**Cumulative Frequency Table:**

Class	Frequency	Cumulative Frequency (cf)
0-10	3	3
10-20	5	8
20-30	11	19
30-40	10	29
40-50	x	$29 + x$
50-60	3	$32 + x$
60-70	2	$34 + x$

Total $n = 34 + x$, so $\frac{n}{2} = \frac{34 + x}{2}$

Median = 34.5 lies in class **30-40**.

So: $l = 30$, $f = 10$, $cf = 19$, $h = 10$

Using the formula:

$$\text{Median} = l + \left(\frac{\frac{n}{2} - cf}{f} \right) \times h$$

$$34.5 = 30 + \left(\frac{\frac{34 + x}{2} - 19}{10} \right) \times 10$$

$$4.5 = \frac{34 + x}{2} - 19$$

$$4.5 + 19 = \frac{34 + x}{2}$$

$$23.5 \times 2 = 34 + x$$

$$47 = 34 + x$$

$$\boxed{x = 13}$$

Source: Chapter 13, Section 13.4 Median of Grouped Data

Explanation

- First identify the median class: since median = 34.5, it lies in 30-40.
- Express n in terms of x and substitute into the median formula.

- The key step students miss: cf before the median class is 19 (cumulative frequency up to 20–30), and $f = 10$ for the median class 30–40.
- Solve the linear equation carefully — $x = 13$ makes $n = 47$, so $n/2 = 23.5$, which is indeed greater than $cf = 19$ and less than 29, confirming 30–40 is the correct median class.

Q50. § 13.3 Mode of Grouped Data § 13.4 Median of Grouped Data § 13.5 Summary

[1]

If the mean and the median of a data are 12 and 15 respectively, then its mode is :

- (a) $13 \cdot 5$
- (b) 21
- (c) 6
- (d) 14

Previously asked in: 2023 30/5/1 Q10

♦ Statistics

13.2 Mean of Grouped Data

13.3 Mode of Grouped Data

13.4 Median of Grouped Data

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Model Answer

(b) 21

Using the empirical relation: $\text{Mode} = 3 \text{ Median} - 2 \text{ Mean} = 3(15) - 2(12) = 45 - 24 = \mathbf{21}$.

Explanation

The key formula is the empirical relationship: **3 Median = Mode + 2 Mean**, given in the Remarks of Section 13.4. Rearranging: $\text{Mode} = 3 \text{ Median} - 2 \text{ Mean}$. Always remember this formula for MCQs and short-answer questions.

Q51. § 13.2 Mean of Grouped Data § 13.4 Median of Grouped Data

[5]

The monthly expenditure on milk in 200 families of a Housing Society is given below :

Find the value of x and also, find the median and mean expenditure on milk.

Previously asked in: 2023 30/4/1 Q35

◆ Statistics

13.2 Mean of Grouped Data

13.4 Median of Grouped Data

Finding the unknown frequency (x) using total frequency condition

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Model Answer**Step 1: Find x**

Total families = 200

$$\therefore 24 + 40 + 33 + x + 30 + 22 + 16 + 7 = 200$$

$$172 + x = 200 \rightarrow x = 28$$

Step 2: Median (using step-deviation / cumulative frequency table, $h = 500$)

Class	f	cf
1000–1500	24	24
1500–2000	40	64
2000–2500	33	97
2500–3000	28	125
3000–3500	30	155
3500–4000	22	177
4000–4500	16	193
4500–5000	7	200

$\frac{n}{2} = 100$. The cf just exceeding 100 is 125 (class **2500–3000**).

$l = 2500$, $cf = 97$, $f = 28$, $h = 500$

$$\text{Median} = 2500 + \frac{100 - 97}{28} \times 500 = 2500 + \frac{1500}{28} = 2500 + 53.57 \approx \text{₹}2553.57$$

Step 3: Mean (step-deviation method, $a = 2750$, $h = 500$)

Class	f_i	x_i	$u_i = \frac{x_i - 2750}{500}$	$f_i u_i$
1000–1500	24	1250	-3	-72
1500–2000	40	1750	-2	-80
2000–2500	33	2250	-1	-33
2500–3000	28	2750	0	0
3000–3500	30	3250	1	30
3500–4000	22	3750	2	44
4000–4500	16	4250	3	48
4500–5000	7	4750	4	28
Total	200			-35

$$\bar{x} = 2750 + \frac{-35}{200} \times 500 = 2750 - 87.5 = \text{₹}2662.50$$

Source: Chapter 13, Sections 13.2 & 13.4

Explanation

- **Finding x:** always start by using $\Sigma f = n$ (total). This fetches 1 mark.
- **Median:** identify median class where cumulative frequency first exceeds $n/2 = 100$; cf up to 2000–2500 is 97, so the **next** class 2500–3000 is the median class. Apply the standard formula carefully.
- **Mean:** step-deviation method is easiest with large x_i ; choose a as the middle class mark. Keep signs of u_i correct — here $\Sigma f_i u_i$ is negative, so mean < assumed mean.
- Show the full table; examiners award marks for the working, not just the final answer.

Q52. § 13.1 Introduction**[1]**

The empirical relation between the mode, median and mean of a distribution is :

- (a) Mode = 3 Median – 2 Mean
- (b) Mode = 3 Mean – 2 Median
- (c) Mode = 2 Median – 3 Mean
- (d) Mode = 2 Mean – 3 Median

Previously asked in: 2023 30/4/1 Q6

◆ **Statistics**

13.2 Mean of Grouped Data

13.3 Mode of Grouped Data

13.4 Median of Grouped Data

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Model Answer**(a) Mode = 3 Median – 2 Mean****Explanation**

The empirical relationship given in the NCERT textbook (Chapter 13, Remarks after Section 13.4) is: **3 Median = Mode + 2 Mean**, which rearranges to **Mode = 3 Median – 2 Mean**. Remember this formula exactly — it is a standard 1-mark question in board exams.

Q53. § 13.4 Median of Grouped Data

[5]

A student noted the number of cars passing through a spot on a road for 100 periods each of 3 minutes and summarised it in the table given below. Find the mean and median of the following data.

Previously asked in: 2023 30/2/1 Q34

◆ Statistics

13.2 Mean of Grouped Data

13.4 Median of Grouped Data

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Model Answer**Mean (Direct Method):**

Class	x_i	f_i	$f_i x_i$
0-10	5	7	35
10-20	15	14	210
20-30	25	13	325
30-40	35	12	420
40-50	45	20	900
50-60	55	11	605
60-70	65	15	975
70-80	75	8	600
Total		100	4070

$$\bar{x} = \frac{\sum f_i x_i}{\sum f_i} = \frac{4070}{100} = 40.7$$

Median:

Class	f_i	cf
0-10	7	7
10-20	14	21
20-30	13	34
30-40	12	46
40-50	20	66
50-60	11	77
60-70	15	92
70-80	8	100

$$n = 100, \text{ so } \frac{n}{2} = 50.$$

The cumulative frequency just greater than 50 is 66 → **Median class = 40-50.**

$$l = 40, cf = 46, f = 20, h = 10$$

$$\text{Median} = l + \left(\frac{\frac{n}{2} - cf}{f} \right) \times h = 40 + \left(\frac{50 - 46}{20} \right) \times 10 = 40 + 2 = 42$$

Source: Chapter 13, Sections 13.2 and 13.4

Explanation

- **Mean:** Use the Direct Method — multiply each class mark x_i by its frequency f_i , sum the products, divide by $\Sigma f_i = 100$.
- **Median:** Build the cumulative frequency column, find $n/2 = 50$, identify the class whose cf first exceeds 50 (that's 40–50 with $cf = 66$), then apply the formula. Examiners expect the full table, identification of median class, and substitution into the formula with correct values of l , cf , f , h .

Q54. § 13.4 Median of Grouped Data

[4]

Activities like running or cycling reduce stress and the risk of mental disorders like depression. Running helps build endurance. Children develop stronger bones and muscles and are less prone to gain weight. The physical education teacher of a school has decided to conduct an inter school running tournament in his school premises. The time taken by a group of students to run 100 m, was noted as follows :

Time (in seconds): 0–20, 20–40, 40–60, 60–80, 80–100

Number of students: 8, 10, 13, 6, 3

Based on the above, answer the following questions :

- (i) What is the median class of the above given data? [1]
 (ii) Find the mean time taken by the students to finish the race, OR find the mode of the above given data. [2]
 (iii) How many students took time less than 60 seconds? [1]

Previously asked in: 2024 30/5/1 Q38

◆ Statistics

13.2 Mean of Grouped Data

13.3 Mode of Grouped Data

13.4 Median of Grouped Data

Cumulative Frequency and Less Than Type

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Model Answer**(i) Median Class:**

Total students = $8 + 10 + 13 + 6 + 3 = 40$; $N/2 = 20$

Cumulative frequencies: 8, 18, 31, 37, 40

Since 20th observation falls in the class **40–60**, the median class is **40–60**.

(ii) Mean:

Class	x_i (mid-value)	f_i	$f_i x_i$
0–20	10	8	80
20–40	30	10	300
40–60	50	13	650
60–80	70	6	420
80–100	90	3	270
Total	40		1720

$$\text{Mean} = \frac{\sum f_i x_i}{\sum f_i} = \frac{1720}{40} = \mathbf{43 \text{ seconds}}$$

OR Mode:

Modal class = **40–60** (highest frequency = 13)

$$\text{Mode} = l + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times h = 40 + \frac{13 - 10}{26 - 10 - 6} \times 20 = 40 + \frac{3}{10} \times 20 = \mathbf{46 \text{ seconds}}$$

(iii) Students who took less than 60 seconds = $8 + 10 + 13 = 31$ students

Source: Statistics, Data Analysis

Explanation

- **(i)** Always find cumulative frequency first; whichever class contains the $N/2$ -th value is the median class.
- **(ii)** For mean, use midpoints. For mode, identify modal class (highest frequency) then apply the formula carefully — examiners check correct substitution of f_0, f_1, f_2 .
- **(iii)** "Less than 60 seconds" means add frequencies of 0–20, 20–40, and 40–60 only.

Q55. § 13.4 Median of Grouped Data**[1]**

If the difference of mode and median of a data is 24, then the difference of its median and mean is :

- A 12
- B 24
- C 8
- D 36

Previously asked in: 2024 30/4/1 Q7

◆ Statistics

13.2 Mean of Grouped Data

13.3 Mode of Grouped Data

13.4 Median of Grouped Data

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Model Answer**(A) 12**

Using the empirical relation: $3 \text{ Median} = \text{Mode} + 2 \text{ Mean}$

Given: $\text{Mode} - \text{Median} = 24$, so $\text{Mode} = \text{Median} + 24$.

$$3 \text{ Median} = (\text{Median} + 24) + 2 \text{ Mean}$$

$$\text{Median} - \text{Mean} = 12$$

Explanation

The key formula is the empirical relationship **$3 \text{ Median} = \text{Mode} + 2 \text{ Mean}$** (from Chapter 13, Remarks).

Rearranging gives $\text{Mode} - \text{Mean} = 3(\text{Median} - \text{Mean})$, and $\text{Mode} - \text{Median} = 2(\text{Median} - \text{Mean})$. So $\text{Median} - \text{Mean} = (\text{Mode} - \text{Median})/2 = 24/2 = \mathbf{12}$. Remember this shortcut for MCQs.

Q56. § 13.4 Median of Grouped Data

[4]

Vocational training complements traditional education by providing practical skills and hands-on experience. While education equips individuals with a broad knowledge base, vocational training focuses on job-specific skills, enhancing employability thus making the student self-reliant. Keeping this in view, a teacher made the following table giving the frequency distribution of students/adults undergoing vocational training from the training institute.

From the above answer the following questions :

- (i) What is the lower limit of the modal class of the above data ? [1]
- (ii) Find the median class of the above data. [2]
- (iii) Give the empirical relationship between mean, median and mode. [1]

Previously asked in: 2024 30/3/1 Q37

♦ Statistics

13.2 Mean of Grouped Data

13.3 Mode of Grouped Data

13.4 Median of Grouped Data

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Model Answer

Given data:

Age (years)	Frequency	Cumulative Frequency
15–19	62	62
20–24	132	194
25–29	96	290
30–34	37	327
35–39	13	340
40–44	11	351
45–49	10	361
50–54	4	365

Total N = 365

(i) The highest frequency is 132, corresponding to class **20–24**.

∴ Lower limit of modal class = **20**

(ii) $N/2 = 365/2 = 182.5$

The cumulative frequency just greater than 182.5 is **194** (class 20–24).

∴ **Median class = 20–24**

(iii) Empirical relationship:

$$\text{Mode} = 3 \times \text{Median} - 2 \times \text{Mean}$$

Explanation

- **Modal class** is the class with the highest frequency (132); its lower limit is simply the starting value of that class.
- **Median class** is found by locating $N/2 = 182.5$ in the cumulative frequency column — the class whose cumulative frequency first exceeds this value.
- The **empirical formula** ($\text{Mode} = 3 \text{ Median} - 2 \text{ Mean}$) is a standard result from the Statistics chapter; students must reproduce it exactly as given in the NCERT textbook.

Q57. § 13.4 Median of Grouped Data

[1]

If value of each observation in a data is increased by 2, then median of the new data

- (A) increases by 2
- (B) increases by $2n$
- (C) remains same
- (D) decreases by 2

Previously asked in: 2024 30/2/1 Q12

♦ Statistics

13.4 Median of Grouped Data

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Model Answer

(A) increases by 2

When each observation is increased by 2, the middle value also shifts up by 2, so the median increases by 2.

Explanation

Median depends on the positional value of the middle observation. If every observation increases by a constant k , the entire data shifts by k , so the median also increases by k . Here $k = 2$, so the answer is (A). Options (B) and (D) are incorrect; (C) would be true only if the data were unchanged.

Q58. § 13.1 Introduction § 13.4 Median of Grouped Data**[4]**

The India Meteorological Department observes seasonal and annual rainfall every year in different sub-divisions of our country. It helps them to compare and analyse the results.

The table below shows sub-divisions wise seasonal (monsoon) rainfall (in mm) in 2023.

Based on the information given above, answer the following questions:

- (i) Write the modal class. [1]
- (ii) Find the median or mean of the given data. [2]
- (iii) If a sub-division having at least 800 mm rainfall during monsoon season is considered a good rainfall sub-division, then how many sub-divisions had good rainfall? [1]

Previously asked in: 2025 30/3/1 Q38

♦ Statistics

13.2 Mean of Grouped Data

13.3 Mode of Grouped Data

13.4 Median of Grouped Data

Reading and Interpreting Frequency Distribution Tables

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Model Answer**(i) Modal Class:**

The class with the highest frequency is **600 – 800** (frequency = 7).

∴ Modal class = **600 – 800**

(ii) Mean of the given data:

Class	x_i (mid-value)	f_i	$f_i x_i$
200–400	300	3	900
400–600	500	4	2000
600–800	700	7	4900
800–1000	900	4	3600
1000–1200	1100	3	3300
1200–1400	1300	3	3900
Σ f_i = 24		Σ $f_i x_i$ = 18600	

$$\text{Mean} = \frac{\Sigma f_i x_i}{\Sigma f_i} = \frac{18600}{24} = \mathbf{775 \text{ mm}}$$

(iii) Sub-divisions with at least 800 mm rainfall = 4 + 3 + 3 = 10 sub-divisions

Explanation

- **(i)** Modal class is simply the class with the highest frequency – just identify it, no calculation needed.
- **(ii)** Use Direct Method for mean: calculate mid-values, multiply by frequency, sum up, then divide by total frequency. Median would require cumulative frequency and locating the median class; mean is simpler here.
- **(iii)** "At least 800 mm" means classes 800–1000, 1000–1200, and 1200–1400, so add their frequencies: 4+3+3 = 10. Examiners look for correct addition of relevant classes.

Q59. § 13.4 Median of Grouped Data**[1]**

Mode and Mean of a data are $15x$ and $18x$, respectively. Then the median of the data is:

- A x
- B $11x$
- C $17x$
- D $34x$

Previously asked in: 2025 30/1/1 Q12

◆ Statistics

13.2 Mean of Grouped Data

13.3 Mode of Grouped Data

13.4 Median of Grouped Data

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Model Answer

Using the empirical relationship: **3 Median = Mode + 2 Mean**

$$3 \text{ Median} = 15x + 2(18x) = 15x + 36x = 51x$$

$$\text{Median} = 17x$$

Answer: (C) $17x$

Explanation

The key formula (given as a Remark in Section 13.4) is **3 Median = Mode + 2 Mean**. Substituting Mode = $15x$ and Mean = $18x$ gives Median = $17x$. Examiners expect you to recall and apply this empirical relationship directly — no derivation needed for an MCQ.

Q60. § 13.4 Median of Grouped Data

[5]

The median of the following data is 50 and sum of all frequencies is 90. Find the values of p and q .

Previously asked in: 2026 30/4/1 Q35 (OR-1)

◆ Statistics

13.4 Median of Grouped Data

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Model Answer**Step 1: Form equations using total frequency = 90**

Class	Frequency	Cumulative Frequency (cf)
20-30	p	p
30-40	15	$p + 15$
40-50	25	$p + 40$
50-60	20	$p + 60$
60-70	q	$p + 60 + q$
70-80	8	$p + 68 + q$
80-90	10	$p + 78 + q$

Sum of frequencies: $p + 15 + 25 + 20 + q + 8 + 10 = 90$

$$p + q + 78 = 90 \implies p + q = 12 \quad \dots (1)$$

Step 2: Identify median class

$$\frac{n}{2} = \frac{90}{2} = 45$$

Median = 50, so the median class is **40-50** (cf just before it is $p + 15$, and cf after it is $p + 40$, which must be ≥ 45).

Here: $l = 40$, $f = 25$, $cf = p + 15$, $h = 10$

Step 3: Apply median formula

$$50 = 40 + \left(\frac{45 - (p + 15)}{25} \right) \times 10$$

$$10 = \frac{(30 - p)}{25} \times 10$$

$$25 = 30 - p \implies p = 5$$

Step 4: Find q

From (1): $5 + q = 12 \implies q = 7$

$$\boxed{p = 5, \quad q = 7}$$

Source: Statistics, Section 13.4 Median of Grouped Data, Chapter 13

Explanation

- **Two equations are needed** for two unknowns: one from total frequency, one from the median formula.
- The median class is the class containing the 45th observation. Since cf up to 40-50 is $p + 40$ and the median lies in this interval, apply the formula with $cf = p + 15$ (cf of the preceding class).

- Examiners award marks for: setting up the cf table correctly (1 mark), forming equation (1) from total frequency (1 mark), identifying median class (1 mark), applying formula and solving for p (1 mark), finding q (1 mark).
- Always write the final boxed values clearly.

Q61. § STATISTICS § 13.2 Mean of Grouped Data § 13.4 Median of Grouped Data

[1]

Assertion (A) : The mean of first 'n' natural numbers is $\frac{n-1}{2}$.

Reason (R): The sum of first 'n' natural numbers is $\frac{n(n+1)}{2}$.

Select the correct answer from the options (A), (B), (C) and (D).

- A Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
- B Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
- C Assertion (A) is true, but Reason (R) is false.
- D Assertion (A) is false, but Reason (R) is true.

Previously asked in: 2026 30/2/1 Q20

♦ Statistics 13.2 Mean of Grouped Data 5.4 Sum of First n Terms of an AP

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Model Answer

(D) Assertion (A) is false, but Reason (R) is true.

The sum of first n natural numbers is $\frac{n(n+1)}{2}$ (R is true), so Mean = $\frac{n(n+1)/2}{n} = \frac{n+1}{2}$, not $\frac{n-1}{2}$. Hence A is false.

Explanation

- R is true:** The standard formula $1 + 2 + \dots + n = \frac{n(n+1)}{2}$ is correct.
- A is false:** Dividing the sum by n gives mean = $\frac{n+1}{2}$, not $\frac{n-1}{2}$ (e.g., mean of 1, 2, 3 is $2 = \frac{3+1}{2}$, not $\frac{3-1}{2} = 1$).
- In Assertion–Reason questions, always verify A independently before checking if R explains it.

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