# Mizoram Board Class 12 Business Mathematics Question Paper with Solutions(Memory Based)

| Time Allowed :3 Hour | Maximum Marks :60 | Total Questions :24 |
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**General Instructions**

**Read the following instructions very carefully and strictly follow them:**

- Answers to this Paper must be written on the paper provided separately.
- You will not be allowed to write during the first 15 minutes
- This time is to be spent in reading the question paper.
- The time given at the head of this Paper is the time allowed for writing the answers,
- The paper has four Sections.
- Section A is compulsory - All questions in Section A must be answered.
- You must attempt one question from each of the Sections B, C and D and one other question from any Section of your choice.

**1. A and B start a business with capitals of 50,000 and 40,000 respectively. After 6 months, C joins them with 80,000. Find the share of each in a profit of 25,000 at the end of the year.**

**Solution:**
**Concept:** In partnership problems, profit is divided in the ratio of **capital** × **time**. Thus, each partner's share depends on the amount of money invested and the duration for which it was invested.

$$\text{Profit ratio} \propto (\text{Capital} \times \text{Time})$$

**Step 1:** Calculate capital–time product for each partner.

$$A : 50,000 \times 12 = 600,000$$

$$B : 40,000 \times 12 = 480,000$$

C joins after 6 months:

$$C : 80,000 \times 6 = 480,000$$

**Step 2:** Find the ratio of their investments.

$$A : B : C = 600,000 : 480,000 : 480,000$$

Dividing by $120,000$:

$$A : B : C = 5 : 4 : 4$$

**Step 3:** Divide the total profit according to the ratio.
Total ratio parts:

$$5 + 4 + 4 = 13$$

Total profit $= 25{,}000$

$$\text{Value of one part} = \frac{25000}{13}$$

**Step 4:** Calculate individual shares.

$$A = \frac{5}{13} \times 25000 = \frac{125000}{13} \approx 9615.38$$

$$B = \frac{4}{13} \times 25000 = \frac{100000}{13} \approx 7692.31$$

$$C = \frac{4}{13} \times 25000 = \frac{100000}{13} \approx 7692.31$$

**Step 5:** Final distribution of profit.

$$A = 9615.38, \quad B = 7692.31, \quad C = 7692.31$$

**Quick Tip**

In partnership problems always use the formula:

$$\text{Profit share} \propto \text{Capital} \times \text{Time}.$$

First compute the capital–time product for each partner, form the ratio, and then divide the total profit accordingly.

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**2. An agent is paid a 5% commission on all sales and an additional 2% del-credere commission on credit sales. If he sells goods worth 50,000 (of which 20,000 are credit sales), calculate his total earning.**

**Solution:**
**Concept:** In agency transactions:

- **Ordinary commission** is calculated on **total sales**.
- **Del-credere commission** is an additional commission given to the agent for guaranteeing credit sales, and it is calculated only on **credit sales**.

**Step 1:** Calculate the ordinary commission.
Total sales = 50,000

$$\text{Ordinary commission} = 5\% \times 50,000$$

$$= \frac{5}{100} \times 50,000 = 2,500$$

**Step 2:** Calculate the del-credere commission.
Credit sales = 20,000

$$\text{Del-credere commission} = 2\% \times 20,000$$

$$= \frac{2}{100} \times 20,000 = 400$$

**Step 3:** Find the total earning of the agent.

$$\text{Total earning} = \text{Ordinary commission} + \text{Del-credere commission}$$

$$= 2,500 + 400 = 2,900$$

**Step 4:** Final Answer.

$$\boxed{\text{Total earning of the agent} = 2,900}$$

**Quick Tip**

Remember the difference:

- **Ordinary Commission** → calculated on **total sales**.
- **Del-credere Commission** → calculated only on **credit sales**.

Add both commissions to obtain the agent's total earnings.

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**3. Find the value of $n$ if**

$$^{n}P_4 = 12 \times {}^{n}P_2.$$

**Solution:**
**Concept:** The permutation formula is

$$^{n}P_r = \frac{n!}{(n-r)!}$$

Using this formula, we express both permutations and then solve the resulting equation.
**Step 1:** Write the permutations using factorial form.

$$^{n}P_4 = \frac{n!}{(n-4)!}$$

$$^nP_2 = \frac{n!}{(n-2)!}$$

Substituting into the given equation:

$$\frac{n!}{(n-4)!} = 12 \times \frac{n!}{(n-2)!}$$

**Step 2:** Simplify the equation.
Cancel $n!$ from both sides:

$$\frac{1}{(n-4)!} = \frac{12}{(n-2)!}$$

Since

$$(n-2)! = (n-2)(n-3)(n-4)!$$

Substitute this into the equation:

$$\frac{1}{(n-4)!} = \frac{12}{(n-2)(n-3)(n-4)!}$$

Cancel $(n-4)!$:

$$1 = \frac{12}{(n-2)(n-3)}$$

**Step 3:** Solve for $n$.

$$(n-2)(n-3) = 12$$

$$n^2 - 5n + 6 = 12$$

$$n^2 - 5n - 6 = 0$$

$$(n-6)(n+1) = 0$$

$$n = 6 \quad \text{or} \quad n = -1$$

**Step 4:** Select the valid value.
Since $n$ represents the number of objects, it must be positive.

$$\boxed{n = 6}$$

**Quick Tip**

For permutation equations, convert each term using

$$^nP_r = \frac{n!}{(n-r)!}$$

Then simplify factorial expressions carefully to form an algebraic equation in $n$.

**4. Expand $(2x-3y)^5$ using the Binomial Theorem.**

**Solution:**
**Concept:** The **Binomial Theorem** states that

$$(a+b)^n = \sum_{r=0}^{n} \binom{n}{r} a^{n-r} b^r$$

For the expression $(2x-3y)^5$, we take

$$a = 2x, \qquad b = -3y, \qquad n = 5$$

**Step 1:** Write the general term.

$$T_{r+1} = \binom{5}{r} (2x)^{5-r} (-3y)^r$$

where $r = 0, 1, 2, 3, 4, 5$.
**Step 2:** Compute each term.

$$T_1 = \binom{5}{0} (2x)^5 = 32x^5$$

$$T_2 = \binom{5}{1} (2x)^4(-3y) = 5 \cdot 16x^4(-3y) = -240x^4y$$

$$T_3 = \binom{5}{2} (2x)^3(9y^2) = 10 \cdot 8x^3 \cdot 9y^2 = 720x^3y^2$$

$$T_4 = \binom{5}{3} (2x)^2(-27y^3) = 10 \cdot 4x^2(-27y^3) = -1080x^2y^3$$

$$T_5 = \binom{5}{4} (2x)(81y^4) = 5 \cdot 2x \cdot 81y^4 = 810xy^4$$

$$T_6 = \binom{5}{5} (-243y^5) = -243y^5$$

**Step 3:** Write the complete expansion.

$$(2x-3y)^5 = 32x^5 - 240x^4y + 720x^3y^2 - 1080x^2y^3 + 810xy^4 - 243y^5$$

**Step 4:** Final Answer.

$$\boxed{(2x-3y)^5 = 32x^5 - 240x^4y + 720x^3y^2 - 1080x^2y^3 + 810xy^4 - 243y^5}$$

**Quick Tip**

For $(a-b)^n$, the signs alternate:

$$+, -, +, -, +, \ldots$$

Always use the general term

$$T_{r+1} = \binom{n}{r} a^{n-r} b^r$$

to systematically compute each term.

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**5. Solve the system of equations using Cramer's Rule:**

$$2x + 3y = 8, \qquad x - y = -1.$$

**Solution:**
**Concept: Cramer's Rule** is used to solve a system of linear equations when the determinant of the coefficient matrix is non-zero.
For the system

$$a_1x + b_1y = c_1, \qquad a_2x + b_2y = c_2$$

the solution is

$$x = \frac{D_x}{D}, \qquad y = \frac{D_y}{D}$$

where

$$D = \begin{vmatrix} a_1 & b_1 \\ a_2 & b_2 \end{vmatrix}, \quad D_x = \begin{vmatrix} c_1 & b_1 \\ c_2 & b_2 \end{vmatrix}, \quad D_y = \begin{vmatrix} a_1 & c_1 \\ a_2 & c_2 \end{vmatrix}$$

**Step 1:** Form the determinant $D$.

$$D = \begin{vmatrix} 2 & 3 \\ 1 & -1 \end{vmatrix}$$

$$= 2(-1) - 3(1) = -2 - 3 = -5$$

Since $D \neq 0$, the system has a unique solution.
**Step 2:** Find $D_x$.

$$D_x = \begin{vmatrix} 8 & 3 \\ -1 & -1 \end{vmatrix}$$

$$= 8(-1) - 3(-1) = -8 + 3 = -5$$

**Step 3:** Find $D_y$.

$$D_y = \begin{vmatrix} 2 & 8 \\ 1 & -1 \end{vmatrix}$$

$$= 2(-1) - 8(1) = -2 - 8 = -10$$

**Step 4:** Calculate the values of $x$ and $y$.

$$x = \frac{D_x}{D} = \frac{-5}{-5} = 1$$

$$y = \frac{D_y}{D} = \frac{-10}{-5} = 2$$

**Step 5:** Final Solution.

$$\boxed{x = 1, \qquad y = 2}$$

**Quick Tip**

In Cramer's Rule:

$$x = \frac{D_x}{D}, \quad y = \frac{D_y}{D}$$

First compute $D$. If $D = 0$, the method cannot give a unique solution.

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**6. A box contains 5 red and 7 white balls. Two balls are drawn at random. What is the probability that both are red?**

**Solution:**
**Concept:** Probability of an event is given by

$$P(E) = \frac{\text{Number of favourable outcomes}}{\text{Total number of possible outcomes}}$$

When selecting objects without replacement, combinations are often used to count the possible selections.
**Step 1:** Find the total number of balls.
Number of red balls = 5
Number of white balls = 7
Total balls:

$$5 + 7 = 12$$

**Step 2:** Find total ways to select 2 balls from 12.

$$\text{Total outcomes} = \binom{12}{2}$$

$$= \frac{12 \times 11}{2} = 66$$

**Step 3:** Find favourable outcomes (both red).
Number of ways to select 2 red balls from 5:

$$\binom{5}{2}$$

$$= \frac{5 \times 4}{2} = 10$$

**Step 4:** Calculate the probability.

$$P(\text{both red}) = \frac{\binom{5}{2}}{\binom{12}{2}}$$

$$= \frac{10}{66}$$

$$= \frac{5}{33}$$

**Step 5:** Final Answer.

$$\boxed{P(\text{both balls are red}) = \frac{5}{33}}$$

**Quick Tip**

When objects are drawn **without replacement**, use combinations to count selections. For selecting $r$ objects from $n$:

$$\binom{n}{r} = \frac{n!}{r!(n-r)!}$$

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**7. A merchant marks his goods 20% above the cost price and allows a discount of 10%. Find his profit percentage.**

**Solution:**
**Concept:** Profit percentage is calculated using

$$\text{Profit } \% = \frac{\text{Profit}}{\text{Cost Price}} \times 100$$

When a marked price and discount are involved:

- Marked Price (MP) = Cost Price + Markup
- Selling Price (SP) = MP  Discount

**Step 1:** Assume the cost price.
Let the Cost Price (CP) = 100.
**Step 2:** Calculate the Marked Price.
The goods are marked 20% above the cost price.

$$\text{MP} = 100 + 20\% \text{ of } 100$$

$$= 100 + 20 = 120$$

**Step 3:** Calculate the Selling Price after discount.
Discount = 10% on MP.

$$\text{SP} = 120 - 10\% \text{ of } 120$$

$$= 120 - 12 = 108$$

**Step 4:** Find the profit.

$$\text{Profit} = SP - CP$$

$$= 108 - 100 = 8$$

**Step 5:** Calculate the profit percentage.

$$\text{Profit } \% = \frac{8}{100} \times 100 = 8\%$$

**Step 6:** Final Answer.

$$\boxed{\text{Profit Percentage} = 8\%}$$

**Quick Tip**

In profit problems with markup and discount:

$$\text{SP} = \text{CP} \times (1 + \text{Markup}) \times (1 - \text{Discount})$$

Using this shortcut can save time in competitive exams.

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