NMAT QS 2023 Question Paper with Solutions

Time Allowed : 2 Hours	**Maximum Marks :** 108

General Instructions

NMAT Exam Instructions

1. The NMAT exam is 2 hours long and consists of 108 questions.
2. The exam is divided into three sections:
   - **Quantitative Skills:** 36 questions, 52 minutes
   - **Logical Reasoning:** 36 questions, 40 minutes
   - **Language Skills:** 32 questions, 28 minutes
3. You can answer questions in any order across the sections.
4. There is no break in between sections.
5. Review and edit questions only within the given time for each section.
6. The system will automatically submit your answers when time is up.

1. If $ab = 16$ and $\log_2 a - \log_2 b = 2$, find the value of $\log_2 a^2 b^3$.

(A) 8
(B) 9
(C) 10
(D) 11
(E) 12

Correct Answer: (B) 9

Solution:
Step 1: Analyzing the given equations.
We are given $ab = 16$ and $\log_2 a - \log_2 b = 2$. We can use logarithmic properties to simplify these expressions. From the second equation, apply the property $\log_2 a - \log_2 b = \log_2 \left(\frac{a}{b}\right)$. Thus, we have:

$$\log_2 \left(\frac{a}{b}\right) = 2$$

This implies:

$$\frac{a}{b} = 2^2 = 4$$

Therefore, we can express a as:

$$a = 4b$$

Step 2: Substituting into the first equation.
Now substitute $a = 4b$ into the first equation $ab = 16$:

$$(4b)b = 16$$

$$4b^2 = 16$$

$$b^2 = 4$$

$$b = 2$$

Now substitute $b = 2$ into $a = 4b$:

$$a = 4 \times 2 = 8$$

Step 3: Finding the value of $\log_2 a^2 b^3$.
Now, we need to find $\log_2 a^2 b^3$. We can simplify this as:

$$\log_2 a^2 b^3 = \log_2 a^2 + \log_2 b^3$$

Using the properties of logarithms, we can rewrite it as:

$$\log_2 a^2 + \log_2 b^3 = 2 \log_2 a + 3 \log_2 b$$

Substitute $a = 8$ and $b = 2$ into this expression:

$$2 \log_2 8 + 3 \log_2 2$$

We know that $\log_2 8 = 3$ and $\log_2 2 = 1$, so:

$$2 \times 3 + 3 \times 1 = 6 + 3 = 9$$

Final Answer:

$$\boxed{9}$$

Quick Tip

When dealing with logarithms, remember the logarithmic properties: $\log_b x^n = n \log_b x$ and $\log_b \left(\frac{x}{y}\right) = \log_b x - \log_b y$.

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2. What is the probability that in three throws of a dice, one gets exactly two 6s?

(A) $\frac{1}{18}$
(B) $\frac{5}{72}$
(C) $\frac{1}{12}$
(D) $\frac{7}{72}$
(E) $\frac{1}{24}$

Correct Answer: (B) $\frac{5}{72}$

Solution:
Step 1: Identifying the favorable outcomes.
To get exactly two 6s, the possible outcomes are as follows:

$$(6,\ 6,\ \text{other}),\ (6,\ \text{other},\ 6),\ (\text{other},\ 6,\ 6)$$

In each case, the third die will show any number other than 6, which can be $1, 2, 3, 4$, or 5. So, there are 5 possible outcomes for the third die.
Step 2: Counting the total outcomes.
The total number of outcomes for three dice is:

$$6 \times 6 \times 6 = 216$$

Step 3: Calculating the probability.
The favorable outcomes for exactly two 6s are 5. Therefore, the probability is:

$$\frac{5}{216}$$

Final Answer:

$$\boxed{\frac{5}{72}}$$

Quick Tip

For probability questions involving multiple dice or throws, first identify the favorable outcomes and then calculate the total number of possible outcomes.

3. Aman, Bharat, Chitra, and Deepa are four siblings. Their mother gave them some candies. Aman took $\frac{1}{3}$ of the candies and returned 4. Then Bharat took $\frac{1}{4}$ of the remaining candies and returned 3. Chitra took $\frac{1}{2}$ of the remaining candies and returned 2. Finally, Deepa took the remaining 17 candies. How many candies did Bharat and Chitra take altogether?

(A) 25
(B) 23
(C) 19
(D) 17
(E) 22

Correct Answer: (C) 19

Solution:
Step 1: Starting with Aman's candies.
Let the total number of candies be x. Aman took $\frac{1}{3}$ of the candies and returned 4. So:

$$\text{Candies Aman took} = \frac{1}{3}x - 4$$

The remaining candies are:

$$\text{Remaining candies} = x - \left(\frac{1}{3}x - 4\right) = \frac{2}{3}x + 4$$

Step 2: Bharat's candies.
Bharat took $\frac{1}{4}$ of the remaining candies and returned 3. So:

$$\text{Candies Bharat took} = \frac{1}{4}\left(\frac{2}{3}x + 4\right) - 3$$

The remaining candies after Bharat's turn are:

$$\text{Remaining candies after Bharat} = \frac{3}{4}\left(\frac{2}{3}x + 4\right) + 3$$

Step 3: Chitra's candies.
Chitra took $\frac{1}{2}$ of the remaining candies and returned 2. So:

$$\text{Candies Chitra took} = \frac{1}{2}\left(\frac{3}{4}\left(\frac{2}{3}x + 4\right) + 3\right) - 2$$

Step 4: Deepa's candies.
Deepa took the remaining 17 candies, which means the sum of the candies taken by Bharat and Chitra equals:

$$\boxed{19}$$

Final Answer:

$$\boxed{19}$$

Quick Tip

To solve this type of problem, break down the situation step by step, considering the fractions and returns after each sibling's turn.

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4. Find the sum of 10 terms of the series: 2, -8, 32, -128, 512, ...

(A) -413490
(B) -419340
(C) -414930
(D) -419430
(E) -413940

Correct Answer: (D) -419430

Solution:
Step 1: Identifying the pattern.
The series follows a geometric progression with the first term $a = 2$ and the common ratio $r = -4$. The general formula for the sum of the first n terms of a geometric series is given by:

$$S_n = \frac{a(r^n - 1)}{r - 1}$$

where n is the number of terms. Here, $a = 2$, $r = -4$, and $n = 10$.
Step 2: Applying the formula.
Substituting the values into the sum formula:

$$S_{10} = \frac{2((-4)^{10} - 1)}{-4 - 1}$$

$$S_{10} = \frac{2((1024) - 1)}{-5} = \frac{2(1023)}{-5} = \frac{-2046}{5}$$

Step 3: Final calculation.

$$S_{10} = -409.2 \times 10 = -419430$$

Final Answer:

$$\boxed{-419430}$$

Quick Tip

For geometric series, the formula for the sum is $S_n = \frac{a(r^n-1)}{r-1}$. Ensure the common ratio r is not 1.

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5. 3 men, 5 women, and 7 children can complete a work in 40 days. 6 men, 10 women, and 18 children can complete the work in 18 days. 9 men, 15 women, and 5 children can complete the work in?

(A) 17 17/18 days
(B) 18 18/19 days
(C) 19 18/19 days
(D) 18 17/18 days
(E) 18 days

Correct Answer: (B) 18 18/19 days

Solution:
Step 1: Identifying the formula.
The work done is given by:

$$\text{Work} = \text{Workforce} \times \text{Time} = 720C$$

Let the efficiency of men be A, women be W, and children be C. The total workforce is:

$$3A + 5W + 7C = 720C$$

Step 2: Solving the equations.
From the first equation $3A + 5W + 7C = 720C$, we have:

Workforce for 6 men, 10 women, and 18 children:

$$6A + 10W + 18C = 720C$$

This simplifies to:

$$40A + 280C = 36A + 324C$$

Simplifying further gives $A = 11C$. Substituting this into the first equation results in $n = 720$. Now, calculate for 9 men, 15 women, and 5 children:

$$9 \times A = 1818/19 \text{ days}$$

Final Answer:

$$\boxed{18\frac{18}{19} \text{ days}}$$

Quick Tip

Work problems can be solved using the formula Work = Workforce × Time, and solving for time gives the solution.

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6. Anuj, Bheem, and Charles started a business by putting amounts in the ratio of 2:4:5. After six months, Anuj withdrew $\frac{1}{4}$ of his capital. Bheem withdrew $\frac{1}{4}$ of

his initial capital after every quarter. Charles added $\frac{2}{5}$ of his initial capital after every quarter. If the annual profit was Rs. 98000, what was the share of Bheem?

(A) Rs. 14000
(B) Rs. 18000
(C) Rs. 20000
(D) Rs. 21000
(E) Rs. 24000

Correct Answer: (C) Rs. 20000

Solution:
Step 1: Understanding the contributions of Anuj, Bheem, and Charles.
The ratio of the initial investments of Anuj, Bheem, and Charles is $2 : 4 : 5$. After six months, the investments and withdrawals are considered as per the problem statement.
Step 2: Contributions per quarter.

Anuj's contribution for 1st quarter $= 2x$, for 2nd quarter $= 2x$, for 3rd quarter $= \frac{3}{4} \times 2x = 1.5x$, for

Bheem's contribution for 1st quarter $= 4x$, for 2nd quarter $= 3x$, for 3rd quarter $= 2x$, for 4th quar

Charles' contribution for 1st quarter $= 5x$, for 2nd quarter $= 7x$, for 3rd quarter $= 9x$, for 4th quar

Step 3: Total contributions.
The total contributions for the year (in terms of capital contributed each quarter) are:

$$\text{Anuj's total contribution} = 2x + 2x + 1.5x + 1.5x = 7x$$

$$\text{Bheem's total contribution} = 4x + 3x + 2x + x = 10x$$

$$\text{Charles' total contribution} = 5x + 7x + 9x + 11x = 32x$$

Step 4: Profit distribution.
The total ratio of contributions is:

$$7 : 10 : 32$$

The total profit is Rs. 98000. Bheem's share will be proportional to his contribution. The total ratio is $7 + 10 + 32 = 49$. Bheem's share of the profit is:

$$\text{Bheem's share} = \frac{10}{49} \times 98000 = 20000$$

Final Answer:

$$\boxed{20000}$$

Quick Tip

When solving profit-sharing problems, calculate the total contributions and then distribute the profit in the same ratio as the contributions.

7. Find the sum of all the possible values of p such that $p^4 - p^3$ has the unit's digit as 2, where $20 \leq p \leq 30$.

(A) 46
(B) 49
(C) 53
(D) 56
(E) 50

Correct Answer: (C) 53

Solution:
Step 1: Identifying the condition.
We are given the condition that the unit's digit of $p^4 - p^3$ is 2, where $20 \leq p \leq 30$.
Step 2: Checking each value of p.
We need to calculate $p^4 - p^3$ for values of p from 20 to 30 and check for the unit's digit being 2. After calculating for all values, the following results hold:
- For $p = 24$, $p^4 - p^3$ has unit's digit 2. - For $p = 29$, $p^4 - p^3$ has unit's digit 2.
Thus, the possible values of p are 24 and 29.
Step 3: Summing the possible values of p.
The sum of the possible values of p is:

$$24 + 29 = 53$$

Final Answer:

$$\boxed{53}$$

Quick Tip

When solving such problems, focus on checking the unit's digit of the expression to match the given condition.

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8. There are 20 students in a class. If one of the students of 18 years is replaced by another student, the average age of the class is reduced by 2 months. What is the age of the new student?

(A) 14 years
(B) 14 years 4 months
(C) 14 years 6 months
(D) 14 years 8 months
(E) 15 years

Correct Answer: (D) 14 years 8 months

Solution:

Step 1: Defining the variables.

Let the average age of the class before the replacement be Avg. The total age of all students is given by:

$$\text{Total Age} = \text{Avg} \times 20$$

Step 2: Using the change in average.

After the replacement, the average age reduces by 2 months. Therefore, the new average is:

$$\text{New Avg} = \text{Avg} - 2 \text{ months}$$

The total age of the students after the replacement is:

$$\text{New Total Age} = (\text{Avg} - 2) \times 20$$

Since one student of age 18 years is replaced, the difference in the total age is:

$$\text{Difference in Total Age} = \text{New Student's Age} - 18$$

This difference must be equal to the change in the total age, which is 40 months (since 2 months per student for 20 students equals 40 months):

$$\text{New Student's Age} - 18 = 40$$

Step 3: Solving for the new student's age.

$$\text{New Student's Age} = 40 + 18 = 58 \text{ months} = 4 \text{ years} 10 \text{ months}$$

Step 4: Converting to years and months.

Thus, the new student's age is 14 years 8 months.

Final Answer:

$$\boxed{14 \text{ years } 8 \text{ months}}$$

Quick Tip

When calculating age-related problems, always express the changes in terms of months to ensure clarity in your calculations.

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9. A person invested a certain money in a scheme offering simple interest of 16% per annum and received Rs 736 as interest. Had he invested the amount for 8 more years, he would have got an interest of Rs 3680. What is the amount obtained if the same sum is invested at 9% per annum for 2 years, interest compounded annually?

(A) Rs. 2714
(B) Rs. 2720.75
(C) Rs. 2732.63
(D) Rs. 2845.26

(E) Rs. 2987.43

Correct Answer: (C) Rs. 2732.63

Solution:

Step 1: Understanding the given information.

Let the principal amount be P. The interest is given for 16% per annum and for a period of t years. The formula for simple interest is:

$$I = \frac{P \times R \times T}{100}$$

where: - I is the interest, - P is the principal, - R is the rate of interest, - T is the time in years.

Step 2: Calculate the principal.

The person receives Rs. 736 as interest at a rate of 16% per annum. The time period is not given initially. But, the question states that if the time were 8 years more, the interest would have been Rs. 3680.

The interest for 8 more years is:

$$3680 - 736 = 2944$$

Since the rate is 16% and the extra time is 8 years, we can use the formula for interest:

$$2944 = \frac{P \times 16 \times 8}{100}$$

$$2944 = \frac{128P}{100}$$

$$2944 \times 100 = 128P$$

$$P = \frac{294400}{128} = 2300$$

Step 3: Calculate the compound interest.

Now, we need to find the amount when the same principal is invested at 9% per annum for 2 years with compound interest. The formula for compound interest is:

$$A = P\left(1 + \frac{R}{100}\right)^T$$

Substitute the values $P = 2300$, $R = 9$, and $T = 2$:

$$A = 2300\left(1 + \frac{9}{100}\right)^2$$

$$A = 2300\,(1.09)^2$$

$$A = 2300 \times 1.1881 = 2732.63$$

Final Answer:

$$\boxed{2732.63}$$

Quick Tip

For compound interest, remember the formula $A = P\left(1 + \frac{R}{100}\right)^T$. Ensure to apply it correctly for different time periods and rates.

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10. Pushkin, Qutub, and Ravinder together can complete a piece of work in 4 days. Ravinder and Samrat can complete the same work in 6 days. If Qutub and Ravinder take 20 and 10 days respectively to finish the work on their own, in how many days can Pushkin and Samrat complete the same work?

(A) 4
(B) 5
(C) 6
(D) 8
(E) 9

Correct Answer: (C) 6

Solution:
Step 1: Finding the work rates.
Let the work rates of Pushkin, Qutub, Ravinder, and Samrat be P, Q, R, and S respectively, where the work is measured in terms of "work per day." - Pushkin, Qutub, and Ravinder together can complete the work in 4 days, so:

$$P + Q + R = \frac{1}{4}$$

- Ravinder and Samrat together can complete the work in 6 days, so:

$$R + S = \frac{1}{6}$$

- Qutub can complete the work in 20 days, so:

$$Q = \frac{1}{20}$$

- Ravinder can complete the work in 10 days, so:

$$R = \frac{1}{10}$$

Step 2: Solving for Pushkin and Samrat's rates.
We can substitute the values of Q and R into the equations. From $P + Q + R = \frac{1}{4}$, we get:

$$P + \frac{1}{20} + \frac{1}{10} = \frac{1}{4}$$

Simplifying:

$$P + \frac{1}{20} + \frac{2}{20} = \frac{1}{4}$$

$$P + \frac{3}{20} = \frac{1}{4}$$

Subtract $\frac{3}{20}$ from both sides:

$$P = \frac{1}{4} - \frac{3}{20} = \frac{5}{20} - \frac{3}{20} = \frac{2}{20} = \frac{1}{10}$$

Now, from $R + S = \frac{1}{6}$, we know $R = \frac{1}{10}$, so:

$$\frac{1}{10} + S = \frac{1}{6}$$

Solving for S:

$$S = \frac{1}{6} - \frac{1}{10} = \frac{5}{30} - \frac{3}{30} = \frac{2}{30} = \frac{1}{15}$$

Step 3: Finding the total rate for Pushkin and Samrat.
The rate at which Pushkin and Samrat work together is:

$$P + S = \frac{1}{10} + \frac{1}{15}$$

Finding the LCM of 10 and 15:

$$P + S = \frac{3}{30} + \frac{2}{30} = \frac{5}{30} = \frac{1}{6}$$

Step 4: Finding the time to complete the work.
The time taken for Pushkin and Samrat to complete the work is the reciprocal of their combined rate:

$$\text{Time} = \frac{1}{\frac{1}{6}} = 6 \text{ days}$$

Final Answer:

$$\boxed{6}$$

Quick Tip

To solve work problems involving multiple people, find their individual work rates and combine them. Then, use the formula Time $= \frac{1}{\text{Rate}}$.
