

CAPSTONE

Math Lecture#09

পেট্রোবাংলা স্পেশাল কোর্স



Topic: Arithmetic

- Boat & Stream
- Pipe & Cistern
- Combination

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Class Test on Lecture Sheet 8

Time: 10 minutes

Obtained Mark:

Total Marks: 10

1. A farmer employed 36 laborer to dig a pond in 15 days, but after 10 days of work he discovered that only 50% of the work was done. How many additional labors are to be employed for completing the job in time?
A. 25 B. 30 C. 32 D. 36 E. None of these
2. A mat weaver can weave 4 mats in 4 days. At the same rate, how many mats would be woven by 8 mat wavers in 8 days?
A. 8 B. 12 C. 16 D. 20 E. None of these
3. Fifteen men take 21 days of 8 hours each to do a piece of work. How many days of 6 hours each would 21 women take, if 3 women do as much work as 2 men do? [IBA MBA June 2015]
A. 25 B. 28 C. 30 D. 36 E. None of these
4. Minhaz and Alam can complete a work in 18 days. After working together for 12 days Minhaz stops and Alam completes the remaining work in 8 days. In how many days can Minhaz complete the work if he works alone? [IBA MBA June 2016]
A. 32 B. 48 C. 56 D. 72 E. None of these
5. A is 30% more efficient than B. How much time will they, working together, take to complete a job which A alone could have done in 23 days?
A. 13 B. 11 C. 21 D. 12 E. None of these
6. Three taps A, B and C can fill a tank in 12, 15 and 20 hours respectively. If A is open all the time and B & C are open for one hour each alternately, the tank will be full in approximately-
A. 6 hrs B. 5 hrs C. 7 hrs D. 7.5 hrs E. None of these
7. A takes 5 days more than B to do a certain job and 9 days more than C; A and B together can do the job in the same time as C. How many days A would take to do it?
A. 15 B. 10 C. 5 D. 20 E. None of these
8. A and B together can do a piece of work in 40 days. A having worked for 20 days, B finishes the remaining work alone in 60 days, in how many days shall B finish the whole work alone?
A. 60 days B. 70 days C. 80 days D. 90 days E. None of these
9. An air conditioner can cool the hall in 40 minutes while another takes 45 minutes to cool under similar conditions. If both air conditioners are switched on at same instance then how long will it take to cool the room approximately?
A. 18 minutes B. 19 minutes C. 22 minutes D. 24 minutes
10. A car manufacturer has 2,992 forklifts, which is approximately one forklift for every 48.9 employees. Which of the following is the closest approximation in thousands, of the number employees employed by the manufacturer?
A. 60 B. 100 C. 150 D. 172

নৌকা ও শ্রোত (Boat & Stream)

◆ স্থির পানিতে নৌকার গতিবেগ হলো প্রকৃত গতিবেগ। শ্রোতের অনুকূলে বা প্রতিকূলে নৌকা যে গতিবেগে চলে, তাকে নৌকার কার্যকরী গতিবেগ বলা হয়।

◆ নৌকার প্রকৃত গতিবেগ v এবং শ্রোতের বেগ u হলে, শ্রোতের অনুকূলে নৌকার গতিবেগ $= v + u$ এবং

$$\text{শ্রোতের প্রতিকূলে নৌকার গতিবেগ} = v - u$$

শ্রোতের অনুকূলে নৌকার বেগ a এবং শ্রোতের প্রতিকূলে নৌকার বেগ b হলে, স্থির পানিতে নৌকার বেগ $= \frac{a+b}{2}$ এবং শ্রোতের বেগ $= \frac{a-b}{2}$

1. একটি নৌকা শ্রোতের অনুকূলে ঘণ্টায় যায় ১৫ কিলোমিটার এবং শ্রোতের প্রতিকূলে ঘণ্টায় যায় ৫ কিলোমিটার। শ্রোতের বেগ কত?

সমাধান: শর্তমতে, নৌকার গতিবেগ + শ্রোতের গতিবেগ $= ১৫$ কিলোমিটার/ঘণ্টা।

$$\text{নৌকার গতিবেগ} - \text{শ্রোতের গতিবেগ} = ৫ \text{ কিলোমিটার/ঘণ্টা।}$$

$$[\text{বিয়োগ করে}] \quad ২ \text{ শ্রোতের গতিবেগ} = ১০ \text{ কিলোমিটার/ঘণ্টা}$$

$$\therefore \text{শ্রোতের গতিবেগ} = ৫ \text{ কিলোমিটার/ঘণ্টা (উত্তর: ৫ কি.মি./ঘণ্টা)}$$

2. নৌকা ও শ্রোতের বেগ যথাক্রমে ১ ঘণ্টায় ১২ কিলোমিটার ও ১৮ কিলোমিটার নদীপথে ২০ কিলোমিটার পথ একবার অতিক্রম করে ফিরে আসতে কত ঘণ্টা সময় লাগবে?

(ক) ৩ (খ) ৪ (গ) ৫ (ঘ) ৬

সমাধান: শ্রোতের অনুকূলে নৌকার বেগ $= (12 + 8) = 20$ কি.মি./ঘণ্টা

$$২০ \text{ কিলোমিটার যেতে সময় লাগবে} = \frac{২০}{২০} = ১ \text{ ঘণ্টা।}$$

$$\text{শ্রোতের প্রতিকূলে নৌকার বেগ} = (12 - 8) = 4 \text{ কি.মি./ঘণ্টা}$$

$$২০ \text{ কিলোমিটার ফিরে আসতে সময় লাগবে} = \frac{২০}{৪} = ৫ \text{ ঘণ্টা।}$$

$$\therefore \text{মোট সময়} = (1 + 5) = 6 \text{ ঘণ্টা (উত্তর: ঘ. ৬)}$$

3. একটি নৌকার শ্রোতের অনুকূলে ১৮ কিলোমিটার যেতে ৪ ঘণ্টা সময় লাগে এবং শ্রোতের প্রতিকূলে একই দূরত্ব অতিক্রম করতে ১২ ঘণ্টা সময় লাগে। নৌকার প্রকৃত গতিবেগ ঘণ্টায় কত কিলোমিটার?

সমাধান: শ্রোতের অনুকূলে বেগ $a = \frac{18}{4} = 4.5$ কিলোমিটার/ঘণ্টা

$$\text{শ্রোতের প্রতিকূলে বেগ, } b = \frac{18}{12} = \frac{3}{2} = 1.5 \text{ কিলোমিটার/ঘণ্টা}$$

$$\therefore \text{নৌকার প্রকৃত বেগ} = \frac{a+b}{2} = \frac{4.5+1.5}{2} = \frac{6}{2} = 3 \text{ কিলোমিটার/ঘণ্টা (উত্তর: ৩ কিলোমিটার/ঘণ্টা)}$$

4. A speedboat, whose speed is 15 km/hr in still water goes 30 km downstream and comes back in a total of 4 hours 30 minutes. What is the speed of the stream in km/hr?

A. 2.5 km/hr B. 3.5 km/hr C. 4 km/hr D. 5 km/hr

Solution: Let, the speed of the stream be x km/hr.

$$\text{Downstream Speed} = 15 + x$$

$$\text{Upstream Speed} = 15 - x$$

$$\text{So, } \frac{30}{15+x} + \frac{30}{15-x} = 4 \frac{1}{2} [4 \text{ hours } 30 \text{ minutes}]$$

$$\Rightarrow \frac{900}{225-x^2} = \frac{9}{2}$$

$$\Rightarrow 9x^2 = 225$$

$$\Rightarrow x^2 = 25$$

$$\therefore x = 5 \text{ (Answer: D. 5 km/hr)}$$

5. A man can row 50 km upstream and 72 km downstream in 9 hours. He can also row 70 km upstream and 90 km downstream in 12 hours. Find the rate of current.

A. 3 kmph B. 8 kmph C. 4 kmph D. None of these

Solution: Let x and y be the upstream and downstream speed respectively.

$$\text{Hence, } \frac{50}{x} + \frac{72}{y} = 9 \text{ and } \frac{70}{x} + \frac{90}{y} = 12$$

$$\text{Solving for } x \text{ and } y \text{ we get } x = 10 \text{ km/hr and } y = 18 \text{ km/hr}$$

$$\therefore \text{Rate of current} = \frac{y-x}{2} = \frac{18-10}{2} = 4 \text{ kmph. (Answer: C. 4 kmph)}$$

6. A boat went down river for a distance of 20 km. It then turned back and returned to its starting point, having travelled a total of 7 hours. On its return trip, at a distance of 12 km from the starting point it encountered a log which had passed the starting point at the moment at which the boat had started downstream. The downstream speed of the boat is-

Solution: Let, the speed of boat in still water be x and speed of stream be y .

$$\begin{aligned} \text{ATQ, } \frac{12}{y} &= \frac{20}{(x+y)} + \frac{20-12}{x-y} \\ \Rightarrow \frac{12}{y} &= \frac{20}{x+y} + \frac{8}{x-y} \\ \Rightarrow \frac{12}{y} &= \frac{20(x-y)+8(x+y)}{(x+y)(x-y)} \\ \Rightarrow \frac{12}{y} &= \frac{20x-20y+8x+8y}{x^2-y^2} \\ \Rightarrow \frac{12}{y} &= \frac{28x-12y}{x^2-y^2} \\ \Rightarrow 12x^2 - 12y^2 &= 28xy - 12y^2 \\ \Rightarrow 12x^2 &= 28xy \\ \Rightarrow 3x &= 7y \quad [\text{উভয়পক্ষকে } 4x \text{ দ্বারা ভাগ করে}] \\ \Rightarrow \frac{x}{y} &= \frac{7}{3} \end{aligned}$$

$$\therefore x:y = 7:3$$

Again, Let the speed be $7a, 3a$ km/hr

$$\begin{aligned} \text{ATQ, } \frac{20}{x+y} + \frac{20}{x-y} &= 7 \\ \Rightarrow \frac{20}{(7a+3a)} + \frac{20}{(7a-3a)} &= 7 \\ \Rightarrow \frac{2}{a} + \frac{5}{a} &= 7 \\ \Rightarrow \frac{7}{a} &= 7 \end{aligned}$$

$$\therefore a = 1 \quad \text{So, Downstream speed } (7a + 3a) = 10a = 10 \times 1 = 10 \text{ km/hr (Answer)}$$

নল ও চৌবাচ্চা (Pipe & Cistern)

- ◆ একটি পাইপ বা নল দ্বারা x ঘন্টায় একটি ট্যাংক পূর্ণ হলে, 1 ঘন্টায় পূর্ণ হবে $\frac{1}{x}$ অংশ।
- ◆ একটি পাইপ বা নল দ্বারা y ঘন্টায় একটি ট্যাংক খালি হলে, 1 ঘন্টায় খালি হবে $\frac{1}{y}$ অংশ।
- ◆ যদি একটি নল দ্বারা x ঘন্টায় একটি চৌবাচ্চা পূর্ণ হয় এবং অপর একটি নল দ্বারা y ঘন্টায় পূর্ণ হয় তাহলে, নল দুটি একত্রে খোলা থাকলে 1 ঘন্টায় পূর্ণ হবে $\frac{1}{x} + \frac{1}{y}$ অংশ।
- ◆ যদি একটি নল দ্বারা একটি চৌবাচ্চা x ঘন্টায় পূর্ণ হয় এবং অপর একটি নল দ্বারা y ঘন্টায় খালি হয়,
 - i. 1 ঘন্টায় পূর্ণ হবে $(\frac{1}{x} - \frac{1}{y})$ অংশ [$y > x$]
 - ii. 1 ঘন্টায় খালি হবে $(\frac{1}{y} - \frac{1}{x})$ অংশ [$x > y$]

শর্টকাট: ১. দুটি নল আলাদাভাবে একটি চৌবাচ্চাকে যথাক্রমে x ও y ঘন্টায় পূর্ণ করলে নল দুটি একত্রে খুলে দিলে চৌবাচ্চা পূর্ণ হবে $\frac{xy}{x+y}$ ঘন্টায়।

২. নলটি নল দ্বারা x ঘন্টায় চৌবাচ্চা পূর্ণ হলে এবং অপর নল দ্বারা y ঘন্টায় চৌবাচ্চা খালি হলে, নলদ্বয় একত্রে খুলে দিলে,

$$\text{i. চৌবাচ্চা পূর্ণ হবে } = \frac{xy}{y-x} \text{ ঘন্টায় } [y > x] \quad \text{ii. চৌবাচ্চা খালি হবে } = \frac{xy}{x-y} \text{ ঘন্টায় } [x > y]$$

8. একটি চৌবাচ্চার দুটি নল সংযুক্ত আছে। প্রথম নল দ্বারা চৌবাচ্চাটি ৬ মিনিটে এবং দ্বিতীয় নল দ্বারা চৌবাচ্চাটি ১২ মিনিটে পূর্ণ হয়। নল দুটি একত্রে খুলে দিলে চৌবাচ্চাটি কতক্ষণে পূর্ণ হবে?

ক. ২ মিনিট

খ. ৩ মিনিট

গ. ৪ মিনিট

ঘ. ১২ মিনিট

সমাধান: ১ম নল দ্বারা চৌবাচ্চাটি ১ মিনিটে পূর্ণ হয় $\frac{1}{6}$ অংশ

২য় নল দ্বারা চৌবাচ্চাটি ১ মিনিটে পূর্ণ হয় $\frac{1}{12}$ অংশ

$$\therefore \text{দুটি নল ১ মিনিটে একসাথে পূর্ণ করে } = \frac{1}{6} + \frac{1}{12} = \frac{2+1}{12} = \frac{3}{12} = \frac{1}{4} \text{ অংশ।}$$

$\frac{1}{4}$ অংশ পূর্ণ হয় ১ মিনিটে।

$$\therefore 1 \text{ অংশ পূর্ণ হয় } \frac{1}{\frac{1}{4}} = \frac{1 \times 4}{1} = 4$$

শর্টকাট: চৌবাচ্চাটি পূর্ণ হবে $= \frac{6 \times 12}{6+12} = \frac{72}{18} = 4$ মিনিটে। (উত্তর: গ. ৪ মিনিটে)

9. একটি চৌবাচ্চার দুটি নল যুক্ত আছে। প্রথম নল দ্বারা চৌবাচ্চাটি 6 মিনিটে পূর্ণ হয়। অপর নলটি দ্বারা চৌবাচ্চাটি 12 মিনিটে খালি হয়। দুটি নল একত্রে খুলে দিলে চৌবাচ্চাটি কতক্ষণে পূর্ণ হবে?

ক. 3 মিনিট

খ. 4 মিনিট

গ. 12 মিনিট

ঘ. 18 মিনিট

সমাধান: 1ম নল দ্বারা 1 মিনিটে পূর্ণ হয় চৌবাচ্চার $\frac{1}{6}$ অংশ
 ২য় " " 1 " " " " $\frac{1}{12}$ "

∴ নলদ্বয় একত্রে খোলা থাকলে 1 মিনিটে পূর্ণ হয় চৌবাচ্চার $\left(\frac{1}{6} - \frac{1}{12}\right) = \frac{2-1}{12} = \frac{1}{12}$ অংশ।

$\frac{1}{12}$ অংশ পূর্ণ হয় 1 মিনিটে।

1 " " " $\frac{1}{12} = \frac{1 \times 12}{1} = 12$ মিনিটে।

শর্টকাট: চৌবাচ্চাটি পূর্ণ হতে = $\frac{6 \times 12}{12-6} = \frac{72}{6} = 12$ মিনিটে। (উত্তর: গ. 12 মিনিটে)

10. দুইটি নল দিয়ে একটি চৌবাচ্চা যথাক্রমে ১২ ও ১৮ ঘণ্টায় পূর্ণ হয়। তৃতীয় আরেকটি নল দ্বারা চৌবাচ্চাটি ২৪ ঘণ্টায় খালি হয়। নল তিনটি একসাথে খুলে দিলে চৌবাচ্চাটি পূর্ণ হতে কত সময় লাগবে?

ক. ৬ ঘণ্টা

খ. ২৪ ঘণ্টা

গ. ৭২ ঘণ্টা

ঘ. $10\frac{2}{7}$ ঘণ্টা

সমাধান: ১ম নল দ্বারা ১ ঘণ্টায় খালি হয় $\frac{1}{12}$ অংশ; ২য় নল দ্বারা ১ ঘণ্টায় পূর্ণ হয় $\frac{1}{18}$ অংশ; ৩য় নল দ্বারা ১ ঘণ্টায় পূর্ণ হয় $\frac{1}{24}$ অংশ

∴ তিনটি নল একসাথে চালু থাকলে ১ ঘণ্টায় পূর্ণ হয় $\left(\frac{1}{12} + \frac{1}{18} - \frac{1}{24}\right) = \frac{6+4-3}{72} = \frac{7}{72}$ অংশ

$\frac{7}{72}$ অংশ পূর্ণ হয় ১ ঘণ্টায়

∴ ১ অংশ পূর্ণ হয় $\frac{1}{\frac{7}{72}} = \frac{1 \times 72}{7} = \frac{72}{7} = 10\frac{2}{7}$ ঘণ্টায়। (উত্তর: ঘ. $10\frac{2}{7}$ ঘণ্টায়)

9. একটি নল দ্বারা ১৮ মিনিটে একটি চৌবাচ্চা পূর্ণ হয়। অপর একটি নল দ্বারা প্রতি মিনিটে ১০ লিটার পানি বের হয়ে যায়। চৌবাচ্চাটি খালি থাকা অবস্থায় নল দুটি একত্রে খুলে দিলে চৌবাচ্চাটি ৭২ মিনিটে পূর্ণ হয়। চৌবাচ্চার ধারণ ক্ষমতা কত?

ক. ৬০ লিটার

খ. ১৮০ লিটার

গ. ২০০ লিটার

ঘ. ২৪০ লিটার

সমাধান: ১ম নলটি ১ মিনিটে পূর্ণ করে $\frac{1}{18}$ অংশ

নল দুটি একত্রে খোলা থাকলে ১ মিনিটে পূর্ণ হয় $\frac{1}{72}$ অংশ

∴ শুধু ২য় নলটি ১ মিনিটে খালি করে $\frac{1}{18} - \frac{1}{72} = \frac{4-1}{72} = \frac{3}{72} = \frac{1}{24}$

২য় নল দ্বারা $\frac{1}{24}$ অংশ খালি হয় ১ মিনিটে

২য় নল দ্বারা ১ অংশ খালি হয় $\frac{1}{\frac{1}{24}} = \frac{1 \times 24}{1} = 24$ মিনিটে

২য় নল, ১ মিনিটে পানি বের করে ১০ লিটার

২৪ মিনিটে পানি বের করে $(24 \times 10) = 240$ লিটার

∴ চৌবাচ্চার ধারণক্ষমতা = 240 লিটার। (উত্তর: ঘ. ২৪০ লিটার)

11. Two pipes A and B can fill a tank in 15 minutes and 20 minutes respectively. Both the pipes are opened together but after 4 minutes, pipe A is turned off. What is the total time required to fill the tank?

A. 10 min. 10 sec

B. 12 min. 40 sec

C. 14 min. 10 sec

D. 14 min. 40 sec

Solution: Part filled in 4 minutes = $4 \left(\frac{1}{15} + \frac{1}{20}\right) = \frac{7}{15}$

Remaining part = $\left(1 - \frac{7}{15}\right) = \frac{8}{15}$

Part filled by B in 1 minute = $\frac{1}{20}$

∴ $\frac{1}{20} : \frac{8}{15} = :: 1 : x$

$x = \left(\frac{8}{15} * 1 * 20\right) = 10\frac{2}{3}$ min = 10 min 40 sec

The tank will be full in (4 min + 10 min + 40 sec) = 14 min. 40 sec (Ans: 14 min. 40 sec)

12. There are two taps in a water tank. The first tap pumps water in the tank and the second one drains it out. The first tap takes 30 minutes to make the tank full and the second tap needs 40 minutes to drain that water out. If both taps are opened at the same time, how long will it take to make a half-full tank?

Solution: Quantity of water filled by the first tap in 1 minute = $\frac{1}{30}$ part

Quantity of water drained by the first tap in minute = $\frac{1}{40}$ part

Quantity of water filled in 1 minute, if both tap are opened = $\frac{1}{30} - \frac{1}{40}$ part

Quantity of water filled in 1 minute, if both tap are opened = $\frac{4-3}{120} = \frac{1}{120}$ part

$\frac{1}{120}$ part of the tank will be filled in 1 minute

1 part of the tank will be filled in 1×120 minute

$\frac{1}{2}$ part of the tank will be filled in $1 \times 120 \times \frac{1}{2}$ minute = 60 minute (Answer)

13. Pipe A can fill a tank in 4 hours and pipe B can fill it in 6 hours. If they are opened on alternate hours and if pipe A is opened first, in how many hours the tank shall be full?

Solution: ATQ, For the first hours tap A is opened and B for second hour.

∴ by both in 2 hours = $\frac{1}{4} + \frac{1}{6} = \frac{5}{12}$ parts

And in 4 hours = $2 \times \frac{5}{12} = \frac{10}{12}$ part = $\frac{5}{6}$ part

Remaining portion = $(1 - \frac{5}{6}) = \frac{1}{6}$

in fifth hour pipe A will be open

$\frac{1}{4}$ part can be filled in 1 hour

∴ $\frac{1}{6}$ part can be filled in $(\frac{1}{6} \times 4)$ hour = $\frac{2}{3}$ hour

∴ Total time = $(4 + \frac{2}{3})$ hour = 4 hour 40 min (Answer)

সমাবেশ (Combination)

- ◆ কতগুলো জিনিস হতে কয়েকটি বা সবকয়টি একসঙ্গে নিয়ে ক্রম বিবেচনা না করে যতগুলো দল তৈরি করা যায় বা যত প্রকারে বাছাই করা যায় তাদের প্রত্যেকটিকে একেকটিকে সমাবেশ বলে।

- ◆ সমাবেশের সূত্র: ${}^n C_r = \frac{n!}{r!(n-r)!}$

14. একটি ফুটবল টুর্নামেন্টে ৬টি দল অংশগ্রহণ করেছে। একক লীগ পদ্ধতিতে খেলা হলে মোট কতটি খেলা পরিচালনা করতে হবে?

ক. 10

খ. 15

গ. 20

ঘ. 50

সমাধান: মোট দলসংখ্যা, $n = 6$ এবং প্রতি খেলায় দলসংখ্যা, $r = 2$

∴ মোট খেলার সংখ্যা = ${}^n C_r = \frac{6!}{2!(6-2)!} = \frac{6 \times 5 \times 4!}{2 \times 1 \times 4!} = 15$

অথবা, প্রথম ১টি দল অন্য ৫ দলের সাথে খেলবে = $5 \times 1 = 5$

দ্বিতীয় দল অন্য ৪ দলের সাথে খেলবে = $4 \times 1 = 4$

তৃতীয় দল অন্য ৩ দলের সাথে খেলবে = $3 \times 1 = 3$

চতুর্থ দলটি অন্য ২ দলের সাথে খেলবে = $2 \times 1 = 2$

পঞ্চম দলটি অন্য ১ দলের সাথে খেলবে = $1 \times 1 = 1$

∴ মোট খেলার সংখ্যা = $5 + 4 + 3 + 2 + 1 = 15$ (উত্তর: খ. 15)

- ◆ করমর্দন ও খেলার সংখ্যা: করমর্দন ও খেলার ক্ষেত্রে সর্বদা ২ জন কিংবা ২টি করে দল নিয়ে সমাবেশ গঠন করা হয় তাই n সংখ্যক লোকের করমর্দন সংখ্যা বা n সংখ্যক দলের খেলার সংখ্যা = ${}^n C_2$ । এ ধরনের সমস্যা $\frac{n(n-1)}{2}$ সূত্র দ্বারাও সমাধান করা যায়।

- ◆ কমিটি/দল গঠন: কমিটি/দলের সদস্যদের দলের সংখ্যা পরিবর্তন হয় না তাই এইরকম সমস্যার সমাধানে সমাবেশের সূত্র ব্যবহার করতে হবে।

15. 4 জন মহিলা ও 6 জন পুরুষের মধ্যে থেকে 4 সদস্যবিশিষ্ট একটি কমিটি গঠন করতে হবে যাতে 1 জন নির্দিষ্ট পুরুষ সর্বদা উপস্থিত থাকেন। কত প্রকারে ঐ কমিটি গঠন করা যাবে?

ক. 84

খ. 120

গ. 210

ঘ. 304

সমাধান: মোট সদস্য = $4 + 6 = 10$ জন। একজন নির্দিষ্ট পুরুষকে বাদ দিয়ে $10 - 1 = 9$ জন থেকে নিতে হবে $4 - 1 = 3$ জন।

∴ কমিটির সংখ্যা = ${}^9 C_3 = \frac{9!}{3!(9-3)!} = \frac{9 \times 8 \times 7 \times 6!}{3 \times 2 \times 1 \times 6!} = \frac{9 \times 8 \times 7}{6} = 84$ (উত্তর: ক. 84)

16. From a group of 7 men and 6 women, five persons are to be selected to form a committee so that at least 3 men are there on the committee in how many ways can it be done?

Solution: Since at least 3 men must be in the committee, we consider all committees which include 3, 4 and 5 men, with 2, 1 and 0 women, respectively.

a. Choose 3 from 7 men and 2 from 6 women = ${}^7C_3 \times {}^6C_2 = 35 \times 15 = 525$

b. Choose 4 from 7 men and 1 from 6 women = ${}^7C_4 \times {}^6C_1$

c. Choose 5 from 7 men and 0 from 6 women = ${}^7C_5 \times {}^6C_0 = 21 \times 1 = 21$

So total ways = $525 + 210 + 21 = 756$ (Answer)

Shortcut:

way no	male	female	committee	total result
1.	5	0	${}^7C_5 \times {}^6C_0$	21
2.	4	1	${}^7C_4 \times {}^6C_1$	210
3.	3	2	${}^7C_3 \times {}^6C_2$	525
Total no of ways = $21 + 210 + 525 = 756$				

17. একটি ক্রিকেট ক্লাবে ৬ জন বোলার ও ৯ জন ব্যাটসম্যান আছে। কতভাবে ১১ জনের একটি দল বাছাই করা যায় যেখানে সর্বনিম্ন ৪ জন বোলার থাকবে?

ক. ৩৬০

খ. ৭২০

গ. ৫৪০

ঘ. ১১৭০

সমাধান: সর্বনিম্ন ৪ জন বোলার নিতে হবে অর্থাৎ বোলার থাকতে পারবেন ৪, ৫, অথবা ৬ জন।

মোট দলের সংখ্যা = $({}^6C_4 \times {}^9C_7) + ({}^6C_5 \times {}^9C_6) + ({}^6C_6 + {}^9C_5) = 1170$ (উত্তর: ঘ. ১১৭০)

18. **COMBINATION** শব্দটি হতে ৪টি অক্ষর বিশিষ্ট সম্ভাব্য সমাবেশ নির্ণয় করুন।

সমাধান: **COMBINATION** শব্দটিতে মোট বর্ণ আছে ১১টি, যার মধ্যে O আছে ২টি, N আছে ২টি এবং I আছে ২টি।

এক জাতীয় সংখ্যাগুলো বাদ দিলে ভিন্ন বর্ণ আছে ৫টি (C, M, B, A, T)

এক জাতীয়গুলো থেকে ১টি করে নিলে বর্ণ আছে ৪টি (C, O, M, B, I, N, A, T)

1	৪টি ভিন্ন ভিন্ন বর্ণ নিয়ে	${}^8C_4 = 70$	C, O, M, B, I, N, A, T থেকে ৪টি
2	২টি এক জাতীয় ও ২টি ভিন্ন	${}^3C_1 \times {}^7C_2 = 63$	OO, NN, II থেকে ২টি বা ১ জোড়া
3	২টি একই এবং অন্য ২টিও একই	${}^3C_2 = 3$	OO, NN, II থেকে ২ জোড়া

মোট = $70 + 63 + 3 = 136$ (উত্তর)

Practice Math

- A boat has a crack in its hull which is leaking water into the boat and could sink the boat in 6 hours. The boat has a pump which can pump the water out in 8 hours. If the boat is 168 km away from the shore and the pump is running, what is the minimum speed the boat should run at so that it can reach the shore before sinking? [Titas Gas (AM)-21; GTCL (AM)-21]
A. 5 km/hr B. 6 km/hr C. 7 km/hr D. 8 km/hr
- A boat sails M miles upstream at rate of r miles per hours. If the rate of the stream is S miles per hours, how long will it take the boat to return to its starting point?
A. $\frac{m}{r+2s}$ B. $\frac{m}{r+s}$ C. $\frac{m+r}{s}$ D. $mr - s$
- A boat takes 8 hours to cover a distance while travelling upstream, whereas while travelling downstream it takes 6 hours. If the speed of the current is 4 kmph, what is the speed of the boat in still water?
A. 12 kmph B. 116 kmph C. 28 kmph D. None of these
- The speed of a boat in still water is 10 km/hr. If it can travel 26 km downstream and 14 km upstream in the same time, the speed of the stream is:
A. 2 km/hr B. 2.5 km/hr C. 3 km/hr D. 4 km/hr
- A boat can travel 20 km downstream in 24 min. The ratio of the speed of the boat in still water to the speed of the stream is 4:1. How much time will the boat take to cover 15 km upstream?
A. 20 min B. 22 min C. 25 min D. 30 min

6. The speed of the boat in still water is 5 times that of the current, it takes 1.1 hours to row to point B from point A downstream. The distance between point A and point B is 13.2 km. How much distance will it cover in 312 minutes upstream?
A. 41.6 km B. 48 km C. 44.8 km D. 43.2 km
7. A man rowed 3 miles upstream in 90 minutes if the river flowed with a current of 2 miles per hour, how long did the man's return trip take?
A. 20 B. 30 C. 40 D. 50 E. 35
8. A certain river has a current of 4 miles per hour. A boat takes twice as long as to travel upstream between two points as it down stream between the same two points. What is the speed of the boat in still water?
A. 6 mph B. 8 mph C. 12 mph D. 1.2 mph E. 10 mph
9. A pipe can fill up an empty tank in 14 minutes. Another pipe flows out 12 liter of water per minute. If the two pipes are opened together and the empty tank is filled up in 98 minutes, how much water does the tank contain? [UCB (PO) 2021]
A. 178 liter B. 184 liter C. 192 liter D. 196 liter E. None of these
10. Two pipes A and B can fill an empty cistern in 32 and 48 hours, respectively. Pipe C can drain the entire cistern in 64 hours when no other pipe is in operation. Initially, when the cistern was empty pipe A and pipe C were turned on. After a few hours. Pipe A was turned off and pipe B was tuned on instantly. In all it took 112 hours to fill the cistern. For how many hours was pipe B turned on?
A. 84 B. 77 C. 70 D. 72
11. Two pipes A and B can fill a tank in 6 hours and 4 hours respectively. If they are opened on alternative hours and if pipe A is opened first, in how many hours the tank shall be full? [Janata Bank (AO) 15]
A. 4 B. 4.5 C. 5 D. 5.5
12. Pipes A and C can fill an empty cistern in 7 and 10.5 hours, respectively while pipe B can drain the filled cistern in 5.25 hours. If the three pipes are turned on together when the cistern is empty, how many hours will it take for the cistern to be $\frac{2}{3}$ full?
A. 121 B. 12 C. 14 D. 15.75
13. One fill pipe A is 3 times faster than second fill pipe B and takes 32 minutes less than the fill pipe B. When will the cistern be full if both pipes are opened together?
A. 6 min B. 8 min C. 12 min D. 10 min
14. A cistern is normally filled with water in 10 hours but takes 5 hours longer to fill because of a leak in its bottom. If the cistern is full, the leak will empty the cistern in- [Janata and Rupali Bank (Officer) 2019]
A. 22.5 hours B. 25 hours C. 27.5 hours D. 30 hours
15. Three pipes A, B and C can fill a tank from empty to full in 30 minutes, 20 minutes and 10 minutes respectively. When the tank is empty, all the three pipes are opened. A, B and C discharge chemical solutions P, Q and R respectively. What is the proportion of the solution R in the liquid in the tank after 3 minutes? [IBA BBA 13-14]
A. $\frac{5}{11}$ B. $\frac{6}{11}$ C. $\frac{7}{11}$ D. $\frac{8}{11}$ E. $\frac{9}{11}$
16. A water tank has two taps (tap-1 and tap-2). Tap-1 can fill a tank in 8 hrs and tap-2 can empty the tank in 16 hrs. How long will they take to fill the tank if both taps are opened simultaneously but tap-2 is closed after 8 hrs?
A. 10 B. 12 C. 14 D. 16 E. 20
17. In how many ways 4 books can be selected out of 10 books if two books is always left out?[BTRC AD '21]
A. 210 B. 70 C. 45 D. 28
18. How many triangle can be formed with the apen points of 12 side polynomial?
A. 220 B. 120 C. 210 D. 180

[বেসামরিক বিমান চলাচল কর্তৃপক্ষ (সিনিয়র অফিসার) ২০২১]

19. In how many ways a team of 11 members can be formed from a group of 15 students if a student who is the owner of the ball is always considered a member of the team? [Agrani Bank Ltd. Off (Cash) 2017]
 A. 14 B. 201 C. 210 D. 1001
20. From a group of 7 men and 6 women, five persons are to be selected to form a committee so that at least 3 men are there on the committee. In how many ways it can be done? [BB (AD) 2011]
 A. 564 B. 645 C. 735 D. 756
21. At a party, everyone shook hands with everybody else. If there were 66 handshakes, how many people were at the party?
 A. 9 B. 15 C. 10 D. 12 E. 13
22. A team of 8 students goes on an excursion, in two cars, of which one can seat 5 and the other only 4. In how many ways can they travel?
 A. 120 B. 126 C. 146 D. 156 E. 166
23. In how many ways 5 different chocolates be distributed to 4 children such that any child can get any number of chocolate?
 A. 20 B. 24 C. 120 D. 625 E. 1024
24. A committee of 3 people is to be chosen from the president and vice president of four different companies. What is the number of different committees that can be chosen if two people who work for the same company cannot both serve on the committee?
 A. 16 B. 24 C. 28 D. 32 E. 40
25. Five members were present at a board meeting. Each member shook hands with all of the other members before the meeting. How many handshakes took place? [MTBL (Officer) 2013]
 A. 10 B. 11 C. 15 D. 20

Home Task Math

26. If a boat goes 7 km upstream in 42 minutes and the speed of the stream is 3kmph, then the speed of the baot in still water is- [Pallikarma Sohayak Foundation (AM) 2014]
 A. 4.2 km/hr B. 9 km/hr C. 13 km/hr D. 21 km/hr
27. A man can row at the rate of 4 km/hr in still water. If the time taken to row a certain distance upstream is 3 times as much as to row the same distance downstream, find the speed of the current.
 A. 1 B. 2 C. 3 D. 4
28. A certain river has a current of 3 miles per hour. A boat takes twice as long travel upstream between two points as it does to travel downstream between the same two points. What is the speed of the boat in still water?
 A. 3 mph B. 6 mph C. 8 mph D. 9 mph E. 12 mph
29. A boat is moving 2 km against the current of the stream in 1 hour and moves 1 km in the direction of the current in 10 minutes. How long will it take the boat to go 5 km in stationary water?
 A. 1 hr 20 minutes B. 1 hr 30 minutes C. 1 hr 15 minutes D. 30 minutes E. 45 minutes
30. If a man goes 18 km downstream in 4 hours and return against the stream in 12 hours, then the speed of the stream in km/hr is:
 A. 3 B. 1.5 C. 1.75 D. 2 E. 1
31. A boat traveled a total of 600 miles in two days. If the distance it traveled on the first day was 150 miles less than twice the distance it traveled on the second day, what was the distance, in miles that it traveled on the second day?
 A. 250 B. 275 C. 350 D. 375 E. 450
32. A boat travelled upstream 90 miles at an average speed of $(v - 3)$ mile per hour and then travelled the same distance downstream at an average speed of $(v + 3)$ mile per hours. If the trip upstream took a half hour longer than the trip downstream, then how many hours did it take the boat travel downstream?
 A. 2.5 B. 2.4 C. 2.3 D. 2.2 E. 2.1

33. Azam can swim 10 km upstream and 25 km downstream in 12 hours. He can also swim 15 km upstream and 50 km downstream in 20 hours. How many hours will it take for him to cover 17.5 km in downstream if the rate of current increase by 40%? [IBA MBA June 2018]
 A. 4.5 hours B. 4 hours C. 3.5 hours D. 3 hours E. None of these
34. Two pipes A and B can fill a tank together in 12 hours. A can fill the tank 10 hours before B. In what time B can fill the tank? [NSI (Field Officer) 2021]
 A. 20 hours B. 25 hours C. 30 hours D. 35 hours
35. Two pipes A and B can fill a tank in 15 minutes and 20 minutes respectively. Both the pipes are open together but after 4 minutes, pipe A is turned off, What is the total time required to fill the tank? [PKB (SEO Cash) 2021]
 A. 10 min 20 sec B. 11 min 45 sec C. 12 min 30 sec D. 14 min 40 sec
36. Two pipes A and B can fill a tank in 6 hours and 4 hours respectively; If they are opened on alternative hours and if pipe A is opened first, in how many hours, the tank shall be full? [Janata Bank (Asst. Off.)-15]
 A. 4 B. 4.5 C. 5 D. 5.5
37. Two pipes can, fill a cistern separately in 24 minutes and 40 minutes respectively and a waste pipe can drain off 30 liters per minute. If all the three pipes open, the cistern fills in one hour. What is the capacity of cistern?
 A. 300 liters B. 400 liters C. 500 liters D. 600 liters
38. One pipe can fill an empty cistern in 7.8 hours while another can drain the cistern when full in 19.5 hours. Both the pipes were turned on when the cistern was half-empty. How long will it take for the cistern to be full?
 A. 3.9 hours B. 7.8 hours C. 6.5 hours D. 5.2 hours
39. 3 pumps, working 8 hours a day, can empty a tank in 2 days. How many hours a day must 4 pumps work to empty the tank in 1 day? [Combined 5 bank (Cash Officer) 2019]
 A. 9 B. 10 C. 11 D. 12
40. A tank is filled in 5 hours by three pipes A, B and C. The pipe C is twice as fast as B and B is twice as fast as A. How much time will pipe A alone take to fill tank?
 A. 20 B. 25 C. 30 D. 35 E. None of these
41. Three pipes can individually fill a water tank in 10, 12 and 15 hours. How many hours will it take for all three pipes opened together to fill half of the tank?
 A. 6 hr B. 5 hr C. 4 hr D. 2 hr E. None of these
42. A large fresh water reservoir is fitted with two type of feeder pipes- hot water pipes and cold water pipes. 6 cold water pipes alone can fill the reservoir in 12 hours. 3 cold water pipes and 9 hot water pipes together can fill the reservoir in 8 hours. How long will 5 hot water pipes alone take to fill the reservoir?
 A. 18 hr 36 min B. 21 hr 36 min C. 20 hr 45 min D. 20 hr 36 min E. None of these
43. A pond can be filled in 15, 20, 30 and 60 hours respectively using four pipes. The first pipe was opened at 8 am, second at 9 am, third at 10 am and fourth at 11 am. When will the pond be full?
 A. 12 pm B. 2 pm C. 1 pm D. 3 pm E. 2:30 pm
44. One pipe A can fill the tank in 24 minutes but another pipe B can empty the tank in 40 minutes. If the tank was filled $\frac{3}{4}$ of the capacity of tank and after 9 minutes B is closed, how much time to need fill the tank if A is running from beginning? [IBA MBA, Dec' 2021]
 A. 15 min B. 6 min C. 11 min D. 25 min E. Cannot be determined
45. 3 pumps working 8 hour a day can empty a tank in 2 days. How many hours a day must 4 pumps work to empty the same tank in 1 day?
 A. 9 B. 10 C. 11 D. 12 E. None of these
46. Pump can fill a tank with water in 2 hours. Because of a leak, it took $2\frac{1}{3}$ hours to fill the tank. The leak can drain all the water of the tank in:
 A. 14 hrs B. 4 hrs C. 7 hrs D. 8 hrs E. None of these

47. A water tank with 84 gallons capacity is filled by pipe A and emptied by pipe B. If the rate of water flow through pipe A is 2 gallons per hour, how many gallons per hour should flow through pipe B so that when both pipes are open, the initially empty tank should be full in capacity in 96 hours?
 A. $\frac{3}{8}$ B. $\frac{4}{3}$ C. $\frac{9}{8}$ D. $\frac{8}{9}$ E. $\frac{2}{3}$
48. Two pipes A and B can fill a cistern in $37\frac{1}{2}$ minutes and 45 minutes respectively. Both pipes are opened. In what time the cistern will be filled in just after half an hour, if the B is turned off after?
 A. 5 mins B. 9 mins C. 10 mins D. 15 mins E. None of these
49. Two pipes A and B can fill a tank in 12 minutes and 15 minutes respectively while a third pipe C can empty the full tank in 20 minutes. All the three pipes are opened in the beginning. However, pipe C is closed 6 minutes before the tank is filled. In what time will the tank be full?
 A. 7 minutes B. 11 minutes C. 10 minutes D. 60 minutes E. 15 minutes
50. Eight pipes are fitted to a water tank. Some of these water pipes are to fill the tank and remaining are to empty the tank. Each water pipe can fill the tank in 12 hours and each waste pipe can empty the tank in 36 hours. On opening all the pipes an empty tank is filled in 3 hours. How many waste pipes are there?
 A. 2 B. 3 C. 4 D. 5 E. 6
51. In a function, the guest can hand shake with only 1 other person. If the number of handshakes is 300 then how many guest were there in the function? [43rd BCS]
 A. 24 B. 25 C. 30 D. 60
52. From a group of 7 men and 6 women, 5 persons are to be selected to form a committee so that at least 3 men are there on the committee. In how many ways can it be done?
 A. 564 B. 645 C. 735 D. 756
53. A select group of 4 is to be formed from 8 men and 6 women in such a way that the group must have at least 1 woman. In how many different ways can it be done?
 A. 364 B. 728 C. 931 D. 1001
54. 8 directors, the vice chairman and the chairman are to be seated around a circular table. If the chairman should sit between a director and the vice chairman, in how many ways can they be seated?
 A. 9! B. 7!*2 C. 9!*2 D. 8!*2 E. 8!
55. The Jones family is going on vacation. The members of the family will sit on one side of the aisle and three seats on the other. The two oldest children will sit together on one side that has only two seats. The parents and the youngest child will sit together on the other side. How many different seating arrangements are possible?
 A. 5 B. 10 C. 12 D. 60 E. 120
56. The retirement plan for a company allows employees to invest in 10 different mutual funds. Six of the 10 funds grew by at least 10% over the last year. If Shahadat randomly selected 4 of the 10 funds, what is the probability that 3 of Shahadat's 4 funds grew by at least 10% over last year?
 A. ${}^6C_3 \div {}^{10}C_4$ B. $({}^6C_3 \times {}^4C_1) \div {}^{10}C_4$ C. $({}^6C_3 \times {}^4C_1) \div {}^{10}P_4$
 D. $({}^6P_3 \times {}^4P_1) \div {}^{10}C_4$ E. $({}^6P_3 \times {}^4P_1) \div {}^{10}P_4$
57. Abir has 4 paintings in the basement. He is going to bring up 2 of them and hang 1 in his den and 1 in his bedroom. In how many ways can he choose which paintings go in each room?
 A. 4 B. 6 C. 12 D. 16 E. 24
58. A committee of 6 is chosen from 8 men and 5 women, so as to contain at least 2 men and 3 women. How many different committees could be formed if two of the men refuse to serve together?
 A. 3510 B. 2620 C. 1404 D. 700 E. 635
59. A box contains 2 white balls, 3 black balls and 4 red balls. In how many ways can 3 balls be drawn from the box, if at least one black ball is to be included in the draw?
 A. 32 B. 48 C. 64 D. 96 E. None of these
60. How many different ways can 2 students be seated in a row of 4 desks, so that there is always at least one empty desk between the students?
 A. 2 B. 3 C. 4 D. 6 E. 12

Written Math

1. Find the number of possible combination that can be made by taking 4 letters of the word 'COMBINATION'? [38th BCS]
2. A club has 20 members. They are electing a principal and a vice president. How many different outcome of the election are possible?
(Assume the president and the vice president must be different members of the club.) [SJIB (TSO)-11]
3. A committee of 5 is to be formed 6 male students and 5 female students. In how many ways can this be done so that the committee contains at least one male and one female student?
[Rupali Bank (Cash Officer) 2018, Sonali Bank (SO) 2018]
4. A man went downstream for 28 km in a motor boat and immediately returned. It took the man twice as long to make the return trip. If the speed of the river flow were twice as high, the trip downstream and back would take 672 minutes. Find the speed of the boat in still water and the speed of the river flow.
[Combined 2 bank (Officer) 2018 (written), Combined 4 Bank (Officer) 2019 (written)]
5. A man can row 30 km upstream and 44 km downstream in 10 hrs. It is also known that he can row 40 km upstream and 55 km downstream in 13 hrs. Find the speed of the man in still water.
[Combined 4 banks (Cash Officer) 2018 (written)]
6. Two boats on opposite banks of a river start moving towards each other. They first pass each other 1400 meters from one bank. They each continue to the opposite bank, immediately turn around and start back to the other bank. When they pass each other a second time, they are 600 meters from the other bank. We assume that each boat travels at a constant speed all along the journey. What's the width of the river?
[BSC Combined Exam (SO) 2018]
7. A boat can take 8 hour to go 32 km against the current and take 4 hour for same distance with the current, what is the speed of the boat and current?
[IFIC Bank (PO) 2011, Modhumoti Bank (MTO) (Written) 2016, Pubali Bank (SO) (Written) 2000]
8. A river is flowing at a speed of 5 kilometer per hour in a particular direction. A man, who can swim at a speed of 20 km per hour in still water, starts swimming along the direction of flow of the river from point A and reaches another point B, which is at a distance of 30 km from the starting point A. On reaching point B, the man turns back and starts swimming against the direction of flow of the river and stops after reaching point A. the total time taken by the man to complete his journey is?
[Sonali Bank (Officer) 2019]
9. Pipe A can fill a tank in 18 hours, pipe B can empty a tank in 12 hours, pipe C can fill tank in 6 hours. The tank is already filled up to $\frac{1}{6}$ of its capacity. Now pipe A is opened in the first hour alone, pipe B is opened in the second hour alone and pipe C is opened in the third hour alone. This cycle is repeated until the tank gets filled. Then in how many hours does the rest of tank gets filled? [Combined 8 Banks (SO)-18]
10. Water flows into an empty 64 gallon drum through pipe A and flows out through pipe B. If the rate of flow through A is 2 gallons/hour, how many gallons per hour must flow out through pipe B so that drum is full in exactly 96 hours?
[Dhaka Bank MTO 2004, RAKUB (Officer) 2011]
11. Two pipes can separately fill a tank in 20 hrs. and 30 hrs. respectively. Both the pipes are opened to fill the tank but when the tank is $\frac{1}{3}$ full a leak develops in the tank through which $\frac{1}{3}$ of the water supplied by both the pipes goes out. How much time will the tank to be full.
12. A cistern can be filled by a tap in 4 hours while it can be emptied by another tap in 9 hours. If both the taps are opened simultaneously then after how much time will the cistern get filled? [IBBL (TO) 2021]
13. There are three pumps P, R and T with a tank. P, R and T simultaneously can fill the tank in 5 hours. Again P and R simultaneously can fill the tank in 7 hours. Then how many hours T need to fill the tank alone?
[Dhaka Bank (ATO) 2021]
14. One pump drains one-half of a pond in 3 hours, and then a second pump starts draining the pond. The two pumps working together finish emptying the pond in half an hour. How long would it take the second pump to drain the pond if it had to do the job alone? [NRBC Bank (Trainee Junior Officer) 2021]
15. A basin can be filled tap A in 5 hours and by B in 8 hours, each tap working on its own. When the basin is full and a draining hole is open, the water is drained in 20 hours. If initially basin empty and someone started the taps together but the drainage hole open, how long does it take for the basin to filled?
[Rupali Bank (Senior Officer) 2020]