



GENERAL APTITUDE

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Interest

If P = Principal, R = Rate of interest, N = Time in years, I = Interest, A = Amount

Then $A = P + I$

Simple Interest

$$S.I. = (P \times R \times N) / 100$$

Basic principal remains constant.

S.I. is good example of AP(Arithmetic Progression)

Compound Interest

$$A = P (1 + R/100)^T$$

T = periods of compounding,

$$C.I. = A - P$$

R = rate for compounding period

Basic principal keeps on increasing as we get interest on interest.

C.I. is good example of GP(Geometric Progression)



Interest

Q. A shopkeeper with an OD facility at 18% with a bank borrowed Rs. 15000 on Jan 8, 2011 and returned the money on June 3, 2011 so as to clear the debt. The amount that he paid was -

- A. Rs. 16080 B. Rs. 16280 C. Rs. 16400 D. None of these

Soln:

- $P = 15000$, $r = 18\%$, $T = 23(\text{jan}) + 28(\text{feb-nonleap}) + 31(\text{march}) + 30(\text{April}) + 31(\text{may}) + 3(\text{june}) = 146$ days
- $146/365 \text{ days} = 2/5 \text{ years.}$
- $SI = 15000 \times 18 \times 2/5 \times 1/100 = 30 \times 18 \times 2 = 1080$

$$\begin{aligned}\text{Amount} &= P + SI \\ &= 15000 + 1080 \\ &= 16080\end{aligned}$$

Ans: A



Interest

Q. A sum of money at simple interest amounts to Rs. 815 in 3 years and to Rs. 854 in 4 years. The sum is:

A. Rs. 650

B. Rs. 690

C. Rs. 698

D. Rs. 700

Soln:-

amount after 4 years = amount after 3 years + simple interest in one year

S.I. in one year = Rs. $(854 - 815) = \text{Rs. } 39$.

S.I. for 3 years = Rs. $(39 \times 3) = \text{Rs. } 117$.

Principal = amount - interest

Principal = $815 - 117$
= Rs. 698.

Ans: C



Interest

Q. A farmer borrowed Rs.3600 at 15% simple interest per annum. At the end of 4 years, he cleared this account by paying Rs.4000 and a donkey. The cost of the donkey is -

A. Rs. 1000

B. Rs. 1200

C. Rs. 1550

D. Rs. 1760

Soln:

SI for 4 years = Rs. $(3600 \times 0.15 \times 4) = \text{Rs. } 2160$

Amount after 4 years = Rs. $(3600 + 2160) = \text{Rs. } 5760$

Cost of donkey = Rs. $(5760 - 4000) = \text{Rs. } 1760$

Ans: D



Interest

Q. P =Rs. 2000, R =10%, N =2yrs , Find A and CI

Soln:

$$\begin{aligned}A &= 2000\left(1 + \frac{10}{100}\right)^2 \\&= 2000\left(\frac{110}{100}\right)^2 \\&= 2000\left(\frac{121}{100}\right) \\&= \text{Rs. } 2420\end{aligned}$$

$$\text{CI} = 2420 - 2000 = \text{Rs. } 420$$

$$2000 \rightarrow 10\% = 200$$

$$10\% \quad 10\%$$

$$2000 \longrightarrow 2200 \longrightarrow 2420$$

$$\text{CI} = 2420 - 2000 = 420$$



Interest

Q. Simple interest on a certain sum of money for 3 years at 8% per annum is half the compound interest on Rs. 4000 for 2 years at 10% per annum. The sum placed on simple interest is:

A. Rs. 1550

B. Rs. 1650

C. Rs. 1750

D. Rs. 2000

Soln:

$$A = P \left(1 + \frac{R}{100} \right)^N = 4000 \left(1 + \frac{10}{100} \right)^2 = 4000 \times \left(\frac{11}{10} \right)^2 = 4000 \times \frac{11}{10} \times \frac{11}{10} = \text{Rs. } 4840$$

OR

$$\begin{array}{ccccc} 4000 & \xrightarrow[1^{\text{st}} \text{ yr}]{10\%} & 4400 & \xrightarrow[2^{\text{nd}} \text{ yr}]{10\%} & 4840 \end{array}$$

$$CI = A - P$$

$$CI = 4840 - 4000 = \text{Rs. } 840$$

Ans: C

$$SI = \frac{1}{2} CI$$

$$\frac{PNR}{100} = \frac{1}{2} \times 840$$

$$\frac{P \times 3 \times 8}{100} = 420$$

$$\begin{aligned} P(\text{sum}) &= \frac{420 \times 100}{3 \times 8} \\ &= \text{Rs. } 1750 \end{aligned}$$



Interest

Q. P = Rs. 4000, R = 20% per annum, N = 6 months. Find CI computed quarterly for given period.

Soln:

N = 6 months (2 quarterly)

rate(R) = 20 % per annum = 5 % quarterly

After every 3 months CI will be calculated.

	by <u>5%=200</u>		by <u>5%=210</u>	
4000		4200		4410

$$\begin{aligned} I &= 4410 - 4000 \\ &= \text{Rs. } 410 \end{aligned}$$



Interest

Q. Difference between Compound interest & simple interest on a sum placed at 8% p.a. compounded annually for 2 years is Rs 128. Find the Principal

- A. 20000
- B. 24000
- C. 26000
- D. 15000

- **Soln:**

- Let the principal be $P = \text{Rs. } 100$.
- time $N = 2$ years, rate of interest $R = 8\%$ per annum
- simple interest = $\frac{PNR}{100} = \frac{100 \times 8 \times 2}{100} = \text{Rs. } 16$

- CI (for 2 years)

- 8% 8%
- 100 $\xrightarrow{\quad}$ 108 $\xrightarrow{\quad}$ 116.64

	16.64		
P	SI	CI	Diff
100	16	16.64	0.64

- $0.64 \rightarrow 100$
- $128 \rightarrow ?$
- $\frac{12800}{0.64} = \text{Rs. } 20000$



Interest

Q. Difference between Compound interest & simple interest on a sum placed at 8% p.a. compounded annually for 2 years is Rs 128. Find the principal

- A. 20000 B. 24000 C. 26000 D. 15000

• **Soln:**

- Let the principal be $P = \text{Rs. } 100$.
- time $N = 2$ years, rate of interest $R = 8\%$ per annum
- simple interest = $\frac{PNR}{100} = \frac{100 \times 8 \times 2}{100} = \text{Rs. } 16$
- compound amount = $P(1 + \frac{R}{100})^N$
- $= 100 \times (1 + \frac{8}{100})^2 = 100 \times (\frac{108}{100})^2 = 100 \times (\frac{11664}{10000}) = \frac{11664}{100} = 116.64$
- compound interest = compound amount – principal
- $C.I = A - P$
 $= 116.64 - 100 = \text{Rs. } 16.64$
- the difference between the compound interest and simple interest = $16.64 - 16.00 = \text{Rs. } 0.64$
- $0.64 \rightarrow 100$
- $128 \rightarrow ?$
- $= \frac{128 \times 100}{0.64} = 20000$
- Thus, the principal is Rs. 20000.

Interest

- If the difference between compound and simple interest is of **two years** than,
Difference = $P(R)^2/(100)^2$
Where P = principal amount, R = rate of interest
- If the difference between compound and simple interest is of **three years** than,
Difference = $3 \times P(R)^2/(100)^2 + P (R/100)^3$.
Here also, P = principal amount, R = rate of interest



Interest

Q.A started business with Rs. 45,000 and B joined afterwards with 30,000. If the profit at the end of a year was divided in the ratio 2 : 1 respectively, then B would have joined A for business after.

A. 1 month

B. 2 months

C. 3 months

D. 4 months

Soln:

- Capital of A = Rs. 45,000 Capital of B = Rs. 30,000
- Ratio of P1:P2=2:1
- using formula,
- $\frac{C_1T_1}{C_2T_2} = \frac{P_1}{P_2}$
- In this type , the time period is 12 months i.e. one year
- $\frac{45000 \times 12}{30000 \times T_2} = \frac{2}{1}$
- $T_2=9$
- B would join business after $(12 - 9) = 3$ months
- **Ans: C**



Interest

Q. If 4 (A's capital) = 6 (B's capital) = 10 (C's capital), then out of a profit of Rs. 4650, C will receive _____

A) Rs.700

B) Rs.800

C) Rs.900

D) Rs.1000

Soln:

$$4A = 6B = 10C$$

$$A = 10/4C = 5/2C \quad \text{and} \quad B = 10/6C = 5/3C$$

$$A + B + C = 4650$$

$$5/2C + 5/3C + C = 4650$$

$$C = 900$$

Share of C or C will receive Rs.900

Ans: C



Partnership

Q. A, B & C enter into a partnership with total of Rs 8,200. A's capital is Rs 1000 more than B's & Rs 2000 less than C's. What is B's share of annual profit of Rs 2,460?

A. Rs 1320

B. Rs 720

C. Rs 420

D. Rs 520

Ans: C



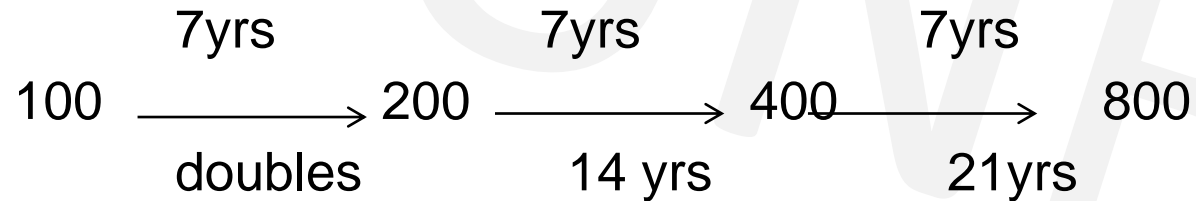
Interest(Assignment)

Q. A sum of money placed at compound interest doubles in 7 years. In how many years the principal becomes-

- a. 4 times of itself
- b. 8 times of itself

Soln:

Let initial value be 100



- a. In 14yrs
- b. In 21 yrs

OR

100----->200 in 7 years

200----->400 in again 7 years then,

400----->800 in 7 years again, thus

the time becomes= $7+7+7=21$ years.



Interest(Assignment)

Q. A started a business by investing Rs. 32000. After 2 months B joined him with some investments. At the end of the year the total profit was divided in the ratio 8:5. How much capital was invested by B?

A. Rs. 30,000 B. Rs. 28000 C. Rs. 24000 D. Rs. 19000

- Soln:
- using formula,
- $\frac{C_1 T_1}{C_2 T_2} = \frac{P_1}{P_2}$
- $\frac{32000 \times 12}{C_2 \times 10} = \frac{8}{5}$
- $C_2 = \text{Rs. } 24000$

Ans: C



Interest(Assignment)

Q. When annual compounding is done, a sum amounts to Rs 5000 in 6 years and 7200 in 8 years.
What is the int rate?

A. 10%

B. 15%

C. 20%

D. 25%

Soln

Let P be the principal & R the int rate

$$\rightarrow 5000 = P(1+R/100)^6 \dots\dots(1)$$

$$\rightarrow 7200 = P(1+R/100)^8 \dots\dots(2)$$

$$\rightarrow 36/25 = (1+R/100)^2$$

\rightarrow Taking square roots of both sides

$$\rightarrow 1+R/100 = 6/5$$

$$\rightarrow R/100 = 1/5$$

$$\rightarrow R = 20\%$$

Ans: C



Interest(Assignment)

Q. A sum fetched a total simple interest of Rs.7056 at the rate of 8 percent per year in 7 years. What is the sum?

A. Rs 12600

B) Rs 15120

C) Rs 10080

D) Rs 7560

Ans : A



Interest(Assignment)

Q. Find the compound interest on Rs. 15,625 for 9 months at 16% per annum compounded quarterly.

A. Rs. 1851

B. Rs. 1941

C. Rs. 1951

D. Rs. 1961

Ans: C



Interest(Assignment)

Q. What is the difference between the simple interest on a principal of Rs. 500 being calculated at 5% per annum for 3 years and 4% per annum for 4 years?

A.Rs. 5 B.Rs. 10 C.Rs. 20 D.Rs. 40 E. None of these

$$\begin{aligned} SI_1 &= P N_1 R_1 / 100 \\ &= \frac{500 \times 3 \times 5}{100} = \text{Rs. } 75 \end{aligned}$$

$$\begin{aligned} SI_2 &= P N_2 R_2 / 100 \\ &= \frac{500 \times 4 \times 4}{100} = \text{Rs. } 80 \end{aligned}$$

$$\text{Difference} = 80 - 75 = \text{Rs. } 5$$

OR

$$500 \Rightarrow 15\% \uparrow \Rightarrow 575 \text{ (1st case)}$$

$$500 \Rightarrow 16\% \uparrow \Rightarrow 580 \text{ (2nd case)}$$

$$\text{difference} = 580 - 575 = \text{Rs. } 5$$

Ans : A



Interest(Assignment)

Q. A sum of money placed at compound interest doubles itself in 4 years. In how many years will it amount to 8 times?

A. 9 years

B. 8 years

C. 27 years

D. 12 years

Ans: D



Interest(Assignment)

Q. Difference between Compound interest & simple interest on a sum placed at 20% per annum compounded annually for 2 years is Rs. 72. Find the sum.

A. Rs. 2400

B. Rs. 8400

C. Rs. 1800

D. Rs. 900

Ans : C



Interest(Assignment)

Q. What is the simple interest on a sum of Rs. 700 if the rate of interest for the first 3 years is 8% per annum and for the last 2 years is 7.5% per annum?

A.Rs. 269.5 B.Rs. 283 C.Rs. 273 D.Rs. 280 E. None of these

Ans: C



Interest(Assignment)

Q. Rs.2100 is lent at compound interest of 5% per annum for 2 years. Find the amount after two years.

- A.Rs. 2300 B.Rs. 2315.25 C.Rs. 2310 D.Rs. 2320 E. None of these

• **Soln:**

• $A = P (1 + R/100)^T$

• $A = 2100(1+5/100)^2$

• $A = 2100 \times [105/100]^2$

• $A = \frac{2100 \times 11025}{10000}$

• Amount, A=Rs.2315.25

• **Ans : B**



Interest(Assignment)

Q. A man borrowed total Rs 2500 at Simple interest from two money lenders. He paid interest at 12% p.a. to one and 14% p.a. to the other. The total interest paid for the year was Rs.326. How much did he borrow at 14%?

A. Rs 1000

B. Rs 1200

C. Rs 1300

D. Rs 1500

Soln:

Let, x = Principal at 12%

&

$2500 - x$ = Principal at 14%

$$\text{SI at Rs. } x = \frac{x \times 1 \times 12}{100} = \frac{12x}{100} = \frac{3x}{25}$$

$$\text{SI at Rs. } 2500 - x = \frac{2500 - x \times 1 \times 14}{100} = \frac{(2500 - x) \times 7}{50} = \frac{17500 - 7x}{50}$$

$$\text{SI at } x + \text{SI at } 2500 - x = 326$$

Substitute and solving the equation gives $x = \text{Rs. } 1200$

We need Principal at $2500 - x = 2500 - 1200 = \text{Rs. } 1300$

Ans: C



Interest(Assignment)

Q.A certain sum of money amounts to Rs. 704 in two years and Rs 800 in 5 years. Find the Principal.

- A. Rs. 640 B. Rs. 600 C. Rs. 550 D. Rs.450
- **Ans: A**



Interest(Assignment)

Q. A started a business by investing Rs. 32000. After 4 months B joined him with some investments. At the end of the year the total profit was divided in the ratio 6:5. How much capital was invested by B?

A. Rs. 30,000

B. Rs. 28000

C. Rs. 40000

D. Rs. 19000

Ans: C



Interest(Assignment)

Q. Three persons started a placement business with a capital of Rs. 3000. B invests Rs. 600 less than A and C invests Rs. 300 less than B. What is B's share in a profit of Rs. 886 ?

- A. Rs. 443
- B. Rs. 354.40
- C. Rs. 265.80
- D. Rs. 177.20

Ans: C



Interest(Assignment)

Q. What should be the simple interest obtained on an amount of Rs 5,760 at the rate of 6% p.a. after 3 years?

- A. Rs 1036.80
- B. Rs 1666.80
- C. Rs 1336.80
- D. Rs 1063.80
- E. None of these

Ans : A



Interest(Assignment)

Q. Anand and Deepak started a business investing Rs.22,500 and Rs.35,000 respectively. Out of a total profit of Rs. 13,800. Deepak's share is

A. Rs 9600

B. Rs 8500

C. Rs 8450

D. Rs 8400

Ans: D

Ratio of their shares-

= 22500 : 35000

= 9 : 14

Deepak's share = Rs.(13800×14/23)

= Rs. 8400



Interest(Assignment)

Q. A started a business with Rs. 21,000 and is joined afterwards by B with Rs. 36,000. After how many months did B join if the profits at the end of the year are divided equally?

A. 4

B. 5

C. 6

D. 7

Ans: B

- Capital of A = Rs. 21000
- Capital of B = Rs. 36000
- Ratio of P1:P2=1:1
- using formula,
- $\frac{C_1T_1}{C_2T_2} = \frac{P_1}{P_2}$
- In this type , the time period is 12 months i.e. one year
- $\frac{21000 \times 12}{36000 \times T_2} = \frac{1}{1}$
- $T_2 = 7$
- B would join business after $(12 - 7) = 5$ months



Interest(Assignment)

Q. A,B,C subscribes Rs. 50000 for a buisness. A subscribes Rs. 4000 more than B and B Rs. 5000 more than C. Out of a total profit of Rs. 35000, A receives :

- A. Rs. 8400
- B. Rs. 11900
- C. Rs. 13600
- D. Rs. 14700

Ans: D



Interest(Assignment)


Q. The simple interest on Rs.1820 from March 9, 2012 to May 21, 2012 at 7.5% rate will be

- A. Rs. 22.50
- B. Rs. 27.30
- C. Rs. 28.80
- D. Rs. 29

Ans: B



Calendar

- In Non Leap year –
 - 365 days
 - 1 year = 52 weeks + 1 odd day(extra day)
 - 28th February
- In Leap year –
 - 366 days
 - 1 year = 52 weeks + 2 odd days
 - 29th February 
- A **century leap year** is a **year** that is exactly divisible by 400
 - **years** 1600 and 2000 were **century leap years**; (400,800,1200,1600,2000 – century leap years till date)
 - **years** 1700, 1800, and 1900 were not **century leap years**.
- To find the day of a week on a given date we use the concept of “**odd days**”.
- 01/01/0001 A.D(Anno Domini) was a Monday and 1st day of week so 1st January 0001 was a Monday.



Calendar

- In a century,
 - 24 leap year
 - 76 non leap years

100 years

Leap year non leap year

$$\begin{array}{rcl} 24 \times 2 & + & 76 \times 1 \\ = \frac{48}{7} & & = \frac{76}{7} \\ \downarrow & & \downarrow \\ 6 & + & 6 \end{array}$$

remainder

$$= 12 \div 7 = 5 \leftarrow \text{remainder}$$

5 extra(odd) days in a century (100 years)

100 years = 5 odd days ← remainder

200 years = $10 \div 7 = 3$ odd days

300 years = $15 \div 7 = 1$ odd days

400 years = 0 odd days (as century leap year)



Calendar

Years	No. of odd
Ordinary year	1
Leap year	2
100 years	5
200 years	3
300 years	1
400 years	0

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Calendar

Day of week	No. of odd
Sunday	0
Monday	1
Tuesday	2
Wednesday	3
Thursday	4
Friday	5
Saturday	6

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Calendar

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Month		Remainder
January	$31 \div 7$	3
February	$28 \div 7$ or $29 \div 7$	0(non leap) or 1(leap)
March	$31 \div 7$	3
April	$30 \div 7$	2
May	$31 \div 7$	3
June	$30 \div 7$	2
July	$31 \div 7$	3
August	$31 \div 7$	3
September	$30 \div 7$	2
October	$31 \div 7$	3
November	$30 \div 7$	2
December	$31 \div 7$	3

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Calendar

Q. What was the day of the week on 15th August, 1947?

Soln:

Completed till 1946

$$\begin{array}{l} 1946 \\ \swarrow \quad \searrow \\ \frac{1900}{400} = 300 \quad \frac{46}{4} = 11(\text{quotient}) \\ \downarrow \quad \quad \quad \downarrow \\ 1 \text{ odd day} \quad 46 + 11 = 57 \quad \frac{57}{7} = 1(\text{remainder}) \end{array}$$

In 1946, odd days are,

$$\begin{array}{rcl} 1900 & 46 & \\ 1 & + & 1 = 2 \text{ odd days} \end{array}$$

1946 month date

$$\text{Total odd days} = 2 + 2 + 1 = 5 \text{ odd days}$$

As per table for days of a week , 5 \longleftrightarrow Friday

As month is August, go till July as per table,

$$\begin{array}{cccccc} J & F & M & A & M & J & J \\ 3 & + & 0 & + & 3 & + & 2 & + & 3 & + & 2 & + & 3 & = & 16 \end{array}$$

$$\text{Now, } \frac{16}{7} = 2 \text{ (remainder)}$$

$$\begin{array}{l} \text{For date ,} \\ \frac{15}{7} = 1 \text{ (remainder)} \end{array}$$



Calendar

For Months -

J	F	M	A	M	J	J	A	S	O	N	D
0	3	3	6	1	4	6	2	5	0	3	5

For years -

1600 – 1699	6
1700 – 1799	4
1800 – 1899	2
1900 – 1999	0
2000 – 2099	6



Calendar

Q. What was the day of the week on 26th January, 1947?

Soln:

1. Last 2 digits of the year → 47
 2. Divide by 4 ($47 \div 4$) = 11 (quotient)
 3. Take the date → 26
 4. Take the no. of month → 0 (from table)
 5. Take the no. of year → 0 (from table)
- 84

(add)
- $\frac{84}{7} = 0$ (remainder)
6. Divide by 7 →

Check table for day of the week

0 ↔ Sunday



Calendar

Q. What was the day of the week on 29th February, 2012?

Soln:

1. Last 2 digits of the year → 12
2. Divide by 4 ($12 \div 4$) = 03(quotient)
3. Take the date → 29
4. Take the no. of month → 03 (from table)
5. Take the no. of year → 06 (from table)

53 (add)

6. Divide by 7 → $\frac{53}{7} = 4$ (remainder)

subtract 1 from remainder

In this case for all dates of **January & February** in a leap year , $4 - 1 = 3$

Check table for day of the week

3 \longleftrightarrow Wednesday



Calendar

Q. Today is Monday. Which day will be on 61st day?

Soln:

1 week = 7 days. Taking the multiple of 7

56 - Monday

or

63 - Monday

57 - Tuesday

62 - Sunday

58 - Wednesday

61 - Saturday

59 - Thursday

60 - Friday

61 - Saturday

$56 + 5 = 61$ days

(add 5 days)

or

$63 - 61 = 2$ days

(subtract 2 days)



Calendar

Q. What dates of May 2002 did Monday fall on?

Soln:

Lets take date = 1st May 2002

1. Last 2 digits of the year → 02
 2. Divide by 4 ($02 \div 4$) = 00 (quotient)
 3. Take the date → 01
 4. Take the no. of month → 01 (from table)
 5. Take the no. of year → 06 (from table)
-
- 10 (add)
6. Divide by 7 → $\frac{10}{7} = 3$ (remainder)

Check table for day of the week

3 ↔ Wednesday

1st May 2002 falls on Wednesday

1	2	3	4	5	6
W	Th	F	Sa	Su	M

↑
first Monday

Now add 7 to it to find remaining Mondays

Dates on which Monday falls are -
6, 13, 20, 27



Calendar

Q. If we have preserved the calendar of 2017. Find the next immediate year in which we can reuse.

A. 2027

B. 2023

C. 2025

D. 2029

Soln:

$x/4$ (x = given year)

$$\frac{2017}{4} = 1 \text{ (remainder)}$$

For any year divide by 4, the possibility of remainder is 0,1,2,3

If remainder = 0 $\rightarrow x + 28$

If remainder = 1 $\rightarrow x + 6$

If remainder = 2/3 $\rightarrow x + 11$

So, $\frac{2017}{4} = 1 \text{ (remainder)}$

$$2017 + 6 = 2023$$

Ans: B



Calendar

Q. Which of the following days can never be the last day of a century?

A. Sunday B. Monday C. Tuesday D. Wednesday

- **Soln:**
- The last day of century can be only
- 1 odd day(Monday)
- 3 odd days (Wednesday)
- 5 odd days (Friday)
- 7 or 0 odd days (Sunday)
- So, century can never end in **Tuesday** , **Thursday** or **Saturday**.
- **Ans: C**



Calendar

- Q. The day on 5th April of a year will be the same day on 5th of which month of the same year?
- A. 5th July B. 5th August C. 5th June D. 5th October
- **Ans A**
- April & July for all years have the same calendar. So, a day on any date of April will be the same day on the corresponding date in July.
- The same day will fall on 5th July of the same year.



Calendar(Assignment)

Q. What was the day of the week on your birthdate?

Q. 13th October 2019 is a Sunday. Find the day on 13th October 1989?

A. Sunday B. Monday C. Friday D. Wednesday

Ans: C

Q. 1st March 2006 falls on a Wednesday .What day does 1st March 2010 fall on?

A. Tuesday B. Monday C. Friday D. Wednesday

Ans: B

Q. Today is Monday. Which day will be after 64 days?

A. Tuesday B. Monday C. Friday D. Wednesday

Ans: A

Q. Today is Monday. After 30 days it will be?

A. Tuesday B. Monday C. Friday D. Wednesday

B. Ans: D



Calendar(Assignment)

Q. 15th August 1947 was a Friday. Find the day on 15th August 1977?

• Soln:

$$\begin{array}{r} 1977 \\ - 1947 \\ \hline 30 \text{ years} \end{array}$$

Leap years between 1947 to 1977

1948	1964	} 8 years
1952	1968	
1956	1972	
1960	1976	

$$30 + 8 = 38$$

total years leap

$$\frac{38}{7} = 3 \text{ (remainder)}$$

As 15th August 1947 was a Friday ,

So, Friday + 3 days = **Monday**



Calendar(Assignment)

Q. 4th January 2016 falls on Monday. What day of the week does 4th January 2017 lies?

A. Wednesday

B. Thursday

C. Tuesday

D. Monday

Soln:

Normal year = 1 odd day

Leap year = 2 odd days

Jan 4, 2016 → Monday

+ 2 (as leap year)

Jan 4, 2017 → Wednesday

Ans: A



Calendar(Assignment)

Q. Wednesday falls on 5th of a month .So which day will fall 5 days after 22nd of the same month?

A. Tuesday

B. Friday

C. Thursday

D. Wednesday

Ans: B

5th = Wednesday

+7

12th = Wednesday

+7

19th = Wednesday

22nd = Saturday

+5

27th = Thursday

5 days after 22nd will be **Friday**



Calendar(Assignment)

Q. On what dates of April, 2001 did Wednesday fall?

A. 1st, 8th, 15th, 22nd, 29th

B. 2nd, 9th, 16th, 23rd, 30th

C. 3rd, 10th, 17th, 24th

D. 4th, 11th, 18th, 25th

Ans: D



Calendar(Assignment)

Q. What is the day on 22 April 2222?

A. Monday

B. Tuesday

C. Saturday

D. Sunday

Ans: A



Calendar(Assignment)

Which of the following is not a leap year?

- A. 700 B. 800 C. 1200 D. 2000

Ans: A

The century divisible by 400 is a leap year.
The year 700 is not a leap year.



Calendar(Assignment)

It was Sunday on Jan 1, 2006. What was the day of the week Jan 1, 2010?

A. Sunday

B. Saturday

C. Friday

D. Wednesday

Ans: C

On 31st December, 2005 it was Saturday.

Number of odd days from the year 2006 to the year 2009 = $(1 + 1 + 2 + 1) = 5$ days.

On 31st December 2009, it was Thursday.

on 1st Jan, 2010 it is Friday.



Calendar(Assignment)

Q. January 1, 2007 was Monday. What day of the week lies on Jan. 1, 2008?

- A. Monday
- B. Tuesday
- C. Wednesday
- D. Sunday

Ans: B



Permutation & Combination

- What is permutation?
- It is the number of ways a group of things can be arranged.

E.g: Consider 3 letters A,B,C . In how many ways they can be arranged?

- A B C
 - A C B
 - B A C
 - B C A
 - C A B
 - C B A
- 6 ways to arrange these 3 letters

- For 3 letter / 4 letter words its possible but for more number of letters we need a formula-
- $nPr = \frac{n!}{(n-r)!}$



Permutation & Combination

Q. Consider 4 letters A,B,C,D and arrange them in 3 spaces

- - - 3 spaces

No . Of letters = 4

No of spaces = 3

$$nPr = 4P_3 = \frac{4!}{(4-3)!} = \frac{4!}{1!} = 4! = 4 \times 3 \times 2 \times 1 = 24 \text{ ways it can be arranged}$$

Q. Arrange 7 letters A,B,C,D,E,F,G in 4 spaces

- - - - 4 spaces

$$nPr = 7P_4 = \frac{7!}{(7-4)!} = \frac{7!}{3!} = \frac{5040}{6} = 840$$



Permutation & Combination - Remember

$$0! = 1$$

$$1! = 1$$

$$2! = 2 \times 1 = 2$$

$$3! = 3 \times 2 \times 1 = 6$$

$$4! = 4 \times 3 \times 2 \times 1 = 24$$

$$5! = 5 \times 4 \times 3 \times 2 \times 1 = 120$$

$$6! = 6 \times 5 \times 4 \times 3 \times 2 \times 1 = 720$$

$$7! = 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1 = 5040$$



Difference between permutation and combination

Combination (order does not matter)

"My fruit salad is a combination of apples, grapes and bananas" We don't care what order the fruits are in, they could also be "bananas, grapes and apples" or "grapes, apples and bananas", its the same fruit salad.



Permutation (When the order does matter)

"The combination to the safe is 472". Now we **do** care about the order. "724" won't work, nor will "247". It has to be exactly **4-7-2**.



Difference between permutation and combination

What is permutation?

Permutation: The various ways of arranging a given number of things by taking some or all at a time are all called as permutations.

Permutation includes word formation, number formation, circular permutation, etc. **In permutation, objects are to be arranged in particular order.** It is denoted by ${}^n P_r$ or $P(n, r)$.

Example: Arrange the given 3 numbers 1, 2, 3 by taking two at a time.

Now these numbers can be arranged in 6 different ways: **(12, 21, 13, 31, 23, 32).**

Here,

12 and 21, 13 and 31 or 23 and 32 do not mean the same, because here order of numbers is important.



Difference between permutation and combination

- **What is combination?**

Combination: Each of different groups or selections formed by taking some or all number of objects is called a combination.

Combination is used in different cases which include team/group/committee.

In combination, objects are selected randomly and here order of objects doesn't matter. It is denoted by ${}^n C_r$ or $C(n, r)$ or ${}^n C_r = {}^n C_{(n-r)}$.

Example: If we have to select two girls out of 3 girls X, Y, Z, then find the number of combinations possible.

Now only two girls are to be selected and arranged. Hence, this is possible in 3 different ways: (XY, YZ, XZ,).

Here,
You cannot make a combination as XY and YX, because these combinations mean the same.



Permutation & Combination

Q. In how many ways can the letters of the word 'LEADER' be arranged?

A. 72 B. 144 C. 360 D. 720 E. None of these

Soln:

The word LEADER has 6 letters. So it can be arranged in $6!$ ways.

Out of these 6 letters, 2 letters are repeated (letter E repeated twice)

So we write it as - $\frac{6!}{2!}$

$6!$ → 6! ways to arrange letters in the word LEADER

$2!$ → 2! In the denominator as letter E is repeated twice

$$= \frac{6 \times 5 \times 4 \times 3 \times 2 \times 1}{2 \times 1}$$

$$= 360 \text{ ways}$$

Ans : C



Permutation & Combination

Q. In how many different ways can the letters of the word 'LEADING' be arranged in such a way that the vowels always come together?

- A. 360 B. 480 C. 720 D. 5040 E. None of these

Soln:

L E A D I N G \longrightarrow vowels in this word are E, A I

Remaining letters(consonants) are - L D N G

now we can arrange the vowels together in the remaining spaces as

_ L _ D _ N _ G _ in 5! ways and vowels be rearranged in those spaces in 3! ways

$$5! \times 3! = 720 \text{ ways}$$

Ans : C



Permutation & Combination

Q. In how many different ways can the letters of the word 'CORPORATION' be arranged so that the vowels always come together?

- A. 810 B. 1440 C. 2880 D. 50400 E. 5760

Soln:

C O R P O R A T I O N----- vowels in this word are O,O,A,I,O

Remaining letters(consonants) are - C R P R T N

now we can arrange the vowels together in the remaining spaces as

_C_R_P_R_T_N_ in 7! ways and vowels be rearranged in those spaces in 5! Ways

But the repeated letters are 2R in consonants and 3O in vowels

$$\frac{7!}{2!} \times \frac{5!}{3!} = 50400 \text{ ways}$$

Ans : D



Permutation & Combination

Q. Out of 7 consonants and 4 vowels, how many words of 3 consonants and 2 vowels can be formed?

- A. 210 B. 1050 C. 25200 D. 21400 E. None of these

Soln:

we need to form a 5 letter word with 3 consonants & 2 vowels = C C C V V

Ways to select, (3 consonants out of 7) AND (2 vowels out of 4)

$$= {}^7C_3 \times {}^4C_2 \times 5! \quad \leftarrow \text{each group has 5 letters and they can be arranged in } 5! \text{ ways}$$

$$= \frac{7 \times 6 \times 5}{3 \times 2 \times 1} \times \frac{4 \times 3}{2 \times 1} \times 5!$$

$$= 35 \times 6 \times 120$$

$$= 25200 \text{ ways}$$

Ans : C



Permutation & Combination

Q. In how many different ways can the letters of the word 'DETAIL' be arranged in such a way that the vowels occupy only the odd positions?

- A. 32 B. 48 C. 36 D. 60 E. 120

Ans: C



Permutation & Combination

Q. 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?

- A. 564 B. 645 C. 735 D. 756 E. None of these

Soln:

We may have (3 men and 2 women) or (4 men and 1 woman) or (5 men only).

Required number of ways = $({}^7C_3 \times {}^6C_2) + ({}^7C_4 \times {}^6C_1) + ({}^7C_5)$

$$\begin{aligned} &= \left(\frac{7 \times 6 \times 5}{3 \times 2 \times 1} \times \frac{6 \times 5}{2 \times 1} \right) + ({}^7C_3 \times {}^6C_1) + ({}^7C_2) \rightarrow [\text{using } {}^nC_r = {}^nC_{(n-r)}] \\ &= 525 + \left(\frac{7 \times 6 \times 5}{3 \times 2 \times 1} \times \frac{6}{1} \right) + \left(\frac{7 \times 6}{2 \times 1} \right) \\ &= 525 + 210 + 21 \\ &= 756 \end{aligned}$$

Ans: D



Permutation & Combination(Assignment)

Q. In a group of 6 boys and 4 girls, four children are to be selected. In how many different ways can they be selected such that at least one boy should be there?

- A. 159 B. 194 C. 205 D. 209 E. None of these

Soln:

(1 boy and 3 girls) or (2 boys and 2 girls) or (3 boys and 1 girl) or (4 boys).

$$= ({}^6C_1 \times {}^4C_3) + ({}^6C_2 \times {}^4C_2) + ({}^6C_3 \times {}^4C_1) + ({}^6C_4)$$

$$= ({}^6C_1 \times {}^4C_1) + ({}^6C_2 \times {}^4C_2) + ({}^6C_3 \times {}^4C_1) + ({}^6C_2) \quad \rightarrow \text{using } {}^nC_r = {}^nC_{(n-r)} \text{ (to reduce calculation)}$$

$$= (6 \times 4) + \left(\frac{6 \times 5}{2 \times 1} \times \frac{4 \times 3}{2 \times 1} \right) + \left(\frac{6 \times 5 \times 4}{3 \times 2 \times 1} \times 4 \right) + \frac{6 \times 5}{2 \times 1}$$

$$= (24 + 90 + 80 + 15)$$

$$= 209$$

Ans: D



Permutation & Combination(Assignment)

Q. How many 4-letter words with or without meaning, can be formed out of the letters of the word, 'LOGARITHMS', if repetition of letters is not allowed?

- A. 40
- B. 400
- C. 5040
- D. 2520

Ans: C



Permutation & Combination(Assignment)

Q. In how many different ways can the letters of the word 'MATHEMATICS' be arranged so that the vowels always come together?

- A. 10080
- B. 4989600
- C. 120960
- D. None of these

Ans: C



Permutation & Combination(Assignment)

Q. In how many different ways can the letters of the word 'OPTICAL' be arranged so that the vowels always come together?

- A. 120
- B. 720
- C. 4320
- D. 2160
- E. None of these

Ans: B



Permutation & Combination(Assignment)

Q. How many Permutations of the letters of the word APPLE are there?

A.600 B.120 C.240 D.60

Ans: D



Permutation & Combination(Assignment)

Q. How many different words can be formed using all the letters of the word ALLAHABAD?

A.7560

B.7890

C.7650

D. None of these

Ans: A



Permutation & Combination(Assignment)

Q. Find the value of ${}^{50}P_2$

- A. 4500
- B. 3260
- C. 2450
- D. 1470

Ans : C



Permutation & Combination(Assignment)

Q. How many words can be formed by using letters of the word 'DELHI'?

- a. 50
- b. 72
- c. 85
- d. 120

Ans : D



Permutation & Combination(Assignment)

Q. Find the number of ways the letters of the word 'RUBBER' can be arranged?

- A. 450
- B. 362
- C. 250
- D. 180

Ans: D



Permutation & Combination(Assignment)

Q. Out of 5 consonants and 4 vowels, how many words of 3 consonants and 2 vowels can be formed?

- A. 60
- B. 200
- C. 5230
- D. 7200

Ans : D



Permutation & Combination(Assignment)

Q. In how many ways can a group of 5 men and 2 women be made out of a total of 7 men and 3 women?

- A. 63
- B. 90
- C. 126
- D. 45
- E. 135

Ans: A



IMPORTANT FORMULAE

- **I.1.**Area of a rectangle=(length x breadth)
- Therefore length = (area/breadth) and breadth=(area/length)
- **2.**Perimeter of a rectangle = 2 x (length + breadth)
- **II.**Area of a square = (side)² =1/2(diagonal)²
- **III** Area of four walls of a room = 2*(length + breadth)*(height)
- **IV** 1.Area of the triangle=1/2(base*height)
- 2. Area of a triangle = (s*(s-a)(s-b)(s-c))^(1/2), where a,b,c are the sides of a triangle & s= ½(a+b+c)
- 3.Area of the equilateral triangle =((3^{1/2})/4)*(side)²



IMPORTANT FORMULAE

- **V.1.**Area of the parellogram =(base *height)
- 2.Area of the rhombus= $\frac{1}{2}$ (product of the diagonals)
- 3.Area of the trapezium= $\frac{1}{2}$ (size of parallel sides)*distance between them.
- **VI** 1.Area of a circle = πr^2 ,where r is the radius
- 2. Circumference of a circle = $2\pi R$.
- 3. Length of an arc = $\frac{2\pi R\theta}{360}$ where θ is the central angle
- 4. Area of a sector = $(\frac{1}{2}) (\text{arc} \times R) = \frac{\pi R^2 \theta}{360}$.
- **VII.** 1. Area of a semi-circle = $(\pi) R^2$.
- 2. Circumference of a semi-circle = $(\pi) R$.
- where, **π** = 3.142



VOLUME AND SURFACE AREA – IMPORTANT FORMULAE

- **I. CUBOID**

- Let length = l, breadth = b and height = h units. Then,
- **1. Volume** = (l x b x h) cubic.units.
- **2. Surface area** = $2(lb + bh + lh)$ sq.units.
- **3. Diagonal** = $\sqrt{l^2 + b^2 + h^2}$ units

- **II. CUBE**

- Let each edge of a cube be of length a. Then,
- **1. Volume** = a^3 cubic units.
- **2. Surface area** = $6a^2$ sq. units.
- **3. Diagonal** = $\sqrt{3} a$ units.

- **III. CYLINDER**

- Let radius of base = r and Height (or length) = h. Then,
- **1. Volume** = ($\pi r^2 h$) cubic units.
- **2. Curved surface area** = ($2\pi rh$). units.
- **3. Total surface area** = $2\pi r (h+r)$ sq. units



VOLUME AND SURFACE AREA – IMPORTANT FORMULAE

- **IV. CONE**

- Let radius of base = r and Height = h . Then,
- **1. Slant height, $l = \sqrt{h^2 + r^2}$**
- **2. Volume** = $(1/3) \pi r^2 h$ cubic units.
- **3. Curved surface area** = (πrl) sq. units.
- **4. Total surface area** = $(\pi rl + \pi r^2)$ sq. units.

- **V. SPHERE**

- Let the radius of the sphere be r . Then,
- **1. Volume** = $(4/3) \pi r^3$ cubic units.
- **2. Surface area** = $(4 \pi r^2)$ sq. units.

- **VI. HEMISPHERE**

- Let the radius of a hemisphere be r . Then,
- **1. Volume** = $(2/3) \pi r^3$ cubic units.
- **2. Curved surface area** = $(2 \pi r^2)$ sq. units.
- **3. Total surface area** = $(3 \pi r^2)$ units.



Surds and Indices

○ Rules of Indices: -

- i. $a^n * a^m = a^{m+n}$
- ii. $\frac{a^m}{a^n} = a^{m-n}$
- iii. $(a^n)^m = a^{mn}$
- iv. $(ab)^n = a^n * b^n$
- v. $\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$
- vi. $a^0 = 1$ (where $a \neq 0$)
- vii. $a^{-n} = \frac{1}{a^n}$

○ Rules of Surds: -

- i. $\sqrt[n]{a} = a^{\frac{1}{n}}$
- ii. $\sqrt[n]{ab} = a^{\frac{1}{n}} * b^{\frac{1}{n}}$
- iii. $\sqrt[n]{\frac{a}{b}} = \frac{a^{\frac{1}{n}}}{b^{\frac{1}{n}}}$
- iv. $\left(\sqrt[n]{a}\right)^n = a$
- v. $\left(\sqrt[n]{a}\right)^m = a^{\frac{m}{n}}$



Races

Races

- A contest of speed in running, riding, driving, sailing or rowing is called a race.
- If in a race Ram is at starting point & Shyam starts from 20 mts ahead, then it is said that Ram has given Shyam a start of 20 mts or Ram gives Shyam 20 mts.
- This means that if they start from same point Ram would beat Shyam by 20 mts.



Races

Q. In a 100 mt race A gives B a start of 25 mt & still wins by 9 sec. Find the speed of A if speed of B is 6 kmph.

A. 8 kmph

B. 9 kmph

C. 10 kmph

D. 12 kmph

Soln

!-----100 m-----!
A<---25--->B<-----75m-----> A=t-9, B=t

$$S_b = 6 \text{ kmph} = 6 \times \frac{5}{18} = \frac{5}{3} \text{ m/s}$$

$$T_b = D_b / S_b = 75 / (\frac{5}{3}) = 45 \text{ sec}$$

$$T_a = T_b - 9 = 36 \text{ sec}$$

$$\begin{aligned} S_a &= D_a / T_a \\ &= 100 / 36 \text{ m/s} \\ &= 100 / 36 \times \frac{18}{5} \\ &= 10 \text{ kmph} \end{aligned}$$

Ans C



Races(Assignment)

Q. In a 100 m race, A can beat B by 25 m and B can beat C by 4 m. In the same race, A can beat C by:

A. 21 m

B. 26 m

C. 28 m

D. 29 m

• **Soln:-**

$$A : B = 100 : 75$$

$$B : C = 100 : 96$$

$$A:C=(\frac{A}{B}\times\frac{B}{C})=(\frac{100}{75}\times\frac{100}{96})=100:72$$

A beats C by $(100-72)=28$ m.

Ans: C



Circular Motion

- Use of both relative speed & LCM
- Let S_a, S_b = speeds of two persons.

S_r = Their relative speed

Distance traveled in 1 round = circumference

Case A : Both running in Same direction

Both meet again first time when \rightarrow **Time = dist/ S_r = Circumference/ $S_a - S_b$**

Case B : Both running in opposite directions(**DistA+ DistB =Circumference**)

Both meet first time when \rightarrow **Time = Circumference/ $S_a + S_b$**

Case C : Both running in same/opposite directions

Both meet again at starting point at LCM of their Lap times.



Circular Motion(Races)

Q. Two friends P & Q start from same point at the same time on a circular track 336 meters long in opposite directions at 6 m/s & 8 m/s respectively. After how much time will they meet again at the starting point for the first time?

A. 56 sec

B. 112 sec

C. 168 sec

D. 214 sec

Ans : C

Step1 – find the time taken by each member /player to complete 1 round

Step2 – Calculate LCM(Lap time)

$$\text{LapTm(P)} = \frac{\text{Circumference}}{S_p} = \frac{336}{6} = 56 \text{ sec}$$

$$\text{LapTm(Q)} = \frac{\text{Circumference}}{S_Q} = \frac{336}{8} = 42 \text{ sec}$$

$$\text{LCM}(42,56) = 168 \text{ sec}$$



Circular Motion(Assignment)

Q. A, B & C start together running along a circular track of 500 m at 8 km/hr, 5 km/hr & 3 km/hr respectively. After how much time will all three meet again at the starting point for the first time?

A. 20 min

B. 24 min

C. 30 min

D. 36 min

Ans: C



