27. CALENDAR

IMPORTANT FACTS AND FORMULAE

Under this heading we mainly deal with finding the day of the week on a particular given date. The process of finding it lies on obtaining the number of odd days.

I. **Odd Days** : Number of days more than the complete number of weeks in a given period is the number of odd days during that period.

II. **Leap Year** : Every year which is divisible by 4 is called a leap year.

Thus, each one of the years 1992, 1996, 2004, 2008, 2012, etc. is a leap year.

Every 4th century is a leap year but no other century is a leap year.

Thus, each one of 400, 800, 1200, 1600, 2000, etc. is a leap year.

None of 1900, 2010, 2020, 2100, etc. is a leap year.

An year which is not a leap year is called an ordinary year.

III. (*i*) *An ordinary year has 365 days.* (*ii*) *A leap year has 366 days.*

IV. **Counting of Odd Days :**

(*i*) 1 ordinary year = 365 days = (52 weeks + 1 day).

∴ *An ordinary year has 1 odd day.*

(*ii*) 1 leap year = 366 days = (52 weeks + 2 days).

∴ *A leap year has 2 odd days.*

(*iii*) 100 years = 76 ordinary years + 24 leap years

= [(76 × 52) weeks + 76 days] + [(24 × 52) weeks + 48 days]

= 5200 weeks + 124 days = (5217 weeks + 5 days).

∴ *100 years contain 5 odd days.*

200 years contain 10 and therefore 3 odd days.

300 years contain 15 and therefore 1 odd day.

400 years contain (20 + 1) and therefore 0 odd day.

Similarly, each one of 800, 1200, 1600, 2000, etc. contains 0 odd days.

Remark : (7*n* + *m*) odd days, where *m* < 7 is equivalent to *m* odd days.

Thus, 8 odd days ≡ 1 odd day etc.

V.

No. of odd days	0	1	2	3	4	5	6
Day	Sun.	Mon.	Tues.	Wed.	Thur.	Fri.	Sat.

SOLVED EXAMPLES

Ex. 1. ***What was the day of the week on 16th July, 1776?***

Sol. 16th July, 1776 = (1775 years + Period from 1st Jan., 1776 to 16th July, 1776)

Counting of odd days :

1600 years have 0 odd day. 100 years have 5 odd days.

75 years = (18 leap years + 57 ordinary years)

= [(18 × 2) + (57 × 1)] odd days = 93 odd days

= (13 weeks + 2 days) = 2 odd days.

$\therefore$ 1775 years have (0 + 5 + 2) odd days = 7 odd days = 0 odd day.

Jan. Feb. March April May June July

31 + 29 + 31 + 30 + 31 + 30 + 16 = 198 days

= (28 weeks + 2 days) = 2 odd days.

$\therefore$ Total number of odd days = (0 + 2) = 2. Required day was **'Tuesday'**.

Ex. 2. ***What was the day of the week on 15th August, 1947?***

Sol. 15th August, 1947 = (1946 years + Period from 1st Jan., 1947 to 15th Aug., 1947)

Counting of odd days :

1600 years have 0 odd day. 300 years have 1 odd day.

47 years = (11 leap years + 36 ordinary years)

= $[(11 \times 2) + (36 \times 1)]$ odd days = 58 odd days = 2 odd days.

Jan. Feb. March April May June July Aug.

31 + 28 + 31 + 30 + 31 + 30 + 31 + 15

= 227 days = (32 weeks + 3 days) = 3 odd days.

Total number of odd days = (0 + 1 + 2 + 3) odd days = 6 odd days.

Hence, the required day was **'Saturday'**.

Ex. 3. ***What was the day of the week on 16th April, 2000?***

Sol. 16th April, 2000 = (1999 years + Period from 1st Jan., 2000 to 16th April, 2000)

Counting of odd days :

1600 years have 0 odd day. 300 years have 1 odd day.

99 years = (24 leap years + 75 ordinary years)

= $[(24 \times 2) + (75 \times 1)]$ odd days = 123 odd days

= (17 weeks + 4 days) = 4 odd days.

Jan. Feb. March April

31 + 29 + 31 + 16 = 107 days = (15 weeks + 2 days) = 2 odd days.

Total number of odd days = (0 + 1 + 4 + 2) odd days = 7 odd days = 0 odd day.

Hence, the required day was **'Sunday'**.

Ex. 4. ***On what dates of July 2004 did Monday fall?***

Sol. Let us find the day on 1st July, 2004.

2000 years have 0 odd day. 3 ordinary years have 3 odd days.

Jan. Feb. March April May June July

31 + 29 + 31 + 30 + 31 + 30 + 1

= 183 days = (26 weeks + 1 day) = 1 odd day.

Total number of odd days = (0 + 3 + 1) odd days = 4 odd days.

$\therefore$ 1st July 2004 was 'Thursday'.

Thus, 1st Monday in July 2004 was on 5th July.

Hence, during July 2004, Monday fell on 5th, 12th, 19th and 26th.

Ex. 5. ***Prove that the calendar for the year 2003 will serve for the year 2014.***

Sol. In order that the calendar for the year 2003 and 2014 be the same, 1st January of both the years must be on the same day of the week.

For this, the number of odd days between 31st Dec., 2002 and 31st Dec., 2013 must be the same.

We know that an ordinary year has 1 odd day and a leap year has 2 odd days.

During this period, there are 3 leap years, namely 2004, 2008 and 2012 and 8 ordinary years.

Total number of odd days = (6 + 8) days = 0 odd day.

Hence, the calendar for 2003 will serve for the year 2014.

Ex. 6. ***Prove that any date in March of a year is the same day of the week as the corresponding date in November that year.***

Sol. We will show that the number of odd days between last day of February and last day of October is zero.

March	April	May	June	July	Aug.	Sept.	Oct.
31	+ 30	+ 31	+ 30	+ 31	+ 31	+ 30	+ 31

= 241 days = 35 weeks = 0 odd day.

$\therefore$ Number of odd days during this period = 0.

Thus, 1st March of an year will be the same day as 1st November of that year.

Hence, the result follows.

EXERCISE 27

(OBJECTIVE TYPE QUESTIONS)

Directions : *Mark (✓) against the correct answer* :

1. January 1, 2004 was a Thursday. What day of the week lies on Jan. 1, 2005 ?
   (*a*) Thursday (*b*) Friday (*c*) Saturday (*e*) Sunday
2. On 8th March, 2005, Wednesday falls. What day of the week was it on 8th March, 2004 ?
   (*a*) Sunday (*b*) Monday (*c*) Tuesday (*d*) Wednesday
3. The calendar for the year 2005 is the same as for the year :
   (*a*) 2010 (*b*) 2011 (*c*) 2012 (*d*) 2013
4. On what dates of April 2001 did Sunday fall ?
   (*a*) 1st, 8th, 15th, 22nd, 29th (*b*) 2nd, 9th, 16th, 23rd, 30th
   (*c*) 4th, 11th, 18th, 25th (*d*) 6th, 13th, 20th, 27th
5. What will be the day of the week on 1st January, 2010 ?
   (*a*) Friday (*b*) Saturday (*c*) Sunday (*d*) Monday
6. What was the day of the week on 17th June, 1998 ?
   (*a*) Monday (*b*) Tuesday (*c*) Wednesday (*d*) Thursday
7. What was the day of the week on 28th May, 2003 ?
   (*a*) Friday (*b*) Saturday (*c*) Sunday (*d*) Monday
8. Today is Friday. After 62 days, it will be :
   (*a*) Saturday (*b*) Monday (*c*) Tuesday (*d*) Thursday
9. The last day of a century cannot be :
   (*a*) Monday (*b*) Wednesday (*c*) Friday (*d*) Tuesday
10. The first Republic Day of India was celebrated on 26th January, 1950. It was :
    (*a*) Tuesday (*b*) Wednesday (*c*) Thursday (*d*) Friday

SOLUTIONS

1. The year 2004 being a leap year, it has 2 odd days. So, first day of 2005 will be 2 days beyond Thursday and so it will be Saturday.
2. The year 2004 being a leap year, it has 2 odd days.
   So, the day on 8th March, 2005 will be two days beyond the day on 8th March, 2004.
   But, 8th March, 2005 is Wednesday. So, 8th March, 2004 is Monday.
3. Count the number of days from 2005 onwards to get 0 odd day.

Year	2005	2006	2007	2008	2010	2011
Odd days	1	1	1	2	1	1 = 7 or 0 odd day.

$\therefore$ Calendar for the year 2005 is the same as that for the year 2012.

4. Find the day on 1st April, 2001. 2000 years contain 2 odd days.

Jan. Feb. March April

31 + 28 + 31 + 1 = 91 days = 13 weeks 0 day = 0 odd day.

Sunday fell on 1st, 8th, 15th, 22nd and 29th of April 2001.

5. 2000 years have 2 odd days.

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009
Odd days	1	1	1	2	1	1	1	2	1

= 11 odd days = 4 odd days.

1st January, 2010 has 1 odd day. Total number of odd days = (2 + 4 + 1) = 7 = 0.

∴ 1st January, 2010 will be a Sunday.

6. 1600 years have 0 odd day. 300 years have 1 odd day.

97 years = 24 leap years + 73 ordinary years

= [(24 × 2) + (73 × 1)] odd days = 121 odd days

= (17 weeks + 2 days) odd days = 2 odd days.

Jan. Feb. March April May June

31 + 28 + 31 + 30 + 31 + 17 = 168 days = 0 odd day.

Total number of odd days = (0 + 1 + 2 + 0) = 3 odd days.

Hence, the required day was **'Wednesday'**.

7. 2000 years have 2 odd days.

The years 2001 and 2002 have (1 + 1) = 2 odd days.

Jan. Feb. March April May

31 + 28 + 31 + 30 + 28

= 148 days = 21 weeks + 1 day = 1 odd day.

Total number of odd days = (2 + 2 + 1) = 5.

∴ The required day was **'Friday'**.

8. Each day of the week is repeated after 7 days. So, after 63 days, it will be Friday.

Hence, after 62 days, it will be Thursday.

9. 100 years contain 5 odd days. So, last day of 1st century is 'Friday'.

200 years contain (5 × 2) = 10 odd days = 3 odd days.

So, last day of 2nd century is 'Wednesday'.

300 years contain (5 × 3) = 15 odd days = 1 odd day.

∴ Last day of 3rd century is 'Monday'.

400 years contain 0 odd day.

∴ Last day of 4th century is 'Sunday'.

Since the order is continually kept in successive cycles, we see that the last day of a century cannot be Tuesday, Thursday or Saturday.

10. 26th Jan., 1950 = (1949 years + Period from 1st Jan., 1950 to 26th Jan., 1950)

1600 years have 0 odd day. 300 years have 1 odd day.

49 years = (12 leap years + 37 ordinary years)

= [(12 × 2) + (37 × 1)] odd days = 61 odd days = 5 odd days.

Number of days from 1st Jan. to 26th Jan. = 26 = 5 odd days.

Total number of odd days = (0 + 1 + 5 + 5) = 11 = 4 odd days.

∴ The required day was **'Thursday'**.