

## CLOCK AND CALENDAR

### Important Facts

- (i) The face or dial of a watch is a circle whose circumference is divided into 60 equal parts, called minute spaces.
- (ii) A clock has two hands, the smaller one is called the hour hand or short hand while the larger one is called the minute hand or long hand.
- (iii) Minute hand and hour hand coincides once in every hour. They coincide 11 times in 12 hours and 22 times in 24 hours.
- (iv) Both hands don't coincide between 12 and 1 O'clock.
- (v) The hands are in the same straight line when they are coincident or opposite to each other.
- (vi) When the two hands are at right angles, they are 15 minutes spaces apart. Both hands (minute and hour) are perpendicular twice in every hour. 22 times in 12 hours and 44 times in 24 hours.
- (vii) Minute hand and hour hand are opposite once in every hour. They do it 11 times in 12 hours and 22 times in 24 hours. It doesn't happen between 6 to 7 O'clock.
- (viii) Angle traced by hour hand in 12 hrs =  $360^\circ$
- (ix) Angle traced by minute hand in 60 min. =  $360^\circ$ .

### Too Fast and Too Slow:

If a watch or a clock indicates 8.15, when the correct time is 8, it is said to be 15 minutes too fast.

On the other hand, if it indicates 7.45, when the correct time is 8, it is said to be 15 minutes too slow.

In one minute, hour hand moves  $1/2^\circ$  and minute hand moves  $6^\circ$ . In one hour, hour hand moves  $30^\circ$  and minute hand move  $360^\circ$ .

### Mirror Image of Clock

If the time is between 1 O'clock to 11:60 O'clock, then to find the mirror image, time is subtracted from 11 : 60.

If the time is between 12 O'clock to 23:60 O'clock, then to find the mirror image, time is subtracted from 23 : 60.

### Angle between Two Hands

Angle are of two types :

Positive angle : It is obtained by moving from hour hand to minute hand moving in clockwise direction.

Negative angle : It is obtained by moving from minute hand to hour hand.

Both types of angles are  $360^\circ$  in total. If one angle is known, other can be obtained by subtracting from  $360^\circ$

#### Solved examples:

1. An accurate clock shows 7 a.m. Through how many degrees will the hour hand rotate when the clock shows 1 p.m.?  
 A.  $154^\circ$  B.  $180^\circ$   
 C.  $170^\circ$  D.  $160^\circ$

**Solution:**

We know that angle traced by hour hand in 12 hrs. =  $360^\circ$

From 7 to 1, there are 6 hours.

Angle traced by the hour hand in 6 hours =  $6 \times (360/12) = 180^\circ$

Option B is the correct answer.

2. By 20 minutes past 4, the hour hand has turned through how many degrees? If then the clock is 12 p.m.

A.  $100^\circ$  B.  $110^\circ$

C.  $120^\circ$  D.  $130^\circ$

**Solution:**

At 4 o'clock the hour hand is at 4 and has an angle of  $30^\circ \times 4 = 120^\circ$

An Hour hand travels  $1/2^\circ$  per minute In 20 minutes it will travel  $20 \times (1/2^\circ) = 10^\circ$ . Adding both we get  $120^\circ + 10^\circ = 130^\circ$  Option D is the correct answer.

3. At what time between 5.30 and 6 will the hands of a clock be at right angles?

A. 44 minutes past 5 B.  $44 \frac{7}{11}$  minutes past 5

C.  $43 \frac{7}{11}$  minutes past 5 D. 43 minutes past 5

**Solution:**

Given: H = 5 and A = 90, since 5 and 6 lies in the first half, a positive sign is considered.

$$T = \frac{2}{11} [H \times 30 \pm A]$$

$$T = \frac{2}{11} [5 \times 30 + 90]$$

$$T = \frac{2}{11} [240] = \frac{480}{11} = 43 \frac{7}{11}$$

Option C is the correct answer.

4. What is the angle between the minute hand and the hour hand of a clock at 5.30?

A.  $05^\circ$  B.  $15^\circ$

C.  $25^\circ$  D.  $35^\circ$

**Solution:**

At 5 o'clock the hour hand is at 5 and hence has made  $30^\circ$  angle.

From 5 to 5.30 its will travel for 30 minutes with a speed of  $\frac{1}{2}^\circ$  Therefore the total distance travelled will be 30 minutes \*  $\frac{1}{2} = 15^\circ$

The full angle made by the hour hand will be  $150^\circ + 15^\circ = 165^\circ$ .

The minute hand at 5 o'clock is at 12, and hence the angle made is zero. In 30 minutes, it will travel a distance of 30 minutes with a speed of  $6^\circ$  per minute. Therefore, the total distance travelled will be 30 minutes \*  $6^\circ = 180^\circ$ .

The angle between the minute and hour hand is  $180 - 165 = 15$

Option B is the correct answer.

5. How many times in a day, the hands of a clock are straight?

- A. 22 B. 24  
 C. 44 D. 48

**Solution:**

The hands of clocks make a straight line of  $180^\circ$  about 22 times in 24 hours. Also, the hands coincide 22 times in 24 hours, the coincidence of the hands also forms a straight line. Hence, the total straight lines are  $22+22 = 44$ .

Option C is the correct answer.

6. A house has two wall clocks, one in kitchen and one more in the bedroom. The time displayed on both the watches is 12.A.M right now. The clock in the bedroom gains five minutes every hour, whereas the one in the kitchen is slower by five minutes every hour. When will both the watches show the same time again?

**Solution:**

The faster clock runs 5 minutes faster in 1 hr.

The slower clock runs 5 minutes slower in 1 hr.

Therefore, in 1 hour, the faster clock will trace  $5 + 5 = 10$  min more when compared to the slower clock.

## Calendar

The year consists of 365 days, 5 hours, 48 minutes (52 weeks and 1 odd day). An extra day is added once in every fourth year which was called the leap year, which has 366 days (52 weeks and 2 odd days).

To find the day of any given date of the year, you need to understand the calendar calculations:

1. First thing to remember, first January 1 AD was Monday therefore, we must count days from Sunday. This means the 0th day was Sunday, so the 7th day was Sunday again and so on and so forth.
2. The day gets repeated after every seventh day (concept of a week), if today is Monday, then 28th day from now will also be Monday as it a multiple of 7 ( $28/7 = 4$ , so four weeks). Here the 30 day will be calculated by  $30/7$ , which is 4 weeks and 2 days, these two days are called odd days. With starting day as Monday and two odd days, the day will be Wednesday; this point is the most critical in calendars. The other of looking at it is since the 28th day is Monday, so the 30th day will be Wednesday. But you have to understand and use the concept of odd days as the question may be about thousands of years.
3. In a normal year there are 365 days so 52 weeks and 1 odd day, in a leap year there are 366 days so 52 weeks and 2 odd days.
4. In 100 years there are 24 leap years and 76 normal years, so the number of odd days are  $24(2) + 76 = 124$ , which is 17 weeks + 5 odd days, so 100 years have 5 odd days.
5. In 200 years the number of odd days is twice the number in 100 years which is 10, which is one week and 3 odd days, so 200 years have 3 odd days. In 300 years, the number of odd days is 15, which is two weeks and 1 odd day, so 300 years have one odd day.
6. 400 year is a leap year; similarly the multiples of 400 are also leap years.
7. In 400 years, the number of odd days become  $20 + 1$ (from the leap year), so total days are 21, which is three weeks and 0 odd days. In 400 years there are 0 odd days
8. In an ordinary year, first and last day of the year are same.

9. For a leap year, if first day is Monday than last day will be Tuesday for the same year.
10. In a leap year, February is of 29 days but in an ordinary year, it has only 28 days.
11. Calendar year is from 1 Jan to 31 Dec. Financial year is from 1 April to 31 March.

### Odd Days:

We are supposed to find the day of the week on a given date.

For this, we use the concept of 'odd days'.

In a given period, the number of days more than the complete weeks are called odd days.

### Leap Year:

- (i) Every year divisible by 4 is a leap year, if it is not a century.
- (ii) Every 4<sup>th</sup> century is a leap year and no other century is a leap year.
- (iii) For example Year ending in 00's but not divisible by 400 is not considered a leap year. e.g., 900, 1000, 1100, 1300, 1400, 1500, 1700, 1800, 1900, 2100 are not leap years.

### Ordinary Year:

The year which is not a leap year is called an ordinary years. An ordinary year has 365 days.

### Counting of Odd Days:

1. 1 ordinary year = 365 days = (52 weeks + 1 day.)  
 $\therefore$  1 ordinary year has 1 odd day.
2. 1 leap year = 366 days = (52 weeks + 2 days)  
 $\therefore$  1 leap year has 2 odd days.
3. 100 years = 76 ordinary years + 24 leap years  
 $= (76 \times 1 + 24 \times 2)$  odd days = 124 odd days.  
 $= (17 \text{ weeks} + \text{days}) \equiv 5$  odd days.  
 $\therefore$  Number of odd days in 100 years = 5.

Number of odd days in 300 years =  $(5 \times 3) \equiv 1$  odd day.

Number of odd days in 400 years =  $(5 \times 4 + 1) \equiv 0$  odd day.

Similarly, each one of 800 years, 1200 years, 1600 years, 2000 years etc

### Day of the Week Related to Odd Days:

No. of days: 0    1    2    3    4    5    6

Day:            Sun. Mon. Tues. Wed. Thurs. Fri. Sat.

**Tables : For calculating odd days**

Month	Jan	Feb	March	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Odd days	3	0/1 ord./Leap yr	3	2	3	2	3	3	2	3	2	3

Months of years	I <sup>st</sup> three months 1 Jan to 31 March	II <sup>nd</sup> three months 1 Apr to 30 June	III <sup>rd</sup> three months 1 July to 30 Sep.	IV <sup>th</sup> (last) three months	Total year 1 Jan to 31 Dec.
Total days	90 / 91 ord / leap	91	92	92	365/366 ord./leap
Odd days	6 / 0 ord. / leap	0 odd day	1 odd day	1 odd day	1 / 2 odd day

**Example:** If 17<sup>th</sup> march 2008 was Monday, what was 1<sup>st</sup> April 2012?

**Solution:** The total number of odd days from 17<sup>th</sup> March 2008 to 17<sup>th</sup> March 2012.

2008 (leap year)	2 odd days
2009 (ordinary year)	1 odd day
2010 (ordinary year)	1 odd day
2011 (ordinary year)	1 odd day
Total odd days =	5 odd days

Since 17<sup>th</sup> march 2008 was Monday and 17<sup>th</sup> march 2012 is 5 days more than Monday. Then adding 5 odd days to Monday, we get Saturday. Hence 17<sup>th</sup> march to April 1<sup>st</sup> we have 15 days. Saturday+15=Sunday. Adding 15 days or (15 = 14+1) to Saturday, we get the answer as Sunday.

**Example:** If today is Sunday, what will be the day on 7777<sup>th</sup> day?

**Solution:** If today is Sunday, then the 7<sup>th</sup> day from today will be Sunday. Similarly, the 14<sup>th</sup> day, 21<sup>st</sup> day or 70<sup>th</sup> day or 700<sup>th</sup> day or 7000<sup>th</sup> day or 7777<sup>th</sup> day will be Sunday. Hence, the answer is Sunday.

**Example:** What day of the week was 15<sup>th</sup> August 1947?

**Solution:** The date August 15<sup>th</sup> 1947 can be divided as follows for easy calculation:

1600 years + 300 years+ 46 years (1901 to 1946) + Jan 1<sup>st</sup> to august 15<sup>th</sup> (of 1947)

Note:- Do not write 47 years in the third section, it would indicate 47<sup>th</sup> year in that century is over.

1600 years + 300 years+ 46 years (1901 to 1946) + Jan 1<sup>st</sup> to august 15<sup>th</sup> (of 1947)

Now let's find out the total number of odd days in each section:

**Section 1:**

1600 is a multiple of 400 years. 400 years have 0 odd days hence 1600 years should have 0 odd days.

**Section 2:**

The second section 30 years will have 1 odd day. Kindly refer to “evaluation of odd days in a century” topic for clarification.

**Section 3:**

This section has 46 years from 1901 to 1946, we know that an ordinary year has one odd day and a leap year has 2 odd days.

Let’s first calculate the total number of leap years from 1901 to 1946.

Division of 46 by 4 gives the quotient as 11, which indicates that from 1901 to 1946 we have 11 leap years. If there are 11 leap years among 46 years then remaining 35 years should be ordinary years. Hence, 35 ordinary years will have 35 odd days and 11 leap years will have  $11 * 2 = 22$  years.

The total number of odd days in 46 years will be  $35 + 22 = 57$  odd days. The division of 57 by 7 given the remainder as 1. This indicates from 1901 to 1946 there is only one odd day.

**Section 4:**

It has months from January to August 15<sup>th</sup>. We have already calculated the total number of odd days in each month in the odd day’s section.

Since 1947 is not a leap year February had zero odd days.

**Example:** Which year in the future will have the same calendar exactly as 2009?

- A. 2010
- B. 2013
- C. 2015
- D. 2017

**Solution:** If the total number of odd days between any years is zero or it’s a multiple of seven. Then, those two years will have the same calendar.

The total number of odd days is listed below:

2009	1
2010	1
2011	1
2012	2
2013	1
2014	1
Total number of odd days = 7	

Hence, 2015 will have the same calendar as 2009. Option C is the correct answer.



10. At what time between 5 and 6 o'clock are the hands of a clock 3 minutes apart?
- (A) 14 min past 2. and  $35\frac{5}{11}$  min past 6      (B) 24 min past 2. and  $3\frac{5}{11}$  min past 7
- (C) 24 min past 5. and  $31\frac{5}{11}$  min past 5      (D) None of these
11. The time in the clock is 11 : 46, what is the mirror image ?
- (A) 11 : 46      (B) 4 : 11      (C) 64 : 11      (D) None of these
12. The time in the clock is 10 : 35, then find its mirror image.
- (A) 01 : 25      (B) 53 : 01      (C) 10 : 53      (D) None of these
13. A clock is started at noon. By 10 minutes past 5, the hour hand has turned through :
- (A)  $145^\circ$       (B)  $150^\circ$       (C)  $155^\circ$       (D)  $160^\circ$
14. At 3.40, the hour hand and the minute hand of a clock form an angle of :
- (A)  $120^\circ$       (B)  $125^\circ$       (C)  $130^\circ$       (D)  $135^\circ$
15. The angle between the minute hand and the hour hand of a clock when the time is 8.30, is :
- (A)  $80^\circ$       (B)  $75^\circ$       (C)  $60^\circ$       (D)  $105^\circ$
16. The angle between the minute hand and the hour hand of a clock when the time is 4.20, is :
- (A)  $0^\circ$       (B)  $10^\circ$       (C)  $5^\circ$       (D)  $20^\circ$
17. At what angle the hands of a clock are inclined at 15 minutes past 5?
- (A)  $58\frac{1}{2}^\circ$       (B)  $64^\circ$       (C)  $67\frac{1}{2}^\circ$       (D)  $72\frac{1}{2}^\circ$
18. The reflex angle between the hands of a clock at 10.25 is :
- (A)  $180^\circ$       (B)  $192\frac{1}{2}^\circ$       (C)  $195^\circ$       (D)  $197\frac{1}{2}^\circ$
19. How many times in a day, the hands of a clock are straight ?
- (A) 22      (B) 24      (C) 44      (D) 48
20. How many times are the hands of a clock at right angle in a days ?
- (A) 22      (B) 24      (C) 44      (D) 48



21. How many times in a day, are the hands of a clock in a straight line but opposite in direction ?  
 (A) 20 (B) 22 (C) 24 (D) 48
22. How much does a watch lose per day, if its hands coincide every 64 minutes ?  
 (A)  $32\frac{8}{11}$  min (B)  $36\frac{5}{11}$  min (C) 90 min (D) 96 min
23. At what time, in minutes, between 3 o'clock and 4 o'clock, both the needles will coincide each other?  
 (A)  $5\frac{1}{11}$  (B)  $12\frac{4}{11}$  (C)  $13\frac{4}{11}$  (D)  $16\frac{4}{11}$
24. At what time between 7 and 8 o'clock will the hands of a clock be in the same straight line but, not together ?  
 (A) 5 min. past 7 (B)  $5\frac{2}{11}$  min. past 7  
 (C)  $5\frac{3}{11}$  min. past 7 (D)  $5\frac{5}{11}$  min. past 7
25. At what time between 4 and 5 o'clock will the hands of a watch point in opposite directions?  
 (A) 45 min. past 4 (B) 40 min. past 4  
 (C)  $50\frac{4}{11}$  min. past 4 (D)  $54\frac{6}{11}$  min. past 4
26. What was the day on 25th January, 1975?  
 (A) Saturday (B) Sunday (C) Monday (D) Tuesday
27. What day of the week was 20th June 1837?  
 (A) Saturday (B) Sunday (C) Monday (D) Tuesday
28. Are the years 800 and 900 leap years ?  
 (A) Yes (B) No (C) Can't say (D) None of these
29. If it was Saturday on 17th December, 1982 what will be the day on 22nd December, 1984?  
 (A) Monday (B) Tuesday (C) Wednesday (D) Sunday
30. In U.P. on 17th Oct. 1996 the president rule was declared. Find the day of week on that date.  
 (A) Tuesday (B) Friday (C) Wednesday (D) None of these
31. Sangeeta remembers that her father's birthday was certainly after eighth but before thirteenth of December. Her sister Natasha remembers that their father's birthday was definitely after ninth but before fourteenth of December. On which date of December was their father's birthday ?  
 (A) 10th (B) 11th (C) 12th (D) Data inadequate

32. Which of the following years is not a leap years ?  
 (A) 1600 (B) 1000 (C) 800 (D) 1200
33. Kate was born on Saturday 22nd March 1982. On what day of the week was she 14 years 7 months and 8 days of age ?  
 (A) Sunday (B) Tuesday (C) Wednesday (D) Monday
34. If on 14th day after 5th March be Wednesday, what day of the week will fall on 10th Dec. of the same year ?  
 (A) Friday (B) Wednesday (C) Thursday (D) Tuesday
35. If the day before yesterday was Saturday, what day will fall on the day after tomorrow ?  
 (A) Friday (B) Thursday (C) Wednesday (E) Tuesday
36. 1.12.91 is the first Sunday. Which is the fourth Tuesday of December 91?  
 (A) 17.12.91 (B) 24.12.91 (C) 26.12.91 (D) 31.12.91
37. Rajan remembers that Roshan was born after 15th March and before 20th March. But his father remembers that Roshan was born after 18th March and before 24th March. What is the date of birth of Roshan ?  
 (A) 18th March (B) 19th March (C) 20th March (D) None of these
38. If 1st October is Sunday, then 1st November will be  
 (A) Monday (B) Tuesday (C) Wednesday (D) Thursday
39. If February 1,1996 is Wednesday, what day is March 3,1996 ?  
 (A) Monday (B) Sunday (C) Saturday (D) Friday
40. Pallavi remembers that her sister Suchitra was born after 20th August and before 26th August. But her elder sister remembers that Suchitra was born after 23rd August and before 29th August. What is the date of birth of Suchitra ?  
 (A) 25th August (B) 24th August (C) 24th or 25th August (D) 24th or 26th August
41. A day after tomorrow will be X-mas day. What will be the day on New-year-day if today is Monday ?  
 (A) Monday (B) Thursday (C) Sunday (D) Wednesday
42. Sunanda remembers that she saw her mother on Tuesday after 26th of a month. If 4th of that month fell on Friday, then on what day of the week did she meet ?  
 (A) 27th (B) 28th (C) 29th (D) None of these

43. If 18th February, 1997 falls on Tuesday then what will be the day on 18th February, 1999?  
 (A) Monday (B) Tuesday (C) Thursday (D) Friday
44. At present Shyama's age is half the age of her father. 20 years ago her age was one fourth of the age of her father. What will be the age of Shyama after 10 years ?  
 (A) 30 years (B) 40 years (C) 50 years (D) 60 years
45. If Saturday falls four days after today which is 6th January, on what day did the 1st of December of previous year fall ?  
 (A) Sunday (B) Wednesday (C) Tuesday (D) Monday (E) Thursday
46. If Thursday falls on 20th Sept. 1984, what day will be on 20th Sept. 1992?  
 (A) Monday (B) Tuesday (C) Sunday (D) Friday
47. Which two months in a year have the same calendar ?  
 (A) June, October (B) April, November (C) April, July (D) October, December
48. If Wednesday falls on 25th May 1977, what day will be on 25th May 1996?  
 (A) Sunday (B) Saturday (C) Friday (D) Monday
49. I bought the January issue of "Vigyan Pragati" in 1986, which contained the calendar of that year. Tell the other year for which this calendar can be used.  
 (A) 1997 (B) 2001 (C) 1995 (D) 2003
50. How many Mondays are there in a particular month of a particular year, if the month ends on Wednesday?  
 (A) 4 (B) 5 (C) 3 (D) None of the

## Answer Key

- |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|
| 1.  | (A) | 2.  | (C) | 3.  | (A) | 4.  | (A) |
| 5.  | (B) | 6.  | (B) | 7.  | (C) | 8.  | (A) |
| 9.  | (B) | 10. | (C) | 11. | (D) | 12. | (A) |
| 13. | (C) | 14. | (C) | 15. | (B) | 16. | (B) |
| 17. | (C) | 18. | (D) | 19. | (C) | 20. | (C) |
| 21. | (B) | 22. | (A) | 23. | (D) | 24. | (D) |
| 25. | (D) | 26. | (A) | 27. | (D) | 28. | (D) |
| 29. | (D) | 30. | (D) | 31. | (D) | 32. | (B) |
| 33. | (A) | 34. | (B) | 35. | (C) | 36. | (B) |
| 37. | (B) | 38. | (C) | 39. | (C) | 40. | (C) |
| 41. | (D) | 42. | (C) | 43. | (C) | 44. | (B) |
| 45. | (D) | 46. | (C) | 47. | (C) | 48. | (B) |
| 49. | (A) | 50. | (D) |     |     |     |     |