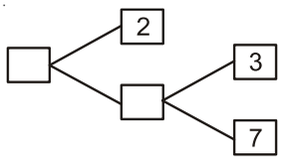
# MATHEMATICS

## 1 : Real Numbers

1. Complete the missing entries in the following factor tree: **[2008] ...[1M]**




2. Find the (HCF × LCM) for the numbers 100 and 190. **[2009] ...[1M]**

3. Has the rational number $\frac{441}{2^5 5^7 7^2}$ a terminating or a non-terminating decimal representation? **[2010] ...[1M]**

4. What is the HCF of smallest prime number and the smallest composite number? **[2018] ...[1M]**

5. Find a rational number between $\sqrt{2}$ and $\sqrt{3}$. **[2019] ...[1M]**

6. HCF of 144 and 198 is **[2020] ...[1M]**

   (a) 9 (b) 18

   (c) 6 (d) 12

7. 225 can be expressed as **[2020] ...[1M]**

   (a) $5 \times 3^2$ (b) $5^2 \times 3$

   (c) $5^2 \times 3^2$ (d) $5^3 \times 3$

8. $2.\overline{35}$ is **[2020] ...[1M]**

   (a) an integer (b) a rational number

   (c) an irrational number (d) a natural number

9. The total number of factors of a prime number is **[2020] ...[1M]**

   (a) 1 (b) 0

   (c) 2 (d) 3

10. The HCF and the LCM of 12, 21, 15 respectively are **[2020] ...[1M]**

    (a) 3, 140 (b) 12, 420

    (c) 3, 420 (d) 420, 3

11. HCF of 92 and 152 is **[2021] ...[1M]**

    (a) 4 (b) 19

    (c) 23 (d) 57

12. $\frac{57}{300}$ is a **[2021] ...[1M]**

    (a) Non-terminating and non-repeating decimal expansion.

    (b) Terminating decimal expansion after 2 places of decimals.

    (c) Terminating decimal expansion after 3 places of decimals.

    (d) Non-terminating but repeated decimal expansion.

13. $5.\overline{213}$ can also be written as **[2021] ...[1M]**

    (a) 5.213213213... (b) 5.2131313...

    (c) 5.213 (d) 5213/1000

14. HCF of two consecutive even numbers is **[2021] ...[1M]**

    (a) 0 (b) 1

    (c) 2 (d) 4

15. The decimal expansion of $\frac{13}{2 \times 5^2 \times 7}$ is **[2021] ...[1M]**

    (a) Terminating after 1 decimal place

    (b) Non-terminating and non-repeating

    (c) Terminating after 2 decimal places

    (d) Non-terminating but repeating

16. The (HCF × LCM) for the numbers 50 and 20 is **[2021] ...[1M]**

    (a) 1000 (b) 50

    (c) 100 (d) 500

17. For which natural number $n$, $6^n$ ends with digit zero? **[2021] ...[1M]**

    (a) 6 (b) 5

    (c) 0 (d) None

18. The exponent of 5 in the prime factorisation of 3750 is **[2021] ...[1M]**

    (a) 3 (b) 4

    (c) 5 (d) 6

19. What is the greatest possible speed at which a girl can walk 95 m and 171 m in an exact number of minutes? **[2021] ...[1M]**

(a) 17 m/min (b) 19 m/min

(c) 23 m/min (d) 13 m/min

20. Three alarm clocks ring their alarms at regular intervals of 20 min, 25 min and 30 min respectively. If they first beep together at 12 noon, at what time will they beep again for the first time? **[2021] ...[1M]**

(a) 4 : 00 pm (b) 4 : 30 pm

(c) 5 : 00 pm (d) 5 : 30 pm

21. The greatest number which when divides 1251, 9377 and 15628 leaves remainder 1, 2, and 3 respectively is **[2021] ...[1M]**

(a) 575 (b) 450

(c) 750 (d) 625

22. If $a$ and $b$ are two coprime numbers, then $a^3$ and $b^3$ are **[2021] ...[1M]**

(a) Coprime (b) Not coprime

(c) Even (d) Odd

23. If $n$ is a natural number, then $2(5^n + 6^n)$ always ends with **[2021] ...[1M]**

(a) 1 (b) 4

(c) 3 (d) 2

24. The LCM of two numbers is 2400. Which of the following CANNOT be their HCF? **[2021] ...[1M]**

(a) 300 (b) 400

(c) 500 (d) 600

25. Given that $\sqrt{2}$ is irrational, prove that $(5+3\sqrt{2})$ is an irrational number. **[2018] ...[2M]**

26. Find the HCF of 1260 and 7344 using Euclid's algorithm. **[2019] ...[2M]**

27. Show that every positive odd integer is of the form $(4q + 1)$ or $(4q + 3)$, where $q$ is some integer. **[2019] ...[2M]**

28. Use Euclid's Division Lemma to show that the square of any positive integer is either of the form $3m$ or $(3m + 1)$ for some integer $m$.

**[2008] ...[3M]**

29. Prove that $3 + \sqrt{2}$ is an irrational number.

**[2009] ...[3M]**

30. Prove that $2 - 3\sqrt{5}$ is an irrational number.

**[2010] ...[3M]**

31. Find HCF and LCM of 404 and 96 and verify that HCF × LCM = Product of the two given numbers. **[2018] ...[3M]**

32. Prove that $\sqrt{2}$ is an irrational number.

**[2019] ...[3M]**

33. Given that $\sqrt{3}$ is an irrational number, show that $(5+2\sqrt{3})$ is an irrational number.

**[2020] ...[3M]**

**OR**

An army contingent of 612 members is to march behind an army band of 48 members in a parade. The two groups are to march in the same number of columns. What is the maximum number of columns in which they can march?

34. Show that the square of any positive integer cannot be of the form $(5q + 2)$ or $(5q + 3)$ for any integer $q$. **[2020] ...[4M]**

**OR**

Prove that one of every three consecutive positive integers is divisible by 3. **[2020] ...[4M]**

## 2 : Polynomials

1. If $(x + a)$ is a factor of $2x^2 + 2ax + 5x + 10$, find $a$. **[2008] ...[1M]**

2. If 1 is a zero of the polynomial $p(x) = ax^2 - 3(a - 1)x - 1$, then find the value of $a$. **[2009]...[1M]**

3. If $\alpha$, $\beta$ are the zeroes of a polynomial, such that $\alpha + \beta = 6$ and $\alpha\beta = 4$, then write the polynomial. **[2010] ...[1M]**

4. If one zero of a quadratic polynomial $(kx^2 + 3x + k)$ is 2, then the value of $k$ is **[2020] ...[1M]**

(a) $\frac{5}{6}$ (b) $-\frac{5}{6}$

(c) $\frac{6}{5}$ (d) $-\frac{6}{5}$

5. The graph of a polynomial is shown in Fig. 2, then the number of its zeroes is **[2020] ...[1M]**

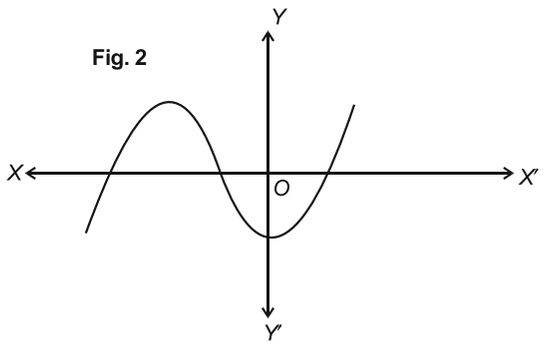



**Fig. 2**

(a) 3 (b) 1

(c) 2 (d) 4

6. If one of the zeroes of the quadratic polynomial $x^2 + 3x + k$ is 2, then the value of $k$ is **[2020] ...[1M]**

(a) 10 (b) –10

(c) –7 (d) –2

7. The quadratic polynomial, the sum of whose zeroes is –5 and their product is 6, is **[2020] ...[1M]**

(a) $x^2 + 5x + 6$

(b) $x^2 – 5x + 6$

(c) $x^2 – 5x – 6$

(d) $–x^2 + 5x + 6$

8. A quadratic polynomial having sum and product of its zeroes as 5 and 0 respectively, is **[2021] ...[1M]**

(a) $x^2 + 5x$ (b) $2x(x – 5)$

(c) $5x^2 – 1$ (d) $x^2 –5x + 5$

9. Zeroes of a quadratic polynomial $x^2 – 5x + 6$ are **[2021] ...[1M]**

(a) –5, 1 (b) 5, 1

(c) 2, 3 (d) –2, –3

10. The zeroes of quadratic polynomial $x^2 + 99x + 127$ are **[2021] ...[1M]**

(a) Both negative

(b) Both positive

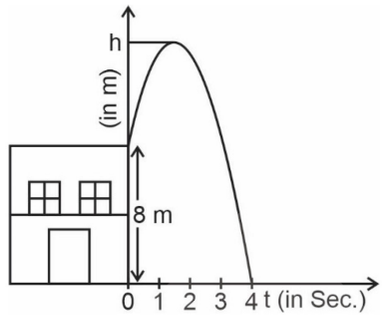
(c) One positive and one negative

(d) Reciprocal of each other

***Case Study Based Questions (Q.11 to Q.15) :*** Sukriti throws a ball upwards, from a rooftop which is 8 m high from ground level. The ball reaches to some maximum height and then returns and hit the ground.

It height of the ball at time $t$(in sec) is represented by h(m), then equation of its path is given as $h = –t^2 + 2t + 8$

Based on above information, answer the following:




11. The maximum height achieved by ball is **[2021] ...[1M]**

(a) 7 m (b) 8 m

(c) 9 m (d) 10 m

12. The polynomial represented by above graph is **[2021] ...[1M]**

(a) Linear polynomial

(b) Quadratic polynomial

(c) Constant polynomial

(d) Cubic polynomial

13. Time taken by ball to reach maximum height is **[2021] ...[1M]**

(a) 2 sec. (b) 4 sec.

(c) 1 sec. (d) 2 min.

14. Number of zeroes of the polynomial whose graph is given is **[2021] ...[1M]**

(a) 1 (b) 2

(c) 0 (d) 3

15. Zeroes of the polynomial are **[2021] ...[1M]**

(a) 4 (b) –2, 4

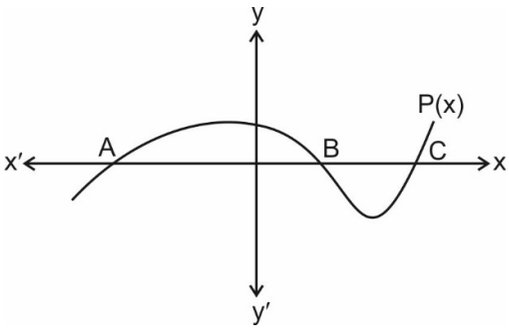
(c) 2, 4 (d) 0, 4

16. The graph of a polynomial $P(x)$ cuts the $x$-axis at 3 points and touches it at 2 other points. The number of zeroes of $P(x)$ is **[2021] ...[1M]**

(a) 1 (b) 2

(c) 3 (d) 5

17. In figure, the graph of a polynomial $P(x)$ is shown. The number of zeroes of $P(x)$ is **[2021] ...[1M]**




(a) 1 (b) 2
(c) 3 (d) 4

18. A quadratic polynomial, the product and sum of whose zeroes are 5 and 8 respectively is **[2021] ...[1M]**

(a) $k[x^2 - 8x + 5]$
(b) $k[x^2 + 8x + 5]$
(c) $k[x^2 - 5x + 8]$
(d) $k[x^2 + 5x + 8]$

19. If $x - 1$ is a factor of the polynomial $p(x) = x^3 + ax^2 + 2b$ and $a + b = 4$, then **[2021] ...[1M]**

(a) $a = 5, b = -1$ (b) $a = 9, b = -5$
(c) $a = 7, b = -3$ (d) $a = 3, b = 1$

20. If $\alpha, \beta$ are the zeros of the quadratic polynomial $p(x) = x^2 - (k + 6)x + 2(2k - 1)$, then the value of $k$, if $\alpha + \beta = \frac{1}{2}\alpha\beta$, is **[2021] ...[1M]**

(a) –7 (b) 7
(c) –3 (d) 3

21. Find all the zeros of the polynomial $x^4 + x^3 - 34x^2 - 4x + 120$, if two of its zeros are 2 and –2. **[2008] ...[2M]**

22. Find all the zeroes of the polynomial $x^3 + 3x^2 - 2x - 6$, if two of its zeroes are $-\sqrt{2}$ and $\sqrt{2}$. **[2009] ...[2M]**

23. If two zeroes of the polynomial $x^3 - 4x^2 - 3x + 12$ are $\sqrt{3}$ and $-\sqrt{3}$, then find its third zero. **[2010] ...[2M]**

24. Divide the polynomial $(4x^2 + 4x + 5)$ by $(2x + 1)$ and write the quotient and the remainder. **[2020] ...[2M]**

25. Find all zeroes of the polynomial $(2x^4 - 9x^3 + 5x^2 + 3x - 1)$ if two of its zeroes are $(2 + \sqrt{3})$ and $(2 - \sqrt{3})$. **[2018] ...[3M]**

26. Find the value of k such that the polynomial $x^2 - (k + 6)x + 2(2k - 1)$ has sum of its zeros equal to half of their product. **[2019] ...[3M]**

27. If $\alpha$ and $\beta$ are the zeroes of the polynomial $f(x) = x^2 - 4x - 5$, then find the value of $\alpha^2 + \beta^2$. **[2020] ...[3M]**

28. Find a quadratic polynomial whose zeroes are reciprocals of the zeroes of the polynomial $f(x) = ax^2 + bx + c$, $a \neq 0$, $c \neq 0$. **[2020] ...[3M]**

**OR**

Divide the polynomial $f(x) = 3x^2 - x^3 - 3x + 5$ by the polynomial $g(x) = x - 1 - x^2$ and verify the division algorithm.

29. If 4 is a zero of the cubic polynomial $x^3 - 3x^2 - 10x + 24$, find its other two zeroes. **[2020] ...[3M]**

## 3 : Pair of Linear Equations in Two Variables

1. Find the number of solutions of the following pair of linear equations :

$x + 2y - 8 = 0$

$2x + 4y = 16$ **[2009] ...[1M]**

2. If the equations $kx - 2y = 3$ and $3x + y = 5$ represent two intersecting lines at unique point, then the value of $k$ is _____. **[2020] ...[1M]**

3. The value of $k$ for which the system of equations $x + y - 4 = 0$ and $2x + ky = 3$, has no solution, is **[2020] ...[1M]**

(a) –2 (b) $\neq 2$
(c) 3 (d) 2

4. The value of $k$, for which the pair of linear equations $x + y - 4 = 0$, $2x + ky - 3 = 0$ have no solution, is **[2021] ...[1M]**

(a) 0 (b) 2
(c) 6 (d) 8

5. Perimeter of a rectangle whose length (l) is 4 cm more than twice its breadth (b) is 14 cm. The pair of linear equations representing the above information is **[2021] ...[1M]**

(a) $\begin{matrix} l+4=2b \\ 2(l+b)=14 \end{matrix}$ (b) $\begin{matrix} l-b=4 \\ 2(l+b)=14 \end{matrix}$

(c) $\begin{matrix} l=2b+4 \\ l+b=14 \end{matrix}$ (d) $\begin{matrix} l=2b+4 \\ 2(l+b)=14 \end{matrix}$

6. The solution of the pair of linear equations $x = -5$ and $y = 6$ is **[2021] ...[1M]**

(a) (–5, 6) (b) (–5, 0)

(c) (0, 6) (d) (0, 0)

7. The value of $k$ for which the pair of linear equations $3x + 5y = 8$ and $kx + 15y = 24$ has infinitely many solutions, is **[2021] ...[1M]**

(a) 3 (b) 9

(c) 5 (d) 15

8. The values of $x$ and $y$ satisfying the two equations $32x + 33y = 34$, $33x + 32y = 31$ respectively are : **[2021] ...[1M]**

(a) –1, 2 (b) –1, 4

(c) 1, –2 (d) –1, –4

9. Two lines are given to be parallel. The equation of one of the lines is $3x – 2y = 5$. The equation of the second line can be **[2021] ...[1M]**

(a) $9x + 8y = 7$ (b) $–12x – 8y = 7$

(c) $–12x + 8y = 7$ (d) $12x + 8y = 7$

***Case Study Based Questions (Q.10 to Q.14) :*** A book store shopkeeper gives books on rent for reading. He has variety of books in his store related to fiction, stories and quizzes etc. He takes a fixed charge for the first two days and an additional charge for subsequent day. Amruta paid ₹22 for a book and kept for 6 days; while Radhika paid ₹16 for keeping the book for 4 days.

Assume that the fixed charge be ₹$x$ and additional charge (per day) be ₹$y$.

Based on the above information, answer any **four** of the following questions.

10. The situation of amount paid by Radhika, is algebraically represented by **[2021] ...[1M]**

(a) $x – 4y = 16$ (b) $x + 4y = 16$

(c) $x – 2y = 16$ (d) $x + 2y = 16$

11. The situation of amount paid by Amruta, is algebraically represented by **[2021] ...[1M]**

(a) $x – 2y = 11$ (b) $x – 2y = 22$

(c) $x + 4y = 22$ (d) $x – 4y = 11$

12. What are the fixed charges for a book? **[2021] ...[1M]**

(a) ₹ 9 (b) ₹10

(c) ₹13 (d) ₹15

13. What are the additional charges for each subsequent day for a book? **[2021] ...[1M]**

(a) ₹ 6 (b) ₹ 5

(c) ₹ 4 (d) ₹ 3

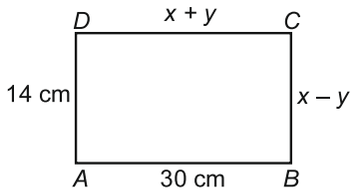
14. What is the total amount paid by both, if both of them have kept the book for 2 more days? **[2021] ...[1M]**

(a) ₹ 35 (b) ₹ 52

(c) ₹ 50 (d) ₹ 58

15. Find the value of $k$ for which the following pair of linear equations have infinitely many solutions $2x + 3y = 7$; $(k – 1)x + (k + 2)y = 3k$. **[2010] ...[2M]**

16. In figure, $ABCD$ is a rectangle. Find the values of $x$ and $y$. **[2018] ...[2M]**




17. Find $c$ if the system of equations $cx + 3y + (3 – c) = 0$; $12x + cy – c = 0$ has infinitely many solutions? **[2019] ...[2M]**

18. Represent the following pair of equations graphically and write the coordinate of points where the lines intersect $y$-axis.

$x + 3y = 6$

$2x – 3y = 12$ **[2008] ...[3M]**

19. Solve for $x$ and $y$

$$\frac{ax}{b} - \frac{by}{a} = a + b$$

$ax - by = 2ab$ **[2009] ...[3M]**

20. The sum of numerator and denominator of a fraction is 3 less than twice the denominator. If each of the numerator and denominator is decreased by 1, the fraction becomes $\frac{1}{2}$. Find the fraction. **[2010] ...[3M]**

21. Solve the following pair of equations

$$\frac{4}{x} + 3y = 8, \frac{6}{x} - 4y = -5.$$ **[2010] ...[3M]**

22. A father's age is three times the sum of the ages of his two children. After 5 years his age will be two times the sum of their ages. Find the present age of the father. **[2019] ...[3M]**

23. A fraction becomes $\frac{1}{3}$ when 2 is subtracted from the numerator and it becomes $\frac{1}{2}$ when 1 is subtracted from the denominator. Find the fraction. **[2019] ...[3M]**

24. Solve graphically : $2x + 3y = 2$, $x - 2y = 8$ **[2020] ...[3M]**

25. Determine graphically the coordinates of the vertices of a triangle, the equations of whose sides are given by $2y - x = 8$, $5y - x = 14$ and $y - 2x = 1$. **[2020] ...[3M]**

26. A peacock is sitting on the top of a pillar, which is 9 m high. From a point 27 in away from the bottom of the pillar, a snake is coming to its hole at the base of the pillar. Seeing the snake the peacock pounces on it. If their speeds are equal, at what distance from the hole is the snake caught ? **[2008] ...[6M]**

## 4 : Quadratic Equations

1. Show that $x = -3$ is a solution of $x^2 + 6x + 9 = 0$. **[2008] ...[1M]**

2. Find the discriminant of the quadratic equation $3\sqrt{3}x^2 + 10x + \sqrt{3} = 0$. **[2009] ...[1M]**

3. The root of the equation $x^2 - 3x - m(m + 3) = 0$, where $m$ is a constant, are **[2011] ...[1M]**

   (A) $m$, $m + 3$

   (B) $-m$, $m + 3$

   (C) $m$, $-(m + 3)$

   (D) $-m$, $-(m + 3)$

4. If 1 is a root of the equations $ay^2 + ay + 3 = 0$ and $y^2 + y + b = 0$, then $ab$ equals **[2012]...[1M]**

   (A) 3 (B) $-\frac{7}{2}$

   (C) 6 (D) –3

5. If the quadratic equation $px^2 - 2\sqrt{5}px + 15 = 0$ has two equal roots, then find the value of $p$. **[2015] ...[1M]**

6. If $x = 3$ is one root of the quadratic equation $x^2 - 2kx - 6 = 0$, then find the value of $k$. **[2018] ...[1M]**

7. For what values of $k$, the roots of the equation $x^2 + 4x + k = 0$ are real? **[2019] ...[1M]**

8. Find the value of $k$ for which the roots of the equation $3x^2 - 10x + k = 0$ are reciprocal of each other. **[2019] ...[1M]**

9. If quadratic equation $3x^2 - 4x + k = 0$ has equal roots, then the value of $k$ is _____. **[2020] ...[1M]**

10. Find the value of $m$ so that the quadratic equation $mx(x - 7) + 49 = 0$ has two equal roots. **[2011] ...[2M]**

11. Find the value(s) of $k$ so that the quadratic equation $3x^2 - 2kx + 12 = 0$ has equal roots. **[2012] ...[2M]**

12. Solve the following quadratic equation for $x$ : $4\sqrt{3}x^2 + 5x - 2\sqrt{3} = 0$. **[2013] ...[2M]**

13. Solve the quadratic equation $2x^2 + ax - a^2 = 0$ for $x$. **[2014] ...[2M]**

14. Solve the following quadratic equation for $x$ :

    $4x^2 + 4bx - (a^2 - b^2) = 0$ **[2015] ...[2M]**

15. If $-5$ is a root of the quadratic equation $2x^2 + px - 15 = 0$ and the quadratic equation $p(x^2 + x) + k = 0$ has equal roots, find the value of $k$. **[2016] ...[2M]**

16. Find the value of $p$, for which one root of the quadratic equation $px^2 - 14x + 8 = 0$ is 6 times the other. **[2017] ...[2M]**

17. Find the nature of the roots of the quadratic equation : **[2022] ...[2M]**

$4x^2 - 5x - 1 = 0$

18. Solve the quadratic equation :

$x^2 + 2\sqrt{2}x - 6 = 0$ for $x$. **[2022] ...[2M]**

19. The sum of two numbers is 8. Determine the numbers if the sum of their reciprocals is $\frac{8}{15}$.

**[2009] ...[3M]**

20. Find the roots of the following quadratic equation : $x^2 - 3\sqrt{5}x + 10 = 0$. **[2011] ...[3M]**

21. Solve for $x$ : $4x^2 - 4ax + (a^2 - b^2) = 0$.

**[2012] ...[3M]**

22. Solve for $x$ : $3x^2 - 2\sqrt{6}x + 2 = 0$. **[2012] ...[3M]**

23. For what value(s) of $k$, the roots of the quadratic equation $(k + 4)x^2 + (k + 1)x + 1 = 0$ are equal? **[2013] ...[3M]**

24. Solve the equation $\frac{4}{x} - 3 = \frac{5}{2x+3}$; $x \neq 0, -\frac{3}{2}$, for $x$. **[2014] ...[3M]**

25. Solve of $x$ :

$\sqrt{3}x^2 - 2\sqrt{2}x - 2\sqrt{3} = 0$ **[2015] ...[3M]**

26. Solve for $x$

$\frac{1}{(x-1)(x-2)} + \frac{1}{(x-2)(x-3)} = \frac{2}{3}$, $x \neq 1, 2, 3$

**[2016] ...[3M]**

27. If $ad \neq bc$, then prove that the equation $(a^2 + b^2)x^2 + 2(ac + bd)x + (c^2 + d^2) = 0$ has no real roots. **[2017] ...[3M]**

28. A plane left 30 minutes late than its scheduled time and in order to reach the destination 1500 km away in time, it had to increase its speed by 100 km/h from the usual speed. Find its usual speed.

**[2018] ...[3M]**

29. In a flight of 600 km, an aircraft was slowed due to bad weather. Its average speed for the trip was reduced by 200 km/hr and time of flight increased by 30 minutes. Find the original duration of flight.

**[2020] ...[3M]**

30. Sum of the areas of two squares is 400 $cm^2$. If the difference of their perimeters is 16 cm, find the sides of the two squares. **[2013] ...[4M]**

31. Solve the following for $x$ :

$\frac{1}{2a+b+2x} = \frac{1}{2a} + \frac{1}{b} + \frac{1}{2x}$ **[2013] ...[4M]**

32. The difference of two natural numbers is 5 and the difference of their reciprocals is $\frac{1}{10}$. Find the numbers. **[2014] ...[4M]**

33. Find the values of $k$ for which the quadratic equation $(k + 4)x^2 + (k + 1)x + 1 = 0$ has equal roots. Also, find the roots. **[2014] ...[4M]**

34. The diagonal of a rectangular field is 16 metres more than the shorter side. If the longer side is 14 metres more than the shorter side, then find the lengths of the sides of the field.

**[2015]...[4M]**

35. A train travels at a certain average speed for a distance of 54 km and then travels a distance of 63 km at an average speed of 6 km/h more than the first speed. If it takes 3 hours to complete the total journey, what is its first speed?

**[2015] ...[4M]**

36. Solve for $x$ :

$\frac{1}{x+1} + \frac{2}{x+2} = \frac{4}{x+4}$; $x \neq -1, -2, -4$

**[2016] ...[4M]**

37. A motor-boat whose speed is 24 km/h in still water takes 1 hour more to go 32 km upstream than to return downstream to the same spot. Find the speed of the stream. **[2016] ...[4M]**

38. Solve of $x$ :

$\frac{1}{x+1} + \frac{3}{5x+1} = \frac{5}{x+4}$, $x \neq -1, \frac{-1}{5}, -4$

**[2017] ...[4M]**

39. Two taps running together can fill a tank in $3\frac{1}{13}$ hours. If one tap takes 3 hours more than the other to fill the tank, then how much time will each tap take to fill the tank? **[2017] ...[4M]**

40. A motor-boat whose speed is 18 km/hr in still water take 1 hr more to go 24 km upstream than to return downstream to the same spot. Find the speed of the stream. **[2018] ...[4M]**

41. A train travels at a certain average speed for a distance of 63 km and then travels a distance of 72 km at an average speed of 6 km/hr more than its original speed. It takes 3 hours to complete total journey, what is the original average speed? **[2018] ...[4M]**

42. Two water taps together can fill a tank in $1\frac{7}{8}$ hours. The tap with longer diameter takes 2 hours less than the tap with smaller one to fill the tank separately. Find the time in which each tap can fill the tank separately. **[2019] ...[4M]**

43. A two digit number is such that the product of its digits is 14. If 45 is added to the number; the digits interchange their places. Find the number. **[2020] ...[4M]**

44. The sum of the ages of a boy and his sister (in years) is 25 and product of their ages is 150. Find their present ages. **[2022] ...[4M]**

45. (a) A 2-digit number is such that the product of its digits is 24. If 18 is subtracted from the number, the digits interchange their places. Find the number. **[2022] ...[4M]**

**OR**

(b) The difference of the squares of two numbers is 180. The square of the smaller number is 8 times the greater number. Find the two numbers. **[2022] ...[4M]**

46. The difference of two numbers is 4. If the difference of their reciprocals is $\frac{4}{21}$, find the two numbers. **[2008] ...[6M]**

47. Solve the following equation for $x$:

$9x^2 - 9(a + b)x + (2a^2 + 5ab + 2b^2) = 0$

**[2009] ...[6M]**

48. If (–5) is a root of the quadratic equation $2x^2 + px - 15 = 0$ and the quadratic equation $p(x^2 + x) + k = 0$ has equal roots, then find the values of $p$ and $k$. **[2009] ...[6M]**

49. Three consecutive positive integers are such that the sum of the square of the first and the product of the other two is 46, find the integers. **[2010] ...[6M]**

50. The difference of squares of two numbers is 88. If the larger number is 5 less than twice the smaller number, then find the two numbers. **[2010] ...[6M]**

51. A train travels 180 km at a uniform speed. If the speed had been 9 km/hour more, it would have taken 1 hour less for the same journey. Find the speed of the train. **[2011] ...[6M]**

52. Find the roots of the equation

$$\frac{1}{2x-3}+\frac{1}{x-5}=1,\ x\neq\frac{3}{2}, 5.$$ **[2011] ...[6M]**

53. A shopkeeper buys books of the ₹80. If he had bought 4 more books for the same amount, each book would have cost ₹1 less. Find the number of books he bought. **[2012] ...[6M]**

54. The sum of two numbers is 9 and the sum of their reciprocals is $\frac{1}{2}$. Find the numbers. **[2012] ...[6M]**

## 5 : Arithmetic Progressions

1. The first term of an AP is $p$ and its common difference is $q$. Find its $10^{th}$ term. **[2008] ...[1M]**

2. If $\frac{4}{5}$, $a$, 2 are three consecutive terms of an AP, then find the value of $a$. **[2009] ...[1M]**

3. If the sum of first $p$ terms of an AP, is $ap^2 + bp$, find its common difference. **[2010] ...[1M]**

4. If the common difference of an AP is 3, then $a_{20} - a_{15}$ is **[2011] ...[1M]**

(A) 5 (B) 3

(C) 15 (D) 20

5. The sum of first 20 odd natural number is **[2012] ...[1M]**

(A) 100 (B) 210

(C) 400 (D) 420

6. The common difference of AP

$\frac{1}{3q}, \frac{1-6q}{3q}, \frac{1-12q}{3q}, \ldots$ is **[2013] ...[1M]**

(A) $q$ (B) $-q$

(C) $-2$ (D) 2

7. The first three terms of an AP respectively are $3y - 1$, $3y + 5$ and $5y + 1$. The $y$ equals **[2014] ...[1M]**

(A) –3 (B) 4

(C) 5 (D) 2

8. For what value of $k$ will $k + 9$, $2k - 1$ and $2k + 7$ are the consecutive terms of an AP? **[2016] ...[1M]**

9. What is the common difference of an AP in which $a_{21} - a_7 = 84$? **[2017] ...[1M]**

10. In an AP, if the common difference ($d$) = – 4, and the seventh term ($a_7$) is 4, then find the first term. **[2018] ...[1M]**

11. How many two digit numbers are divisible by 3? **[2019] ...[1M]**

12. The $n^{th}$ term of an AP is $(7 - 4n)$, then what is its common difference? **[2020] ...[1M]**

13. The value of $x$ for which $2x$, $(x + 10)$ and $(3x + 2)$ are the three consecutive terms of an AP, is **[2020] ...[1M]**

(a) 6 (b) –6

(c) 18 (d) –18

14. The first term of an AP is $p$ and the common difference is $q$, then its $10^{th}$ term is **[2020] ...[1M]**

(a) $q + 9p$ (b) $p - 9q$

(c) $p + 9q$ (d) $2p + 9q$

15. Which term of the AP 3, 15, 27, 39, ... will be 120 more than its $21^{st}$ term? **[2009, 2019]...[2M]**

16. In an AP, the first term is 2, the last term is 29 and sum of the terms is 155. Find the common difference of the AP **[2010] ...[2M]**

17. Find how many two-digit numbers are divisible by 6. **[2011] ...[2M]**

18. Find the sum of all three digit natural numbers, which are multiples of 7. **[2012] ...[2M]**

**OR**

How many three-digit natural numbers are divisible by 7? **[2013] ...[2M]**

19. The first and the last term of an AP are 5 and 45 respectively. If the sum of all its terms is 400, find its common difference. **[2014, 2017] ...[2M]**

20. In an AP, if $S_5 + S_7 = 167$ and $S_{10} = 235$, then find the AP, where $S_n$ denotes the sum of its first $n$ terms. **[2015] ...[2M]**

21. The $4^{th}$ term of an AP is zero. Prove that the $25^{th}$ term of the AP is three times its $11^{th}$ term. **[2016] ...[2M]**

22. Which term of the progression 20, $19\frac{1}{4}, 18\frac{1}{2}, 17\frac{3}{4}, .....$ is the first negative term? **[2017] ...[2M]**

23. Find the sum of first 8 multiples of 3. **[2018]...[2M]**

24. If $S_n$, the sum of first $n$ terms of an AP is given by $S_n = 3n^2 - 4n$, find the $n^{th}$ term. **[2019]...[2M]**

25. Show that $(a - b)^2$, $(a^2 + b^2)$ and $(a + b)^2$ are in A.P. **[2020] ...[2M]**

26. **(a)** Which term of the A.P. 3, 8, 13, 18, ... is 78? **[2022] ...[2M]**

**OR**

**(b)** Find the common difference of an A.P. whose $n^{th}$ term is given by **[2022] ...[2M]**

$a_n = 6n - 5$.

27. Find the sum of the first fifteen multiples of 8. **[2022] ...[2M]**

28. (a) Which term of the A.P. $-\frac{11}{2}, -3, -\frac{1}{2}, .....$ is $\frac{49}{2}$? **[2022] ...[2M]**

**OR**

(b) Find $a$ and $b$ so that the numbers

$a$, 7, $b$, 23 are in A.P.

29. Find the sum of first 20 terms of an A.P. whose $n^{th}$ term is given as $a_n = 5 - 2n$. **[2022] ...[2M]**

30. For what value of $n$ are the $n^{th}$ terms of two AP's 63, 65, 67, ... and 3, 10, 17, ... equal? **[2008] ...[3M]**

31. If $m$ times the $m^{th}$ term of an AP is equal to $n$ times its $n^{th}$ term, find the $(m + n)^{th}$ term of the AP. **[2008] ...[3M]**

32. In an AP, the first term is 8, $n^{th}$ term is 33 and sum to first $n$ terms is 123. Find $n$ and $d$, the common difference. **[2008] ...[3M]**

33. The sum of first six terms of an arithmetic progression is 42. The ratio of its $10^{th}$ term to its $30^{th}$ term is 1 : 3. Calculate the first and the thirteenth term of the AP.? **[2009] ...[3M]**

34. In an AP, the sum of first ten terms is –150 and the sum of its next ten terms is –550. Find the AP **[2010] ...[3M]**

35. Find an AP whose fourth term is 9 and the sum of its sixth term and thirteenth term is 40.

**[2011] ...[3M]**

36. The $16^{th}$ term of an AP is 1 more than twice its $8^{th}$ term. If the $12^{th}$ term of the AP is 47, then find its $n^{th}$ term. **[2012] ...[3M]**

37. The sum of first $n$ terms of an AP is $3n^2 + 4n$. Find the $25^{th}$ term of this AP. **[2013] ...[3M]**

38. If the seventh term of an AP is $\frac{1}{9}$ and its ninth term is $\frac{1}{7}$, find its $63^{rd}$ term. **[2014] ...[3M]**

39. The $14^{th}$ term of an AP is twice its $8^{th}$ term. If its $6^{th}$ term is –8, then find the sum of its first 20 terms. **[2015] ...[3M]**

40. If the ratio of the sum of first $n$ terms of two AP's is $(7n + 1) : (4n + 27)$, find the ratio of their $m^{th}$ terms. **[2016] ...[3M]**

**OR**

If the ratio of the sum of the first $n$ terms of two AP's is $(7n + 1) : (4n + 27)$, then find the ratio of their $9^{th}$ terms. **[2016] ...[3M]**

41. The first and the last terms of an A.P. are 8 and 350 respectively. If its common difference is 9, how many terms are there and what is their sum? **[2011] ...[4M]**

42. How many multiples of 4 lie between 10 and 250? Also find their sum. **[2011] ...[4M]**

43. Sum of the first 20 terms of an AP is –240 and its first term is 7. Find its $24^{th}$ term. **[2012] ...[4M]**

44. Find the number of terms of the AP –12, –9, –6, ... 12. If 1 is added to each term of this AP, then find the sum of terms of the AP thus obtained. **[2013] ...[4M]**

45. In an AP of 50 terms, the sum of first 10 terms is 210 and the sum of its last 15 terms is 2565. Find the AP. **[2014] ...[4M]**

46. Find the $60^{th}$ term of the AP 8, 10, 12 ....., if it has a total of 60 terms and hence find the sum of its last 10 terms. **[2015] ...[4M]**

47. The houses in a row numbered consecutively from 1 to 49. Show that there exists a value of $X$ such that sum of numbers of houses preceding the house numbered $X$ is equal to sum of the numbers of houses following $X$.

**[2016] ...[4M]**

48. The sum of four consecutive numbers in an AP is 32 and the ratio of the product of the first and the last term to the product of two middle terms is 7 : 15. Find the numbers. **[2018] ...[4M]**

49. If the sum of first four terms of an AP is 40 and that of first 14 terms is 280. Find the sum of its first $n$ terms. **[2019] ...[4M]**

50. If 4 times the 4th term of an AP is equal to 18 times the 18th term, then find the $22^{nd}$ term.

**[2020] ...[4M]**

**OR**

How many terms of the AP : 24, 21, 18, ... must be taken so that their sum is 78?

**[2020] ...[4M]**

51. The sum of four consecutive numbers in AP is 32 and the ratio of the product of the first and last terms to the product of two middle terms is 7 : 15. Find the numbers. **[2020] ...[4M]**

**OR**

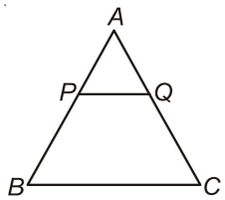
Solve : $1 + 4 + 7 + 10 + \ldots + x = 287$

**[2020] ...[4M]**

## 6 : Triangles

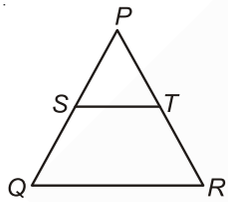
1. The lengths of the diagonals of a rhombus are 30 cm and 40 cm. Find the side of the rhombus. **[2008] ...[1M]**

2. In figure, $PQ \parallel BC$ and $AP : PB = 1 : 2$. Find $\frac{\text{ar}(\Delta APQ)}{\text{ar}(\Delta ABC)}$. **[2008] ...[1M]**

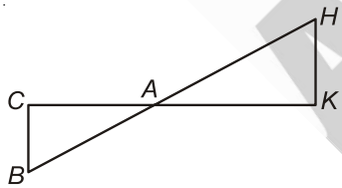



3. In $\Delta LMN$, $\angle L = 50°$ and $\angle N = 60°$. If $\Delta LMN \sim \Delta PQR$, then find $\angle Q$. **[2009] ...[1M]**

4. In below figure, $S$ and $T$ are points on the sides $PQ$ and $PR$ respectively of $\Delta PQR$, such that $PT = 2$ cm, $TR = 4$ cm and $ST$ is parallel to $QR$. Find the ratio of the areas of $\Delta PST$ and $\Delta PQR$. **[2010] ...[1M]**

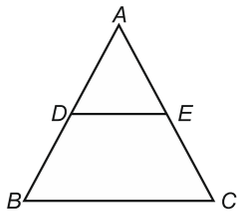



5. In below figure, $\Delta AHK$ is similar to $\Delta ABC$. If $AK = 10$ cm, $BC = 3.5$ cm and $HK = 7$ cm, find $AC$. **[2010] ...[1M]**




6. Given $\Delta ABC \sim \Delta PQR$, if $\frac{AB}{PQ} = \frac{1}{3}$, then find $\frac{\text{ar}(\Delta ABC)}{\text{ar}(\Delta PQR)}$. **[2018] ...[1M]**

7. In figure, $DE \parallel BC$, $AD = 1$ cm and $BD = 2$ cm. What is the ratio of the ar($\Delta ABC$) to the ar($\Delta ADE$)? **[2019] ...[1M]**




8. The perimeters of two similar triangles are 25 cm and 15 cm respectively. If one side of the first triangle is 9 cm, then the corresponding side of second triangle is _____. **[2020] ...[1M]**

9. In Fig. 3, in $\Delta ABC$, $DE \parallel BC$ such that $AD = 2.4$ cm, $AB = 3.2$ cm and $AC = 8$ cm, then what is the legnth of $AE$? **[2020] ...[1M]**

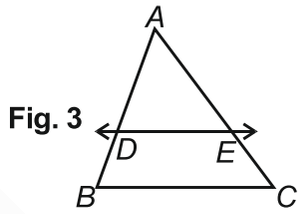
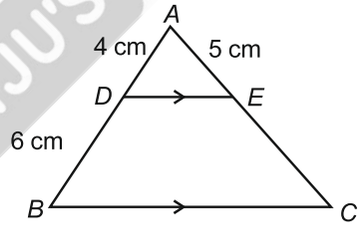



**Fig. 3**

10. Given $\Delta ABC \sim \Delta PQR$, if $\frac{AB}{PQ} = \frac{1}{3}$, then $\frac{\text{ar}(\Delta ABC)}{\text{ar}(\Delta PQR)} =$ ____. **[2020] ...[1M]**

11. $ABC$ is an equilateral triangle of side $2a$, then length of one of its altitude is _____. **[2020] ...[1M]**

12. In $\Delta ABC$, $DE \parallel BC$, $AD = 4$ cm, $DB = 6$ cm and $AE = 5$ cm. The length of $EC$ is **[2021] ...[1M]**




(a) 7 cm (b) 6.5 cm
(c) 7.5 cm (d) 8 cm

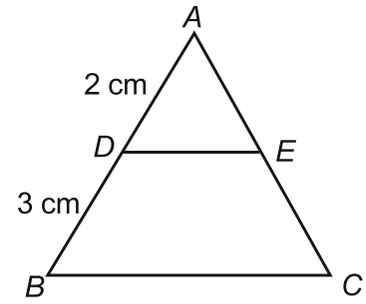
13. It is given that $\Delta DEF \sim \Delta PQR$. $EF : QR = 3 : 2$, then value of ar($DEF$) : ar($PQR$) is **[2021] ...[1M]**

(a) 4 : 9 (b) 4 : 3
(c) 9 : 2 (d) 9 : 4

14. Which of the following is a correct statement? **[2021] ...[1M]**

(a) Two congruent figures are always similar
(b) Two similar figures are always congruent
(c) All rectangles are similar
(d) The polygons having same number sides are similar

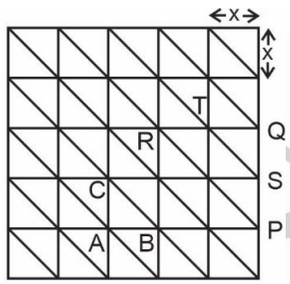
15. In $\Delta ABC$, $DE \parallel BC$, $AD$ = 2 cm, $DB$ = 3 cm, $DE : BC$ is equal to **[2021] ...[1M]**




(a) 2 : 3 (b) 2 : 5

(c) 1 : 2 (d) 3 : 5

***Case Study Based Questions (Q.16 to Q.20)*** **:**




Diagrammatic View

Quilts are available in various colours and design. Geometric design includes shapes like squares, triangles, rectangles, hexagons, etc.

One such design is shown above. Two triangles are highlighted, $\Delta ABC$ and $\Delta PQR$.

Based on above information, answer the following questions:

16. Which of the following criteria is not suitable for $\Delta ABC$ to be similar to $\Delta QRP$? **[2021] ...[1M]**

(a) SAS (b) AAA

(c) SSS (d) RHS

17. If each square is of length $x$ unit, then length $BC$ is equal to **[2021] ...[1M]**

(a) $x\sqrt{2}$ unit (b) $2x$ unit

(c) $2\sqrt{x}$ unit (d) $x\sqrt{x}$ unit

18. Ratio $BC : PR$ is equal to **[2021] ...[1M]**

(a) 2 : 1 (b) 1 : 4

(c) 1 : 2 (d) 4 : 1

19. ar($PQR$) : ar($ABC$) is equal to **[2021] ...[1M]**

(a) 2 : 1 (b) 1 : 4

(c) 4 : 1 (d) 1 : 8

20. Which of the following is **not** true? **[2021] ...[1M]**

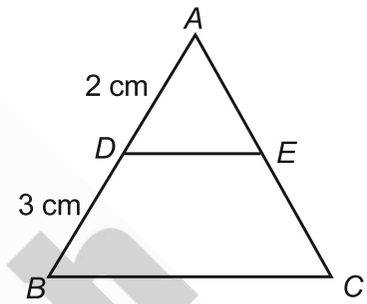
(a) $\Delta TQS \sim \Delta PQR$

(b) $\Delta CBA \sim \Delta STQ$

(c) $\Delta BAC \sim \Delta PQR$

(d) $\Delta PQR \sim \Delta ABC$

21. In figure, $DE \parallel BC$, $AD$ = 2 cm and $BD$ = 3 cm, then ar($\Delta ABC$) : ar($\Delta ADE$) is equal to **[2021] ...[1M]**




(a) 4 : 25 (b) 2 : 3

(c) 9 : 4 (d) 25 : 4

22. In $\Delta ABC$ and $\Delta DEF$, $\angle F = \angle C$, $\angle B = \angle E$ and $AB = \frac{1}{2}DE$. Then, the two triangles are **[2021] ...[1M]**

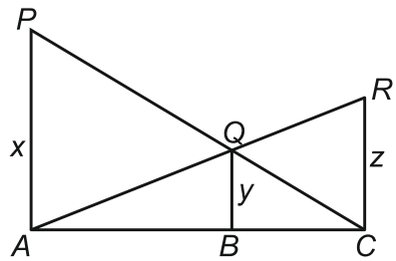
(a) Congruent, but not similar.

(b) Similar, but not congruent

(c) Neither congruent nor similar.

(d) Congruent as well as similar.

23. In fig., $PA$, $QB$ and $RC$ are each perpendicular to $AC$. If $x$ = 8 cm and $z$ = 6 cm, then $y$ is equal to **[2021] ...[1M]**




(a) $\frac{56}{7}$ cm (b) $\frac{7}{56}$ cm

(c) $\frac{25}{7}$ cm (d) $\frac{24}{7}$ cm

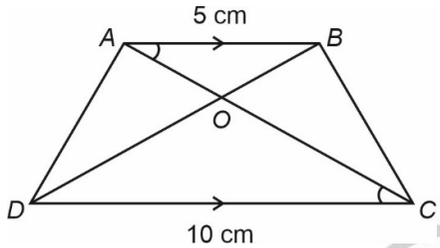
24. In a $\Delta ABC$, $\angle A = x°$, $\angle B = (3x - 2)°$, $\angle C = y°$. Also $\angle C - \angle B = 9°$. The sum of the greatest and the smallest angles of this triangle is **[2021] ...[1M]**

(a) 107° (b) 135°

(c) 155° (d) 145°

***Case Study Based Questions (Q.25 to Q.29)*** : A farmer has a field in the shape of trapezium, whose map with scale 1 cm = 20 m, is given below :

The field is divided into four parts by joining the opposite vertices.




Based on the above information, answer any **four** of the following questions :

25. The two triangular regions $AOB$ and $COD$ are **[2021] ...[1M]**

(a) Similar by AA criterion

(b) Similar by SAS criterion

(c) Similar by RHS criterion

(d) Not similar

26. The ratio of the area of the $\Delta AOB$ to the area of $\Delta COD$, is **[2021] ...[1M]**

(a) 4 : 1 (b) 1 : 4

(c) 1 : 2 (d) 2 : 1

27. If the ratio of the perimeter of $\Delta AOB$ to the perimeter of $\Delta COD$ would have been 1 : 4, then **[2021] ...[1M]**

(a) $AB = 2CD$ (b) $AB = 4CD$

(c) $CD = 2AB$ (d) $CD = 4AB$

28. If in $\Delta$s $AOD$ and $BOC$, $\frac{AO}{BC} = \frac{AD}{BO} = \frac{OD}{OC}$, then **[2021] ...[1M]**

(a) $\Delta AOD \sim \Delta BOC$

(b) $\Delta AOD \sim \Delta BCO$

(c) $\Delta ADO \sim \Delta BCO$

(d) $\Delta ODA \sim \Delta OBC$

29. If the ratio of areas of two similar triangles $AOB$ and $COD$ is 1 : 4, then which of the following statements is true? **[2021] ...[1M]**

(a) The ratio of their perimeters is 3 : 4

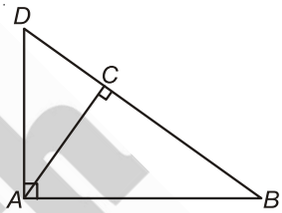
(b) The corresponding altitudes have a ratio 1 : 2

(c) The medians have a ratio 1 : 4

(d) The angle bisectors have a ratio 1 : 16

30. $E$ is a point on the side $AD$ produced of parallelogram $ABCD$ and $BE$ intersects $CD$ at $F$. Show that $\Delta ABE \sim \Delta CFB$. **[2008] ...[2M]**

31. In figure, $\Delta ABD$ is a right triangle, right-angled at $A$ and $AC \perp BD$. Prove that $AB^2 = BC.BD$. **[2009] ...[2M]**




32. In Fig.2, $DE \parallel AC$ and $DC \parallel AP$. Prove that $\frac{BE}{EC} = \frac{BC}{CP}$ **[2020] ...[2M]**

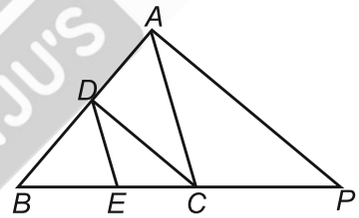
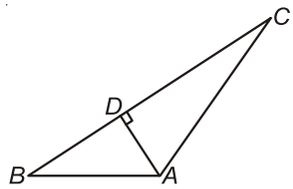
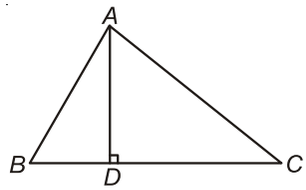



**Fig. 2**

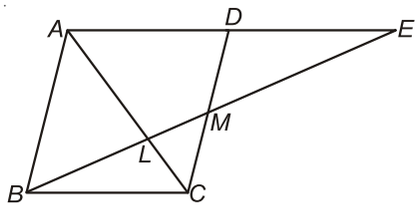
33. In figure, $AD \perp BC$. Prove that $AB^2 + CD^2 = BD^2 + AC^2$. **[2008] ...[3M]**



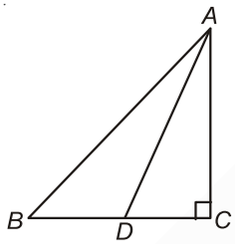

34. In figure, $AD \perp BC$ and $BD = \frac{1}{3} CD$. Prove that $2CA^2 = 2AB^2 + BC^2$ **[2009] ...[3M]**



35. In figure, $M$ is mid-point of side $CD$ of a parallelogram $ABCD$. The line $BM$ is drawn intersecting $AC$ at $L$ and $AD$ produced at $E$. Prove that $EL = 2BL$. **[2009] ...[3M]**



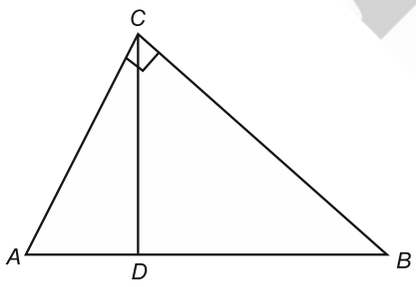

36. In below figure, $ABC$ is a right triangle, right angled at $C$, and $D$ is the midpoint of $BC$. Prove that $AB^2 = 4AD^2 - 3AC^2$. **[2010] ...[3M]**




37. Prove that the area of an equilateral triangle described on one side of the square is equal to half the area of the equilateral triangle described on one of its diagonal. **[2018] ...[3M]**

38. If the area of two similar triangles are equal, prove that they are congruent. **[2018] ...[3M]**

39. In figure, $\angle ACB = 90°$ and $CD \perp AB$, prove that $CD^2 = BD \times AD$. **[2019] ...[3M]**




40. If $P$ and $Q$ are the points on side $CA$ and $CB$ respectively of $\Delta ABC$, right angled at $C$, prove that $(AQ^2 + BP^2) = (AB^2 + PQ^2)$ **[2019] ...[3M]**

41. Prove that, in a right triangle, the square of the hypotenuse is equal to the sum of the squares of the other two sides. **[2020] ...[3M]**

42. In Fig. 5, $\angle D = \angle E$ and $\frac{AD}{DB} = \frac{AE}{EC}$, prove that $BAC$ is an isosceles triangle. **[2020] ...[3M]**

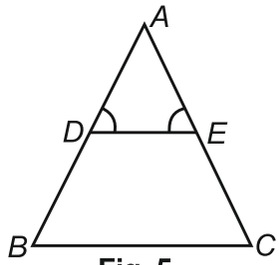
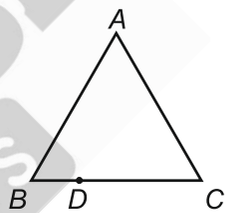



**Fig. 5**

43. In a triangle, if square of one side is equal to the sum of the squares of the other two sides, then prove that the angle opposite to the first side is a right angle. **[2020] ...[3M]**

44. In an equilateral $\Delta ABC$, $D$ is a point on side $BC$ such that $BD = \frac{1}{3}BC$. Prove that $9(AD)^2 = 7(AB)^2$. **[2018] ...[4M]**




45. Prove that, in a right triangle, the square of the hypotenuse is equal to the sum of the squares of the other two sides. **[2018, 2019] ...[4M]**

46. In Fig. 6, $DEFG$ is a squre in a triantgle $ABC$ right angled at $A$.

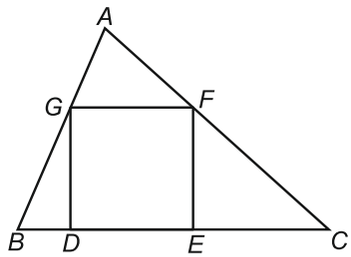



Fig. 6

Prove that

(i) $\Delta AGF \sim \Delta DBG$, (ii) $\Delta AGF \sim \Delta EFC$

**[2020] ...[4M]**

**OR**

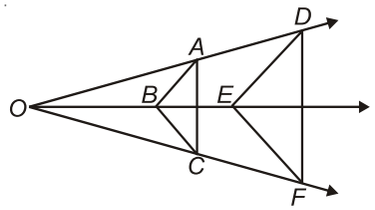
In an obtuse $\Delta ABC(\angle B$ is obtuse), $AD$ is perpendicular to $CB$ produced. Then prove that $AC^2 = AB^2 + BC^2 + 2BC \times BD$

**[2020] ...[4M]**

47. If a line is drawn parallel to one side of a triangle to intersect the other two sides in distinct points, prove that the other two sides are divided in the same ratio.

Using the above, prove the following :

In figure, $AB \parallel DE$ and $BC \parallel EF$. Prove that $AC \parallel DF$. **[2008] ...[6M]**




48. Prove that the ratio of the areas of two similar triangles is equal to the square of the ratio of their corresponding sides.

Using the above, prove the following :

If the areas of two similar triangles are equal, then prove that the triangles are congruent.

**[2010] ...[6M]**

## 7 : Coordinate Geometry

1. If $P(2, p)$ is the mid-point of the line segment joining the points $A(6, -5)$ and $B(-2, 11)$, find the value of $p$. **[2010] ...[1M]**

2. If $A(1, 2)$, $B(4, 3)$ and $C(6, 6)$ are the three vertices of a parallelogram $ABCD$, find the coordinates of the fourth vertex $D$. **[2010] ...[1M]**

3. If $P\left(\frac{a}{2}, 4\right)$ is the midpoint of the line-segment joining the points $A(-6, 5)$ and $B(-2, 3)$, then the value of $a$ is **[2011] ...[1M]**

(A) –8 (B) 3

(C) –4 (D) 4

4. If $A$ and $B$ are the points $(-6, 7)$ and $(-1, -5)$ respectively, then the distance $2AB$ is equal to **[2011] ...[1M]**

(A) 13 (B) 26

(C) 169 (D) 238

5. The coordinates of the point $P$ dividing the line segment joining the points $A(1, 3)$ and $B(4, 6)$ in the ratio 2 : 1 are **[2012] ...[1M]**

(A) (2, 4) (B) (3, 5)

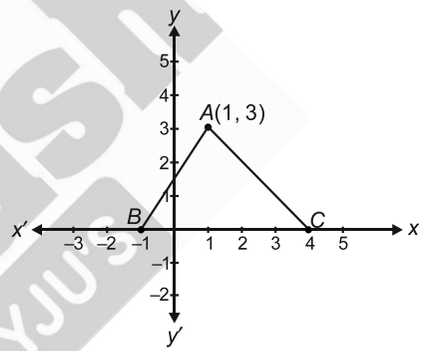
(C) (4, 2) (D) (5, 3)

6. If the coordinates of the one end of a diameter of a circle are (2, 3) and the coordinates of its centre are (–2, 5), then the coordinates of the other end of the diameter are **[2012] ...[1M]**

(A) (–6, 7) (B) (6, –7)

(C) (6, 7) (D) (–6, –7)

7. In below figure, the area of the triangle $ABC$ (in sq. units) is **[2013] ...[1M]**




(A) 15 (B) 10

(C) 7.5 (D) 2.5

8. If the points $A(x, 2)$, $B(-3, -4)$ and $C(7, -5)$ are collinear, then the value of $x$ is **[2014] ...[1M]**

(A) –63 (B) 63

(C) 60 (D) –60

9. Find the distance of a point $P(x, y)$ from the origin. **[2018] ...[1M]**

10. Find the coordinates of a point $A$, where $AB$ is diameter of a circle whose centre is (2, –3) and $B$ is the point (1, 4). **[2019] ...[1M]**

11. Distance of point $P(3, 4)$ from $x$-axis is **[2020] ...[1M]**

(a) 3 units

(b) 4 units

(c) 5 units

(d) 1 unit

12. If the distance between the points $A(4, p)$ and $B(1, 0)$ is 5 units, then the value(s) of $p$ is (are) **[2020] ...[1M]**

(a) 4 only (b) –4 only

(c) ±4 (d) 0

13. If the point $C(k, 4)$ divides the line segment joining two points $A(2, 6)$ and $B(5, 1)$ in ratio 2 : 3, the value of $k$ is _____. **[2020] ...[1M]**

**OR**

If points $A(-3, 12)$, $B(7, 6)$ and $C(x, 9)$ are collinear, then the value of $x$ is _____. **[2020] ...[1M]**

14. The distance between the points $(a\cos\theta + b\sin\theta, 0)$ and $(0, a\sin\theta - b\cos\theta)$, is **[2020] ...[1M]**

(a) $a^2 + b^2$

(b) $a^2 - b^2$

(c) $\sqrt{a^2 + b^2}$

(d) $\sqrt{a^2 - b^2}$

15. If the point $P(k, 0)$ divides the line segment joining the points $A(2, -2)$ and $B(-7, 4)$ in the ratio 1 : 2, then the value of $k$ is **[2020] ...[1M]**

(a) 1 (b) 2

(c) –2 (d) –1

16. The value of $p$, for which the points $A(3, 1)$, $B(5, p)$ and $C(7, -5)$ are collinear, is **[2020] ...[1M]**

(a) –2 (b) 2

(c) –1 (d) 1

17. A point $(x, 1)$ is equidistant from (0, 0) and (2, 0). The value of $x$ is **[2021] ...[1M]**

(a) 1 (b) 0

(c) 2 (d) 1/2

18. The ratio in which the point (4, 0) divides the line segment joining the points (4, 6) and (4, –8) is **[2021] ...[1M]**

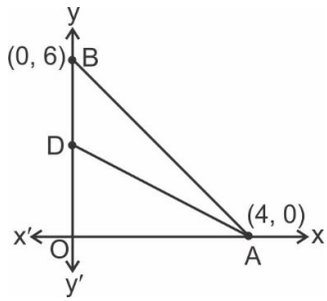
(a) 1 : 2

(b) 3 : 4

(c) 4 : 3

(d) 1 : 1

19. The vertices of a triangle $OAB$ are $O(0, 0)$, $A(4, 0)$ and $B(0, 6)$. The median $AD$ is drawn on $OB$. The length $AD$ is **[2021] ...[1M]**




(a) $\sqrt{52}$ units (b) 5 units

(c) 25 units (d) 10 units

20. The origin divides the line segment $AB$ joining the points $A(1, -3)$ and $B(-3, 9)$ in the ratio : **[2021] ...[1M]**

(a) 3 : 1 (b) 1 : 3

(c) 2 : 3 (d) 1 : 1

21. The perpendicular bisector of a line segment $A(-8, 0)$ and $B(8, 0)$ passes through a point $(0, k)$. The value of $k$ is **[2021] ...[1M]**

(a) 0 only

(b) 0 or 8 only

(c) Any real number

(d) Any non-zero real number

22. A circle of radius 3 units is centred at (0, 0). Which of the following points lie outside the circle? **[2021] ...[1M]**

(a) (–1, –1) (b) (0, 3)

(c) (1, 2) (d) (3, 1)

23. The mid-point of line segment joining the points (–3, 9) and (–6, –4) is **[2021] ...[1M]**

(a) $\left(\frac{-3}{2}, \frac{-13}{2}\right)$ (b) $\left(\frac{9}{2}, \frac{-5}{2}\right)$

(c) $\left(\frac{-9}{2}, \frac{5}{2}\right)$ (d) $\left(\frac{9}{2}, \frac{5}{2}\right)$

24. If $A\left(3, \sqrt{3}\right)$, $B(0, 0)$ and $C(3, k)$ are the three vertices of an equilateral triangle $ABC$, then the value of $k$ is **[2021] ...[1M]**

(a) 2 (b) –3

(c) $-\sqrt{3}$ (d) $-\sqrt{2}$

25. Three vertices of a parallelogram $ABCD$ are $A(1, 4)$, $B(-2, 3)$ and $C(5, 8)$. The ordinate of the fourth vertex $D$ is **[2021] ...[1M]**

(a) 8 (b) 9

(c) 7 (d) 6

26. Points $A(-1, y)$ and $B(5, 7)$ lie on a circle with centre $O(2, -3y)$. The values of $y$ are **[2021] ...[1M]**

(a) 1, –7 (b) –1, 7

(c) 2, 7 (d) –2, –7

27. The ratio in which the line $3x + y - 9 = 0$ divides the line segment joining the points (1, 3) and (2, 7) is **[2021] ...[1M]**

(a) 3 : 2 (b) 2 : 3

(c) 3 : 4 (d) 4 : 3

28. If $A(4, -2)$, $B(7, -2)$ and $C(7, 9)$ are the vertices of a $\Delta ABC$, then $\Delta ABC$ is **[2021] ...[1M]**

(a) Equilateral triangle

(b) Isosceles triangle

(c) Right angled triangle

(d) Isosceles right angled triangle

29. The line segment joining the points $P(-3, 2)$ and $Q(5, 7)$ is divided by the y-axis in the ratio **[2021] ...[1M]**

(a) 3 : 1 (b) 3: 4

(c) 3 : 2 (d) 3 : 5

30. The base of $BC$ of an equilateral $\Delta ABC$ lies on the $y$-axis. The co-ordinates of $C$ are $(0, -3)$. If the origin is the mid-point of the base $BC$, what are the co-ordinates of $A$ and $B$? **[2021] ...[1M]**

(a) $A\left(\sqrt{3}, 0\right), B(0, 3)$

(b) $A\left(\pm 3\sqrt{3}, 0\right), B(3, 0)$

(c) $A\left(\pm 3\sqrt{3}, 0\right), B(0, 3)$

(d) $A\left(-\sqrt{3}, 0\right), B(3, 0)$

31. Find the value of $k$ if the points $(k, 3)$, $(6, -2)$ and $(-3, 4)$ are collinear. **[2008] ...[2M]**

32. If the points $A(4, 3)$ and $B(x, 5)$ are on the circle with the centre $O(2, 3)$, find the value of $x$. **[2009] ...[2M]**

33. Find the value of $y$ for which the distance between the points $A(3, -1)$ and $B(11, y)$ is 10 units. **[2011] ...[2M]**

34. If a point $A(0, 2)$ is equidistant from the points $B(3, p)$ and $C(p, 5)$ then find the value of $p$. **[2012] ...[2M]**

35. The points $A(4, 7)$, $B(p, 3)$ and $C(7, 3)$ are the vertices of a right triangle, right-angled at $B$, find the values of $P$. **[2015] ...[2M]**

36. Find the relation between $x$ and $y$ if the points $A(x, y)$, $B(-5, 7)$ and $C(-4, 5)$ are collinear. **[2015] ...[2M]**

37. Let $P$ and $Q$ be the points of trisection of the line segment joining the points $A(2, -2)$, and $B(-7, 4)$ such that $P$ is nearer to $A$. Find the coordinates of $P$ and $Q$. **[2016] ...[2M]**

38. Prove that the points (3, 0), (6, 4) and (–1, 3) are the vertices of a right angled isosceles triangle. **[2016] ...[2M]**

39. A line intersects the $y$-axis and $x$-axis at the points $P$ and $Q$ respectively. If (2, –5) is the mid-point of $PQ$, then find the coordinates of $P$ and $Q$. **[2017] ...[2M]**

40. If the distances of $P(x, y)$ from $A(5, 1)$ and $B(-1, 5)$ are equal, then prove that $3x = 2y$. **[2017] ...[2M]**

41. Find the ratio in which $P(4, m)$ divides the line segment joining the points $A(2, 3)$ and $B(6, -3)$. Hence find $m$. **[2018] ...[2M]**

42. Find the ratio in which the segment joining the points (1, –3) and (4, 5) is divided by $x$-axis? Also find the coordinates of this point on $x$-axis. **[2019] ...[2M]**

43. If $P$ divides the joining of $A(-2, -2)$ and $B(2, -4)$ such that $\frac{AP}{AB} = \frac{3}{7}$, find the coordinates of $P$. **[2008] ...[3M]**

44. The mid-points of the sides of a triangle are (3, 4), (4, 6) and (5, 7). Find the coordinates of the vertices of the triangle. **[2008] ...[3M]**

45. Find the ratio in which the point $(2, y)$ divides the line segment joining the points $A(-2, 2)$ and $B(3, 7)$. Also find the value of $y$. **[2009] ...[3M]**

46. Find the area of the quadrilateral $ABCD$ whose vertices are $A(-4, -2)$, $B(-3, -6)$, $C(3, -2)$ and $D(2, 3)$ **[2009] ...[3M]**

47. Point $P$ divides the line segment joining the points $A(2, 1)$ and $B(5, -8)$ such that $\frac{AP}{AB} = \frac{1}{3}$. If $P$ lies on the line $2x - y + k = 0$, find the value of $k$. **[2010] ...[3M]**

48. If $R(x, y)$ is a point on the line segment joining the points $P(a, b)$ and $Q(b, a)$, then prove that $x + y = a + b$. **[2010] ...[3M]**

49. Point $P(x, 4)$ lies on the line segment joining the points $A(-5, 8)$ and $B(4, -10)$. Find the ratio in which point $P$ divides the line segment $AB$. Also find the value of $x$. **[2011] ...[3M]**

50. Find the area of quadrilateral $ABCD$, whose vertices are $A(-3, -1)$, $B(-2, -4)$, $C(4, -1)$ and $D(3, 4)$. **[2011] ...[3M]**

51. Find the area of the triangle formed by joining the midpoints of the sides of the triangle whose vertices are $A(2, 1)$, $B(4, 3)$ and $C(2, 5)$. **[2011] ...[3M]**

52. A point $P$ divides the line segment joining the points $A(3, -5)$ and $B(-4, 8)$ such that $\frac{AP}{PB} = \frac{K}{1}$. If $P$ lies on the line $x + y = 0$, then find the value of $K$. **[2012] ...[3M]**

53. If the vertices of triangle are $(1, -3)$, $(4, p)$ and $(-9, 7)$ and its area is 15 sq. units, find the value(s) of $p$. **[2012] ...[3M]**

54. Find the ratio in which the $y$-axis divides the line segment joining the points $(-4, -6)$ and $(10, 12)$. Also, find the coordinates of the point of division. **[2013] ...[3M]**

55. Show that the points $(-2, 3)$, $(8, 3)$ and $(6, 7)$ are the vertices of a right triangle. **[2013] ...[3M]**

56. If the point $A(0, 2)$ is equidistant from the points $B(3, p)$ and $C(p, 5)$, find $P$, also find the length of $AB$. **[2014] ...[3M]**

57. If the points $A(-2, 1)$, $B(a, b)$ and $C(4, -1)$ are collinear and $a - b = 1$, find the values of $a$ and $b$. **[2014] ...[3M]**

58. If the coordinates of points $A$ and $B$ are $(-2, -2)$ and $(2, -4)$ respectively, find the coordinates of $P$ such that $AP = \frac{3}{7}AB$, where $P$ lies on the line segment $AB$. **[2015] ...[3M]**

59. If the point $P(x, y)$ is equidistant from the points $A(a + b, b - a)$ and $B(a - b, a + b)$. Prove that $bx = ay$. **[2016] ...[3M]**

60. In what ratio does the point $\left(\frac{24}{11}, y\right)$ divide the line segment joining the points $P(2, -2)$ and $Q(3, 7)$? Also find the value of $y$. **[2017] ...[3M]**

61. If $A(-2, 1)$, $B(a, 0)$, $C(4, b)$ and $D(1, 2)$ are the vertices of a parallelogram $ABCD$, find the values of $a$ and $b$. Hence find the lengths of its sides. **[2018] ...[3M]**

62. If $A(-5, 7)$, $B(-4, -5)$, $C(-1, -6)$ and $D(4, 5)$ are the vertices of quadrilateral, find the area of the quadrilateral $ABCD$. **[2018] ...[3M]**

63. Find the point on $y$-axis which is equidistant from the points $(5, -2)$ and $(-3, 2)$. **[2019]...[3M]**

64. The line segment joining the points $A(2, 1)$ and $B(5, -8)$ is trisected at the points $P$ and $Q$ such that $P$ is nearer to $A$. If $P$ also lies on the line given by $2x - y + k = 0$, find the value of $k$. **[2019] ...[3M]**

65. **Read the following passage carefully and then answer the questions given at the end.**
To conduct Sports Day activities, in your rectangular shaped school ground ABCD, lines have been drawn with chalk powder at a distance of 1 m each. 100 flower pots have been placed at a distance of 1 m from each other along AD, as shown in Fig. 5. Niharika runs $\frac{1}{4}$th the distance AD on the 2nd line and posts a green flag. Preet runs $\frac{1}{5}$th the distance AD on the eighth line and posts a red flag.

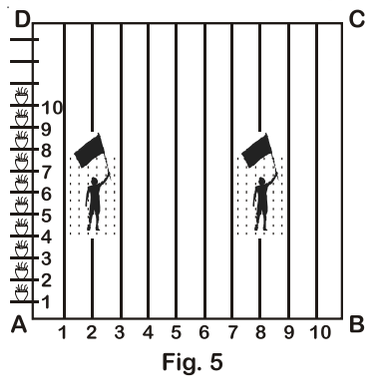



**Fig. 5**

(i) What is the distance between the two flags?

(ii) If Rashmi has to post a blue flag exactly half way between the line segment joining the two flags, where should she post the blue flag? **[2020] ...[3M]**

66. Find the area of triangle $PQR$ formed by the points $P(-5, 7)$, Q$(-4, -5)$ and $R(4, 5)$.

**[2020] ...[3M]**

**OR**

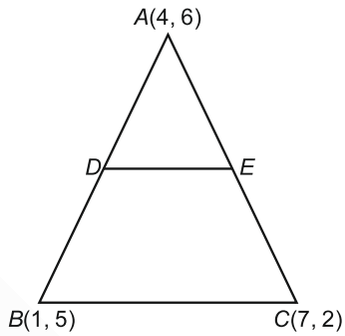
If the point $C(-1, 2)$ divides internally the line segment joining $A(2, 5)$ and $B(x, y)$ in the ratio 3 : 4, find the coordinates of $B$. **[2020] ...[3M]**

67. If the area of triangles $ABC$ formed by $A(x, y)$, $B(1, 2)$ and $C(2, 1)$ is 6 square units, then prove that $x + y = 15$. **[2013] ...[4M]**

68. Find the ratio in which the point $P(x, 2)$ divides the line segment joining the points $A(12, 5)$ and $B(4, -3)$. Also find the value of $x$. **[2014] ...[4M]**

69. Find the values of $k$ so that the area of the triangle with vertices $(1, -1)$, $(-4, 2k)$ and $(-k, -5)$ is 24 sq. units. **[2015] ...[4M]**

70. In figure, the vertices of $\Delta ABC$ are $A(4, 6)$, $B(1, 5)$ and $C(7, 2)$. A line-segment $DE$ is drawn to intersect the sides $AB$ and $AC$ at $D$ and $E$ respectively such that $\frac{AD}{AB} = \frac{AE}{AC} = \frac{1}{3}$. Calculate the area of $\Delta ADE$ and compare it with area of $\Delta ABC$. **[2016] ...[4M]**




71. If the points $A(k + 1, 2k)$, $B(3k, 2k + 3)$ and $C(5k - 1, 5k)$ are collinear, then find the value of $k$. **[2017] ...[4M]**

## 8 : Introduction to Trigonometry

1. If $\tan A = \frac{5}{12}$, find the value of $(\sin A + \cos A) \sec A$. **[2008] ...[1M]**

2. If $\sec^2\theta(1 + \sin\theta)(1 - \sin\theta) = k$, then find the value of $k$. **[2009] ...[1M]**

3. If $3x = \text{cosec}\theta$ and $\frac{3}{x} = \cot\theta$, find the value of $3\left(x^2 - \frac{1}{x^2}\right)$. **[2010] ...[1M]**

4. What is the value of $(\cos^2 67° - \sin^2 23°)$?

**[2018] ...[1M]**

5. Find $A$ if $\tan 2A = \cot(A - 24°)$ **[2019] ...[1M]**

6. Find the value of $(\sin^2 33° + \sin^2 57°)$

**[2019] ...[1M]**

7. The value of $(\sin 20° \cos 70° + \sin 70° \cos 20°)$ is _____. **[2020] ...[1M]**

8. If $\tan(A+B) = \sqrt{3}$ and $\tan(A-B) = \frac{1}{\sqrt{3}}$, $A > B$, then the value of A is _____.**[2020] ...[1M]**

9. If $5\tan\theta = 3$, then what is the value of $\left(\frac{5\sin\theta - 3\cos\theta}{4\sin\theta + 3\cos\theta}\right)$ ? **[2020] ...[1M]**

10. $\frac{\cos 80°}{\sin 10°} + \cos 59° \text{cosec}\, 31° =$ _____.

**[2020] ...[1M]**

11. The value of $\left(\sin^2\theta + \frac{1}{1+\tan^2\theta}\right) =$ _____.

**[2020] ...[1M]**

**OR**

The value of $(1 + \tan^2\theta)(1 - \sin\theta)(1 + \sin\theta)$ =_____. **[2020] ...[1M]**

12. The value of $(\tan^2 45° - \cos^2 60°)$ is

**[2021] ...[1M]**

(a) 1/2 (b) 1/4

(c) 3/2 (d) 3/4

13. Which of the following is not defined?

**[2021] ...[1M]**

(a) sec 0° (b) cosec 90°

(c) tan 90° (d) cot 90°

14. In a right-angled triangle $PQR$, $\angle Q = 90°$. If $\angle P = 45°$, then value of $\tan P - \cos^2 R$ is

**[2021] ...[1M]**

(a) 0 (b) 1

(c) 1/2 (d) 3/2

15. If $\tan\theta = \frac{2}{3}$, then the value of $\sec\theta$ is **[2021] ...[1M]**

(a) $\frac{\sqrt{13}}{3}$ (b) $\frac{\sqrt{5}}{3}$

(c) $\sqrt{\frac{13}{3}}$ (d) $\frac{3}{\sqrt{13}}$

16. If $\sin\theta - \cos\theta = 0$, then the value of $\theta$ is **[2021] ...[1M]**

(a) 30° (b) 45°

(c) 90° (d) 0°

17. $\frac{1}{1+\sin\theta} + \frac{1}{1-\sin\theta}$ can be simplified to get **[2021] ...[1M]**

(a) $2\cos^2\theta$ (b) $\frac{1}{2}\sec^2\theta$

(c) $\frac{2}{\sin^2\theta}$ (d) $2\sec^2\theta$

18. $(1 + \tan^2 A)(1 + \sin A)(1 - \sin A)$ is equal to **[2021] ...[1M]**

(a) $\frac{\cos^2 A}{\sec^2 A}$ (b) 1

(c) 0 (d) 2

19. If $\cot\theta = \frac{1}{\sqrt{3}}$, the value of $\sec^2\theta + \text{cosec}^2\theta$ is **[2021] ...[1M]**

(a) 1 (b) $\frac{40}{9}$

(c) $\frac{38}{9}$ (d) $5\frac{1}{3}$

20. In $\Delta ABC$ right angled at $B$, $\sin A = \frac{7}{25}$, then the value of $\cos C$ is **[2021] ...[1M]**

(a) $\frac{7}{25}$ (b) $\frac{24}{25}$

(c) $\frac{7}{24}$ (d) $\frac{24}{7}$

21. Given that $\sec\theta = \sqrt{2}$, the value of $\frac{1+\tan\theta}{\sin\theta}$ is **[2021] ...[1M]**

(a) $2\sqrt{2}$ (b) $\sqrt{2}$

(c) $3\sqrt{2}$ (d) 2

22. If $\theta$ is an acute angle and $\tan\theta + \cot\theta = 2$, then the value of $\sin^3\theta + \cos^3\theta$ is **[2021] ...[1M]**

(a) 1 (b) $\frac{1}{2}$

(c) $\frac{\sqrt{2}}{2}$ (d) $\sqrt{2}$

23. If $a\cot\theta + b\,\text{cosec}\theta = p$ and $b\cot\theta + a\,\text{cosec}\theta = q$, then $p^2 - q^2 =$ **[2021] ...[1M]**

(a) $a^2 - b^2$ (b) $b^2 - a^2$

(c) $a^2 + b^2$ (d) $b - a$

24. If $\sec\theta + \tan\theta = p$, then $\tan\theta$ is **[2021] ...[1M]**

(a) $\frac{p^2+1}{2p}$ (b) $\frac{p^2-1}{2p}$

(c) $\frac{p^2-1}{p^2+1}$ (d) $\frac{p^2+1}{p^2-1}$

25. If $\sec 4A = \text{cosec}(A - 20°)$, where $4A$ is an acute angle, find the value of $A$. **[2008] ...[2M]**

26. In a $\Delta ABC$, right-angled at $C$, if $\tan A = \frac{1}{\sqrt{3}}$, find the value of $\sin A\cos B + \cos A\sin B$. **[2008] ...[2M]**

27. If $\cot\theta = \frac{15}{8}$, then evaluate $\frac{(2+2\sin\theta)(1-\sin\theta)}{(1+\cos\theta)(2-2\cos\theta)}$. **[2009] ...[2M]**

28. Find the value of $\tan 60°$, geometrically. **[2009] ...[2M]**

29. Without using trigonometric tables, find the value of the following expression

$$\frac{\sec(90°-\theta).\text{cosec}\,\theta - \tan\theta(90°-\theta)\cot\theta + \cos^2 25° + \cos^2 65°}{3\tan 27°\cdot\tan 63°}$$

**[2010] ...[2M]**

30. Find the value of $\text{cosec}\,30°$ geometrically. **[2010] ...[2M]**

31. Prove that $\sqrt{\frac{1-\sin\theta}{1+\sin\theta}} = \sec\theta - \tan\theta$. **[2020] ...[2M]**

**OR**

Prove that $\frac{\tan^2\theta}{1+\tan^2\theta} + \frac{\cot^2\theta}{1+\cot^2\theta} = 1$ **[2020] ...[2M]**

32. The rod *AC* of a TV disc antenna is fixed at right angles to the wall *AB* and a rod *CD* is supporting the disc as shown in Fig.4. If *AC* = 1.5 m long and *CD* = 3 m, find (i) tanθ (ii) secθ + cosecθ **[2020] ...[2M]**

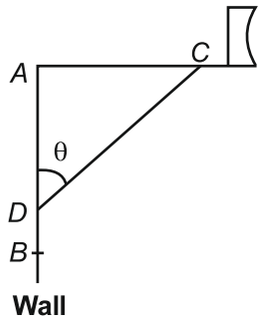



**Fig.4**

33. Prove that : (1 + cot *A* + tan *A*)(sin *A* – cos *A*) = sin *A* tan *A* – cot *A* cos *A*. **[2008] ...[3M]**

34. Without using trigonometric tables, evaluate the following :

$$2\left(\frac{\cos 58^\circ}{\sin 32^\circ}\right)-\sqrt{3}\left(\frac{\cos 38^\circ \operatorname{cosec} 52^\circ}{\tan 15^\circ \tan 60^\circ \tan 75^\circ}\right)$$

**[2008] ...[3M]**

35. Evaluate :

$$\frac{2}{3}\operatorname{cosec}^2 58^\circ-\frac{2}{3}\cot 58^\circ \tan 32^\circ-\frac{5}{3}\tan 13^\circ$$

$\tan 37^\circ \tan 45^\circ \tan 53^\circ \tan 77^\circ$ **[2009] ...[3M]**

36. Prove the following :

$$\frac{\tan A}{1-\cot A}+\frac{\cot A}{1-\tan A}=1+\tan A+\cot A.$$

**[2010] ...[3M]**

37. Prove the following :

$$(\operatorname{cosec} A-\sin A)(\sec A-\cos A)=\frac{1}{\tan A+\cot A}.$$

**[2010] ...[3M]**

38. If 4 tanθ = 3, evaluate $\left(\frac{4\sin\theta-\cos\theta+1}{4\sin\theta+\cos\theta-1}\right)$ **[2018] ...[3M]**

39. If tan2*A* = cot (*A* – 18°), where 2*A* is an angle, find the value of *A*. **[2018] ...[3M]**

40. Prove that : $(\sin\theta + \operatorname{cosec}\theta)^2 + (\cos\theta + \sec\theta)^2 = 7 + \tan^2\theta + \cot^2\theta$. **[2019] ...[3M]**

41. Prove that : (1 + cotA – cosecA) (1 + tanA + secA) = 2. **[2019] ...[3M]**

42. Prove that (1 + tan *A* – sec *A*) × (1 + tan *A* + sec *A*) = 2 tan *A* **[2020] ...[3M]**

**OR**

Prove that $\frac{\operatorname{cosec}\theta}{\operatorname{cosec}\theta-1}+\frac{\operatorname{cosec}\theta}{\operatorname{cosec}\theta+1}=2\sec^2\theta$

**[2020] ...[3M]**

43. If $\sin\theta+\cos\theta=\sqrt{3}$, then prove that tanθ + cotθ = 1. **[2020] ...[3M]**

44. Prove that $\frac{\sin A-2\sin^3 A}{2\cos^3 A-\cos A}=\tan A$ **[2018] ...[4M]**

45. Prove that $\frac{\sin A-\cos A+1}{\sin A+\cos A-1}=\frac{1}{\sec A-\tan A}$ **[2019] ...[4M]**

## 9 : Some Applications of Trigonometry

1. A tower stands vertically on the ground. From a point on the ground which is 25 m away from the foot of the tower, the angle of elevation of the top of the tower is found to be 45°. Then the height (in meters) of the tower is **[2011] ...[1M]**

(A) $25\sqrt{2}$ (B) $25\sqrt{3}$

(C) 25 (D) 12.5

2. The length of shadow of a tower on the plane ground is $\sqrt{3}$ times the height of the tower. The angle of elevation of Sun is **[2012] ...[1M]**

(A) 45° (B) 30°

(C) 60° (D) 90°

3. The angle of depression of a car, standing on the ground, from the top of a 75 m high tower, is 30°. The distance of the car from the base of the tower (in metre) is **[2013] ...[1M]**

(A) $25\sqrt{3}$ (B) $50\sqrt{3}$

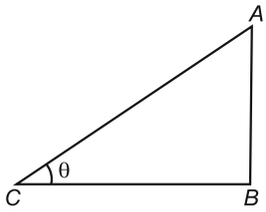
(C) $75\sqrt{3}$ (D) 150

4. A ladder makes an angle of 60º with the ground when placed against a wall. If the foot of the ladder is 2 m away from the wall, then the length (in meters) is **[2014] ...[1M]**

(A) $\frac{4}{\sqrt{3}}$ (B) $4\sqrt{3}$

(C) $2\sqrt{2}$ (D) 4

5. In the following figure, a tower *AB* is 20 m high and *BC*, its shadow on the ground is $20\sqrt{3}$ m long. Find the Sun's altitude. **[2015] ...[1M]**




6. A ladder leaning against a wall makes an angle of 60º with the horizontal. If the foot of the ladder is 2.5 m away from the wall, find the length of the ladder. **[2016] ...[1M]**

7. If a tower 30 m high, casts a shadow $10\sqrt{3}$ m long on the ground, then what is the angle of elevation of the sun? **[2017] ...[1M]**

8. The ratio of the length of a vertical rod and the length of its shadow is $1:\sqrt{3}$. Find the angle of elevation of the sun at that moment?

**[2020] ...[1M]**

9. From the top of a vertical tower, the angles of depression of two cars, in the same straight line with the base of the tower, at an instant are found to be 45° and 60°. If the cars are 100 m in apart and are on the same side of the tower, find the height of the tower. ($\sqrt{3}$ = 1.73)

**[2011] ...[3M]**

10. A kite is flying at a height of 45 m above the ground. The string attached to the kite is temporarily tied to a point on the ground. The inclination of the string with the ground is 60°. Find the length of the string assuming that there is no slack in the string. **[2012] ...[3M]**

11. The horizontal distance between two poles is 15 m. The angle of depression of the top of first pole as seen from the top of second pole is 30°. If the height of the second pole is 24 m, find the height of the first pole. [Use $\sqrt{3}$ = 1.732]

**[2013] ...[3M]**

12. Two ships are there in the sea on either side of a light house in such a way that the ships and the light house are in the same straight line. The angles of depression of two ships as observed from the top of the light house are 60º and 45º. If the height of the light house is 200 m, find the distance between the two ships. $\left[\text{Use } \sqrt{3} = 1.73\right]$ **[2014] ...[3M]**

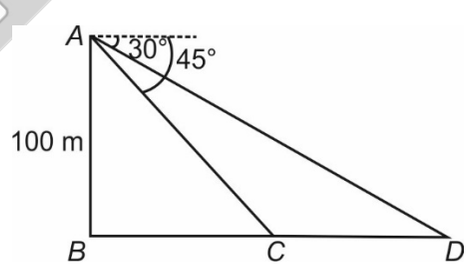
13. The angle of elevation of an aeroplane from point A on the ground is 60º. After flight of 15 seconds, the angle of elevation changes to 30º. If the aeroplane is flying at a constant height of $1500\sqrt{3}$ m, find the speed of the plane in km/hr. **[2015] ...[3M]**

14. A man standing on the deck of a ship, which is 10 m above water level, observes the angle of elevation of the top of a hill as 60º and the angle of depression of the base of the hill as 30º. Find the distance of the hill from the ship and the height of the hill. **[2016] ...[3M]**

15. On a straight line passing through the foot of a tower, two points *C* and *D* are at distances of 4 m and 16 m from the foot respectively. If the angles of elevation from *C* and *D* of the top of the tower are complementary, then find the height of the tower. **[2017] ...[3M]**

16. (a) As observed from the top of a light house 100 m above sea level, the angle of depression of a ship, sailing directly towards it, changes from 30° to 45°. Determine the distance travelled by the ship during this time. **[2022] ...[3M]**

$\left(\text{Use } \sqrt{3} = 1.73\right)$




**OR**

(b) At a point on level ground, the angle of elevation of a vertical tower is, found to be $\alpha$ such that $\tan\alpha = \frac{1}{3}$. After walking 100 m towards the tower, the angle of elevation $\beta$ becomes such that $\tan\beta = \frac{3}{4}$. Find the height of the tower. **[2022] ...[3M]**

17. In Fig. 3, *AB* is tower of height 50 m. A man standing on its top, observes two cars on the opposite sides of the tower with angles of depression 30° and 45° respectively. Find the distance between the two cars. **[2022] ...[3M]**

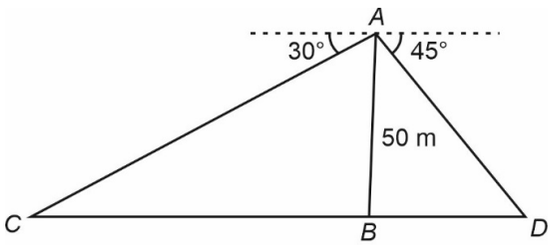



**Fig. 3**

18. Two poles of equal heights are standing opposite to each other on either side of the roads, which is 80 m wide. From a point between them on the road, the angles of elevation of the top of the poles are 60º and 30º respectively. Find the height of the poles and the distances of the point from the poles. **[2013] ...[4M]**

19. The angles of elevation and depression of the top and the bottom of a tower from the top of a building, 60 m high, are 30° and 60° respectively. Find the difference between the heights of the building and the tower and the distance between them. **[2014] ...[4M]**

20. At a point *A*, 20 metres above the level of water in a lake, the angle of elevation of a cloud is 30º. The angle of depression of the reflection of the cloud in the lake, at *A* is 60º. Find the distance of the cloud from *A*. **[2015] ...[4M]**

21. The angle of elevation of the top *Q* of a vertical tower *PQ* from a point *X* on the ground is 60º. From a point *Y*, 40 m vertically above *X*, the angle of elevation of the top *Q* of tower is 45º. Find the height of the tower *PQ* and the distance *PX*. $\left(\text{Use } \sqrt{3} = 1.73\right)$ **[2016] ...[4M]**

22. An aeroplane is flying at a height of 300 m above the ground. Flying at this height, the angles of depression from the aeroplane of two points on both banks of a river in opposite directions are 45° and 30° respectively. Find the width of the river. $\left[\text{Use } \sqrt{3} = 1.732\right]$ **[2017] ...[4M]**

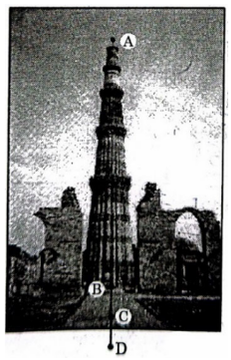
23. As observed from the top of a 100 m high light house from the sea-level, the angles of depression of two ships are 30° and 45°. If one ship is exactly being the other on the same side of the light house, find the distance between the two ships. $\left[\text{Use } \sqrt{3} = 1.732\right]$ **[2018] ...[4M]**

24. A man in a boat rowing away from a light house 100 m high takes 2 minutes to change the angle of elevation of the top of the light house from 60° to 30°. Find the speed of the boat in metres per minute. $\left[\text{Use } \sqrt{3} = 1.732\right]$ **[2019] ...[4M]**

25. The angle of elevation of the top of a building from the foot of a tower is 30°. The angle of elevation of the top of the tower from the foot of the building is 60°. If the tower is 60 m high, find the height of the building. **[2020] ...[4M]**

26. A vertical tower stands on a horizontal plane and is surmounted by a vertical flag-staff of height 6 m. At a point on the plane, the angle of elevation of the bottom and top of the flag-staff are 30° and 45° respectively. Find the height of the tower. $\left(\text{Take } \sqrt{3} = 1.73\right)$ **[2020] ...[4M]**

27. ***Case Study Based Question :*** Qutub Minar, located in South Delhi, India, was built in the year 1193. It is 72 m high tower. Working on a school project, Charu and Daljeet visited the monument. They used trigonometry to find their distance from the tower. Observe the picture given below. Points *C* and *D* represent their positions on the ground in line with the base of tower, the angles of elevation of top of the tower (Point *A*) are 60° and 45° from points *C* and *D* respectively. **[2022] ...[4M]**




(i) Based on above information, draw a well-labelled diagram. **[1]**

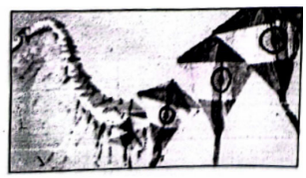
(ii) Find the distances *CD*, *BC* and *BD*. (use $\sqrt{3}$ = 1.73) **[3]**

28. ***Case Study Based Question :***

**Kite Festival**

Kite festival is celebrated in many countries at different times of the year. In India, every year 14th January is celebrated as International Kite Day. On this day many people visit India and participate in the festival by flying various kinds of kites.

The picture given below, shows three kites flying together.



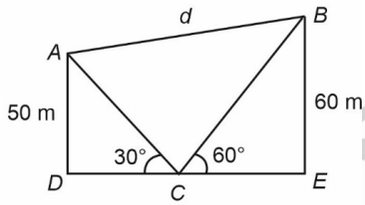



**Fig. 5**

In Fig. 5, the angles of elevation of two kites (Points *A* and *B*) from the hands of a man (Point *C*) are found to be 30° and 60° respectively. Taking *AD* = 50 m and *BE* = 60 m, find **[2022] ...[4M]**

(1) the lengths of strings used (take them straight) for kites *A* and *B* as shown in the figure. **[2]**

(2) the distance '*d*' between these two kites **[2]**

29. The angle of elevation of an aeroplane from a point *A* on the ground is 60°. After a flight of 30 seconds, the angle of elevation changes to 30°. If the plane is flying at a constant height of $3600\sqrt{3}$ m, then find the speed (in km/hour) of the plane. **[2008] ...[6M]**

30. An aeroplane when flying at a height 3125 m from the ground passes vertically below another plane at that instant when the angles of elevation of the two planes from the same point on the ground are 30° and 60° respectively. Find the distance between the two planes at that instant. **[2009] ...[6M]**

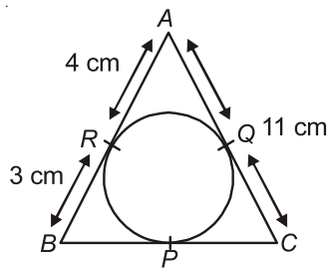
31. From the top of a 7 m high building, the angle of elevation of the top of a tower is 60° and the angle of depression of the foot of the tower is 45°. Find the height of the tower. **[2010] ...[6M]**

32. The angle of elevation of the top of a vertical tower from a point on the ground is 60°. From another point 10 m vertically above the first, its angle of elevation is 30°. Find the height of the tower. **[2011] ...[6M]**

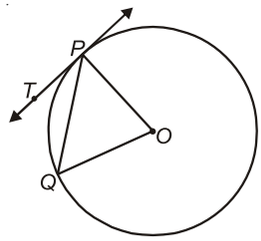
33. The angle of elevation of the top of a hill from the foot of a tower is 60° and the angle of depression from the top of the tower to the foot of the hill is 30°. If the tower is 50 m high, find the height of the hill. **[2012] ...[6M]**

## 10 : Circles

1. In figure, $\Delta ABC$ is circumscribing a circle. Find the length of *BC*. **[2009, 2012] ...[1M]**




2. If figure, *O* is the centre of a circle, *PQ* is a chord and *PT* is the tangent at *P*. If $\angle POQ = 70°$, then $\angle TPQ$ is equal to **[2011] ...[1M]**



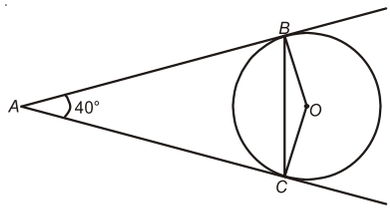

(A) 55°

(B) 70°

(C) 45°

(D) 35°

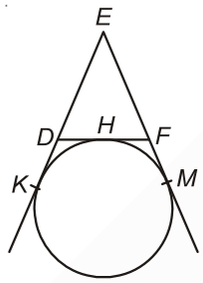
3. In figure, $AB$ and $AC$ are tangents to the circle with center $O$ such that $\angle BAC = 40°$. Then $\angle BOC$ is equal to **[2011] ...[1M]**




(A) 40° (B) 50°

(C) 140° (D) 160°

4. In figure, a circle touches the side $DF$ of $\Delta EDF$ at $H$ and touches $ED$ and $EF$ produced at $K$ and $M$ respectively. If $EK = 9$ cm, then the perimeter of $\Delta EDF$ (in cm) is **[2012] ...[1M]**



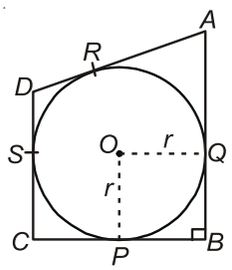

(A) 18

(B) 13.5

(C) 12

(D) 9

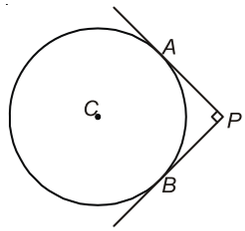
5. In below figure, a circle with centre $O$ is inscribed in a quadrilateral $ABCD$ such that, it touches the sides $BC$, $AB$, $AD$ and $CD$ at point $P$, $Q$, $R$ and $S$ respectively. If $AB = 29$ cm, $AD = 23$ cm, $\angle B = 90°$ and $DS = 5$ cm, then the radius of the circle (in cm) is **[2013] ...[1M]**




(A) 11 (B) 18

(C) 6 (D) 15

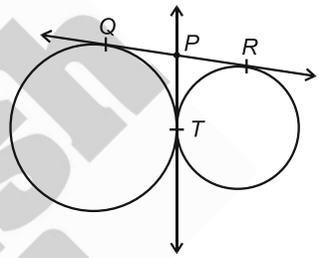
6. In below figure, $PA$ and $PB$ are two tangents drawn from an external point $P$ to a circle with centre $C$ and radius 4 cm. If $PA \perp PB$, then the length of each tangent is **[2013] ...[1M]**




(A) 3 cm (B) 4 cm

(C) 5 cm (D) 6 cm

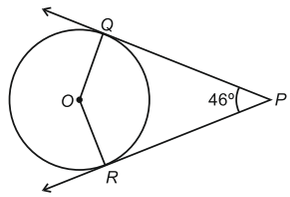
7. In figure, $QR$ is a common tangent to the given circles, touching externally at the point $T$. The tangent at $T$ meets $QR$ at $P$. If $PT = 3.8$ cm, then the length of $QR$ (in cm) is **[2014] ...[1M]**




(A) 3.8 (B) 7.6

(C) 5.7 (D) 1.9

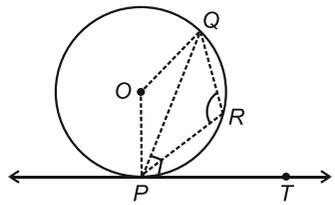
8. In figure, $PQ$ and $PR$ two tangents to a circle with centre $O$. If $\angle QPR = 46°$, $\angle QOR$ equals: **[2014] ...[1M]**



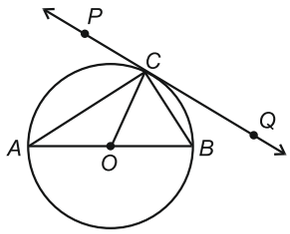

(A) 67° (B) 134°

(C) 44° (D) 46°

9. In the following figure, $PQ$ is a chord of a circle with centre $O$ and $PT$ is a tangent. If $\angle QPT = 60°$, find $\angle PRQ$ **[2015] ...[1M]**



10. In the figure, $PQ$ is a tangent at a point $C$ to a circle with centre $O$. If $AB$ is a diameter and $\angle CAB = 30^\circ$, find $\angle PCA$. **[2016] ...[1M]**




11. If the angle between two tangents drawn from an external point $P$ to $a$ circle of radius $a$ and centre of $O$, is 60°, then find the length of $OP$.

**[2017] ...[1M]**

12. In Fig. 1, on a circle of radius 7 cm, tangent $PT$ is drawn from a point $P$ such that $PT$ = 24 cm. If $O$ is the centre of the circle, then the length of $PR$ is **[2020] ...[1M]**

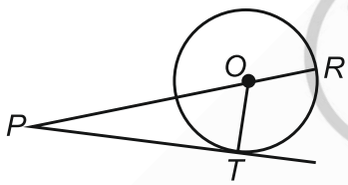



Fig. 1

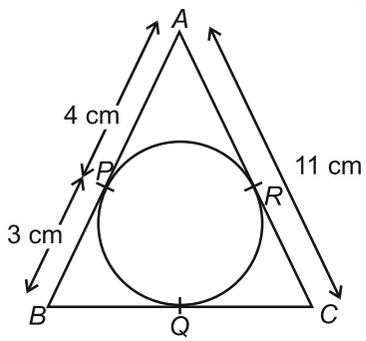
(a) 30 cm

(b) 28 cm

(c) 32 cm

(d) 25 cm

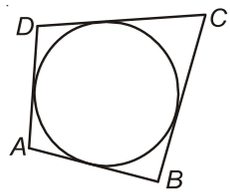
13. In Fig. 1, $\Delta ABC$ is circumscribing a circle, the length of $BC$ is _____ cm. **[2020] ...[1M]**



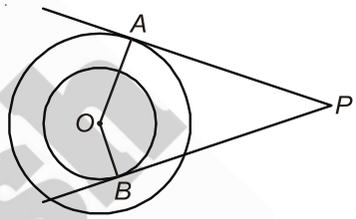

14. If all the sides of a parallelogram touch a circle, show that the parallelogram is a rhombus.

**[2008, 2010, 2012] ...[3M], [2013, 2014] ...[2M]**

15. In figure, a circle touches all the four sides of a quadrilateral $ABCD$ whose sides are $AB$ = 6 cm, $BC$ = 9 cm and $CD$ = 8cm, find the length of side $AD$. **[2011] ...[2M]**

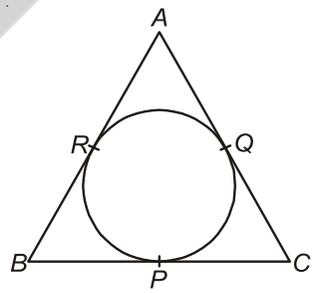



16. Tangents $PA$ and $PB$ are drawn from an external point $P$ to two concentric circle with centre $O$ and radii 8 cm and 5 cm respectively, as shown in figure, if $AP$ = 15 cm, then find the length of $BP$. **[2012] ...[2M]**



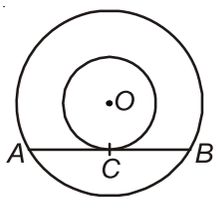

17. In figure, an isosceles triangle $ABC$, with $AB = AC$, circumscribes a circle. Prove that the point of contact $P$ bisects the base $BC$.

**[2012] ...[2M]**

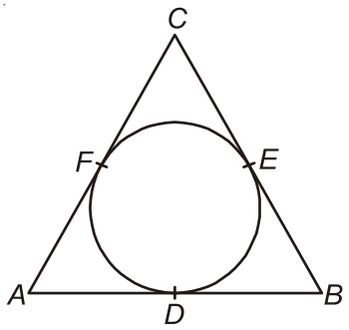



18. In figure, the chord $AB$ of the larger of the two concentric circles, with centre $O$, touches the smaller circle at $C$. Prove that $AC = CB$.

**[2012] ...[2M]**



19. In below figure, a circle is inscribed in triangle *ABC* touches its sides *AB*, *BC* and *AC* at points *D*, *E* and *F* respectively. If *AB* = 12 cm, *BC* = 8 cm and *AC* = 10 cm, then find the length of *AD*, *BE* and *CF*. **[2013] ...[2M]**

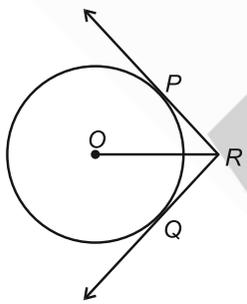



20. Prove that the line segment joining the point of contact of two parallel tangents of a circle passes through its centre. **[2014] ...[2M]**

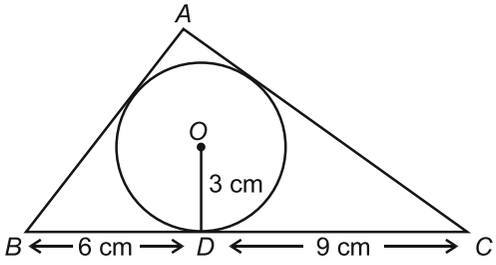
21. If from an external point *P* of a circle with centre *O*, two tangents *PQ* and *PR* are drawn such that $\angle QPR = 120^\circ$, prove that $2PQ = PO$.

**[2014] ...[2M]**

22. In the following figure, two tangents *RQ* and *RP* are drawn from an external point *R* to the circle with centre *O*, if $\angle PRQ = 120^\circ$, then prove that *OR* = *PR* + *RQ*. **[2015] ...[2M]**

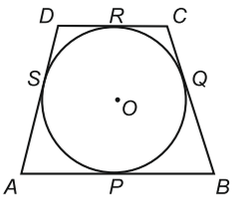



23. In figure, a $\Delta ABC$ is drawn to circumscribe a circle of radius 3 cm, such that the segments *BD* and *DC* are respectively of lengths 6 cm and 9 cm. If the area of $\Delta ABC$ is 54 $cm^2$, then find the lengths of sides *AB* and *AC*. **[2015] ...[2M]**

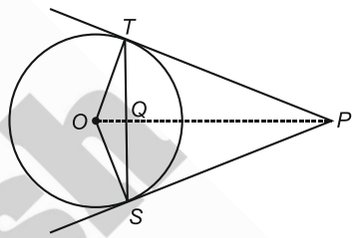



24. In figure, a quadrilateral *ABCD* is drawn to circumscribe a circle, with centre *O*, in such a way that the sides *AB*, *BC*, *CD* and *DA* touch the circle at the points *P*, *Q*, *R* and *S* respectively. Prove that *AB* + *CD* = *BC* + *DA*.

**[2012[4], 2016] ...[2M]**




25. In figure, from an external point *P*, two tangents *PT* and *PS* are drawn to a circle with centre *O* and radius *r*. If *OP* = 2*r*, show that $\angle OTS = \angle OST = 30^\circ$ **[2016] ...[2M]**




26. Prove that the tangents drawn at the end points of a chord of a circle make equal angles with the chord. **[2017] ...[2M]**

27. A circle touches all the four sides of a quadrilateral *ABCD*. Prove that *AB* + *CD* = *BC* + *DA*.

**[2017] ...[2M]**

28. In Fig. 4, a circle touches all the four sides of a quadrilateral *ABCD*. If *AB* = 6 cm, *BC* = 9 cm and *CD* = 8 cm, then find the length of *AD*.

**[2020] ...[2M]**

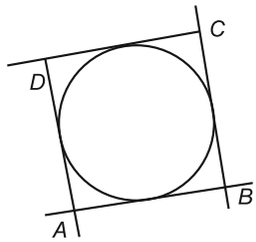



**Fig. 4**

29. In Fig.3, two tangents *TP* and *TQ* are drawn to a circle with centre *O* from an external point *T*. Prove that $\angle PTQ = 2\angle OPQ$. **[2020] ...[2M]**

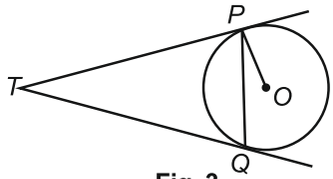



**Fig. 3**

30. (a) In Fig. 1, perimeter of $\Delta PQR$ is 20 cm. Find the length of tangent $PA$. **[2022] ...[2M]**

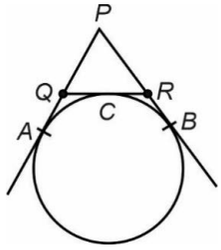



**Fig. 1**

**OR**

(b) In Fig. 2, $BC$ is tangent to the circle at point $B$ of circle centred at $O$. $BD$ is a chord of the circle so that $\angle BAD = 55°$. Find $m\angle DBC$

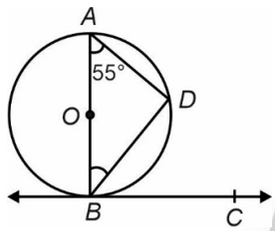



**Fig. 2**

31. (a) In Fig. 1, $AB$ is diameter of a circle centered at $O$. $BC$ is tangent to the circle at $B$. If $OP$ bisects the chord $AD$ and $\angle AOP = 60°$, then find $m\angle C$. **[2022] ...[2M]**

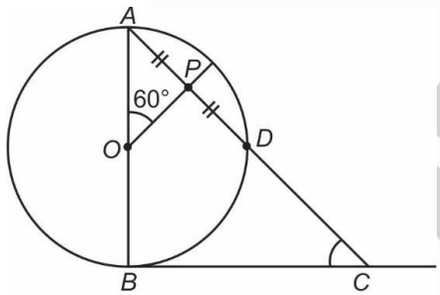



**Fig. 1**

**OR**

(b) In Fig. 2, $XAY$ is a tangent to the circle centered at $O$. If $\angle ABO = 40°$, then find $m\angle BAY$ and $m\angle AOB$.

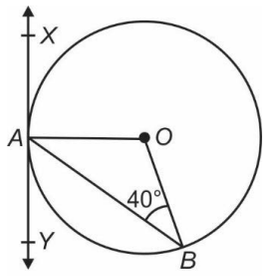
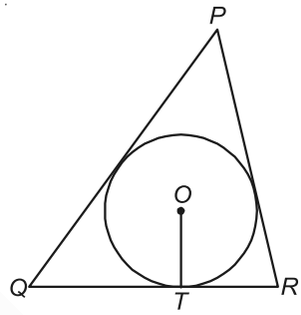


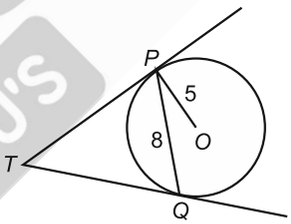

**Fig. 2**

32. In given figure, a triangle $PQR$ is drawn to circumscribe a circle of radius 6 cm such that the segments $QT$ and $TR$ into which $QR$ is divided by the point of contact $T$, are of lengths 12 cm and 9 cm respectively. If the area of $\Delta PQR = 189$ cm$^2$, then find the lengths of sides $PQ$ and $PR$. **[2011] ...[3M]**



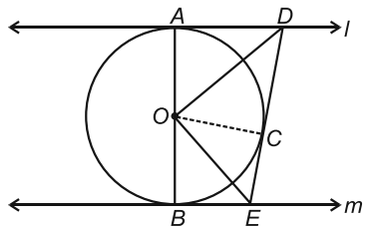

33. Prove that opposite sides of a quadrilateral circumscribing a circle subtend supplementary angles at the centre of the circle. **[2012] ...[3M]**

34. In Figure, $PQ$ is a chord of length 8 cm of a circle of radius 5 cm and centre $O$. The tangents at $P$ and $Q$ intersect at point $T$. Find the length of $TP$. **[2019] ...[3M]**




35. Prove that the tangent at any point of a circle is perpendicular to the radius through the point of contact. **[2011, 2012, 2013] ...[4M]**

36. In figure, $l$ and $m$ are two parallel tangents to a circle with centre $O$, touching the circle at $A$ and $B$ respectively. Another tangent at $C$ intersects the line $l$ at $D$ and $m$ at $E$. Prove that $\angle DOE = 90°$ **[2013] ...[4M]**



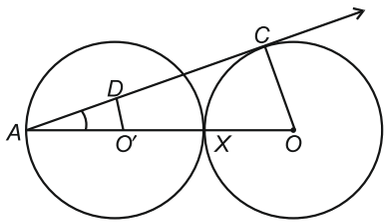

37. Prove that the length of the tangents drawn from an external point to a circle are equal.

**[2014, 2015, 2016, 2017] ...[4M]**

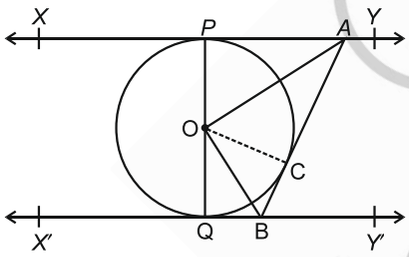
38. Prove that the tangent drawn at the midpoint of an arc of a circle is parallel to the chord joining the end points of the arc. **[2015] ...[4M]**

39. In figure, two equal circles, with centres $O$ and $O'$, touch each other at $X$. $OO'$ produced meets the circle with centre $O'$ at $A$. $AC$ is tangent to the circle with centre $O$, at the point $C$. $O'D$ is perpendicular to $AC$. Find the value of $\frac{DO'}{CO}$.

**[2016] ...[4M]**




40. In the given figure, $XY$ and $X'Y'$ are two parallel tangents to a circle with centre $O$ and another tangent $AB$ with point of contact $C$, is intersecting $XY$ at $A$ and $X'Y'$ at $B$. Prove that $\angle AOB = 90°$. **[2017] ...[4M]**




41. (a) Prove that a parallelogram circumscribing a circle is a rhombus. **[2022] ...[4M]**

**OR**

(b) Prove that the perpendicular at the point of contact to the tangent to a circle passes through the centre of the circle. **[2022] ...[4M]**

42. In Fig. 4, $PQ$ is a chord of length 8 cm of a circle of radius 5 cm. The tangents at $P$ and $Q$ meet at a point $T$. Find the length of $TP$.

**[2022] ...[4M]**

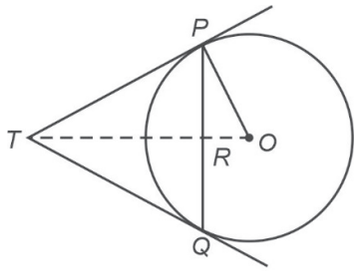
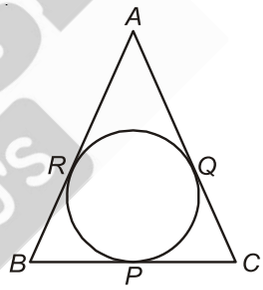



**Fig. 4**

43. Prove that the lengths of tangents drawn from an external point to a circle are equal. Using the above, prove the following :

$ABC$ is an isosceles triangle in which $AB = AC$, circumscribed about a circle, as shown in figure, Prove that the base is bisected by the point of contact. **[2008] ...[6M]**




44. Prove that the lengths of the tangents drawn from an external point to a circle are equal.

Using the above theorem prove that:

If quadrilateral $ABCD$ is circumscribing a circle, then $AB + CD = AD + BC$. **[2009] ...[6M]**

## 11 : Constructions

1. Draw a line-segment $AB$ of length 7 cm. Using ruler and compasses, find a point $P$ on $AB$ such that $\frac{AP}{AB} = \frac{3}{5}$. **[2011] ...[2M]**

2. Draw a right triangle in which the sides containing the right angle are 5 cm and 4 cm. Construct a similar triangle whose sides are $\frac{5}{3}$ times the sides of the given triangle. **[2008] ...[3M]**

3. Draw a right triangle in which sides (other than hypotenuse) are of length 8 cm and 6 cm. The construct another triangle whose sides are $\frac{3}{4}$ times the corresponding sides of the first triangle. **[2009] ...[3M]**

4. Construct a triangle $ABC$ in which $BC = 8$ cm, $\angle B = 45°$ and $\angle C = 30°$. Construct another triangle similar to $\Delta ABC$ such that its sides are $\frac{3}{4}$ of the corresponding sides of $\Delta ABC$.

**[2010] ...[3M]**

5. Draw a pair of tangents to a circle of radius 3 cm, which are inclined to each other at an angle of 60°. **[2011] ...[3M]**

6. Draw a right triangle in which the sides (other than hypotenuse) are of lengths 4 cm and 3 cm. Then construct another triangle whose sides are $\frac{3}{5}$ times the corresponding sides of the given triangle. **[2011] ...[3M]**

7. Draw a triangle $ABC$ with side $BC$ = 6 cm, $\angle C$ = 30° and $\angle A$ = 105°. Then construct another triangle whose sides are $\frac{2}{3}$ times the corresponding sides of $\Delta ABC$. **[2012] ...[3M]**

8. Construct a tangent of a circle of radius 4 cm from a point on the concentric circle of radius 6 cm. **[2013] ...[3M]**

9. Draw a right triangle $ABC$ in which $AB$ = 6 cm, $BC$ = 8 cm and $\angle B$ = 90°. Draw $BD$ perpendicular from $B$ on $AC$ and draw a circle passing through the points $B$, $C$ and $D$. Construct tangents from $A$ to this circle. **[2014] ...[3M]**

10. Draw a circle of radius 4 cm. From a point 7 cm away from the centre of circle. Construct a pair of tangents to the circle. **[2020] ...[3M]**

**OR**

Draw a line segment of 6 cm and divide it in the ratio 3 : 2. **[2020] ...[3M]**

11. Draw a circle of radius 2.5 cm. Construct a pair of tangents from a point $P$ at a distance of 6 cm from the centre of the circle. **[2022] ...[3M]**

12. Draw two concentric circles of radii 2 cm and 5 cm. From a point on the outer circle, construct a pair of tangents to the inner circle. **[2022] ...[3M]**

13. Construct a $\Delta ABC$ in which $AB$ = 6 cm, $\angle A$ = 30° and $\angle B$ = 60°, construct another $\Delta AB'C'$ similar to $\Delta ABC$ with base $AB'$ = 8 cm. **[2015] ...[4M]**

14. Draw a circle of radius 4 cm. Draw two tangents to the circle inclined at an angle of 60° to each other. **[2016] ...[4M]**

15. Construct a triangle $ABC$ with side $BC$ = 7 cm, $\angle B$ = 45°, $\angle A$ = 105°. Then construct another triangle whose sides are $\frac{3}{4}$ times the corresponding sides of the $\Delta ABC$. **[2017]...[4M]**

16. Draw a triangle $ABC$ with $BC$ = 6 cm, $AB$ = 5 cm and $\angle ABC$ = 60°. Then construct a triangle whose sides are $\frac{3}{4}$ of the corresponding sides of the $\Delta ABC$. **[2018] ...[4M]**

17. Construct a $\Delta ABC$ in which $CA$ = 6 cm, $AB$ = 5 cm and $\angle BAC$ = 45°. Then construct a triangle whose sides are $\frac{3}{5}$ of the corresponding sides of $\Delta ABC$. **[2019] ...[4M]**

18. Draw a line segment $AB$ of length 7 cm. Taking A as centre, draw a circle of radius 3 cm and taking $B$ as centre, draw another circle of radius 2 cm. Construct tangents to each circle from the centre of the other circle. **[2020] ...[4M]**

## 12 : Areas Related to Circles

1. If the diameter of a semicircular protractor is 14 cm, then find its perimeter. **[2009] ...[1M]**

2. The perimeter (in cm) of a square circumscribing a circle of radius $a$ cm, is **[2011] ...[1M]**

   (A) 8$a$ (B) 4$a$

   (C) 2$a$ (D) 16$a$

3. If the area of a circle is equal to sum of the areas of two circles of diameters 10 cm and 24 cm, then the diameter of the larger circle (in cm) is **[2012] ...[1M]**

   (A) 34 (B) 26

   (C) 17 (D) 14

4. If the difference between the circumference and the radius of a circle is 37 cm, then using $\pi = \frac{22}{7}$, the circumference of the circle is (in cm) **[2013] ...[1M]**

   (A) 154

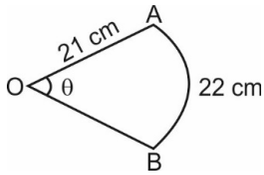
   (B) 44

   (C) 14

   (D) 7

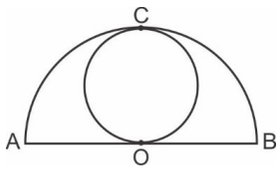
5. The areas of two circles are in the ratio 9 : 4, then what is the ratio of their circumferences? **[2020] ...[1M]**

6. A circular arc of length 22 cm subtends an angle $\theta$ at the centre of the circle of radius 21 cm. The value of $\theta$ is **[2021] ...[1M]**



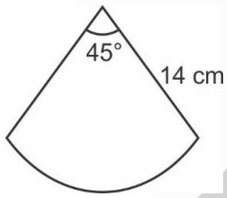

(a) 90° (b) 50°
(c) 60° (d) 30°

7. In the given figure, a circle is touching a semi-circle at *C* and its diameter *AB* at *O*. If *AB* = 28 cm, what is the radius of the inner circle? **[2021] ...[1M]**



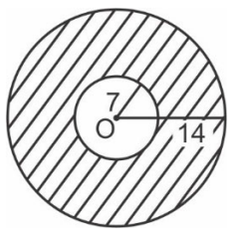

(a) 14 cm (b) 28 cm
(c) 7 cm (d) $\frac{7}{2}$ cm

8. The perimeter of the sector of a circle of radius 14 cm and central angle 45° is **[2021] ...[1M]**




(a) 11 cm (b) 22 cm
(c) 28 cm (d) 39 cm

9. Two concentric circles are centred at *O*. The area of shaded region, if outer and inner radii are 14 cm and 7 cm respectively, is **[2021] ...[1M]**




(a) 462 $cm^2$
(b) 154 $cm^2$
(c) 231 $cm^2$
(d) 308 $cm^2$

10. The area of a quadrant of a circle where the circumference of circle is 176 m, is **[2021] ...[1M]**

(a) 2464 $m^2$ (b) 1232 $m^2$
(c) 616 $m^2$ (d) 308 $m^2$

11. The minute hand of a clock is 84 cm long. The distance covered by the tip of minute hand from 10 : 10 am to 10 : 25 am is **[2021] ...[1M]**

(a) 44 cm (b) 88 cm
(c) 132 cm (d) 176 cm

12. The diameter of a car wheel is 42 cm. The number of complete revolutions it will make in moving 132 km is **[2021] ...[1M]**

(a) $10^4$ (b) $10^5$
(c) $10^6$ (d) $10^3$

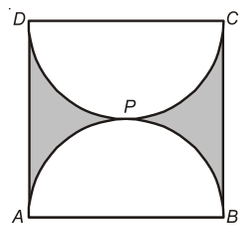
13. The area of a square that can be inscribed in a circle of area $\frac{1408}{7}$ $cm^2$ is **[2021] ...[1M]**

(a) 321 $cm^2$ (b) 642 $cm^2$
(c) 128 $cm^2$ (d) 256 $cm^2$

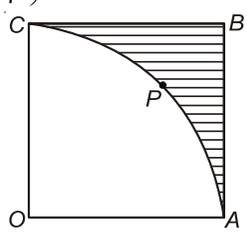
14. If the perimeter of a circle is half to that of a square, then the ratio of the area of the circle to the area of the square is **[2021] ...[1M]**

(a) 22 : 7 (b) 11 : 7
(c) 7 : 11 (d) 7 : 22

15. Find the perimeter of the shaded region in figure, if *ABCD* is a square of side 14 cm and *APB* and *CPD* are semicircles. $\left(\text{Use } \pi = \frac{22}{7}\right)$ **[2011]...[2M]**




16. In figure, *OABC* is a square of side 7 cm. If *OAPC* is a quadrant of a circle with centre *O*, then find the area of the shaded region. $\left(\text{Use } \pi = \frac{22}{7}\right)$ **[2012] ...[2M]**

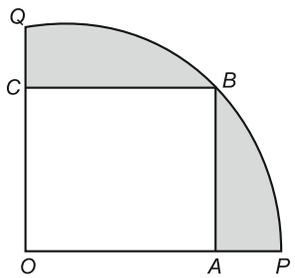


17. Two circular pieces of equal radii and maximum area, touching each other are cut out from a rectangular card board of dimensions 14 cm × 7 cm. Find the area of the remaining card board.

$\left(\text{Use } \pi = \frac{22}{7}\right)$ **[2013] ...[2M]**

18. In figure, a square *OABC* is inscribed in a quadrant *OPBQ* of a circle. If *OA* = 20 cm, find the area of the shaded region (Use $\pi$ = 3.14).

**[2014] ...[2M]**



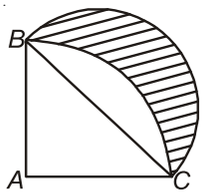

19. The perimeter of a sector of a circle with radius 6.5 cm is 31 cm, then find the area of the sector. **[2020] ...[2M]**

20. A piece of wire 22 cm long is bent into the form of an arc of a circle subtending an angle of 60° at its centre. Find the radius of the circle.

$\left[\text{Use}\, \pi = \frac{22}{7}\right]$ **[2020] ...[2M]**

21. In figure, *ABC* is a quadrant of a circle of radius 14 cm and a semicircle is drawn with *BC* as diameter. Find the area of the shaded region.

**[2008] ...[3M]**

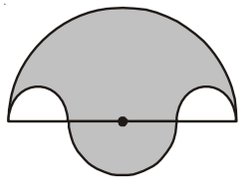



22. The area of an equilateral triangle is $49\sqrt{3}$ cm$^2$. Taking each angular point as centre, circles are drawn with radius equal to half the length of the side of the triangle. Find the area of triangle not included in the circle. $\left[\text{Take } \sqrt{3} = 1.73\right]$

**[2009] ...[3M]**

23. In below figure, the boundary of shaded region consists of four semicircular arcs, two smallest being equal. If diameter of the largest is 14 cm and that of the smallest is 3.5 cm, calculate the area of the shaded region. $\left[\text{Use } \pi = \frac{22}{7}\right]$

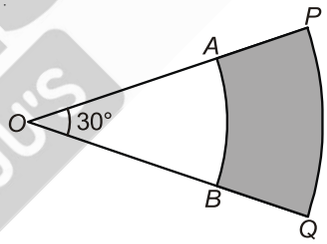
**[2010] ...[3M]**



24. A chord of a circle of radius 14 cm subtends an angle of 120° at the centre. Find the area of the corresponding minor segment of the circle.

$\left[\text{Use } \pi = \frac{22}{7} \text{ and } \sqrt{3} = 1.73\right]$ **[2011] ...[3M]**

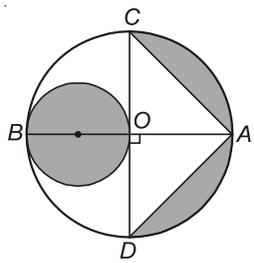
25. In figure, *PQ* and *AB* are respectively the arcs of two concentric circles of radii 7 cm and 3.5 cm and centre *O*. If $\angle POQ$ = 30°, then find the area of the shaded region. $\left(\text{Use } \pi = \frac{22}{7}\right)$ **[2012]...[3M]**



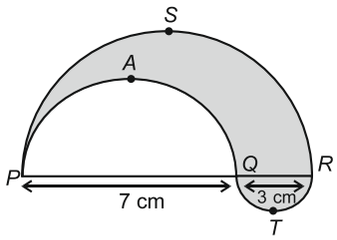

26. In a circle of radius 21 cm, an arc subtends an angle of 60° at the centre. Find (i) the length of the arc (ii) area of the sector formed by the arc.

$\left(\text{Use } \pi = \frac{22}{7}\right)$ **[2013] ...[3M]**

27. In below figure, *AB* and *CD* are two diameters of a circle with centre *O*, which are perpendicular to each other. *OB* is the diameter of the smaller circle. If *OA* = 7 cm, find the area of the shaded region. $\left(\text{Use } \pi = \frac{22}{7}\right)$ **[2013] ...[3M]**

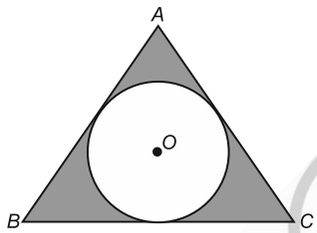


28. In figure, *PSR*, *RTQ* and *PAQ* are three semicircles of diameters 10 cm, 3 cm and 7 cm respectively. Find the perimeter of the shaded region. [Use $\pi = 3.14$] **[2014] ...[3M]**




29. If a circle is inscribed in an equilateral triangle *ABC* of side 12 cm. Find the radius of inscribed circle and the area of the shaded region.

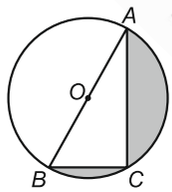
$\left[\text{Use } \pi = 3.14 \text{ and } \sqrt{3} = 1.73\right]$ **[2014]...[3M]**




30. Find the area of the minor segment of a circle of radius 14 cm, when its central angle is 60º. Also find the area of the corresponding major segment.

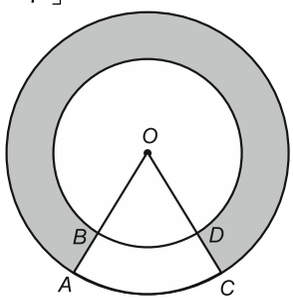
$\left[\text{Use } \pi = \frac{22}{7}\right]$ **[2015] ...[3M]**

31. In figure, *O* is the centre of a circle such that diameter *AB* = 13 cm and *AC* = 12 cm. *BC* is joined. Find the area of the shaded region. (Take $\pi = 3.14$) **[2016] ...[3M]**

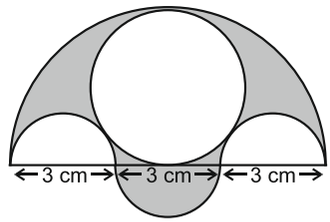



32. In figure, find the area of the shaded region, enclosed between two concentric circles of radii 7 cm and 14 cm where $\angle AOC = 40°$.

$\left[\text{Use } \pi = \frac{22}{7}\right]$ **[2016] ...[3M]**

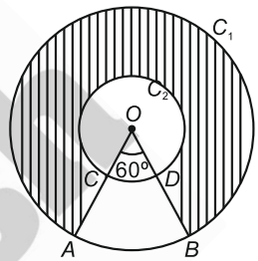



33. Three semicircles each of diameter 3 cm, a circle of diameter 4.5 cm and a semicircle of radius 4.5 cm are drawn in the given figure. Find the area of the shaded region. **[2017] ...[3M]**



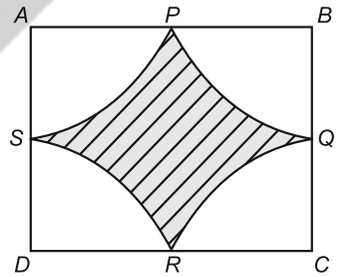

34. In the given figure, two concentric circles with centre *O* have radii 21 cm and 42 cm. If $\angle AOB = 60°$, find the area of the shaded region.

$\left[\text{Use } \pi = \frac{22}{7}\right]$ **[2017] ...[3M]**



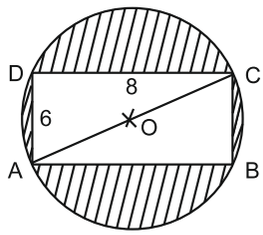

35. Find the area of the shaded region in figure, where arcs drawn with centres *A*, *B*, *C* and *D* intersect in pairs at midpoints *P*, *Q*, *R* and *S* of the sides *AB*, *BC*, *CD* and *DA* respectively of a square of side 12 cm. [Use $\pi = 3.14$]

**[2018] ...[3M]**

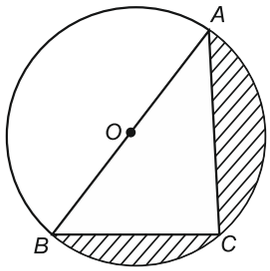



36. Find the area of the shaded region in given figure 4, if *ABCD* is a rectangle with sides 8 cm and 6 cm and *O* is the centre of circle. (Take $\pi = 3.14$)

**[2019] ...[3M]**

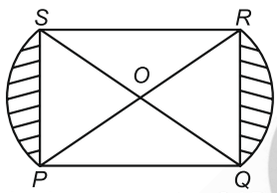


37. Find the area of the shaded region in figure, if *AC* = 24 cm, *BC* = 10 cm and *O* is the centre of the circle. [Use $\pi$ = 3.14] **[2010] ...[4M]**

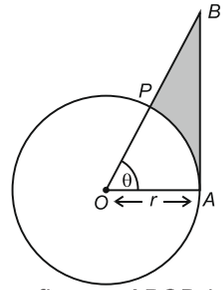



38. In the following figure, *PQRS* is square lawn with side *PQ* = 42 metres. Two circular flower beds are there on the sides *PS* and *QR* with centre at *O*, the intersections of its diagonals. Find the total area of the two flower beds (shaded parts).

**[2015] ...[4M]**

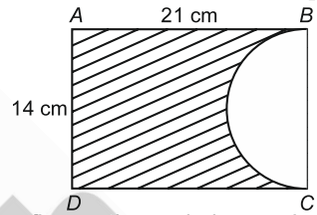



39. In figure, is shown a sector *OAP* of a circle with centre *O*, containing $\angle\theta$. *AB* is perpendicular to the radius *OA* and meets *OP* produced at *B*. Prove that the perimeter of shaded region is $r\left[\tan\theta + \sec\theta + \frac{\pi\theta}{180^\circ} - 1\right]$. **[2016] ...[4M]**



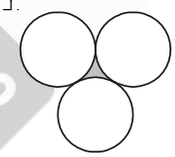

40. In the given figure, *ABCD* is a rectangle of dimensions 21 cm × 14 cm. A semicircle is drawn with *BC* as diameter. Find the area and the perimeter of the shaded region in the figure.

**[2017] ...[4M]**




41. In below figure, three circles each of radius 3.5 cm are drawn in such a way each of them touches the other two. Find the area enclosed between these three circles (shaded region).

$\left[\text{Use } \pi = \frac{22}{7}\right]$ **[2011] ...[6M]**



## 13 : Surface Areas and Volumes

1. The surface area of a sphere is 616 $cm^2$. Find its radius. **[2008] ...[1M]**

2. The slant height of a frustum of a cone is 4 cm and the perimeters (circumferences) of its circular ends are 18 cm and 6 cm. Find the curved surface area of the frustum. (Use $\pi = \frac{22}{7}$) **[2010]...[1M], 2017...[3M]**

3. The radius (in cm) of the largest right circular cone that can be cut out from a cube of edge 4.2 cm is **[2011] ...[1M]**

   (A) 4.2

   (B) 2.1

   (C) 8.4

   (D) 1.05

4. If the radius of the base of a right circular cylinder is halved, keeping the height same, then the ratio of the volume of the cylinder thus obtained to the volume of original cylinder is

   **[2012] ...[1M]**

   (A) 1 : 2 (B) 2 : 1

   (C) 1 : 4 (D) 4 : 1

5. The number of solid spheres, each of diameter 6 cm that can be made by melting a solid metal cylinder of height 45 cm and diameter 4 cm is

   **[2014] ...[1M]**

   (A) 3 (B) 5

   (C) 4 (D) 6

6. Two cones have their heights in the ratio 1 : 3 and radii in the ratio 3 : 1. What is the ratio of their volumes? **[2020] ...[1M]**

7. Two cubes each of volume 27 $cm^3$ are joined end to end to form a solid. Find the surface area of the resulting cuboid. **[2011] ...[2M]**

8. A cone of height 20 cm and radius of base 5 cm is made up of modelling clay. A child reshapes it in the form of a sphere. Find the diameter of the sphere. **[2011] ...[2M]**

9. The volume of a hemisphere is $2425\frac{1}{2}$ $cm^3$. Find its curved surface area. $\left[\text{Use } \pi = \frac{22}{7}\right]$ **[2012] ...[2M]**

10. 3 cubes each of 8 cm edge are joined end to end. Find the total surface area of the cuboid so formed. **[2022] ...[2M]**

11. A solid piece of metal in the form of a cuboid of dimensions 11 cm × 7 cm × 7 cm is melted to form '*n*' number of solid spheres of radii $\frac{7}{2}$ cm each. Find the value of *n*. **[2022] ...[2M]**

12. An open metal bucket is in the shape of a frustum of a cone of height 21 cm with radii of its lower and upper ends as 10 cm and 20 cm respectively. Find the cost of milk which can completely fill the bucket at ₹30 per litre. $\left[\text{Use } \pi = \frac{22}{7}\right]$ **[2011] ...[3M]**

13. From a solid cylinder of height 7 cm and base diameter 12 cm, a conical cavity of same height and same base diameter is hollowed out. Find the total surface area of the remaining solid. $\left[\text{Use } \pi = \frac{22}{7}\right]$ **[2012] ...[3M]**

14. A cylindrical bucket, 32 cm high and with radius of base 18 cm, is filled with sand. This bucket is emptied on the ground and a conical heap of sand is formed. If the height of the conical heap is 24 cm, then find the radius and slant height of the heap. **[2012] ...[3M]**

15. A vessel is in the form of hemispherical bowl surmounted by a hollow cylinder of same diameter. The diameter of the hemispherical bowl is 14 cm and the total height of the vessel is 13 cm. Find the total surface area of the vessel. $\left[\text{Use } \pi = \frac{22}{7}\right]$ **[2013] ...[3M]**

16. A wooden toy was made by scooping out a hemisphere of same radius from each end of a solid cylinder. If the height of the cylinder is 10 cm, and its base is of radius 3.5 cm, find the volume of wood in the toy. $\left[\text{Use } \pi = \frac{22}{7}\right]$ **[2013] ...[3M]**

17. A farmer connects a pipe of internal diameter 20 cm from a canal into cylindrical tank which is 10 m in diameter and 2 m deep. If the water flows through the pipe at the rate of 4 km per hour, in how much time will the tank be filled completely? **[2014] ...[3M]**

18. A solid metallic right circular cone 20 cm high and whose vertical angle is 60°, is cut into two parts at the middle of its height by a plane parallel to its base. If the frustum so obtained be drawn into a wire of diameter $\frac{1}{12}$ cm, find the length of the wire. **[2014] ...[3M]**

19. Due to sudden floods, some welfare associations jointly requested the government to get 100 tents fixed immediately and offered to contribute 50% of the cost. If the lower part of each tent is of the form of a cylinder of diameter 4.2 m and height 4 m with the conical upper part of same diameter but height 2.8 m, and the canvas to be used costs ₹100 per sq. m, find the amount, the association will have to pay. What values are shown by these association? $\left[\text{Use } \pi = \frac{22}{7}\right]$ **[2015] ...[3M]**

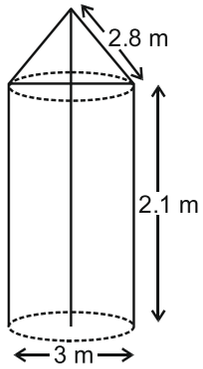
20. A hemispherical bowl of internal diameter 36 cm contains liquid. This liquid is filled into 72 cylindrical bottles of diameter 6 cm. Find the height of each bottle, if 10% liquid is wasted in this transfer. **[2015] ...[3M]**

21. A cubical block of side 10 cm is surmounted by a hemisphere. What is the largest diameter that the hemisphere can have? Find the cost of painting the total surface area of the solid so formed, at the rate of ₹5 per sq. cm. [Use $\pi = 3.14$] **[2015] ...[3M]**

22. 504 cones, each of diameter 3.5 cm and height 3 cm, are melted and recast into a metallic sphere, find the diameter of the sphere and hence find its surface area. $\left[\text{Use } \pi = \frac{22}{7}\right]$ **[2015] ...[3M]**

23. In figure, a tent is in the shape of a cylinder surmounted by a conical top of same diameter. If the height and diameter of cylindrical part are 2.1 m and 3 m respectively and the slant height of conical part is 2.8 m, find the cost of canvas needed to make the tent if the canvas is available at the rate of ₹ 500/sq. metre.

$\left[\text{Use } \pi = \frac{22}{7}\right]$ **[2016] ...[3M]**




24. A conical vessel, with base radius 5 cm and height 24 cm, is full of water. This water is emptied into a cylindrical vessel of base radius 10 cm. Find the height to which the water will rise in the cylindrical vessel. $\left(\text{Use } \pi = \frac{22}{7}\right)$

**[2016] ...[3M]**

25. A sphere of diameter 12 cm, is dropped in a right circular cylindrical vessel, partly filled with water. If the sphere is completely submerged in water, the water level in the cylindrical vessel rises by $3\frac{5}{9}$ cm. Find the diameter of the cylindrical vessel. **[2016] ...[3M]**

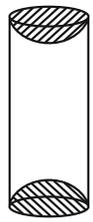
26. In a canal, 5.4 m wide and 1.8 m deep, water is flowing with a speed of 25 km/hr. How much area can it irrigate in 40 minutes, if 10 cm of standing water is required for irrigation?

**[2017] ...[3M]**

27. The dimensions of a solid iron cuboid are 4.4 m × 2.6 m × 1.0 m. It is melted and recast into a hollow cylindrical pipe of 30 cm inner radius and thickness 5 cm. Find the length of the pipe.

**[2017] ...[3M]**

28. A wooden article was made by scooping out a hemisphere from each end of a solid cylinder, as shown in figure. If the height of the cylinder is 10 cm and its base is of radius 3.5 cm. Find the total surface area of the article. **[2018] ...[3M]**



29. A heap of rice is in the form of a cone of base diameter 24 m and height 3.5 m. Find the volume of the rice. How much canvas cloth is required to just cover the heap? **[2018] ...[3M]**

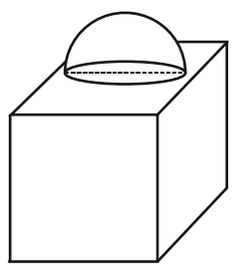
30. Water in a canal, 6 m wide and 1.5 m deep, is flowing with a speed of 10 km/hour. How much area will it irrigate in 30 minutes; if 8 cm standing water is needed? **[2019] ...[3M]**

31. A solid metallic cuboid of dimension 24 cm × 11 cm × 7 cm is melted and recast into solid cones of base radius 3.5 cm and height 6 cm. Find the number of cones so formed. **[2020] ...[3M]**

32. A cone of base radius 4 cm is divided into two parts by drawing a plane through the mid-point of its height and parallel to its base. Compare the volume of the two parts.

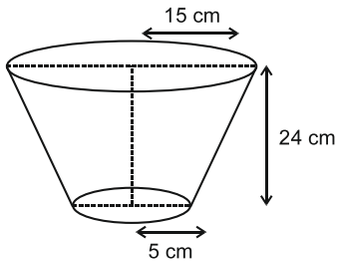
**[2020] ...[3M]**

33. Figure shows a decorative block which is made of two solids – a cube and a hemisphere. The base of the block is a cube with edge 5 cm and the hemisphere, fixed on the top, has a diameter of 4.2 cm. Find the total 2 surface area of the block. $\left[\text{Take } \pi = \frac{22}{7}\right]$ **[2009] ...[4M]**



34. Water is flowing through a cylindrical pipe, of internal diameter 2 cm, into a cylindrical tank of base radius 40 cm, at the rate of 0.4 m/s. Determine the rise in level of water in the tank in half an hour. **[2013] ...[4M]**

35. A bucket open at the top, and made up of a metal sheet is in the form of a frustum of a cone. The depth of the bucket is 24 cm and the diameters of its upper and lower circular ends are 30 cm and 10 cm respectively. Find the cost of metal sheet used in it at the rate of ₹ 10 per 100 $cm^2$. [Use $\pi$ = 3.14] **[2013] ...[4M]**




36. Sushant has a vessel, of the form of an inverted cone, open at the top, of height 11 cm and radius of top as 2.5 cm and is full of water. Metallic spherical balls each of diameter 0.5 cm are put in the vessel due to which $\frac{2}{5}$ th of the water in the vessel flows out. Find how many balls were put in the vessel. Sushant made the arrangement so that the water that flows out irrigates the flower beds. What value has been shown by Sushant? **[2014] ...[4M]**

37. From a solid cylinder of height 2.8 cm and diameter 4.2 cm a conical cavity of the same height and same diameter is hollowed out. Find the total surface area of the remaining solid. [Take $\pi$ = 22/7] **[2014] ...[4M]**

38. From each end of a solid metal cylinder, metal was scooped out in hemispherical form of same diameter. The height of the cylinder is 10 cm and its base is of radius 4.2 cm. The rest of the cylinder is melted and converted into a cylindrical wire of 1.4 cm thickness. Find the length of the wire. $\left[\text{Use } \pi = \frac{22}{7}\right]$ **[2015] ...[4M]**

39. Due to heavy floods in a state, thousands were rendered homeless. 50 schools collectively offered to the state government to provide place and the canvas for 1500 tents to be fixed by the governments and decided to share the whole expenditure equally. The lower part of each tent is cylindrical of base radius 2.8 cm and height 3.5 m, with conical upper part of same base radius but of height 2.1 m. If the canvas used to make the tents costs ₹ 120 per sq. m, find the amount shared by each school to set up the tents. What value is generated by the above problem?

$\left(\text{Use } \pi = \frac{22}{7}\right)$ **[2016] ...[4M]**

40. In a rainwater harvesting system, the rainwater from a roof of 22 m × 20 m drains into a cylindrical tank having diameter of base 2 m and height 3.5 m. If the tank is full, find the rainfall in cm. **[2017] ...[4M]**

41. The diameters of the lower and upper ends of a bucket in the form of a frustum of a cone are 10 cm and 30 cm respectively. If its height is 24 cm, find : **[2018] ...[4M]**

    (i) The area of the metal sheet used to make the bucket.

    (ii) Why we should avoid the bucket made by ordinary plastic? [Use $\pi$ = 3.14]

42. A bucket open at the top is in the form of a frustum of a cone with a capacity of 12308.8 $cm^3$. The radii of the top and bottom of circular ends of the bucket are 20 cm and 12 cm respectively. Find the height of the bucket and also the area of the metal sheet used in making it. (Use $\pi$ = 3.14) **[2019] ...[4M]**

43. An open metal bucket is in the shape of a frustum of cone of height 21 cm with radii of its lower and upper ends are 10 cm and 20 cm respectively. Find the cost of milk which can completely fill the bucket at the rate of ₹ 40 per litre. **[2020] ...[4M]**

**OR**

A solid is in the shape of a cone surmounted on a hemisphere. The radius of each of them being 3.5 cm and the total height of the solid is 9.5 cm. Find the volume of the solid.

**[2020] ...[4M]**

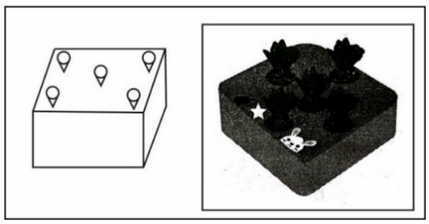
44. A bucket in the form of a frustum of a cone of height 30 cm with radii of its lower and upper ends as 10 cm and 20 cm, respectively. Find the capacity of the bucket. Also find the cost of milk which can completely fill the bucket at the rate of ₹40 per litre. $\left(\text{Use } \pi = \frac{22}{7}\right)$ **[2020] ...[4M]**

45. ***Case Study Based Question :***

A solid cuboidal toy is made of wood. It has five cone shaped cavities to hold toy carrots.

The dimensions of the toy are cuboid – 10 cm × 10 cm × 8 cm.

Each cone carved out – Radius = 2.1 cm and Height = 6 cm. **[2022] ...[4M]**



(i) Find the volume of wood carved out to make five conical cavities.

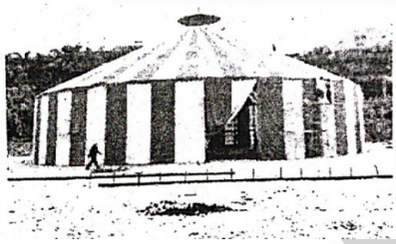
(ii) Find the volume of the wood in the final product.

46. ***Case Study Based Question :***

A 'circus' is a company of performers who put on shows of acrobats, clowns, etc. to entertain people started around 250 years back, in open fields, now generally performed in tents.

**[2022] ...[4M]**

On such 'Circus Tent' is shown below.



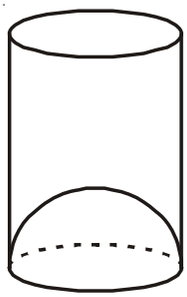
The tent is in the shape of a cylinder surmounted by a conical top. If the height and diameter of cylindrical part are 9 m and 30 m respectively and height of conical part is 8 m with same diameter as that of the cylindrical part, then find

(1) the area of the canvas used in making the tent; **[3]**

(2) the cost of the canvas bought for the tent at the rate ₹ 200 per sq. m, if 30 sq. m canvas was wasted during stitching. **[1]**

47. If the radii of the circular ends of a conical bucket, which is 16 cm high, are 20 cm and 8 cm, find the capacity and total surface area of the bucket. $\left[\text{Use } \pi = \frac{22}{7}\right]$ **[2008] ...[6M]**

48. A juice seller serves his customers using a glass as shown in figure. The inner diameter of the cylindrical glass is 5 cm, but the bottom of the glass has a hemispherical portion raised which reduces the capacity of the glass. If the height of the glass is 10 cm, find the apparent capacity of the glass and its actual capacity. (Use $\pi$ = 3.14) **[2009] ...[6M]**



49. A cylindrical vessel with internal diameter 10 cm and height 10.5 cm is full of water. A solid cone of base diameter 7 cm and height 6 cm is completely immersed in water. Find the volume of

(i) Water displaced out of the cylindrical vessel.

(ii) Water left in the cylindrical vessel.

**[2009] ...[6M]**

50. A milk container is made of metal sheet in the shape of frustum of a cone whose volume is $10459\frac{3}{7}$ cm$^3$. The radii of its lower and upper circular ends are 8 cm and 20 cm respectively. Find the cost of metal sheet used in making the container at the rate of ₹ 1.40 per square centimeter. $\left[\text{Use } \pi = \frac{22}{7}\right]$ **[2010] ...[6M]**

51. A toy is in the form of a hemisphere surmounted by a right circular cone of the same base radius as that of the hemisphere. If the radius of base of the cone is 21 cm and its volume is $\frac{2}{3}$ of the volume of the hemisphere, calculate the height of the cone and the surface area of the toy.

**[2010] ...[6M]**

52. Water is flowing at the rate of 15 km/hour through a pipe of diameter 14 cm into a cuboidal pond which is 50 m long and 44 m wide. In what time will the level of water in the pond rise by 21 cm?

**[2011] ...[6M]**

53. A bucket is in the form of a frustum of a cone and it can hold 28.49 litres of water. If the radii of its circular ends are 28 cm and 21 cm, find the height of the bucket. $\left[\text{Use } \pi = \frac{22}{7}\right]$ **[2012] ...[6M]**

54. A solid is in the shape of a cone standing on a hemisphere with both their radii being equal to 7 cm and the height of the cone is equal to its diameter. Find the volume of the solid. $\left[\text{Use } \pi = \frac{22}{7}\right]$ **[2012] ...[6M]**

## 14 : Statistics

1. Find the class marks of classes 10 – 25 and 35 – 55. **[2008] ...[1M]**

2. The median and mode respectively of a frequency distribution are 26 and 29. Then its mean is **[2020] ...[1M]**

   (a) 27.5 (b) 24.5

   (c) 28.4 (d) 25.8

3. If the mean of the first *n* natural number is 15, then find *n*. **[2020] ...[1M]**

4. Find the mean of the following distribution:

| Classes | Frequency |
|---|---|
| 3 – 5 | 5 |
| 5 – 7 | 10 |
| 7 – 9 | 10 |
| 9 – 11 | 7 |
| 11 – 13 | 8 |

**[2020] ...[2M]**

**OR**

Find the mode of the following data :

| Class : | Frequency : |
|---|---|
| 0 – 20 | 6 |
| 20 – 40 | 8 |
| 40 – 60 | 10 |
| 60 – 80 | 12 |
| 80 – 100 | 6 |
| 100 – 120 | 5 |
| 120 – 140 | 3 |

**[2020] ...[2M]**

5. Find the mode of the following frequency distribution: **[2022] ...[2M]**

| Class : | Frequency : |
|---|---|
| 20 – 30 | 25 |
| 30 – 40 | 30 |
| 40 – 50 | 45 |
| 50 – 60 | 42 |
| 60 – 70 | 35 |

6. If mode of the following frequency distribution is 55, then find the value of *x*. **[2022] ...[2M]**

| Class : | Frequency : |
|---|---|
| 0 – 15 | 10 |
| 15 – 30 | 7 |
| 30 – 45 | *x* |
| 45 – 60 | 15 |
| 60 – 75 | 10 |
| 75 – 90 | 12 |

7. The table below shown the salaries of 280 persons : **[2018] ...[3M]**

| Salary (In thousand) | No. of Person |
|---|---|
| 5 – 10 | 49 |
| 10 – 15 | 133 |
| 15 – 20 | 63 |
| 20 – 25 | 15 |
| 25 – 30 | 6 |
| 30 – 35 | 7 |
| 35 – 40 | 4 |
| 40 – 45 | 2 |
| 45 – 50 | 1 |

Calculate the median salary of the data.

8. Find the mode of the following frequency distribution. **[2019] ...[3M]**

| Class | Frequency |
|---|---|
| 0 - 10 | 8 |
| 10 - 20 | 10 |
| 20 - 30 | 10 |
| 30 - 40 | 16 |
| 40 - 50 | 12 |
| 50 - 60 | 6 |
| 60 - 70 | 7 |

9. Find the mean of the following frequency distribution : **[2022] ...[3M]**

| Class : | Frequency : |
|---|---|
| 10 – 15 | 4 |
| 15 – 20 | 10 |
| 20 – 25 | 5 |
| 25 – 30 | 6 |
| 30 – 35 | 5 |

10. The median of following frequency distribution is 25. Find the value of *x*. **[2022] ...[3M]**

| Class : | Frequency : |
|---|---|
| 0 – 10 | 6 |
| 10 – 20 | 9 |
| 20 – 30 | 10 |
| 30 – 40 | 8 |
| 40 – 50 | *x* |

11. (a) The mean of the following frequency distribution is 25. Find the value of *f*.

**[2022] ...[3M]**

| Class | Frequency |
|---|---|
| 0 – 10 | 5 |
| 10 – 20 | 18 |
| 20 – 30 | 15 |
| 30 – 40 | *f* |
| 40 – 50 | 6 |

**OR**

(b) Find the mean of the following data using assumed mean method :

| Class | Frequency |
|---|---|
| 0 – 5 | 8 |
| 5 – 10 | 7 |
| 10 – 15 | 10 |
| 15 – 20 | 13 |
| 20 – 25 | 12 |

12. Heights of 50 students of Class X of a school are recorded and following data is obtained :

**[2022] ...[3M]**

| Height (in cm) | Number of students |
|---|---|
| 130 – 135 | 4 |
| 135 – 140 | 11 |
| 140 – 145 | 12 |
| 145 – 150 | 7 |
| 150 – 155 | 10 |
| 155 – 160 | 6 |

Find the median height of the students.

13. The mean of the following distribution is 18. Find the frequency *f* of the class 19 – 21. **[2018]...[4M]**

| Class | Frequency |
|---|---|
| 11 – 13 | 3 |
| 13 – 15 | 6 |
| 15 – 17 | 9 |
| 17 – 19 | 13 |
| 19 – 21 | *f* |
| 21 – 23 | 5 |
| 23 – 25 | 4 |

14. The following distribution gives the daily income of 50 workers of a factory : **[2018] ...[4M]**

| Daily income (In) | Number of workers |
|---|---|
| 100 – 120 | 12 |
| 120 – 140 | 14 |
| 140 – 160 | 8 |
| 160 – 180 | 6 |
| 180 – 200 | 10 |

Convert the distribution above to a less than type cumulative frequency distribution and draw its ogive.

15. If the median of the following frequency distribution is 32.5. Find the values of $f_1$ and $f_2$.

| Class | 0-10 | 10-20 | 20-30 | 30-40 | 40-50 | 50-60 | 60-70 | Total |
|---|---|---|---|---|---|---|---|---|
| Frequency | $f_1$ | 5 | 9 | 12 | $f_2$ | 3 | 2 | 40 |

**[2019] ...[4M]**

16. The marks obtained by 100 students of a class in an examination are given below.

| Marks | No. of students |
|---|---|
| 0 – 5 | 2 |
| 5 – 10 | 5 |
| 10 – 15 | 6 |
| 15 – 20 | 8 |
| 20 – 25 | 10 |
| 25 – 30 | 25 |
| 30 – 35 | 20 |
| 35 – 40 | 18 |
| 40 – 45 | 4 |
| 45 – 50 | 2 |

Draw '*a* less than' type cumulative frequency curves (ogive). Hence find median. **[2019] ...[4M]**

17. Find the mean of the following data:

**[2020] ...[4M]**

| Classes | Frequency |
|---|---|
| 0 – 20 | 20 |
| 20 – 40 | 35 |
| 40 – 60 | 52 |
| 60 – 80 | 44 |
| 80 – 100 | 38 |
| 100 – 120 | 31 |

18. The following table gives production yield per hectare (in quintals) of wheat of 100 farms of a village :

| Production yield / hect. | No. of farms |
|---|---|
| 40 – 45 | 4 |
| 45 – 50 | 6 |
| 50 – 55 | 16 |
| 55 – 60 | 20 |
| 60 – 65 | 30 |
| 65 – 70 | 24 |

Change the distribution to 'a more than' type distribution and draw its ogive. **[2020] ...[4M]**

**OR**

The median of the following data is 525. Find the values of $x$ and $y$, if total frequency is 100 :

**[2020] ...[4M]**

| Class : | Frequency : |
|---|---|
| 0 – 100 | 2 |
| 100 – 200 | 5 |
| 200 – 300 | $x$ |
| 300 – 400 | 12 |
| 400 – 500 | 17 |
| 500 – 600 | 20 |
| 600 – 700 | $y$ |
| 700 – 800 | 9 |
| 800 – 900 | 7 |
| 900 – 1000 | 4 |

19. Find mean, median and mode of the following data: **[2008] ...[6M]**

| Classes | Frequency |
|---|---|
| 0 – 20 | 6 |
| 20 – 40 | 8 |
| 40 – 60 | 10 |
| 60 – 80 | 12 |
| 80 – 100 | 6 |
| 100 – 120 | 5 |
| 120 – 140 | 3 |

20. During the medical check-up of 35 students of a class their weights were recorded as follows:

| Weight (in kg) | Number of students |
|---|---|
| 38 – 40 | 3 |
| 40 – 42 | 2 |
| 42 – 44 | 4 |
| 44 – 46 | 5 |
| 46 – 48 | 14 |
| 48 – 50 | 4 |
| 50 – 52 | 3 |

Draw a less than type and a more than type ogive from the given data. Hence obtain the median weight from the graph. **[2009] ...[6M]**

21. Find the mean, mode and median of the following frequency distribution: **[2010] ...[6M]**

| Class | Frequency |
|---|---|
| 0 – 10 | 4 |
| 10 – 20 | 4 |
| 20 – 30 | 7 |
| 30 – 40 | 10 |
| 40 – 50 | 12 |
| 50 – 60 | 8 |
| 60 – 70 | 5 |

## 15 : Probability

1. A die is thrown once. Find the probability of getting a number less than 3. **[2008] ...[1M]**

2. Two coins are tossed simultaneously. Find the probability of getting exactly one head. **[2009] ...[1M]**

3. A card is drawn at random from a well shuffled pack of 52 playing cards. Find the probability of getting a red face card. **[2010] ...[1M]**

4. A card is drawn from a well-shuffled deck of 52 playing cards. The probability that the card will not be an ace is **[2011] ...[1M]**

(A) $\frac{1}{13}$ (B) $\frac{1}{4}$

(C) $\frac{12}{13}$ (D) $\frac{3}{4}$

5. Two dice are thrown together. The probability of getting the same number on both dice is **[2012] ...[1M]**

(A) $\frac{1}{2}$ (B) $\frac{1}{3}$

(C) $\frac{1}{6}$ (D) $\frac{1}{12}$

**OR**

A pair of dice is thrown once. Find the probability of getting the same number on each dice. **[2008] ...[2M]**

6. The probability of getting an even number, when a die is thrown once, is **[2013] ...[1M]**

(A) $\frac{1}{2}$ (B) $\frac{1}{3}$

(C) $\frac{1}{6}$ (D) $\frac{5}{6}$

7. A box contains 90 discs, numbered from 1 to 90. If one disc is drawn at random from the box, the probability that it bears a prime-number less than 23, is **[2013] ...[1M]**

(A) $\frac{7}{90}$ (B) $\frac{10}{90}$

(C) $\frac{4}{45}$ (D) $\frac{9}{89}$

8. If two different dice are rolled together, the probability of getting an even number on both dice, is : **[2014] ...[1M]**

(A) $\frac{1}{36}$ (B) $\frac{1}{2}$

(C) $\frac{1}{6}$ (D) $\frac{1}{4}$

9. A number is selected at random from the numbers 1 to 30. The probability that it is a prime number. **[2014] ...[1M]**

(A) $\frac{2}{3}$ (B) $\frac{1}{6}$

(C) $\frac{1}{3}$ (D) $\frac{11}{30}$

10. Two different dice are tossed together. Find the probability that the product of the two numbers on the top of the dice is 6. **[2015] ...[1M]**

11. A card is drawn at random from a well shuffled pack of 52 playing cards. Find the probability of getting neither a red card nor a queen. **[2016] ...[1M]**

12. The probability of selecting a rotten apple randomly from a heap of 900 apples is 0·18. What is the number of rotten apples in the heap? **[2017] ...[1M]**

13. The probability that a number selected at random from the numbers 1, 2, 3, ..., 15 is a multiple of 4 is **[2020] ...[1M]**

(a) $\frac{4}{15}$ (b) $\frac{2}{15}$

(c) $\frac{1}{15}$ (d) $\frac{1}{5}$

14. If a pair of dice is thrown once, then what is the probability of getting a sum of 8? **[2020] ...[1M]**

15. A letter of English alphabet is chosen at random. What is the probability that the chosen letter is a consonant. **[2020] ...[1M]**

16. A die is thrown once. What is the probability of getting a number less than 3? **[2020] ...[1M]**

**OR**

If the probability of winning a game is 0.07, what is the probability of losing it? **[2020] ...[1M]**

17. Two coins are tossed together. The probability of getting exactly one head is **[2021] ...[1M]**

(a) 1/4 (b) 1/2

(c) 3/4 (d) 1

18. If $P(E) = 0.65$, then the value of $P(\text{not } E)$ is **[2021] ...[1M]**

(a) 1.65 (b) 0.25

(c) 0.65 (d) 0.35

19. A bag contains 16 red balls 8 green balls and 6 blue balls. One ball is drawn at random. The probability that it is blue is **[2021] ...[1M]**

(a) $\frac{1}{6}$ (b) $\frac{1}{5}$

(c) $\frac{1}{30}$ (d) $\frac{5}{6}$

20. The probability of happening of an event is 0.02. The probability of not happening of the event is **[2021] ...[1M]**

(a) 0.02 (b) 0.80

(c) 0.98 (d) $\frac{49}{100}$

21. For an event $E$, $P(E)+P(\overline{E})=x$, then the value of $x^3-3$ is **[2021] ...[1M]**

(a) –2 (b) 2

(c) 1 (d) –1

22. The probability that the drawn card from a pack of 52 cards is neither an ace nor a spade is **[2021] ...[1M]**

(a) $\frac{9}{13}$ (b) $\frac{35}{52}$

(c) $\frac{10}{13}$ (d) $\frac{19}{26}$

23. Which of the following cannot be the probability of an event? **[2021] ...[1M]**

(a) 0.01 (b) 3%

(c) $\frac{16}{17}$ (d) $\frac{17}{16}$

24. A dice is rolled twice. The probability that 5 will not come up either time is **[2021] ...[1M]**

(a) $\frac{11}{36}$ (b) $\frac{1}{3}$

(c) $\frac{13}{36}$ (d) $\frac{25}{36}$

25. A ticket is drawn at random from a bag containing tickets numbered from 1 to 40. Find the probability that the selected ticket has a number which is a multiple of 5. **[2011] ...[2M]**

26. A number is selected at random from first 50 natural numbers. Find the probability that it is a multiple of 3 and 4. **[2012] ...[2M]**

27. A card is drawn at random from a well shuffled pack of 52 playing cards. Find the probability that the drawn card is neither a king nor a queen. **[2013] ...[2M]**

28. Rahim tosses two different coins simultaneously. Find the probability of getting at least one tail. **[2014] ...[2M]**

29. Two different dice are tossed together. Find the probability.

(i) Of getting doublet

(ii) Of getting a sum 10, of the numbers on the two dice. **[2018] ...[2M]**

30. An integer is chosen at random between 1 and 100. Find the probability that it is

(i) Divisible by 8

(ii) Not divisible by 8 **[2018] ...[2M]**

31. A game consists of tossing a coin 3 times and noting the outcome each time. If getting the same result in all the tosses is a success, find the probability of losing the game. **[2019]...[2M]**

32. A die is thrown once. Find the probability of getting a number which (i) is a prime number (ii) lies between 2 and 6. **[2019] ...[2M]**

33. A bag contains 5 red balls and some blue balls. If the probability of drawing a blue ball at random from the bag is three times that of a red ball, find the number of blue balls in the bag. **[2020] ...[2M]**

34. Two different dice are thrown together, find the probability that the sum of the numbers appeared is less than 5. **[2020] ...[2M]**

**OR**

Find the probability that 5 Sundays occur in the month of November of a randomly selected year. **[2020] ...[2M]**

35. If a number x is chosen at random from the numbers –3, –2, –1, 0, 1, 2, 3. What is probability that $x^2 \le 4$? **[2020] ...[2M]**

36. Two dice are thrown simultaneously. What is the probability that

(i) 5 will not come up on either of them?

(ii) 5 will come up on at least one?

(iii) 5 will come up at both dice? **[2009] ...[3M]**

37. Cards bearing numbers 1, 3, 5, ..., 35 are kept in a bag. A card is drawn at random from the bag. Find the probability of getting a card bearing

(i) A prime number less than 15

(ii) A number divisible by 3 and 5. **[2010]...[3M]**

38. Two dice are rolled once. Find the probability of getting such numbers on the two dice, whose product is 12. **[2011] ...[3M]**

39. A box contains 80 discs which are numbered from 1 to 80. If one disc is drawn at random from the box, find the probability that it bears a perfect square number. **[2011] ...[3M]**

40. A card is drawn from a well shuffled deck of 52 cards. Find the probability of getting (i) a king of red colour (ii) a face card (iii) the queen of diamond. **[2012] ...[3M]**

41. The probability of selecting a red ball at random from a jar that contains only red, blue and orange balls is $\frac{1}{4}$. The probability of selecting a blue ball at random from the same jar is $\frac{1}{3}$. If the jar contains 10 orange balls, find the total number of balls in the jar. **[2015] ...[3M]**

42. Three different coins are tossed together. Find the probability of getting **[2016] ...[3M]**

    (i) Exactly two heads

    (ii) At least two heads

    (iii) At least two tails.

43. A bag contains 15 white and some black balls. If the probability of drawing a black ball from the bag is thrice that of drawing a white ball, find the number of black balls in the bag. **[2017] ...[3M]**

44. A group consists of 12 persons, of which 3 are extremely patient, other 6 are extremely honest and rest are extremely kind. A person from the group is selected at random. Assuming that each person is equally likely to be selected, find the probability of selecting a person who is

    (i) Extremely patient

    (ii) Extremely kind or honest. Which of the above values you prefer more? **[2013]...[4M]**

45. A bag contains cards numbers from 1 to 49. A card is drawn from the bag at random, after mixing the cards thoroughly. Find the probability that the number on the drawn card is **[2014] ...[4M]**

    (A) An odd number

    (B) A multiple of 5

    (C) A perfect square

    (D) An even prime number

46. A card is drawn at random from a well-shuffled deck of playing cards. Find the probability that the card drawn is **[2015] ...[4M]**

    (i) A card of spade or an ace.

    (ii) A black king.

    (iii) Neither a jack nor a king

    (iv) Either a king or a queen.

47. A number $x$ is selected at random from the 1, 2, 3 and 4. Another number $y$ is selected at random from the numbers 1, 4, 9 and 16. Find the probability the product of $x$ and $y$ is less than 16. **[2016] ...[4M]**

48. Two different dice are thrown together. Find the probability that the numbers obtained have **[2017] ...[4M]**

    (i) Even sum, and (ii) Even product

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