CONTENTS

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SANSKRITI
THE CIVIL SERVICES SCHOOL

Syllabus

Academic Session 2017-2018

Term 1 :MARCH-AUGUST

MARCH:

REAL NUMBERS

Euclid's division lemma, Fundamental Theorem of Arithmetic - statements after reviewing work done earlier and after illustrating and motivating through examples. Proofs of results – irrationality of $\sqrt{2}$,$\sqrt{3}$, $\sqrt{5}$ decimal expansions of rational numbers in terms of terminating/non-terminating recurring decimals.

POLYNOMIALS

Zeros of a polynomial.Relationship between zeros and coefficients of a polynomial with particular reference to quadratic polynomials.Statement and simple problems on division algorithm for polynomials with real coefficients.

APRIL :

Complete Polynomials.

SIMILAR TRIANGLES

Definitions, examples, counter examples of similar triangles.

1. (Prove) If a line is drawn parallel to one side of a triangle to intersect the other two sides in distinct points, the other two sides are divided in the same ratio.
2. (Motivate) If a line divides two sides of a triangle in the same ratio, the line is parallel to the third side.
3. (Motivate) If in two triangles, the corresponding angles are equal, their corresponding sides are proportional and the triangles are similar.
4. (Motivate) If the corresponding sides of two triangles are proportional, their corresponding angles are equal and the two triangles are similar.
5. (Motivate) If one angle of a triangle is equal to one angle of another triangle and the sides including these angles are proportional, the two triangles are similar.
6. (Motivate) If a perpendicular is drawn from the vertex of the right angle of a right triangle to the hypotenuse, the triangles on each side of the perpendicular are similar to the whole triangle and to each other.

7. (Prove) The ratio of the areas of two similar triangles is equal to the ratio of the squares on their corresponding sides.
8. (Prove) In a right triangle, the square on the hypotenuse is equal to the sum of the squares on the other two sides.
9. (Prove) In a triangle, if the square on one side is equal to sum of the squares on the other two sides, the angles opposite two the first side is a right triangle.

TRIGONOMETRIC RATIOS

Trigonometric ratios of an acute angle of a right-angled triangle. Proof of their existence (well defined); motivate the ratios, whichever are defined at 0^0 and 90^0.

Values (with proofs) of the trigonometric ratios of 30^0, 45^0 and 60^0. Relationships between the ratios.

MAY:

Continue with Trigonometric Ratios:

TRIGONOMETRIC IDENTITIES

Proof and applications of the identity $\sin^2 A + \cos^2 A = 1$. Only simple identities to be given. Trigonometric ratios of complementary angles.

JULY:

HEIGHTS AND DISTANCES

Simple and believable problems on heights and distances. Problems should not involve more than two right triangles. Angles of elevation/depression should be only 30^0, 45^0 and 60^0.

PAIR OF LINEAR EQUATIONS IN TWO VARIABLES

Pair of linear equations in two variables. Geometric representation of different possibilities of solutions/inconsistency.

Algebraic conditions for number of solutions. Solution of pair of linear equations in two variables algebraically – by substitution, by elimination and by cross multiplication. Simple situational problems must be included. Simple problems on equations reducible to linear equations may be included.

COORDINATE GEOMETRY

Review the concepts of coordinate geometry done earlier including graphs of linear equations. Awareness of geometrical representation of quadratic polynomials. Distance between two points and section formula (internal). Area of a triangle.

AUGUST:

QUADRATIC EQUATIONS

Standard form of a quadratic equation $ax^2+bx+c=0$, $(a\neq 0)$. Solution of the quadratic equations (only real roots) by factorization and by completing the square and by using quadratic formula.Relationship between discriminant and nature of roots.

Problems related to day-to-day activities to be incorporated.

Term II (SEPTEMBER-NOVEMBER)

SEPTEMBER:

STATISTICS

Mean , median and mode of grouped data (bimodal situation to be avoided).

Cumulative frequency graph (less than and more than ogives)

CIRCLES

Meaning of a tangent.

(Prove) Radius is perpendicular to the tangent at the point of contact (Prove) Tangents drawn to a circle from an external point are equal. Simple applications.

OCTOBER:

AREAS OF PLANE FIGURES

Motivate the area of a circle; area of sectors and segments of a circle.Problems based on areas and perimeter/circumference of the above said plane figures. (In calculating area of segment of a circle, problems should be restricted to central angle of 60^0, 90^0 and 120^0 . Plane figures involving triangles, simple quadrilaterals and circle should be taken.)

SURFACE AREAS AND VOLUMES

(i) Problems on finding surface areas and volumes of combinations of the following solids: cubes, cuboids, spheres, hemispheres and right circular cylinders/cones.

Frustum of a cone.

(ii) Problems involving converting one type of metallic solid into another and other mixed problems. (Problems with combination of not more than two different solids be taken.)

NOVEMBER:

ARITHMETIC PROGRESSIONS

Motivation for studying AP. Derivation of standard results of finding the *n*th term and sum of first *n* terms.

CONSTRUCTIONS

Construction of tangents to a circle through an external point.To construct a triangle similar to a given triangle as per the scale factor.

PROBABILITY

Classical definition of probability. Connection with probability as given in Class IX. Simple problems on single events, not using set notation.

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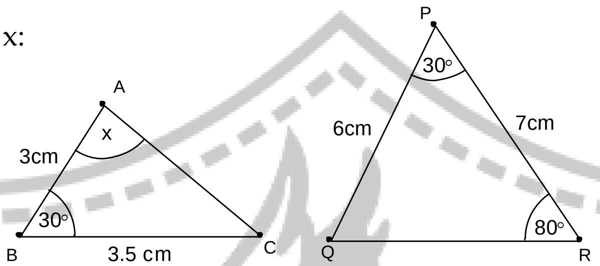
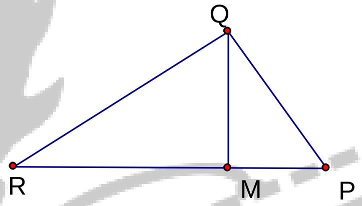
Assignment No. 1

<u>SIMILAR TRIANGLES</u>

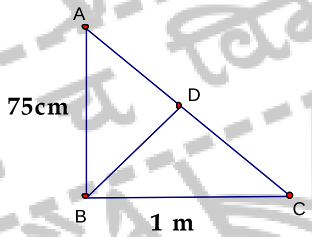
1) Find the value of x:



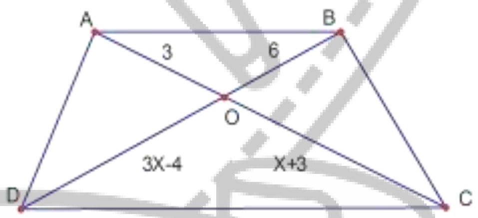
2) In the adjoining figure, QM ⊥ RP and $RP^2 - PQ^2 = QR^2$. If ∠QPM = 30°, then find ∠MQR.



3) If AB ⊥ BC and BD ⊥ AC then find BD.



4) In the given figure, if AB ∥ CD then find the value of x.



5) In ΔABC, DE ∥ BC and DE = 4cm, BC = 8cm. If ar (ΔADE) = 15 sq cm, then find ar(DECB).

6) In ΔABC, DE ∥ BC. If AD = 3.6 cm, AE = 2.4 cm and EC =1.2cm then find AB.

7) The areas of two similar triangles are 25 sq.cm and 81 sq.cm. If the altitude of the bigger triangle is 1.8cm, then the corresponding altitude of the smaller triangle is ________.

8) In ΔABC, D and E are points on AB and AC respectively such that AD = 2cm, DB = 6cm, AE = 3.1 cm and EC = 9.3 cm. Then ar(ΔABC) : ar(ΔADE) is ___________.

9) The diagonals of trapezium ABCD intersect at O and AB ∥ CD. If AB = 3 CD and ar(ΔAOB) = 48 sqcm then find ar(ΔCOD).

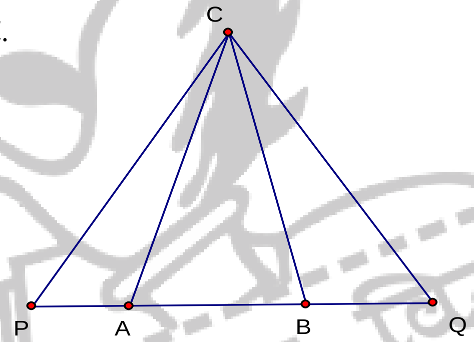
10) In ΔABC, DE ∥ BC, AD =3cm, BD = 3.6cm, AE = 1.4cm and DE = 1.2 cm. Find AC and BC.

11) D and E are points on the sides AB and AC respectively of ΔABC. If AD = 5.7 cm, DB = 3.5 cm, AE = 3.6cm and AC = 4.5cm, is DE ∥ BC?

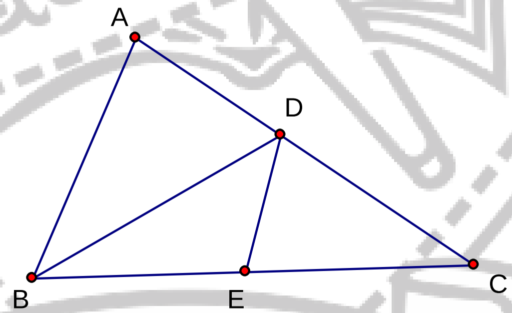
12) In ΔABC, AD ⊥ BC and $AD^2 = BD.CD$, prove that ∠ BAC = 90°.

13) If in ΔABC, AB = AC and D is a point on AC such that $BC^2 = AC.DC$, prove that BD = BC.

14) In ΔABC, CA = CB and AB is produced in both ways to P and Q such that $AC^2 = AP.BQ$ Prove that ΔACP ~ΔBQC.

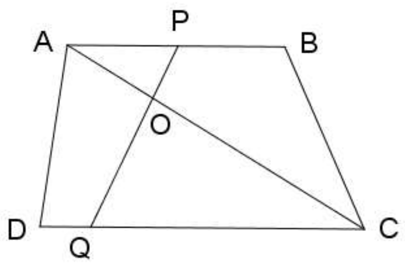


15) In the given figure ∠DBC = ∠ACB and $\frac{AC}{BD} = \frac{CB}{CE}$. Prove that Δ ACB~Δ DCE



16) Prove that if two triangles are similar, then the ratio of their areas is equal to the square of the ratio of their corresponding altitudes.

17) In the following figure, AB || CD. Prove that OA.CQ = OC.AP



Assignment no. 2(a)
TRIGONOMETRY

1. P is the point (3, –4) on a Cartesian plane and makes an angle θ with the *y*-axis from the origin. Draw a reperesentation of the above information and find:
   (a) the length of the hypotenuse (b) 3sinθ + tanθ (c) cosθ + sinθ + tanθ
2. If $2\cos^2\theta = \frac{1}{2}$, find the value of θ
3. If $2\cos\theta = \sqrt{3}$, evaluate $3\sin\theta - 4\sin^3\theta$
4. In $\Delta ABC, \angle C = 90^\circ$. If $\tan B = \frac{1}{\sqrt{3}}$ then evaluate $\sin A\cos B + \cos A\sin B$
5. In $\Delta ABC, \angle B = 90^\circ$, $BD \perp AC$. If $\mathrm{AB = 3cm, AC = 5cm}$, find AD
6. If in $\Delta ABC, AB = 6\sqrt{3}cm, AC = 12cm, BC = 6cm,$ find $\angle A$ and $\angle B$.
7. If $\sin\theta - \cos\theta = 0$, then evaluate $\sin^4\theta + \cos^4\theta$.
8. If $\tan(A + 2B) = \frac{1}{\sqrt{3}}$ and $A = B$ find the values of A and B.
9. Evaluate $\cos 1^\circ \cos 2^\circ \cos 3^\circ ....\cos 180^\circ$
10. Find the value of x if $\tan 3x = \sin 45^\circ \cos 45^\circ + \sin 30^\circ$
11. If $\cos\theta = \frac{\sqrt{3}}{2}$ and $\sin\phi = \frac{1}{2}$, evaluate $\sin(\theta + \phi)$.
12. If $\cos\theta = \frac{60}{61}$ find the value of $120\tan\theta$.
13. If $\cos\theta = \frac{2t}{1+t^2}$, find $\text{cosec}\theta$.
14. If $\cos A = \frac{12}{13}$, evaluate $\sin A(1 - \tan A)$.
15. If $\tan\theta = \frac{p}{q}$, evaluate $\frac{p\sin\theta - q\cos\theta}{p\sin\theta + q\cos\theta}$
16. If $\tan 2\theta = \frac{1}{\sqrt{3}}$, find $\cot 3\theta$.
17. If $3\sin\theta = 2\cos\theta$, evaluate $\frac{4\sin\theta - 3\cos\theta}{5\sin\theta + \cos\theta}$.

18. If $\tan\theta = \sqrt{3}$ and $\sec\phi = \sqrt{2}$ evaluate $\sin\theta\cos\phi - \cos\theta\sin\phi$.

19. If $\tan A = \frac{3}{4}$, then prove that $\sin A\cos A = \frac{12}{25}$.

20. If for some angle θ, $\cot 2\theta = \frac{1}{\sqrt{3}}$, then find the value of $\sin 3\theta$.

Assignment No. 2(b)

TRIGONOMETRY

1. If $\cos 9\alpha = \sin \alpha$ and $9\alpha < 90°$, then find the value of $\tan 5\alpha$.

2. If $\tan 2A = \cot\left(A - 60^\circ\right)$, where $2A$ is an acute angle, find A.

3. If $\sin\theta + \cos\theta = \sqrt{2}\sin\left(90^\circ - \theta\right)$, find the value of $\cot\theta$.

4. If $\sin x + \operatorname{cosec} x = 2$, find the value of $\sin^2 x + \operatorname{cosec}^2 x$.

5. If $\sin\left(5^\circ - 2\alpha\right) = \cos\left(5\alpha - 5^\circ\right)$, find the value of α.

6. Evaluate $\sin^2 1^\circ + \sin^2 2^\circ + \sin^2 3^\circ + \ldots\ldots\ldots\ldots + \sin^2 89^\circ + \sin^2 90^\circ$

7. If $x\sin\theta = y\cos\theta$ and $x\sin^3\theta + y\cos^3\theta = \sin\theta\cos\theta$, then prove that $x^2 + y^2 = 1$.

8. Find the value of A if $3\tan A + \cot A = 5\operatorname{cosec} A$ where $0° < A \le 90°$.

9. Find A and B if $\sin(2A + B) = \frac{\sqrt{3}}{2}$ and $\cos(A + 2B) = 0$

10. If $\cos(A - B) = \cos A\cos B + \sin A\sin B$, evaluate $\cos 15°$

11. If $\operatorname{cosec} A + \cot A = 5$, find the value of sinA and cosA.

12. If $A + B = 90°$, prove that $\sqrt{\frac{\tan A\tan B + \tan A\cot B}{\sin A\sec B} - \frac{\sin^2 B}{\cos^2 A}} = \tan A$

13. Prove that $\frac{\tan^3\theta}{1 + \tan^2\theta} + \frac{\cot^3\theta}{1 + \cot^2\theta} = \sec\theta\operatorname{cosec}\theta - 2\sin\theta\cos\theta$

14. Evaluate $\frac{2\cos 43°\operatorname{cosec} 47°}{5\left(\cos^2 29° + \cos^2 61^\circ\right)} - 3\tan^2 60° - \cos(35° - \theta) + \sin(55° + \theta)$

15. Without using trigonometric tables, find the value of :

$$\frac{2}{3}\left(\frac{\sec 56^\circ}{\operatorname{cosec} 34^\circ}\right) - 2\cos^2 20^\circ + \frac{1}{2}\cot 18^\circ\cot 35^\circ\cot 45^\circ\cot 72^\circ\cot 55^\circ - 2\cos^2 70°$$

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16. Prove that $\operatorname{cosec}^2\theta\ (\sin^4\theta - \cos^4\theta + 1) = 2$.

17. Express $\sec\theta$ in terms of $\operatorname{cosec}\theta$.

18. Express $\tan 84° + \operatorname{cosec}^2 72° - \frac{2}{3}\cot 32° + \frac{4}{3}\cos 66°$ in terms of trigonometric ratios of angles between 0° and 45°.

19. Prove that $\sqrt{\frac{\sec A - 1}{\sec A + 1}} + \sqrt{\frac{\sec A + 1}{\sec A - 1}} = 2\operatorname{cosec} A$

20. Prove that $\frac{1}{\operatorname{cosec}\theta - \cot\theta} - \frac{1}{\sin\theta} = \frac{1}{\sin\theta} - \frac{1}{\operatorname{cosec}\theta + \cot\theta}$

<u>**Web Resources**</u>

- **http://tinyurl.com/livebinders-trigo**
- **http://tinyurl.com/trigo-game**
- **http://tinyurl.com/trigo-application**
- **http://tinyurl.com/trigo-application10**

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Assignment no.3
REAL NUMBERS

1) The largest number that divides 70 and 125 leaving remainders 5 and 8 respectively is
a) 13 b) 65 c) 875 d) 1750

2) If two positive integers *a* and *b* are written as $a = x^3y^2$ and $b = xy^3$ where *x* and *y* are prime numbers, then HCF(*a,b*) is
a) xy b) xy^2 c) x^3y^3 d) x^4y^5

3) If two positive integers *a* and *b* are written as $a = x^3y^2$ and $b = xy^3$ where *x* and *y* are prime numbers, then LCM(*a,b*) is
a) xy b) xy^2 c) x^3y^3 d) x^4y^5

4) Find the least number that is divisible by all numbers from 1 to 10.
a) 315 b) 2520 c) 311040 d) 3110400

5) The decimal expansion of $\frac{147}{120}$ will terminate after how many places of decimal?
a) 1 b) 2 c) 3 d) will not terminate

6) By Euclids division lemma x = qy + r , x > y , the value of q and r for x = 27 and y=5 are:
a) q= 5, r =3 b) q= 6 , r= 3, c) q=3, r= 5 d) q=5, r=2

7) If the HCF of 55 and 22 is expressed in the form 55m – 22 × 2, then the value of m is
a) 1 b) -1 c) 2 d) -2

8) The HCF of 5^{13} and 2^{26}
a) 0 b) 1 c) 13 d) 26

9) Without actual division state whether the following rational numbers have terminating or non terminating decimal representation:
(i) $\frac{189}{270}$ (ii) $\frac{81}{96}$ (iii) $\frac{217}{2^2 \times 5^3 \times 7}$ (iv) $\frac{61}{360}$ (v) $\frac{3921}{900}$

10) Find the decimal representation of the following:
(i) $\frac{217}{2^2 \times 5^3 \times 7}$ (ii) $\frac{19}{2^3 \times 5^2}$ (iii) $\frac{25}{2^3 \times 5^5}$ (iv) $\frac{187}{2^4 \times 5^6 \times 11}$

11) Find the HCF of the smallest prime number and the smallest composite number.

12) If HCF(252 , 378) = 126, find their LCM.

13) Can the HCF and LCM of two numbers be (i) 9 and 2238 (ii) 15 and 26445 respectively?

14) If $32.3\overline{7}$ is expressed in the form $\frac{p}{q}$, what can you say about q?

15) Find the LCM of 896 and 784 if HCF (896, 784) =112.

16) If n is an odd integer, show that $n^2 - 1$ is divisible by 8.

17) Find the HCF and LCM of 156 and 208 using fundamental theorem of arithmetic.

18) Find the HCF of 392 and 700 using Euclid's Division lemma. Also find their LCM.

19) Using Euclid's division lemma, find the HCF of 391, 595 and 646.

20) Prove that $3+4\sqrt{2}$ is an irrational number.

Web Resources
http://tinyurl.com/irrational-numbers10

The 3n+1 Problem (Collatz Problem)

Take any natural number, from which you derive a sequence of numbers according to the following rules.

If the number is even, the next number is half of it. If the number is odd, you have to treble it and add 1. This is the next number. Strangely enough this sequence always **ends with the number 1.**

1st example: The first number is 16.

Sequence: 16, 8, 4, 2, 1

2nd example: The first number is 15.

Sequence: 15, 46, 23, 70, 35, 106, 53, 160, 80, 40, 20,10, 5, 16, ,8 ,4 ,2 ,1

3rd example: If you begin with 77 671, you reach 1,570,824,736 as the biggest number. In the end you reach 1 after 232 steps.

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Assignment No. 4
POLYNOMIALS

1) The number of polynomials having zeroes as -2 and 5 are

a) 1 b) 2 c) 3 d) more than 3

2) The zeroes of the polynomial $x^2 + 99x + 127$ are

a) Both +ve b) both -ve c) both equal d) one +ve and one -ve

3) If sum of the zeros of aquadratic polynomial $kx^2 + 2x + 3k$ is equal to the product of its zeros then k = ?

a) $\frac{1}{3}$ b) $-\frac{1}{3}$ c) $\frac{2}{3}$ d) $-\frac{2}{3}$

4) If 1 is a zero of the polynomial $p(x) = a^2x^2 - 3ax + 3x - 1$, then the value of a is

a) 1 b) 2 c) 1 , 2 d) -1 , -2

5) The zeroes of $4y^2 + 8y$ are

a) 0, 2 b) 0, -2 c) 4, 2 d) 4, -2

6) What will be the degree of the remainder if $3y^4 - 6y^2 - 8y - 5$ is divided by a quadratic polynomial?

a) 3 b) 2 c) 1 d) 1 or 0

7) If the graph of a polynomial neither touches nor intersects the x axis, then how many zeroes will the polynomial have?

8) What must be added to $6x^5 + 5x^4 + 11x^3 - 3x^2 + x + 5$ so that it may be exactly divisible by $3x^2 - 2x + 4$?

9) Find a quadratic polynomial whose sum and product of zeroes are
(i) $\sqrt{2} + 3$, $\sqrt{2} - 3$ (ii) $\frac{-6}{7}$, $\frac{-2}{3}$ respectively.

10) Find a quadratic polynomial whose zeroes are (i) 0 , $\sqrt{17}$ (ii) -15 , $\frac{-3}{5}$.

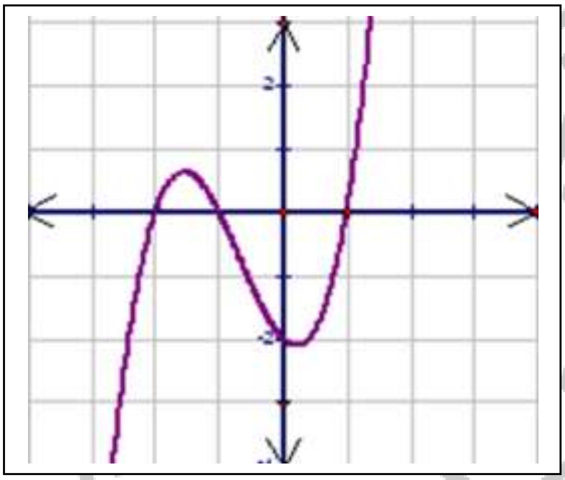
11) Find the quadratic polynomial whose one zero is $5 - \sqrt{3}$ and product of zeroes is 22.

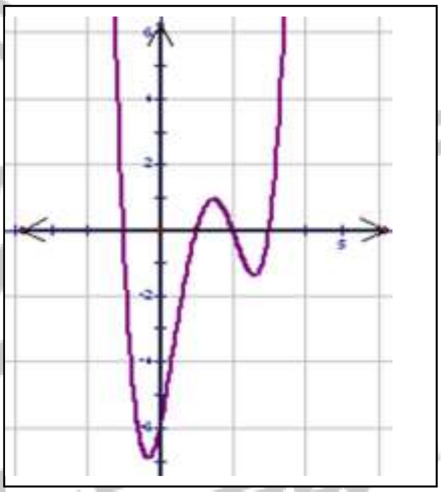
12) If α, β are zeroes of the polynomial $x^2 - 2x - 15$ then form a quadratic polynomial whose zeroes are 2α and 2β.

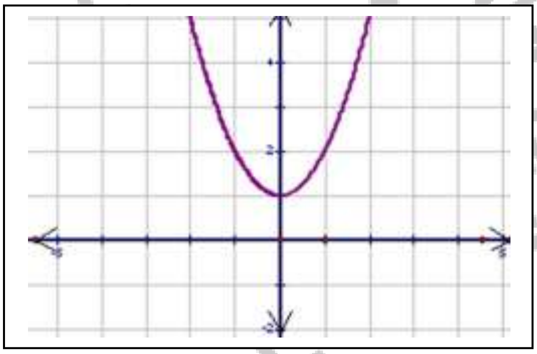
13) Find the value of k if the zeroes of the polynomial $6x^2 - 13x + (4k - 6)$ are the reciprocal of each other. Also find the zeroes.

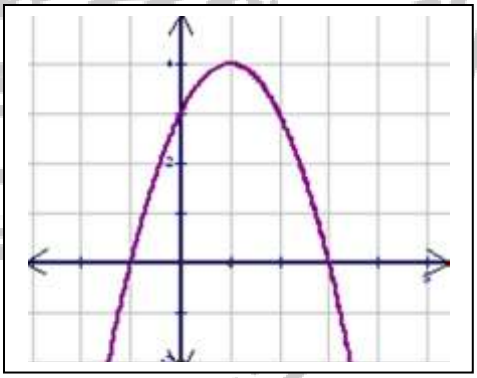
14) On dividing $x^3 - 5x^2 + 6x - 4$ by a polynomial g(x), the quotient and remainder are $x - 3$ and $-3x + 5$ respectively. Find the polynomial g(x).

15) The graphs of y = p(x) are given below. Write the number of zeroes of each polynomial.









16) Find the quadratic polynomial whose sum of the zeroes is 8 and one zero is $4 + 2\sqrt{3}$.

17) If α, β are the zeroes of the polynomial p(x)= $2x^2 - 5x + 3$,without finding the zeroes evaluate (i) $\frac{1}{\alpha} + \frac{1}{\beta}$ (ii) $\alpha^2 + \beta^2$ (iii) $\alpha^3 + \beta^3$ (iv) $\alpha^3\beta + \alpha\beta^3$

18) Find all zeroes of the polynomial $3x^4 - 9x^3 + 4x^2 + 6x - 4$ if $\sqrt{\frac{2}{3}}$ and $-\sqrt{\frac{2}{3}}$ are two of its zeroes.

19) If the polynomial $6x^4 + 8x^3 - 5x^2 + ax + b$ is exactly divisible by $2x^2 - 5$, then find the values of a and b.

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20) The polynomial $x^2 - k(x-4) - 2(3x+1)$ has zeroes α, β. Find the value of k if $\alpha + \beta = \frac{\alpha\beta}{2}$.

Web Resources

http://tinyurl.com/polynomials10

Assignment no. 5(a)

LINEAR EQUATIONS

1) The pair of equations $y = 0$ and $y = 7$ has

a) one solution b) two solutions c) no solution d) infinitely many solutions

2) The pair of equations $x = a$ and $y = b$ graphically represents lines which are

a) parallel b) intersecting at (a, b)

c) coincident d) intersecting at (b, a)

3) If a pair of equations is consistent then the graphs of these equations are

a) parallel b) coincident c) intersecting d) either intersecting or coincident

4) For what value of k will the equations $3x + 4y = 1$ and $(1-7k)x - (9k-2)y - (1-2k) = 0$ have infinitely many solutions?

a) k = 2 b) k = 3 c) k = -2 d) k= -3

5) For what value of k will the equations 4x + 5y = 12 and kx +10y = 48 represent intersecting lines?

a) $k = 8$ b) $k \neq 7$ c) $k \neq 8$ d) $k = 7$

6) For what values of a and b will the equations $(a+b)x - (a+b-3)y = 4a + b$ and 2x - 3y = 7 be dependent?

7) For what values of a and b will the equations $(2a-1)x + 3y = 5$ and $3x + (b-1)y = 2$ have infinitely many solutions?

8) Draw the graph of $3x + 5y - 15 = 0$ and $3x - 4y + 12 = 0$. Determine the area bounded by these lines and the x-axis.

9) Draw the graph of $x + 2y = 12$ and $4x - y = 3$. Also, determine the area bounded by these lines and the y-axis.

10) Solve graphically the equations $4x - 3y = 0$ and $2x + 3y - 18 = 0$. Find the ratio of the areas of the triangles formed by these lines and the axes.

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11) Determine graphically the vertices of the triangle the equations of whose sides are $2y - x = 8,\ 5y - x = 14$ and $-2x + y = 1$.

12) Solve the following equations for x and y :

a. $148x + 231y = 527$, $231x + 148y = 610$

b. $\frac{4y - 6x}{xy} = 1$, $\frac{3y + 4x}{xy} = 5$, $x \neq 0, y \neq 0$

c. $\frac{631}{x} + \frac{279}{y} = 910$, $\frac{279}{x} + \frac{631}{y} = 910$

d. $3x - \frac{y + 7}{11} + 2 = 10$, $2y + \frac{x + 11}{7} = 10$

e. $\sqrt{2}\,x + \sqrt{18}\;y = 0$, $\sqrt{3}\,x + \sqrt{45}\,y = 0$

f. $\frac{4}{x} + 3y = 14$, $\frac{3}{x} - 4y = 23$.

14) Solve the following equations for x and y :

$$\frac{2}{3(2x + y)} - \frac{1}{3x - y} = \frac{-5}{12},\ \frac{1}{2x + y} - \frac{2}{3(3x - y)} = \frac{-5}{6}\ ,2x + y \neq 0, 3x - y \neq 0$$

Web Resources

- **http://tinyurl.com/equations10**
- **http://tinyurl.com/linear-equations10**

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Assignment no. 5(b)

LINEAR EQUATIONS

1) Father's age is twice the sum of ages of his two children. After 20 years, his age will be equal to the sum of the ages of his children. Find the age of the father.

2) On selling a tea set at 5% loss and a lemon set at 15% gain, a shopkeeper gains Rs 7. If he sells the tea set at 5% gain and the lemon set at 10% gain, he gains Rs 13. Find the actual price of the tea set.

3) Points A and B are 90 km apart from each other on the highway. A car starts from A and another from B at the same time. If they travel in the same direction they meet after 9 hours and if they travel in the opposite direction hey meet after 9/7 hours. Find their speeds.

4) A person invested some money at 12 % simple interest and some other amount at 10 %simple interest. He received yearly interest of Rs 130. But if he had interchanged the amounts invested, he would have received Rs 4 more as interest. How much did he invest at different rates?

5) Seven times a two digit number is equal to four times the number obtained by reversing the digits. If the digits differ by 3, find the number.

6) Rohan travels 600 km partly by train and partly by car. He takes eight hours if he travels 120 km by train and the rest by car. He takes 20 minutes more if he travels 200 km by train and the rest by car. Find the speed of the train and the car.

7) A boat covers 32 km upstream and 36 km down stream in 7 hours. Also it covers 40 km upstream and 48 km downstream in 9 hours. Find the speed of the boat in still water and that of the stream.

8) 8 men and 12 boys can finish a piece of work in 10 days while 6 men and 8 boys can finish the work in 14 days. Find the time taken by one man alone and one boy alone to finish the work.

9) A part of monthly expenses of a family is constant and the remaining varies with the price of wheat .When the rate of wheat is Rs 250 per quintal , the total monthly

expenses is Rs 1000 and when the rate of wheat is Rs 240 per quintal , the total monthly expenses is Rs 980 . Find the total monthly expenses when the rate of wheat is Rs 350 per quintal.

10) It takes 12 hours to fill a swimming pool using two pipes. If the pipe of larger diameter is used for 4 hours and the pipe of smaller diameter for 9 hours, only half the pool can be filled. How long would each pipe take to fill the pool separately?

Fun Corner

TheNumber 2997 Mr. Pfiffigknows a trick.

"Tell me three numbers with 3 digits without 0. I also tell you three numbers (below Underlined). If we add these six numbers, the result always is 2997."

Three examples:

724	166	111
+196	+456	+555
+732	+822	+888
+803	+177	+888
+267	+543	+444
+275	+833	+111
----	----	----
2997	2997	2997

Do you recognize Pfiffig's trick?

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Did You Know?

Mathematics is full of fascinating facts and I can only give a small flavour of them here. I hope one or two of them will make you think "Wow!"

1. Language

George Bernard Shaw said Britain and America are "two nations separated by a common language", but did you know that this happens even in mathematics which is supposed to be a language all of its own. The differences aren't confined to spelling (as in centre/center).

	British	American	
	Maths	Math	I don't know how this came about but, unlike the next example, no-one I know in the UK uses the US form
	Soluble	Solvable	A specialized term in group theory
			I came across this one quite recently. The definitions are completely reversed:
	Trapezium trapezoid	trapezoid trapezium	Quadrilateral with one pair of sides parallel Quadrilateral with no sides parallel
	right-angled triangle	right triangle	
	sine rule	law of sines	A trigonometric formula for triangles
	Formulae	Formulas	The US version of the plural of formula is taking over rapidly in Britain
	billion = 10^{12}	billion = 10^{9}	In Britain this battle has been lost many years ago. A British billion used to mean a million million but its use for finance has ensured that the US thousand million has taken over. There were similar differences for trillion etc

There must be many other differences. Do you know of any?

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Assignment No. 6
STATISTICS

1. What measure of central tendency is represented by the abscissa of the point where 'less than ogive' and 'more than ogive' intersect?

   a) mean b) median c) mode d) none of the above

2. A set of numbers consists of three 4s, two 5s, six 6s, nine 8s and seven 10s. What is the mode of this collection of numbers?

   a) 10 b) 9 c) 7 d) 8

3. If the mode of a data is 45 and mean is 27, then the median is

   a) 30 b) 27 c) 33 d) none of the above

4. Find the median of the series: -5, 11, 10, -3, 5, 5, 8, -8, 3, -10

   a) 5 b) 1 c) 4 d) 2

5. In a distribution , Ogives are the graphical representation of

   a) Raw data b) frequency c) class limits d) cumulative frequency

6. If $u_i = \frac{x_i - 25}{10}$, $\sum f_i u_i = 20$ *and* $\sum f_i = 100$ then $\bar{x}$ is equal to

   a) 27 b) 25 c) 30 d) 35

7. If the 'less than' and the 'more than' ogives intersect at the point (27, 34), then find the median of the distribution and also find the total number of observations.

8. Find the mean for the following frequency distribution:

C.I	84-90	90-96	96-102	102 -108	108-114
Frequency	8	12	15	10	5

9. Median of the following frequency distribution is 46. Find the missing frequencies.

Class Intervals	10-20	20-30	30-40	40-50	50-60	60-70	70-80	Total
Frequency	12	30	f_1	65	f_2	25	18	230

Hence find the mode of the distribution correct to two places of decimal.

10. Calculate the mode:

Marks	Below 10	Below 20	Below 30	Below 40	Below 50	Below 60	Below 70	Below 80
No. of students	16	21	35	52	58	78	94	100

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11. Calculate the median and mode of the following distribution. Using the empirical formula, find the mean.

C.I	500-509	510-519	520-529	530-539	540-549	550-559	560-569
Freq	15	20	25	32	18	7	3

12. The mean of the following distribution is 78. Evaluate the missing frequencies corresponding to the classes 80-90 and 90-100

C.I	50-60	60-70	70-80	80-90	90-100	Total
Freq	8	6	12	$4x - 1$	$2y + 3$	50

13. Draw the less than ogive for the following distribution. Also find the median from the graph.

Marks	Above 0	Above10	Above 20	Above 30	Above 40	Above 50
No of students	76	72	64	52	20	0

14. Draw 'less than' and 'more than' ogives for the following distribution. Find the median from the graph.

Heights (in cm)	145-150	150-155	155-160	160-165	165-170	170-175
No of persons	8	10	9	15	10	8

Web Resources

- http://tinyurl.com/statistics-recap
- http://tinyurl.com/cumulative-frequency10
- http://tinyurl.com/cumulativefrequency-median

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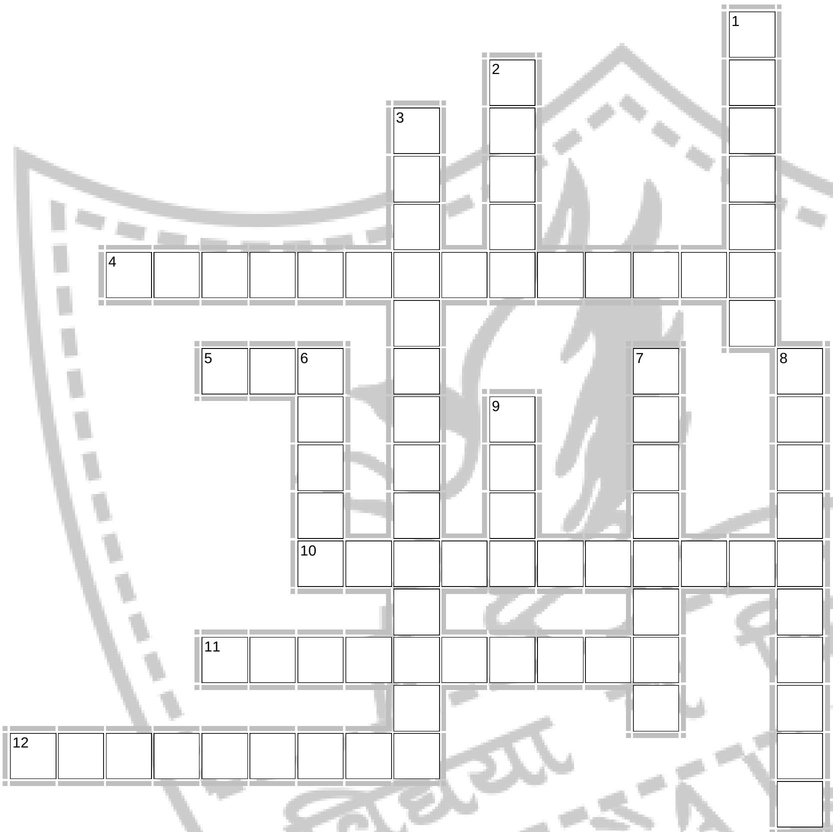
Crossword Puzzle



EclipseCrossword.com

Across

4. used to find the coordinates of a point dividing a line segment in a given ratio
5. the ratio of the circumference to the diameter of a circle
10. line drawn from the eye of the observer to the point in the object observed
11. Greek philosohper and mathematician .
12. the ratio of the side adjacent to the side opposite to a given acute angle

Down

1. when discriminant is greater than zero the roots are real and-----
2. common difference in the AP 1,-1,-3.....
3. the tangents meets the circle here
6. the length of tangents drawn from an external point to a circle are-----
7. x co-ordinate
8. the longest side in a right triangle
9. sine ratio of this angle is always zero

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Assignment No.7
HEIGHTS & DISTANCES

1. What is the angle of elevation of a 15 meter high tower from a point 15 metres away from its foot?
2. If the shadow of a vertical pole at a particular time of the day is equal to $\sqrt{3}$ times its height, what is the elevation of the source of light at that time?
3. The distance between two vertical poles is 60 m. The height of one of the poles is double the height of the other. The angles of elevation of the top of the poles from the middle point of the line segment joining their feet are complementary to each other. Find the heights of the poles.
4. A tower stands near an airport. The angle of elevation θ of the tower from a point on the ground is such that its tangent is 5/12. On walking 192 metres towards the tower in the same straight line, the tangent of the angle of elevation ϕ is found to be ¾. Find the height of the tower.

   If it is desired that any building/tower built near the Airport should not be of height more than 150 metres, has the tower been built keeping in mind the requirements? If no, please mention the qualities lacking on the part of the architect.
5. The angle of elevation of a stationary cloud from a point 60 m above the lake is 30° and the angle of depression of its reflection in the lake is found to be 60°. Find the height of the cloud.
6. A man on the top of a vertical observation tower observes a car moving at a uniform speed coming directly towards it. If it takes 10 min for the angle of depression to change from 30° to 45°, how soon after this will the car reach the observation tower?
7. Two pillars of equal heights stand on either side of a road which is 150 m. At a point on the road between the pillars, the angles of elevations of the top of the pillars are 60° and 30°. Find the height of the pillars and the position of the observation on the road.
8. The angle of elevation of an aeroplane from a point on the ground is 45°. After flying for 15 seconds, the angle of elevation changes to 30°. If the aeroplane is flying at a height of 2500 m, find the speed of the plane.
9. The angle of elevation of the top of a vertical tower from a point on the ground is 60°. From another point 10m vertically above the first, its angle of elevation is 45°. Find the height of the tower.

10. From the top of a tower h metres high, the angles of depression of two objects, which are in line with the foot of the tower are α and β ($\beta > \alpha$). Find the distance between the two objects.
11. The angles of depression of the top and bottom of a 100 m high building from the top of a tower are 30° and 60° respectively. Find the height of the tower.
12. Write 'True' or 'False' and justify your answer in each case:

    (a) If the length of the shadow of a tower is increasing, then the angle of elevation of the Sun is also increasing.

    (b) The angle of elevation of the top of a tower is 30°. If the height of the tower is doubled, then the angle of elevation of its top will also be doubled.

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Assignment 8(a)

QUADRATIC EQUATIONS

1) Which of the following equations have no real roots?

a) $x^2 - 2\sqrt{3}x + 5 = 0$ b) $2x^2 + 6\sqrt{2}x + 9 = 0$

c) $x^2 - 2\sqrt{3}x - 5 = 0$ d) $2x^2 - 6\sqrt{2}x - 9 = 0$

2) If -2 is a root of the equation $x^2 - px - 6 = 0$, then the value of p is

a) 1 b) -1 c) 2 d) -2

3) Which costant should be added and subtracted to solve the quadratic equation $x^2 + \sqrt{3}x - 5 = 0$ by the method of completing the square?

a) $\frac{\sqrt{3}}{2}$ b) $\frac{\sqrt{3}}{4}$ c) $\frac{3}{2}$ d) $\frac{3}{4}$

4) Find the roots of the equation $x^2 - 3x - 10 = 0.$

5) 'If the coefficient of x^2 and the constant term of a quadratic equation have opposite signs, then the quadratic equation has real roots.' Is this statement true? Why or why not?

6) Find the discriminant of $2\sqrt{3}\ x^2 - 3\sqrt{2}x - 5 = 0$.

7) Solve $4x^2 + 5x = 0.$

8) In each of the following, find the value(s) of p for which the given equations will have real roots:

(i) $px^2 + 8x - 4 = 0$ (ii) $9x^2 - px + 1 = 0$ (iii) $7x^2 - 31x - p = 0$

9) Solve the following equations for x:

i) $2\sqrt{3}\,x^2 + 5\,x - 4\sqrt{3} = 0$

ii) $3x^2 + 2\sqrt{5}x - 5 = 0$

iii) $15x^2 - 4x - 22 = 0$

iv) $\frac{1}{a+b+x} = \frac{1}{a} + \frac{1}{b} + \frac{1}{x}$

v) $4x^2 - 4mx + m^2 - n^2 = 0$

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

vii) $\frac{4x}{x-2} - \frac{3x}{x-1} = 7\frac{1}{2}, x \neq 1,\ 2$

Assignment No. 8(b)

QUADRATIC EQUATIONS

1) One year ago a man was 8 times as old as his son. Now, his age is equal to the square of his son's age. Find their present ages.
2) The hypotenuse of a right triangle is 5m. If the smaller leg is doubled and the longer leg is tripled, the new hypotenuse is $6\sqrt{5}$ m.Find the sides of the triangle.
3) Two trains leave a railway station at the same time. The first train leaves due west and the other due north. The first train travels 5 km/hr faster than the second train. If they are 50 km apart after 2 hours, find their speeds.
4) A motor boat takes 2 hrs more to cover a distance of 30 km upstream than it takes to cover the same distance downstream. If the speed of the stream is 5km/hr, find the speed of the boat in still water.
5) The sum of two natural numbers is 8. Find the numbers if the sum of their reciprocals is 8/15.
6) A plane left 30 minutes later than the scheduled time and in order to reach its destination 1500 km away it increases its speed by 250km/hr from its usual speed. Find its usual speed.
7) A train travels at a certain average speed for a distance of 63km and then travels a distance of 72km at an average speed of 6km/h more than its original speed. If it takes 3 hours to complete the total journey, what is its original average speed?
8) Rs 6500 were divided equally among a certain number of persons. Had there been 15 more persons, each would have got Rs 30 less. Find the original number of persons.
9) Two circles touch externally. The sum of their areas is 130π sq.cm and the distance between the centres is 14 cm. Find the radii of the circles.
10) A two digit number is such that the product of its digits is 18. When 63 is subtracted from the number, the digits interchange their places. Find the number.
11) If twice the area of a smaller square is subtracted from the area of a larger square, the result is 14cm^2. However, if twice the area of the larger square is added to three times the area of the smaller square, the result is 203cm^2. Determine the sides of the two squares.

Assignment No. 9
ARITHMETIC PROGRESSION

1) The list of numbers -6, -3, 0, 3, …………

a) does not form an A.P b) is an A.P with common difference -9

c) is an A.P with common difference -3 d) is an A.P with common difference 3

2) 20^{th} term from the end in the A.P. 3, 8, 13,……., 253 is

a) 103 b) 98 c) 158 d) 153

3) If $2x+1,\ x^2+x+1,\ 3x^2-3x+3$ are the consecutive terms of an A.P. then the value of x is

a) 1 b) 2 c) 1, 2 d) -1, -2

4) Write the next term: $\sqrt{12}, \sqrt{27} \sqrt{48}, \sqrt{75}$,..........

a) $\sqrt{99}$ b) $\sqrt{96}$ c) $\sqrt{108}$ d) $\sqrt{114}$

5) If 5 times the 5^{th} term of an A.P is equal to 9 times its 9^{th} term then its 14^{th} term is

a) 0 b) 1 c) 70 d) 196

6) If in an A.P, the sum of three numbers is 15 and their product is 45 then the numbers are

a) 3,5,7 b) 2,4,7 c) 1,5,9 d) 0,5,9

7) If the 10^{th} term of an AP is 0, then 27^{th} term : 15^{th} term

a) 1 : 1 b) 17 : 5 c) 1 : 3 d) 3 : 1

8) The n^{th} term of an AP cannot be n^2+1. Justify the statement.

9) Solve the equation for x:

$1+4+7+...+x=287$

10) If for an AP, $S_n = 3n^2 + n$, then find its 22^{nd} term. Also find k if $a_k = 64$.

11) Which term of the AP: 241, 236, 231, …… is the first negative term?

12) Find the sum of first 15 terms of an AP whose nth term is $2n + 1$.

13) Three numbers are in the ratio 3: 7 : 9. If 5 is subtracted from the second, the resulting numbers are in AP. Find the original numbers.

14) In an AP, if the 12th term is –13 and the sum of the first four terms is 24, find the sum of first 10 terms of the AP.

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15) The taxi fare after each km, when the fare is Rs 25 for the first km and Rs 7 for each additional km, does not form an AP as the **total fare** (in Rs) after each km is

25, 7, 7, 7, …

Is the above statement true? Give reasons.

16) The sum of the third and the seventh terms of an AP is 6 and their product is 8. Find the sum of the first 16 terms of the AP.

17) In each year, a tree grows 4cm less than it grew in the previous year. If it grew 1m in the first year, in how many years will it stop growing?

18) How many terms of the AP 24, 21, 18… must be taken so that the sum is 78? Explain the **double answer**.

19) Find the sum of the two middlemost terms of the AP: $-11, -7, -3, ..., 49$

20) If the sum of the first five terms of an AP is equal to one-fourth of the sum of next five terms of the AP and the first term of the AP is 2, then find the sum of the first 20 terms of the AP.

<u>Web Resources</u>

http://tinyurl.com/pbzffv3

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Assignment No.10
COORDINATE GEOMETRY

1) Find the distance between $(a\cos 35°, 0)$ and $(0, a\cos 55°)$.

2) AOBC is a rectangle with vertices A(0, 4) , O(0, 0), B(6, 0) and C(4, 6). Find the length of the diagonal AB.

3) Find the point on the x-axis which is equidistant from A(-2, 3) and B(5, 4).

4) If the distance between the points (-2, -2) and (3, a) is 13, then find the values of a.

5) A line intersects the x and y axes at P and Q respectively. If (2, 6) is the midpoint of PQ, then find the coordinates of P and Q.

6) If one end of a diameter of a circle is (2, 3) and the centre is (-2, 5), then find the coordinates of the other end.

7) If the points A(2, 3), B(4, k) and C(6,-3) are collinear then find the value of k.

8) In what ratio does the point $\left(\frac{1}{2}, 6\right)$ divide the line segment joining the points (3, 5) and (-7, 9)?

9) Find the perimeter of a triangle with vertices (0, 4), (0, 0) and (3, 0).

10) A(3, 1) , B(12, -2) and C(0, 2) cannot be the vertices of a triangle. State true or false and justify your answer.

11) Find the area of the triangle ABC with A(3, -6) and midpoints of sides through A being (4,-5) and (5,-2).

12) The midpoints of the sides of a triangle are (3, 4), (4, 6) and (5, 7). Find the vertices of the triangle and also the area of the triangle.

13) Find the ratio in which the x-axis divides the join of the points (1, -3) and (4, 5). Also find the coordinates of the point.

14) Find the fourth vertex of a parallelogram whose three vertices are (3, 5), (1, 2) and (7, 6).

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15) If P($9a$-2, -b) divides the line segment joining A($3a$+1, -3) and B($8a$, 5) in the ratio 3:1, find the values of a and b.

16) Find the point of intersection of y-axis and the perpendicular bisector of the line segment joining (-5, -2) and (3, 2).

17) The vertices of a triangle are (0, 0), (0, $2x$) and ($2y$, 0). Find the coordinates of the point equidistant from each vertex.

18) Amit starts walking from his house to office but instead of going to the office directly, he goes to a bank first, from there to his daughter's school and then reaches the office. If the house is situated at (2, 4), bank at (5, 8), school at (13, 14) and office at (13, 26), find the extra distance travelled by Amit in reaching his office. (Assume that all distances are in *km*)

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Assignment No. 11
CIRCLES

1) If radii of the two circles are 6 cm and 10 cm, then the length of the chord of one circle which is tangent to the other is

a) 8 cm b) 16 cm c) 20 cm d) 10 cm

2) PA and PB are tangents to a circle with centre O. If $\angle OAB = 35°$, then $\angle APB$ is

a) 70° b) 65° c) 90° d) 55°

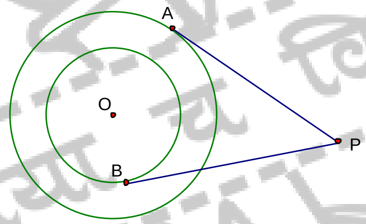
3) The distance between two parallel tangents of a circle whose radius is 3.5 cm is

a) 7 cm b) 3.5cm c) 10cm d) cannot determined

4) A parallelogram circumscribing a circle is a

a) Square b) rectangle c) rhombus d) trapezium

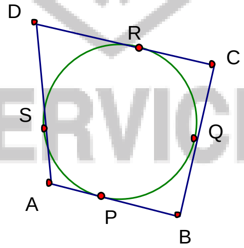
5) Two concentric circles with centre O are of radii 5 cm and 3 cm. From an external point P, tangents PA and PB are drawn to these circles. If AP = 12 cm, find BP.



6) AB is the tangent to a circle with centre O through a point A outside the circle. If $OA = x + 2$ cm, $OB = x - 6$ cm, $AB = x + 1$ cm, find the actual lengths of AB, OA and OB.

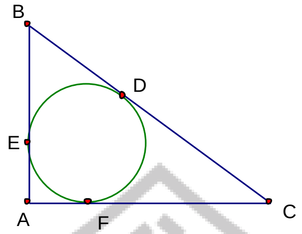
7) The lengths of three consecutive sides of a quadrilateral circumscribing a circle are 4cm, 5 cm and 7 cm. Find the length of the fourth side of the quadrilateral.

8) A circle is inscribed in a quadrilateral ABCD. Given BC = 38 cm, BQ = 27 cm, CD = 25 cm and $\angle ADC = 90°$, find the radius of the circle.



9) Prove that the tangents drawn at the ends of a chord of a circle make equal angles with the chord.

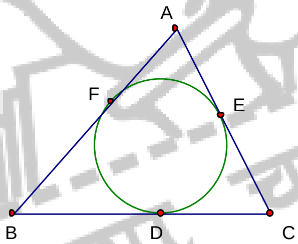
10) The sides BC, AB and AC of ΔABC right angled at A, touch a circle at D, E and F respectively. If BD = 30 cm and CD = 7cm, calculate AF and radius of the circle.



11) ABC is a triangle. A circle touches sides AB and AC produced and side BC at X, Y and Z respectively. Show that $AX = AY = \frac{1}{2}$ Perimeter of ΔABC.

12) Two tangent segments AB and AC are drawn to a circle with centre O through a point A such that $\angle BAC = 120^\circ$. Prove that OA = 2AB.

13) In the following figure, prove that $AF + BD + CE = \frac{1}{2}$ Perimeter of ΔABC.



14) If ABC is an isosceles triangle in which AB =AC in the above figure, prove that D is the midpoint of BC.

15) If AB and CD are common tangents to two circles of unequal radii, prove that AB = CD.

Assignment No.12

AREAS RELATED TO CIRCLES

1. The area (in sq. cm) of a sector whose radius is 18 cm and angle 30° is

   a) 3π b) 18π c) 27π d) 54π

2. In a circle of diameter 12cm, an arc subtends 120° at the centre. Length of the arc (in cm) is

   a) 2π b) 4π c) 8π d) 12π

3. If the perimeter and the area of a circle are numerically equal, then the radius of the circle is

   a) 2 units b) π units c) 4 units d) 7 units

4. If a circular grass lawn of 35m in radius has a path 7 m wide running around it on the outside, then the area of the path is

   a) 1450 m^2 b) 1576 m^2 c) 1694 m^2 d) 3368 m^2

5. If the length of the arc of a sector of a circle of radius 16cm is 18.5 cm, then the area of the sector is equal to

   a) 148 cm^2 b) 154 cm^2 c) 176 cm^2 d) 296 cm^2

6. The ratio of the area of a square to that of the square drawn on its diagonal is

   a) 2 : 1 b) 1 : 2 c) $\sqrt{2} : 1$ d) $1 : \sqrt{2}$

7. A square and an equilateral triangle have equal perimeters. If the diagonal of the square is $12\sqrt{2}$ cm, then the area of the triangle is

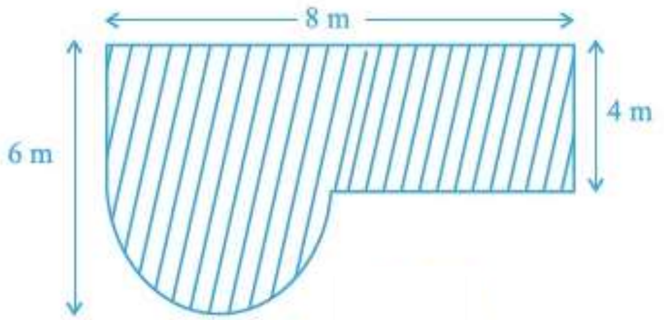
   a) $64\sqrt{3}$ sq.cm b) $36\sqrt{3}$ sq.cm c) $12\sqrt{3}$ sq.cm d) $16\sqrt{3}$ sq.cm

8. The areas of two concentric circles forming a ring are 154 cm^2 and 616 cm^2. Find the width of the ring.

   a) 14cm b) 21cm c) 7cm d) 8cm

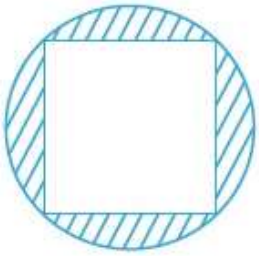
9. The difference between the circumference and the radius of a circle is 37cm. Find the area of the circle.

10. Find the area of the given figure:



11. Find the radius of a circle whose circumference is the sum of the circumferences of ten circles of radii 4cm, 7cm, 10cm, 13cm,….

12. Three horses are tethered at three corners of a triangular field whose sides are 150 m, 200 m and 260m. How much area will the horses be able to graze altogether if the length of their ropes is 7m each?
13. A chord of length 10cm subtends at the centre of a circle an angle of 90°. Find the area of the minor segment formed by this chord.
14. In the given figure, a square of diagonal 8cm is inscribed in a circle. Find the shaded area.



15. PQRS is a diameter of a circle of radius 6 cm. The length PQ, QR and RS are equal. Semi-circles are drawn on PQ and QS as diameters as shown in figure 1. Find the perimeter of the shaded region.
16. In figure 2, BC is a tangent to a circle with centre A, AC = 18 cm and AB = 9 cm. Find the area of the shaded region.

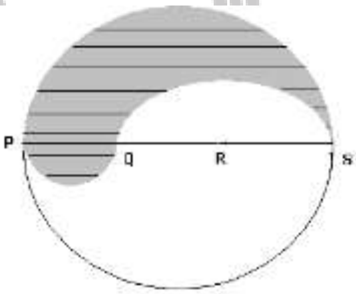


figure 1

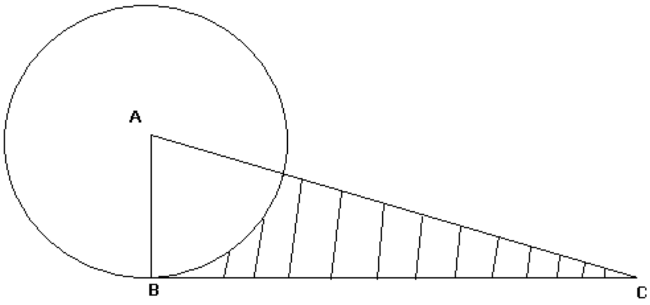
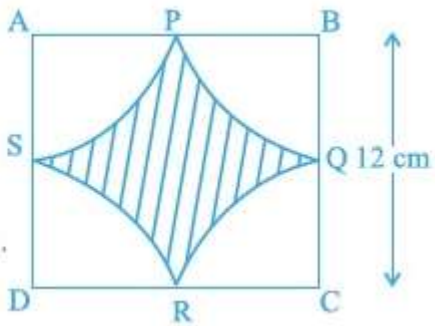


figure 2

17. In the given figure, arcs drawn with centres A, B, C, D intersect at midpoints P, Q, R, S of the sides AB, BC, CD and DA respectively of a square ABCD. Find the shaded area. (Use $\pi = 3.14$)



Web Resources

http://tinyurl.com/arc-length-sector

Assignment No.13
CONSTRUCTIONS

1) To divide a line segment AB in the ratio $p : q$ (p, q are positive integers), draw a ray AX so that ∠BAX is an acute angle and then mark points on ray AX at equal distances such that the minimum number of these points is

a) greater of p and q b) $p+q-1$ c) $p+q$ d) pq

2) To divide a line segment AB in the ratio 5:6, draw a ray AX such that ∠BAX is an acute angle, then draw a ray BY parallel to AX and the points A_1, A_2, A_3,… and B_1, B_2, B_3,… are located at equal distances on AX and BY respectively. Then the points joined are

a) A_5 and B_6 b) A_6 and B_5 c) A_4 and B_5 d) A_5 and B_4

3) Construct a triangle with sides 5cm, 7.5 cm and 6cm.Construct a similar triangle to it whose sides are $\frac{2}{3}$ of the corresponding sides of the first triangle.

4) Construct a triangle with sides 6cm, 3cm and 5cm.Construct a similar triangle to it whose sides are $\frac{5}{3}$ of the corresponding sides of the first triangle.

5) Construct ΔABC with BC = 6cm, $\angle$ B = 45° and $\angle$ C = 60°. Then construct a $\Delta A'B'C \sim \Delta$ABC such that its sides are $\frac{3}{5}$ of the corresponding sides of ΔABC.

6) Draw a circle of radius 4cm. Take a point 6cm away from its centre, construct a pair of tangents to the circle and measure their lengths.

7) Draw a pair of tangents to a circle of radius 6cm which are inclined to each other at an angle of 75°.

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An Interesting Fact

π =3.2 By Law

In 1897 the General Assembly of the State of Indiana in the USA tried to pass legislation that appears to say that π is to be 3.2, though the Bill does not make it very clear. On top of that they had the nerve to try to get everyone else to pay royalties for this 'discovery'.

The Bill was referred to the House Committee on Canals, which was also referred to as the Committee on Swamp Lands! By chance a professor of mathematics happened to be present during a debate and heard an ex-teacher saying "The case is perfectly simple. If we pass this bill which establishes a new and correct value for π, the author offers to our state without cost the use of his discovery and its free publication in our school text books, while everyone else must pay him a royalty." Fortunately, the professor was able to teach the senators about mathematics and the Bill was stopped becoming an object for ridicule.

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Assignment no.14

SURFACE AREAS AND VOLUMES

1. If the perimeter of one face of a cube is 20 cm, then its surface area is

   a) 120 sq.cm b) 150 sq.cm c) 125 sq.cm d) 400 sq.cm

2. The base radii of a cone and cylinder are equal. If their curved surface areas are also equal, then the ratio of the slant height of the cone to the height of the cylinder is

   a) 2 : 1 b) 1 :2 c) 1 : 3 d) 3 : 1

3. If the base area of a cone is 51 cm^2 and its volume is 85 cm^3, then its vertical height is

   a) 3.5 cm b) 4 cm c) 4.5 cm d) 5 cm

4. A solid sphere of radius x is melted and cast into the shape of solid cone of height x, the radius of the base of the cone is

   a) $2x$ b) $3x$ c) x d) $4x$

5. If the height of a cylinder is 4 times the circumference (c) of its base, then the volume of the cylinder in terms of circumference (in cubic units) is

   a) $\frac{4c^3}{\pi}$ b) $\frac{2c^3}{\pi}$ c) $\frac{c^3}{\pi}$ d) $\frac{c^3}{4\pi}$

6. What is the radius of a sphere whose volume is numerically equal to five times its surface area?

   a) 5 b) 10 c) 15 d) 20

7. How many three metre cubes can be cut from a cuboid measuring 18 m X 12m X 9 m?

   a) 36 b) 12 c) 72 d) 1000

8. A solid is composed of a cylinder surmounted by a cone at one end and a hemisphere on the other. If the diameter and the total height of the solid are 7 cm and 23.5 cm respectively and the height of the cylindrical part is 8 cm, find the total surface area and the volume of the solid.

9. An open metal bucket is in the shape of a frustum of a cone mounted on a hollow cylindrical base made of the same metallic sheet. The diameters of the two circular ends are 30 cm and 10 cm. The total vertical height of the bucket is 30 cm whereas the height of the cylindrical base is 6 cm. Find the area of the metal sheet used to make the bucket. Also find the capacity of the bucket in litres.

10. A milk tanker cylindrical in shape having diameter 2m and length 4.2m supplies milk to two booths in the ratio 3:2. One of the milk booths has a rectangular vessel having base area 3.96m^2 and the other has a cylindrical vessel having a diameter 2m. Find the level of milk in each of the two vessels.

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11. Water flows out through a circular pipe, whose internal diameter is 2cm, at the rate of 0.8m/s into a cylindrical tank, the radius of whose base is 40 cm. By how much will the level of water rise in 1 hour 30 minutes?
12. Solid spheres of diameter 6 cm are dropped into a cylindrical beaker containing some water and are fully submerged. If the diameter of the beaker is 18 cm and the water rises by 40 cm, find the number of solid spheres dropped in the water.
13. A sector of a circle of radius 15 cm has an angle of 120°. It is rolled up so that the two binding radii are joined together to form a cone. Find the volume of the cone.
14. A hollow sphere of external and internal diameters 8 cm and 4 cm respectively is melted into a cone of height 14 cm. Find the diameter of the base of the cone.
15. The height of a cone is 40 cm. A small cone is cut off at the top by a plane parallel to the base. If its volume is 1/8 of the volume of the given cone, at what height above the base is the section made?
16. A circle of radius 10.5 cm is rotated about its diameter. Find the surface area and the volume of the solid thus generated.
17. A hollow cylindrical pipe is made of copper and the volume of copper used in the pipe is $484\,cm^3$. If the internal radius is 6 cm and the length of the pipe is 14 cm, find the thickness of the pipe.
18. A cone of radius 4cm is divided into two parts by drawing a plane through the midpoint of its axis and parallel to its base. Compare the volumes of the two parts.

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Assignment No. 15
PROBABILITY

1) Which of the following cannot be the probability of an event?

a) 0.7 b) 0 c) -1.2 d) 18%

2) Out of vowels of the English alphabet, one letter is selected at random. The probability of selecting 'e' is

a) $\frac{1}{26}$ b) $\frac{5}{26}$ c) $\frac{1}{4}$ d) $\frac{1}{5}$

3) A box contains 200 oranges. If one orange is taken out from the box at random and the probability of its being rotten is 0.05, then the number of rotten oranges in the box is

a) 5 b) 10 c) 20 d) 2

4) The probability that a non leap year selected at random has 53 Sundays is

a) $\frac{1}{365}$ b) $\frac{2}{365}$ c) $\frac{2}{7}$ d) $\frac{1}{7}$

5) Probability that tomorrow will be holiday is 0.58. Probability that tomorrow will not be a holiday is

a) 0.42 b) 0.58 c) 1 d) 1.58

6) A single dice is rolled. Find the probability of getting

(i) a prime number (ii) a composite number (iii) even prime number
(iv) multiple of 6 (v) factors of 6.

7) Two dice are rolled simultaneously. Write the total possible outcomes. Find the probability of getting

(i) a doublet (ii) a total of 8 (iii) total of 9 or 11 (iv) product 11
(v) product 6 (vi) total greater than 10 (vii) product less than 2.

8) Three coins are tossed simultaneously. Write the total possible outcomes. Find the probability of getting

(i) at least 2 heads (ii) at most 2 tails (iii) exactly 3 heads
(iv) at least 3 heads (v) at most 3 heads

9) From a deck of 52 cards all face cards and aces are removed. From the remaining cards one card is drawn. Find the probability of getting

(i) a face card (ii) a red card (iii) a spade (iv)10 of hearts (v) black jack.

10) All the diamonds are removed from a deck of cards. Find the probability of getting

(i) a face card (ii) a red card (iii) an ace (iv) 10 of hearts

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11) A bag contains tickets numbered from 10 to 50. One ticket is drawn at random. Find the probability that the number on the card is

(i) prime (ii) divisible by 3 (iii) odd (iv) divisible by 3and 5

(v) a perfect square (vi) less than 20 (vii) not less than 11 (viii) even prime.

12) A bag contains some red marbles and 4 blue marbles. If the probability of drawing a blue marble is double that of a red marble, find the total number of marbles in the bag.

13) In a bag there are some red balls, some green balls and the remaining are blue balls. The probability of drawing a red ball is $\frac{1}{3}$, that of blue is $\frac{1}{2}$. If there are 9 green balls in the bag, find the total number of balls and the number of red and blue balls in the bag.

14) In a bag there are 12 balls out of which some are red balls, some are green balls and the remaining are blue balls. The probability of drawing a red ball is $\frac{1}{3}$, that of blue is $\frac{1}{4}$. Find the number of green balls in the bag.

15) An urn contains 7 black, 4 blue and 3 white marbles. One marble is drawn out of the urn. Find the probability that the marble drawn is

(i) red (ii) black or white (iii) blue (iv) not black.

16) In a bag there are 20 marbles out of which some are blue and some are red. If 4 blue marbles are removed from the bag, the probability of drawing a blue marble then becomes $\frac{1}{4}th$ of its original probability. Find the number of blue and red marbles in the bag.

17) A three digit number is selected at random from the set of all three digit numbers. Find the probability of the number having all the three digits same.

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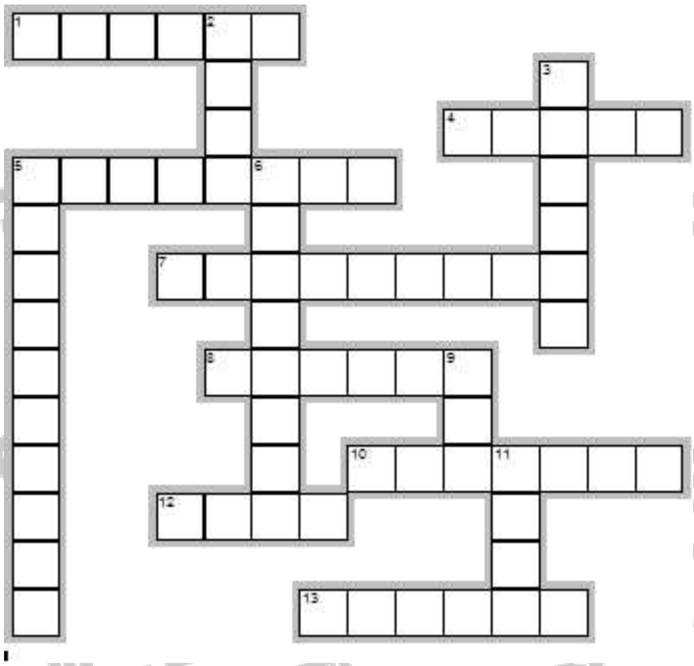
Crossword Puzzle



Across

1. Amount of space taken up by a 3D object
4. Performing an experiment once
5. A three dimesional object with two parallel and congruent circular bases
7. A polynomial with degree two
8. A line that intersects a circle at two distinct points
10. A quadrilateral with four sides equal
12. Probability of an impossible event
13. An angle greater than 180 degrees but less than 360 degress

Down

2. A selfish average
3. In geometry- to divide into two equal parts
5. Mid value of class interval
6. A chord of a circle that passes through centre
9. Number of tangents drawn from an external point to a circle
11. Observation with highest frequency

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PRACTICE ASSIGNMENT

1. Is $(x+2)^2 = 2x(x^2-2)$ a quadratic equation?

2. If a card is drawn from a well shuffled deck of cards, what is the probability of getting neither an ace nor a king?

3. State the Fundamental Theorem of Arithmetic.

4. Tom was born in August 2000. What is the probability that he was born on 3rd August?

5. A rational number $\frac{a}{b}$ will have a terminating decimal representation if b is of the form…………

6. For what values of k will the pair of equations $4x+2y=3$ and $5x+ky=-7$ have a unique solution?

7. What is the sum of the zeroes of $p(x) = x^3-4x^2+5x-29$?

8. On dividing a cubic polynomial by a quadratic polynomial, what would be the degree of the quotient obtained?

9. Why $13\times19\times23+23$ is a composite number?

10. Express $\cot\theta$ in terms of $\sin\theta$.

11. If H.C.F (114, 209) = 19, find the L.C.M of (114, 209).

12. State Euclid's Division Lemma.

13. ΔABC and ΔDEF are similar and $\frac{ar(\Delta ABC)}{ar(\Delta DEF)} = \frac{100}{36}$.If AC = 5 cm, find DF.

14. Check whether $\frac{81027}{6^2\times5^2}$ will give a terminating or a repeating decimal.

15. If $\frac{p}{q} = 43.78$, what can you say about the prime factors of q?

16. State the Pythagoras Theorem.

17. If α and β are the roots of the equation $2x^2-11x+14=0$, evaluate $\left(\alpha+\frac{1}{\beta}\right)\left(\beta+\frac{1}{\alpha}\right)$

18. Given below are three equations: Pick up the pair which has infinite solutions.

    $4x-5y=3$; $5x-4y=5$; $8x-10y=6$.

19. Write the equation of a line which is parallel to the line whose equation is

    $5x-3y+11=0$.

20. Express y in terms of x: $7x-3y=15$ and check whether the point $(2,1)$ is a solution of the equation or not.

21. What are the equations of the x-axis and the y-axis?

22. "The mean calculated in a grouped frequency distribution is the exact mean. " Do you agree? Give reasons.

23. For what value of k will the equations $2x+3y=7$ and $4x=ky+14$ represent a pair of coincident lines?

24. If one zero of the polynomial $(a^2+4)x^2+13x+4a$ is reciprocal of the other, find the value of a.

25. Small spherical balls are formed by melting a solid sphere. How many balls can be formed if radius of each ball is half of the radius of the given sphere?

26. If the 'less than' and the 'more than' ogives of a distribution intersect at (38, 45) then find the median of the distribution.

27. Two AP's have the same common difference. The first terms of the APs are 39 and 58 respectively. What is the difference between their 16^{th} terms?

28. For what value of k will the numbers $3k+4$, $7k+1$ and $12k-5$ be in A.P?

29. Find n so that the nth terms of the following two A.P's are equal.
    1, 7, 13, 19,……………………
    64, 63, 62, 61,………………….

30. If $S_n = n^2+3n$, find t_{10}.

31. If the 19^{th} term of an AP is 39, find S_{37}.

32. Find the nth term of $\frac{1}{p}, \frac{1-p}{p}, \frac{1-2p}{p}$,…………………….

33. A man goes 15 m due East and then 20 m due South. Find his distance from the starting point.

34. Two towers of heights 10 m and 30 m stand on a plane ground with their feet 15 m apart. Find the distance between their tops.

35. If ΔABC is similar to ΔPQR, perimeter of ΔABC =30 cm, perimeter of ΔPQR = 45 cm, PR = 9 cm, then find AC.

36. ABCD is a trapezium in which AB is parallel to CD and AB = 2 CD. Diagonals AC and BD intersect at O. If $area(\Delta AOB) = 84cm^2$, find the $area(\Delta COD)$.

37. D and E are points on sides AB and AC of ΔABC. AD = 2 cm, AE = 3 cm, BD = 1.5 cm, CE = y, DE = 3.6 cm, BC = x, find x and y.

38. In ΔPQR, $\angle P = 90°$ and in ΔPSR, $\angle S = 90°$. If PS = 6 cm, SR = 8 cm and QR = 26 cm, find the area ΔPQR.

39. If $\sin B = \frac{m^2 - n^2}{m^2 + n^2}$, find $\sec B + \tan B$.

40. Point C(2,3) divides the segment joining A (3,5) and B in the ratio 1 : 2, find the coordinates of B.

41. Find the length of the diagonals of a rhombus each of whose sides is of length 20 cm and each of whose acute angles is 60°.

42. Find the zeroes of $x^2 + 5x$.

43. If one zero of $5x^2 + 13x - a$ is reciprocal of the other, find the value of a.

44. Find the quadratic polynomial whose zeroes are $5 + \sqrt{2}$ and $5 - \sqrt{2}$.

45. How many terms are there in the AP: 25, 50, 75, …………1000 ?

46. TA and TB are the tangents drawn to a circle from a point T outside the circle. If $\angle ATB = 60°$, find $\angle AOB$ and $\angle TAB$.

47. The length of the tangent drawn from a point Q outside the circle is 16 cm. If the radius of the circle is 12 cm, how far is Q from the centre of the circle?

48. Find k so that $kx(x-2) + 6 = 0$ may have two equal roots.

49. The non negative real root of the equation $3x^2 - 5x - 2 = 0$ is ………

50. Find the non zero root of the equation $3z - 5z^2 = 0$.

51. State the nature of roots of $ax^2 + bx + c = 0$, if $b^2 - 4ac > 0$ (given a, b and c are real numbers).

52. "Sandeep's father is 30 years older than him. The product of their ages 2 years from now will be 400." Represent this information in the form of a quadratic equation.

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53. If one root of $2x^2 - 8x - m = 0$ is $\frac{5}{2}$, find the values of m.

54. A cone and a hemisphere have equal bases and equal volumes. Find the ratio of their heights.

55. Find the missing terms in the following AP □, 13, □, 3.

56. Can the HCF and LCM of two numberts be 27 and 288?

57. A student draws both the ogives and finds that they intersect at (30, 45) then the median of the distribution is ---------and the total number of observations is ------.

58. Circumferences of two circles are in the ratio 2 : 3, find the ratio of their areas.

59. Evaluate $\frac{(1+\cos\theta)(1-\cos\theta)}{(1+\sin\theta)(1-\sin\theta)}$ if $\tan\theta = \frac{1}{\sqrt{5}}$

60. If $\frac{p}{q} = 3.\overline{9145}$, what can be said about q?

61. D and E are points on sides AB and AC of ΔABC, DE|| BC. If AD = 3 cm, BD = 2 cm, then find $ar(ADE) : ar(ABC)$.

62. Find the common difference of the AP whose nth term is $t_n = \frac{3n}{3n+4}$.

63. PA and PB are tangents to the circle. CD is a third tangent touching the circle at Q. If PB = 10 cm and CQ =2 cm find PC.

64. Find the perimeter of a protractor having length of its base as 14 cm.

65. The probability of Subodh winning a race is $\frac{5}{9}$. What is the probability of his not winning the race?

66. The mean and median of a distribution both are equal to 635.97. Find the mode.

67. At how many points will the polynomial $x^3 + 8$ intersect the x-axis?

68. If 3 is a root of the equation $7x^2 - (k+1)x + 3 = 0$, find the value of k.

69. A race track is in the form of a ring whose inner and outer circumferences are 352 m and 396 m respectively. Find the width of the track.

70. Write a polynomial whose zeroes are $\frac{-4}{5}$ and $\frac{3}{4}$.

71. Three vertices of a parallelogram are (2, -2), (8, 4) and (5, 7), find the fourth vertex.

72. Find the point which is three-fourth of the way from (3, 1) to (-2, 5).

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73. Find the perpendicular distance of (5, 12) from the y-axis.

74. Find the distance of the point P(-a cosθ, a sinθ) from the origin.

75. If sum and product of the zeroes of $ky^2 + 2y + 3k$ are equal, find k.

76. 3 cubes of edges 2 cm each are joined end to end to form a cuboid. Find the ratio of the volume of a cube to the volume of the cuboid formed.

77. What is the perimeter of a quadrant of a circle of radius 2r?

78. If ΔABC ~ΔPQR, $\angle A = 45^\circ$ and $\angle B = 100^\circ$, find $\angle R$.

79. If $x\cos A = 1$ and $\tan A = y$, Evaluate $5x^2 - 5y^2$.

80. Find the LCM of the smallest prime number and the smallest composite number.

81. Find the radius of the circle if its area is equal to three times its circumference.

82. What is the maximum number of terms a polynomial of degree 6 may have?

83. What is the maximum value of $\frac{1}{\operatorname{cosec}\theta}$?

84. Find the value of p for which the points (-1, 3), (2, p) and (5, -1) are collinear.

85. What type of a graph will be represented by the polynomial $-3x^2 + 5x + 4$?

86. Find the length of the diagonal of the largest cube that can be inscribed in a sphere of radius 21 cm.

87. Sumit and Amit want to go from home to school. The location of their house is at (3,-1) and the school is at (3,5). Sumit first drives to the community centre which is at (7,-1) and then to the mall which is at (7,5) and then reaches the school, whereas Amit walks from home straight to the school. Find the distances travelled by the two. Also who is wiser? Give two reasons justifying your choice.

88. A student left for his school 10 minutes later than the scheduled time. In order to reach on time, he increases his speed by 1 km/hr. If his school is 2 km away from home, find his speed of walking.Which value is displayed in his action?

89. Students of a school hostel which is 4 km away from the school building, 40% of the students walk to the school, 20% travel by bus and the remaining cycle to the school.

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Find the probability that a student (picked up at random) of the hostel:

(a) cycles to school (b) walks to the school

What suggestion will a teacher give to a student regarding travelling from hostel to the school? Why?

90. A person saves Rs 250 in the first month, Rs 300 in the second month, Rs 350 in the third month, and so on. How much saving would he be able to do in 5 years?

What is the value promoted/displayed by his action?

91. A contract on construction job specifies a penalty for delay of completion beyond a certain date as follows: Rs 200 for the first day, Rs 250 for the second day, Rs 300 for the third day, etc, the penalty for each succeeding day being Rs 50 more than the preceding day.

If the contractor delays the construction by 45 days, how much penalty will he be required to pay?

Is charging the penalty justified? Give reasons.

92. Shubhra has a piggy bank in which she saves and puts coins. She has saved 100 coins of 50 paise, 50 coins of Re 1, 20 coins of Rs 2 and 10 coins of Rs 5 in it. If it is equally likely that one of the coins will fall out when the piggy bank is turned upside down. What is the probability that the coin that falls out is

(a) Re 1 coin (b) Rs 5 coin (c) 50 paisa coin?

What is the value displayed by the little girl Shubhra?

93. Rakesh goes to a mithai shop.

Offer 1) is a plate with one rasgulla. The radius of the rasgulla is 2.1 cm and is filled with sugar syrup which is 25% of its volume.

Offer 2) is a plate with 4 rasgullas, each having a radius which is $1/4^{th}$ of the radius of the bigger one. The sugar syrup in each rasgulla is also 25% of the volume.

Which plate will you suggest to a diet conscious person? Why?

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SAMPLE PAPER 1

TERM-1

Section A

1. Let $\Delta ABC \sim \Delta PQR$, 4BC = 3QR and ar($\Delta$ABC) = 81 cm^2, then find ar(ΔPQR).
2. Express sec 50° + cot 78° in terms of t-ratios of angles between 0° and 45°.
3. If -3 and 2 are roots of the quadratic equation $x^2 - (p+2)x - q = 0$ then find the values of p and q.
4. Without actually performing the long division , state whether $\frac{129}{2^2 \times 5^7 \times 7^5}$ will have a terminating or non-terminating repeating decimal expansion.

Section B

5. Is 7 x 5 x 3 x 2 + 3 composite number? Justify your answer.

   OR

   Write one rational and one irrational number between $\sqrt{2}$ and $\sqrt{3}$.
6. If one zero of a polynomial $(a^2 + 9)x^2 + 13x + 6a$ is reciprocal of the other, find the value of a.
7. Find the acute angle θ, satisfying the equation: $\operatorname{cosec}^2\theta + \cot^2\theta = 3$.
8. For what value(s) of k will the following pair of linear equations has no solution?

   kx + 3y = k – 2

   12x + ky = k
9. D and E are respectively the points on the sides AB and AC of a ΔABC such that AB = 5.6 cm, AD = 1.4 cm, AC = 7.2 cm and AE = 1.8 cm. Show that DE∥ BC.
10. One root of the equation $2x^2 + mx + 10 = 0$ is $\frac{5}{2}$. Find the value of m and the other root.

Section C

11. Prove that $5 + 2\sqrt{3}$ is irrational.
12. On dividing $x^3 - 3x^2 + 5x + 2$ by a polynomial g(x), the quotient and the remainder were x-2 and 2x + 4 respectively. Find g(x).
13. Check graphically whether the pair of linear equations 4x – y – 8 = 0 and 2x – 3y + 6 = 0 is consistent. If it is consistent, find its solution.

14. In ΔPQR, S and T are points on sides PQ and PR respectively such that $\frac{PS}{SQ} = \frac{PT}{TR}$ and ∠PST = ∠PRQ. Prove that PQR is an isosceles triangle.
15. Solve for x and y :

$$\frac{5}{x+y} - \frac{2}{x-y} + 1 = 0$$

$$\frac{15}{x+y} + \frac{7}{x-y} - 10 = 0$$

16. Prove that : $\frac{1+\sec A}{\sec A} = \frac{\sin^2 A}{1-\cos A}$
17. Six bells commence tolling together and toll at intervals of 2, 4, 6, 8, 10 and 12 minutes respectively. In 30 hours, how many times do they all toll together?
18. If α and β are the zeroes of the quadratic polynomial $x^2 - 2x + 3$, find the polynomial whose zeroes are α+2 and β+2.
19. Find the ratio in which the line segment joining the points (-3, 10) and (6, -8) is divided by the point (-1, 6).
20. Find the point on x axis which is equidistant from (2, -5) and (-2, 9)

Section D

21. In a unit test, the sum of marks of Anjali in Mathematics and English is 30. Had she got 2 marks more in Mathematics and 3 marks less in English, the product of marks would have been 210. Find her marks in the two subjects.
22. In what ratio is the line segment joining the points (-2,-3) and (3,7) divided by y-axis.? Also find the coordinates of the points of division.
23. Obtain all the zeroes of the polynomial $x^4 + 3x^3 - 3x^2 - 15x - 10$, if two of its zeroes are $\sqrt{5}$ and - $\sqrt{5}$.
24. If tan A = $\sqrt{3} - 1$, evaluate $\frac{\tan A}{1+\tan^2 A}$.
25. Prove that:

$$\frac{1}{\sec A - \tan A} - \frac{1}{\cos A} = \frac{1}{\cos A} - \frac{1}{\sec A + \tan A}$$

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26. The area of a rectangle reduces by 160 m^2 if its length is increased by 5 m and breadth is reduced by 4 m. However if length is decreased by 10 m and breadth is increased by 2 m, then its area is decreased by 100 m^2. Find the dimensions of the rectangle.

OR

If 1 is added to both the numerator and the denominator of a given fraction, it becomes $\frac{4}{5}$. If, however, 5 is subtracted from both the numerator and the denominator, the fraction becomes $\frac{1}{2}$. Find the fraction.

27. Three sets of books-English, Mathematics and Science containing 336, 240 and 96 books respectively have to be stacked in such a way that all the books are stored subject-wise and the height of each stack has to be same. What is the greatest number of books possible in each stack?

28. In a ΔABC, right angled at A, if tan C = $\sqrt{3}$, find the value of sin B cos C + cos B sin C.

29. The perpendicular from A on side BC of a ΔABC intersects BC at D such that DB = 3 CD.

Prove that : $2AB^2 = 2AC^2 + BC^2$.

31. Prove that if in a triangle, the square of one side is equal to the sum of the squares of the other two sides, then the angle opposite to the first side is a right angle.

SANSKRITI
THE CIVIL SERVICES SCHOOL

SAMPLE PAPER -2
TERM-2
SECTION -A

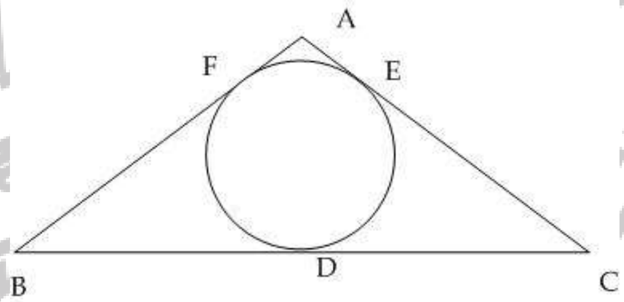
Question numbers 1 to 4are of one mark each.

1. If t, 2t-1, 2t+1 are three consecutive terms of an AP, find the value of t.
2. If the last term of an A.P 5, 3, 1, -1 ……… is -41, then the A.P consists of how many terms?
3. From a point Q, the length of the tangent to a circle 24cm and the distance of Q from the centre is 25cm. Find the radius of the circle.
4. If PQ and PR are tangents to a circle with centre O from a point P which is outside the circle such that ∠QPR = 30˚, then find ∠PRQ.

SECTION B

Question numbers 5 to 10 carry 2 marks each.

5. The in-circle of an isosceles triangle *ABC* in which *AB* = *AC*, touches the sides *BC, CA* and *AB* at *D, E* and *F* respectively. Prove that *BD* = *DC*



6. If the third term and ninth term of an A.P are 4 and -8 respectively, which term of A.P is zero?
7. Find the perimeter of the figure where arc AED is a semi-circle and ABCD is a rectangle given that AB = 20 cm and BC = 14 cm

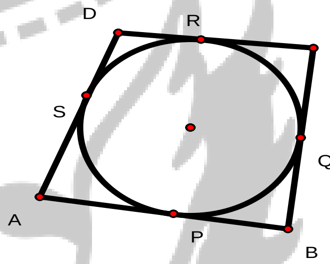
8. A solid spherical ball is melted and recast into smaller balls of equal size. If the radius of smaller ball is one-eighth of the original ball, find the number of smaller balls made, assuming that there is no wastage of metal in the process.

9. A card is drawn from a well shuffled deck of 52 cards. Find the probability of getting a) a non-face card b) a black king or red queen.

OR

Two dice are thrown simultaneously. Find the probability of getting a) a doublet of even number b) a multiple of 2 on one die and multiple of 3 on other.

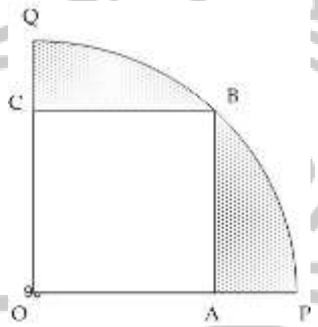
10. A quadrilateral ABCD is drawn to circumscribe a circle. Prove that AB + CD = AD + BC.



SECTION – C

Question numbers 11 to 20 carry 3 marks each.

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



12. Prove that the opposite sides of a quadrilateral circumscribing a circle subtend supplementary angles at the centre of the circle.

13. In a godown , there are 25 parcels in the first row, 22 in the second row, 19 in the third so on. In the last row, there are only 4 parcels. Find the number of rows of parcels in the godown.

14. From an external point P, two tangents PA and PB are drawn to a circle with centre O. Show that OP is perpendicular bisector of AB.

Or

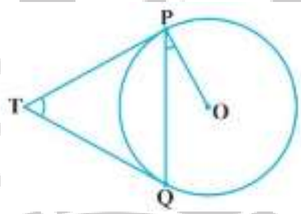
Prove that the opposite sides of a quadrilateral circumscribing a circle subtend supplementary angles at the centre of the circle.

15. 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) the area of the sector formed by the arc (iii) area of the minor segment formed by the corresponding chord

16. A jar contains only red, green and white balls. The probability of selecting a red ball at random is $\frac{2}{5}$ and that of a white ball is $\frac{1}{5}$. If the jar contains 12 green balls , find the number of red and white balls.

17. Water in a canal, 6m wide and 1.5m deep, is flowing with a speed of 10km/h. How much area will it irrigate in 30 minutes if 0.08 m of standing water is needed

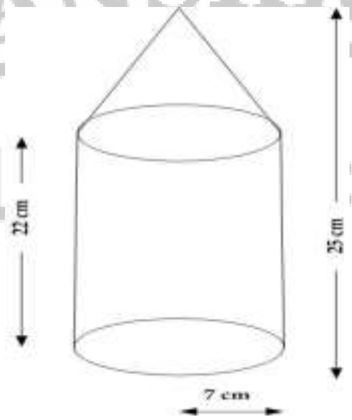
18. Two tangents TP and TQ are drawn to a circle with centre O from an external point. Prove that: $\angle PTQ = 2\angle OPQ$.



19. Rahul donates some part of his income to an orphanage every month. In a particular month, he wishes to donate toys for the children. Each toy is in the form of a cone mounted on a cylinder of a common base radius 7 cm. The total height of the toy is 25 cm and the height of the conical part is 3 cm.

    (1) Find the volume of each toy.

    (2) What type of nature is shown by Rahul?

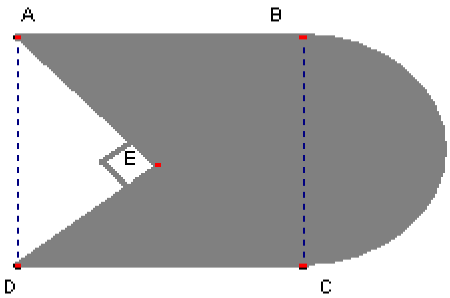


20. Construct a triangle similar to ΔABC whose sides are 5/2 times that of ΔABC, where ΔABC has sides 3cm, 5cm and 6cm

SECTION – D

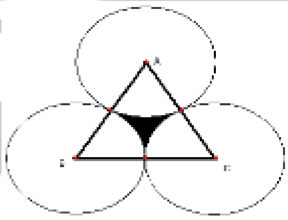
Question numbers 21 to 31 carry 4marks each.

21. Find the area of the shaded region. Given ABCD is a square of side 10cm andDE = 6cm



22. Draw a triangle ABC in which AC = AB= 4.5 cm, and ∠ A =90˚. Construct a triangle ADE similar to triangle ABC with its corresponding sides equal to ¾th of the corresponding sides of triangle ABC.
23. "The lengths of tangents drawn from an external point to a circle are equal" : - Prove the statement.
24. Two pillars of equal height stand on either side of road which is 150m wide. From a point on the road between the pillars, the elevations of top of the pillars are 60˚ and 30˚. Find the height of the pillars and the position of the point.

25. The area of an equilateral triangle is 17320.5 cm^2.Taking each angular point as centre, the circles are drawn with radius equal to half the length of the side of the triangle. Find the area of shaded region. (take$\sqrt{3}$ = 1.73205 and π = 3.14).



26. A bucket is in the form of frustum of a cone whose radii of the bases are 33cm and 27 cm. Its slant height is 10 cm. Find the total surface area and volume.

27. A right angled triangle with sides 15cm, 20cm is made to revolve about its hypotenuse. Find the volume and surface area of the double cone so formed.(use π =3.14)

28. Three coins are tossed once.

    a) Write the sample space

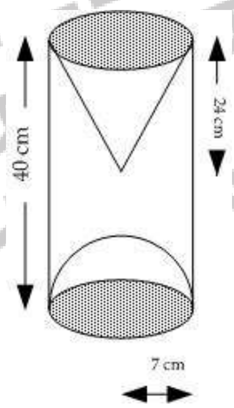
    b) Find the probability of getting atmost one head

    c) Find the probability of getting 2 heads

    d) Find the probability of no head.

29. ABC is a triangle. A circle touches sides AB and AC produced at X and Y respectively, and the side BC at Z. Show that: $AX = AY = \frac{1}{2}$ perimeter of ΔABC.

30. A wooden article was made by scooping out a hemisphere from one end of a cylinder and a cone from the other end as shown in the figure. If the height of the cylinder is 40 cm, radius of cylinder is 7 cm and the height of the cone is 24 cm, find the total surface area of the article.



31. The figure depicts a racing track whose left and right ends are semicircular. The distance between the two inner parallel line segments is 60m and they are each 106m long. If the track is 10m wide, find the area of the track.