Year	Questions	Marks
2013	5	5
2014	5	5
2015	5	5
2016	5	5
Total	**20**	**20**

1. Match the column – I with column – II. If $\propto$ and β are the zeroes of the quadratic polynomial $f(x) = x^2 - 3x - 2$, then

Column – I	Column – II
(i) $\propto^2\beta + \propto\beta^2 =$	(a) $\frac{4\sqrt{17}-1}{4}$
(ii) $\propto - \beta + \frac{1}{2\propto\beta} =$	(b) -6
(iii) $\propto - \beta + \frac{1}{2\propto\beta} =$	(c) 161
(iv) $\propto^4 + \beta^4 =$	(d) $-\frac{3}{2}$

(A) (i)→(b), (ii)→(a), (iii)→(d), (iv)→(c)
(B) (i)→(d), (ii)→(b), (iii)→(c), (iv)→(a)
(C) (i)→(b), (ii)→(d), (iii)→(c), (iv)→(a)
(D) (i)→(b), (ii)→(d), (iii)→(a), (iv)→(c)

Answer: C

Solution: $f(x) = x^2 - 3x - 2$

$A = 1, \quad b = -3, \; c = -2$

$\propto + \beta = -\frac{b}{a} = \frac{-(-3)}{1} = 3$ and $\propto\beta = \frac{c}{a} = \frac{-2}{1} = -2$

(i) $\alpha^2\beta + \alpha\beta^2 = \alpha\beta(\alpha + \beta) = -6$

(ii) $\frac{1}{\alpha} + \frac{1}{\beta} = \frac{\alpha+\beta}{\alpha\beta} = \frac{3}{-2}$

(iii) $\propto - \beta + \frac{1}{2\alpha\beta}$

$\Longrightarrow (\alpha - \beta)^2 = (\alpha - \beta)^2 - 4\alpha\beta = 17$

$\Longrightarrow (\alpha - \beta) = \sqrt{17}$

$(\alpha - \beta) + \frac{1}{2\alpha\beta} = \sqrt{17} + \frac{1}{2(-2)} = \frac{4\sqrt{17}-1}{4}$

(iv) $\alpha^4 + \beta^4 = 161$

[2013]

2. Match the columns.

Column – I	Column - II
(i) $(\sec^2\theta + \tan^2\theta)^2 - 4\sec^2\theta\tan^2\theta = (\tan^2 60^0 + 4\cos^2 45^0 + 3\sec^2 30^0 + 5\cos^2 90^0)$	(p) 9
(ii) $\text{Cosec}30^0 + \sec60^0 - \cot^2 30^0$	(q) 8/17
(iii) If $\sec\theta + \tan\theta = 4$, then $\cos\theta =$	(r) 4
(iv) $\text{Tan}5^0\tan85^0 + \tan10^0\tan80^0\tan35^0\tan55^0 + \tan25^0\tan65^0 =$	(s) 1

(A) (i) → (s), (ii) → (p), (iii) → (r), (iv) → (q)
(B) (i) → (s), (ii) → (p), (iii) → (q), (iv) → (r)

(C) (i) → (p), (ii) → (r), (iii) → (q), (iv) → (s) (D) (i) → (q), (ii) → (p), (iii) → (s), (iv) → (r)

Answer: B

Solution: $\tan 5^0 \tan 85^0 + \tan 10^0 \tan 80^0 + \tan 35^0 \tan 55^0 + \tan 25^0 \tan 65^0$

$= \tan 5^0 \cot 5^0 + \tan 10^0 \cot 10^0 + \tan 35^0 \cot 35^0 + \tan 25^0 \cot 25^0$

$= 1 + 1 + 1 + 1 = 4$

So, (iv) matches (r). Hence the answer is option B.

[2014]

3. Match the columns.

Column-I	Column-II
(i) When an odd integer 'a' is divided by 2, then remainder r can be	(p) 5
(ii) When an integer 'a' whose unit digit is 4 is divided by 5, then remainder r can be	(q) 1
(iii) A whole number lying between $\sqrt{2}$ and 2 $\sqrt{2}$ is	(r) 2
(iv) If the digit at the unit's place of a number is 5, then it is surely divisible by	(s) 4

(A) (i) → (p), (ii) → (r), (iii) → (s), (iv) → (q) (B) (i) → (q), (ii) → (s), (iii) → (p), (iv) → (r)

(C) (i) → (p), (ii) → (r), (iii) → (q), (iv) → (s) (D) (i) → (q), (ii) → (s), (iii) → (r), (iv) → (p)

Answer: D

Solution: (i) → (q), (ii) → (s), (iii) → (r), (iv) → (p)

[2015]

4. State 'T' for true and 'F' for false.

I. A sequence is an A.P., if and only if the sum of its n terms is of the form An2 + Bn, where A and B are constants.

II. If 18, a, b, –3 are in A.P., then a + b = 15.

III. If a, c, b are in A.P., then 2c = a + b.

IV. The nth term from the end of an A.P. is the $(m - n + 1)^{th}$ term from the beginning, where m terms are in A.P

	I	II	III	IV
(A)	F	F	T	T
(B)	T	T	T	F
(C)	F	T	T	F
(D)	T	T	T	T

Answer: D

Solution: All statements are true as per A.P. terms. So, Option D is the correct answer.

[2016]

5. Which of the following statements is incorrect?

(A) The abscissa of every point on y-axis is zero.

(B) The ordinate of a point is its perpendicular distance from x-axis.

(C) The coordinates of any point on y-axis are of the form (0, y).

(D) If points $A(x_1, y_1)$, $B(x_2, y_2)$ and $C(x_3, y_3)$ are collinear, then $x_1(y_2 - y_3) + x_2(y_1 - y_3) + x_3(y_1 - y_2) = 0$.

Answer: D

Solution: If points $A(x_1, y_1)$, $B(x_2, y_2)$, $C(x_3, y_3)$ are collinear, then $x_1(y_1 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2) = 0$

But in the question it is given as, $x_1(y_1 - y_3) + x_2(y_1 - y_3) + x_3(y_1 - y_2) = 0$

So, option D is incorrect

It is $x_1 (y_2 - y_3) + x_2 (y_3 - y_1) + x_3 (y_1 - y_2) = 0$

[2013]

6. Which of the following situations do not form an A.P.?

(i) The fee charged from a student every month by a school for the whole session when the monthly fee is 400

(ii) The fee charged every month by a school from classes I to XII, when the monthly fee for class I is 250 and it increases by 50 for the next higher class.

(iii) The amount of money in the account of Sanchi at the end of every year when 1000 is deposited at simple interest at the rate of 10% per annum.

(iv) The number of bacteria in a certain food item after each second, when they double themselves in every second.

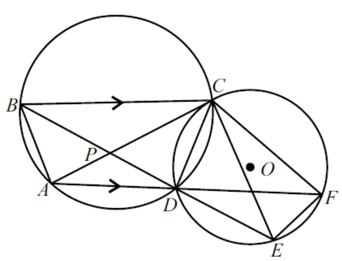
(A) Only (i) (B) Only (ii) (C) Both (ii) and (iv) (D) Only (iv)

Answer: D

Solution: Only fourth option does not form an A.P as there is a geometric progression when the number of bacteria doubles themselves every second.

[2014]

7. The two circles intersect at C and D, where O is the Centre of the second circle. AD produced and cuts the second circle at F. BD produced and cuts the second circle at E. ∠DEF = 110°, ∠ACB = 32° and ∠DAB = 118°.



Find:

(i) ∠ACE (ii) ∠COD

(i)		(ii)
(A)	96°	68°
(B)	72°	59°
(C)	59°	72°
(D)	68°	96°

Answer: D

Solution: ABCD is a cyclic quadrilateral in the bigger circle and CDEF is cyclic quadrilateral.

Given $<DEF = 110^0$, $< ACB = 32^0$ and $<DAB = 118^0$

<ACB and <CAD are congruent.

As $<DAB = 118^0$ then $<BCD = 180 - 118 = 62^0$,

<ACD = <BCD - <ACB = 62 – 32 = 30^0
<CAD + <ACD + <ADC = 180
32 + 30 + <ADC = 180 => <ADC = 180 -62 = 118^0
In smaller circle
<CDF = 180 - < ADC = 180 -118 = 62^0
As <DEF = 110^0, <DCF = 180 -110 = 70^0
In triangle DCF, we have <CDF = 62, <DCF = 70
Hence < CFD = 180 -70-62 = 48^0
As <CFD is the angle made at circumference,
Using Central Angle Theorem the angle made at Centre
<COD = 2 × <CFD = 2 × 48 = 96^0
<CBD = <CAD = 32 (angle in the same segments are equal)
<CBD = <FDE = 32^0 (alternate angle)
<CED = <CFD = 48^0 (angle in the same segments are equal)
Let's consider CE cuts DF at Q
<AQE = 180 – 48 - 32 = 100^0
<CQD = 180 -100 = 80^0
<DCQ = 180 – 80 - 62 = 38^0
<ACE = <ACD + < DCQ or (<DCE) = 30 + 38 = 68^0
Hence we get < ACE = 68^0 and < COD = 96^0

[2015]

8. A die is thrown twice. What is the probability that
(i) 5 will not come up either time?
(ii) 5 will come up at least once?

	(i)	(ii)
(A)	$\frac{24}{36}$	$\frac{11}{36}$
(B)	$\frac{25}{36}$	$\frac{13}{36}$
(C)	$\frac{11}{36}$	$\frac{25}{36}$
(D)	$\frac{25}{36}$	$\frac{11}{36}$

Answer: D
Solution: Total no of outcomes = 6 × 6 = 36
(I) Total no of outcomes when 5 comes up on either time are (5, 1), (5, 2), (5, 3), (5, 4), (5, 5), (5, 6), (1,5),(2,5), (3,5), (4,5), (6,5)
Hence, total no of favorable cases = 11
P (5 will come up either time) = 11/36
P (5 will not come up either time) 1 - 11/36 = 25/36.................... (1)
(II) Total number of cases, when 5 can come at least once = 11
P (5 can come at least once) = 11/36...................... (2)
So, option D is the correct answer.

[2016]

9. Which of the following options hold?

Statement 1: Let $x = \frac{p}{q}$ be a rational number, such that the prime factorization of **q** is not of the form $2^m \times 5^n$, where **m**, **n** are non-negative integers. Then, x has a decimal expansion which is none terminating repeating. statement 2: $\frac{64}{455}$ is a terminating repeating.

(A) Statement 1 is true but statement 2 is false.
(B) Statement 1 is false but statement 2 is true.
(C) Both the statements are true.
(D) Both the statements are false.

Answer: A

Solution: $\frac{64}{455} = \frac{2^6}{5\times7\times13}$ There are 7 and 13 also in denominator is not form of $2^m \times 5^n$ hence $\frac{64}{455}$ is not terminating

[2013]

10. Find the mean, mode and median respectively of the following data.

xi	58	59	60	61	62	63	64	65	66
fi	2	3	6	15	10	5	4	3	2

(A) 51.72, 62, 61
(B) 61, 62, 61
(C) 61, 60, 61
(D) 61.72, 61, 61

Answer: D

Solution:

x_i	f_i
116	2
177	3
360	6
915	15
620	10
315	5
256	4
195	3
132	2

Mean = = = 61.72.

Hence, the answer is fourth option.

[2014]

11. Study the statements carefully.

Statement I: Both the roots of the equation $x^2 - x + 1 = 0$ are real.

Statement II: The roots of the equation $ax^2 + bx + c = 0$ are real if and only if $b^2 - 4ac \geq 0$.

Which of the following options hold?

(A) Both Statement I and Statement II are true
(B) Both Statement I and Statement II are false.
(C) Statement I am true but Statement II is false.
(D) Statement I am false and Statement II is true.

Answer: D

Solution: Statement 1 is false as for $x^2 - x + 1 = 0$ the discriminant $D = b^2 - 4ac$ is negative. Statement is true.

[2015]

12. Fill in the blanks.

(i) P and Q are the end points of the diameter of a circle, having its Centre at R. If he coordinates of P and Q are respectively (–3, 3) and (5, 1), then the coordinates of R are_____.

(ii) If the point C (–1, 2) divides internally the line segment joining A (2, 5) and B in the ratio 3:4, then the coordinates of B are______.

(iii) If the points A (1, 2), B (0, 0) and C (a, b) are collinear, then____.

(iv)The points (–4, 0), (4, 0) and (0, 3) are the vertices of a/an____.

	(i)	**(ii)**	**(iii)**	**(iv)**
(A)	(1, 2)	(–5, –2)	2b = a	Isosceles triangle
(B)	(2, 1)	(–5, –2)	2a = b	Right angled triangle
(C)	(1, 2)	(–5, –2)	2a = b	Isosceles triangle
(D)	(2, 4)	(–5, 2)	2b = a	Right angled triangle

Answer: C

Solution: (i) R is the Centre of the circle and so it is the midpoint of PQ. Using mid-point formula, the coordinate of R is (5 – 3)/2, (3 + 1)/2 = (1, 2).

(ii) Using section formula we can find the coordinates of B as -1 = {3(x) + 4(2)} / 7 i.e., x = 15/3 = -5

Similarly 2 = (3y + 20)/7 i.e., y = -2 so, coordinates of B are (-5, -2).

From (i) and (ii) it is clear (iii) If the points A (1, 2), B (0, 0) and C (a, b) are collinear then we must have,

$x_1 (y_2 - y_3) + x_2 (y_3 - y_1) + x_3 (y_1 - y_2) = 0$

i.e., 1(0 –b) + 0(b – 2) + a (2 – 0) = 0 or -b + 0 + 2a = 0 or 2a = b

Hence Option (C) is correct.

[2016]

13. There is a question and two statements numbered I and II given below it. You have to decide whether the data provide in the statements is/are sufficient to answer the given question?

What is the volume of a cube?

I. The area of each face of the cube is 64 square meters.

II. The length of one side of the cube is 8 meters.

(A) If the data in statement I alone are sufficient to answer the question, while the data in statement II alone are not sufficient to answer the question.

(B) If the data in statement II alone are sufficient to answer the question, while the data in statement I alone are not sufficient to answer the question.

(C) If the data either in statement I or in statement II alone are sufficient to answer the question.

(D) If the data even in both statements I and II together are not sufficient to answer the question.

Answer: C

Solution: The area of each face of the cube is 64 sq units this implies side of the cube is 8 units the volume of cube is side x side x side = 8 x 8 x 8 = 512 sq units If the data either side or area alone is sufficient to answer the question.

[2013]

14. Fill in the blanks.
Let a=P/q be a rational number such that p and q are P and the prime factorization of q is not of the form 2n×5m, where n and m are whole numbers, then a has a decimal expansion which is Q and R.

P	Q	R
(A) Prime	Non-terminating	Non-repeating
(B) Co-prime	Terminating	Repeating
(C) Co-prime	Non-terminating	Repeating
(D) Prime	Non-terminating	Repeating

Answer: C
Solution: p and q does not have any common factor. Also q is not multiples of either 2 and 5, so a is non-Terminating and repeating.

[2014]

15. Fill in the blanks.
In 'Less Than' Ogive, the cumulative frequencies are written corresponding to the P__ limits of the classes of the Given data in 'More Than' Ogive, the cumulative frequencies are written corresponding to the Q__ limit of the Classes Y-coordinate = n/2 on an ogive, point P whose (i.e., half of the total number of the entries), has its x-coordinate equal to the R__ of the data. Two ogives, one 'less than' type and the other 'more than' type for the same data when drawn simultaneously on the same graph, intersect each other at the point P whose S__ = n/2 and T__ = median of the data where n is the total number of the entries of the data.

	P	Q	R	S	T
(A)	Upper	Lower	Median	y-coordinate	x-coordinate
(B)	Lower	Upper	Median	y-coordinate	x-coordinate
(C)	Upper	Lower	Median	x-coordinate	y-coordinate
(D)	Upper	Lower	Upper	y-coordinate	x-coordinate limit

Answer: A
Solution: P = Upper, Q = Lower, R = Median, S = y- coordinate, T = x-coordinate

[2015]

16. Match the following:

Column I		Column II	
(a)	$\frac{cos60^0+sin30^0-cot30^0}{\tan 60^0+sec45^0-cosec\ 45^0} =$	(i)	$\sec^6\theta$
(b)	$\sec^2\theta\ (1 + \sin\theta)\ (1 - \sin\theta) =$	(ii)	0
(c)	$\left(\frac{\sin 29^0}{\cos 61^0}\right) + (\frac{cos27^0}{\sin 63^0})^2 - 4cos^2 45^0 =$	(iii)	1
(d)	$\tan^6\theta + 3\tan^2\theta\sec^2\theta + 1 =$	(iv)	$\sqrt{3} - \frac{1}{3}$

(A) (a)→(iv), (b)→(iii), (c)→(i), (d)→(ii)
(B) (a)→(i), (b)→(iv), (c)→(iii), (d)→(ii)
(C) (a)→(i), (b)→(iv), (c)→(ii), (d)→(iii)
(D) (a)→(iv), (b)→(iii), (c)→(ii), (d)→(i)

Answer: D

Solution: Option D is the right match between Column I and Column II. Option D is the correct answer.

[2016]

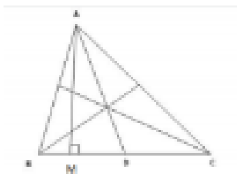
17. Fill in the blank:

_____ Times the sum of the squares of the sides of a triangle is equal to four times the sum of the squares of the medians of the triangle.

(A) Two (B) Three (C) Five (D) One and half

Answer: B

Solution:



To Prove 3 ($AB^2 + BC^2 + CA^2$) = 4 ($AD^2 + BE^2 + CF^2$)

From the figure,

AM perpendicular to BC and AD is the median.

In the triangle, AMB and AMC, by Pythagoras theorem,

$AB^2 = AM^2 + BM^2$ --------- (I)

$AC^2 = AM^2 + CM^2$ --------- (II)

Adding (I) and (II)

$AB^2 + AC^2 = 2\ AM^2 + BM^2 + CM^2$

But BM = BD − DM & CM = DM + DC = DM + BD as DC = BD

∴, $BM^2 + CM^2 = (BD - DM)^2 + (DM + BD)^2$

$BM^2 + CM^2 = {}^2 (BD)^2 + DM^2$

Now, $AB^2 + AC^2 = 2\ AM^2 + BM^2 + CM^2$

$AB2 + AC^2 = 2\ AM^2 + 2\ (BD)^2 + 2\ DM2$

$AB2 + AC^2 = 2\ (AD)^2 + 2\ BD^2$

Since, $AM^2 + DM^2 = (AD)^2$

$AB^2 + AC^2 = 2\ (AD)^2 + \frac{(BC)^2}{2}$ ----------- (III)

Similarly,

$BC^2 + AB^2 = 2\ (BE)^2 + \frac{(AC)^2}{2}$ ----------- (IV)

$AC^2 + BC^2 = 2\ (CF)^2 + \frac{(AB)^2}{2}$ ----------- (V)

Now adding (III), (IV), and (v) we get

$2\ (AB^2 + AC^2 + BC^2) = 2\ (AD^2 + BE^2 + CF^2) + (1/2)\ (AB^2 + BC^2 + AC^2)$

Now multiplying throughout by 2,

$4\ (AB^2 + AC^2 + BC^2) = 4\ (AD^2 + BE^2 + CF^2) + (AB^2 + BC^2 + AC^2)$

$3\ (AB^2 + BC^2 + CA^2) = 4\ (AD^2 + BE^2 + CF^2)$

[2013]

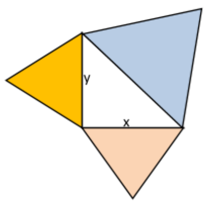
18. Which of the following statements is true?

Statement-1: The area of the equilateral triangle described on the hypotenuse of a right angled triangle is equal to the sum of the areas of the equilateral triangles described on the other two sides of the triangle.

Statement-2: The area of the equilateral triangle described on the side of right angled isosceles triangle is half of the area of the equilateral triangle described on its hypotenuse.

(A) Only statement-1
(B) Only statement-2
(C) Both statement-1 and statement-2
(D) Neither statement-1 nor statement-2

Answer: C
Solution: Statement I is true



Let the sides of the right angled triangle be x and y. Then the hypotenuse becomes $\sqrt{x^2+y^2}$

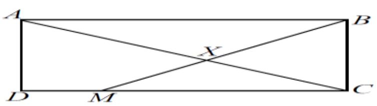
Now the area of equilateral triangle with hypotenuse as its side $= \frac{\sqrt{3}}{4}\left(\sqrt{x^2+y^2}\right)^2 = \frac{\sqrt{3}}{4}(x^2+y^2)$

And sum of areas of equilateral triangles formed on the sides x and y $= \frac{\sqrt{3}}{4}x^2 + \frac{\sqrt{3}}{4}y^2 = \frac{\sqrt{3}}{4}(x^2+y^2)$

Statement II is also true
Use the same method as above, just that in isosceles triangle x = y.

[2014]

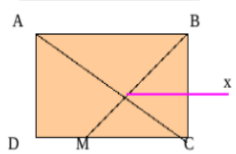
19. ABCD is a rectangle and M is a point on CD.
AC and BM meet at X.



It is given that CM = 3MD. Find:
(i) Area of ΔCXM: area of ΔAXB
(ii) Area of ΔBXC: area of rectangle ABCD

(i)		(ii)
(A)	9:16	3:11
(B)	9:16	3:14
(C)	16:9	14:3
(D)	16:9	11:3

Answer: B
Solution:



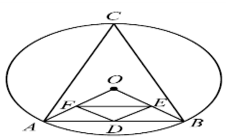
M is a point on CD, and AC and BM meet at x.
AB is parallel to MD and CM = 3MD hence, DC = AB = DM + CM = 4MD
Triangle AXB and triangle CXM are similar,
The sides of triangle CXM and AXB are in the ration of 3:4

Hence the ratio of their area will be Area of triangle CXM: Area of triangle AXB = 3^2: 4^2 = 9:16
Now, Area of triangle BCM = 3MD × BC/2
Area of triangle CXM + Area of triangle BXC = 1.5 BC×MD ----------- (1)
Area of triangle ABC = BC×4MD/2
Area of triangle AXB + Area of triangle BXC = 2BC×MD ------------ (2)
Area of triangle CXM = (9/16) Area of triangle AXB
Let's plug this in equation 1
(9/16)Area of triangle AXB + Area of triangle BXC = 1.5 BC×MD
Multiply both side of above equation by 16,
9 Area of triangle AXB + 16 Area of triangle BXC = 24 BC×MD --------- (3)
Multiply 2nd Equation by 9
9 Area of triangle AXB + 9 Area of BXC = 18 BC×MD ------------- (4)
Subtract Equation 4 from equation 3
7 × Area of triangle BXC = 6 BC×MD
Area of triangle BXC = (6/7) BC×MD ------------------- (5)
Area of rectangle ABCD = 4 MD×BC ----------------- (6)
Divide equation 5 by equation 6
Area of triangle BXC: Area of rectangle ABCD = 6:28 = 3:14
Hence the correct answer is B.

[2015]

20. Consider the following statements.

Statement I: In the given figure, O is the Centre of the circle with D, E and F as mid points of AB, BO and OA, respectively. If ∠DEF is 30°, then ∠ACB is 60°.



Statement II: Angle subtended by an arc at the Centre is twice the angle subtended by it on the remaining part of the circle.

Which of the following options hold?

(A) Both Statement I and Statement II are true.
(B) Statement I am true but Statement II is false.
(C) Statement I am false but Statement II is true.
(D) Both Statement I and Statement II are false.

Answer: A

Solution: Both statements I and II are true. Because (I) Angle subtended by an arc at the Centre is twice the angle subtended by it on the remaining part of the circle. (II) If angle DEF is 30 degree then angle ACB will be 2 × 30 = 60 degree. So, option A is the correct answer.

[2016]