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Secondary School Examination - 2020
Marking Scheme- MATHEMATICS BASIC
Subject Code : 241 Paper Code: 430/1/1,2,3

General Instructions:

1. You are aware that evaluation is the most important process in the actual and correct assessment of the candidates. A small mistake in evaluation may lead to serious problems which may affect the future of the candidates, education system and teaching profession. To avoid mistakes, it is requested that before starting evaluation, you must read and understand the spot evaluation guidelines carefully.**Evaluation is a 10-12 days mission for all of us. Hence, it is necessary that you put in your best effortsin this process.**

2. Evaluation is to be done as per instructions provided in the Marking Scheme. It should not be done according to one's own interpretation or any other consideration. Marking Scheme should be strictly adhered to and religiously followed. **However, while evaluating, answers which are based on latest information or knowledge and/or are innovative, they may be assessed for their correctness otherwise and marks be awarded to them. In class-X, while evaluating two competency based questions, please try to understand given answer and even if reply is not from marking scheme but correct competency is enumerated by the candidate, marks should be awarded.**

3. The Head-Examiner must go through the first five answer books evaluated by each evaluator on the first day, to ensure that evaluation has been carried out as per the instructions given in the Marking Scheme. The remaining answer books meant for evaluation shall be given only after ensuring that there is no significant variation in the marking of individual evaluators.

4. Evaluators will mark(√) wherever answer is correct. For wrong answer 'X"be marked. Evaluators will not put right kind of mark while evaluating which gives an impression that answer is correct and no marks are awarded. **This is most common mistake which evaluators are committing.**

5. If a question has parts, please award marks on the right-hand side for each part. Marks awarded for different parts of the question should then be totaled up and written in the left-hand margin and encircled. This may be followed strictly.

6. If a question does not have any parts, marks must be awarded in the left-hand margin and encircled. This may also be followed strictly.

7. If a student has attempted an extra question, answer of the question deserving more marks should be retained and the other answer scored out.

8. No marks to be deducted for the cumulative effect of an error. It should be penalized only once.

9. A full scale of marks 0 - 80 has to be used. Please do not hesitate to award full marks if the answer deserves it.

10. Every examiner has to necessarily do evaluation work for full working hours i.e. 8 hours every day and evaluate 20 answer books per day in main subjects and 25 answer books per day in other subjects (Details are given in Spot Guidelines).

11. Ensure that you do not make the following common types of errors committed by the Examiner in the past:-
    - Leaving answer or part thereof unassessed in an answer book.
    - Giving more marks for an answer than assigned to it.
    - Wrong totaling of marks awarded on a reply.
    - Wrong transfer of marks from the inside pages of the answer book to the title page.
    - Wrong question wise totaling on the title page.
    - Wrong totaling of marks of the two columns on the title page.
    - Wrong grand total.
    - Marks in words and figures not tallying.
    - Wrong transfer of marks from the answer book to online award list.
    - Answers marked as correct, but marks not awarded. (Ensure that the right tick mark is correctly and clearly indicated. It should merely be a line. Same is with the X for incorrect answer.)
    - Half or a part of answer marked correct and the rest as wrong, but no marks awarded.

12. While evaluating the answer books if the answer is found to be totally incorrect, it should be marked as cross (X) and awarded zero (0)Marks.

13. Any unassessed portion, non-carrying over of marks to the title page, or totaling error detected by the candidate shall damage the prestige of all the personnel engaged in the evaluation work as also of the Board. Hence, in order to uphold the prestige of all concerned, it is again reiterated that the instructions be followed meticulously and judiciously.

14. The Examiners should acquaint themselves with the guidelines given in the Guidelines for spot Evaluation before starting the actual evaluation.

15. Every Examiner shall also ensure that all the answers are evaluated, marks carried over to the title page, correctly totaled and written in figures and words.

16. The Board permits candidates to obtain photocopy of the Answer Book on request in an RTI application and also separately as a part of the re-evaluation process on payment of the processing charges.

QUESTION PAPER CODE 430/1/1

EXPECTED ANSWER/VALUE POINTS

SECTION A

1. HCF of 144 and 198 is

(a) 9 (b) 18 (c) 6 (d) 12

Sol. (b) 18 1

2. The median and mode respectively of a frequency distribution are 26 and 29. Then its mean is

(a) 27.5 (b) 24.5 (c) 28.4 (d) 25.8

Sol. (b) 24.5 1

3. In Fig. 1, on a circle of radius 7 cm, tangent PT is drawn from a point P such that PT = 24 cm. If 0 is the centre of the circle, then the length of PR is

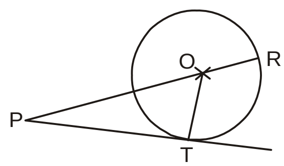

Fig. 1

(a) 30 cm (b) 28 cm (c) 32 cm (d) 25 cm

Sol. (c) 32 cm 1

4. 225 can be expressed as

(a) 5×3^2 (b) $5^2 \times 3$ (c) $5^2 \times 3^2$ (d) $5^3 \times 3$

Sol. (d) $5^2 \times 3^2$ 1

5. The probability that a number selected at random from the numbers 1, 2, 3, ..., 15 is a multiple of 4 is

(a) $\frac{4}{15}$ (b) $\frac{2}{15}$ (c) $\frac{1}{15}$ (d) $\frac{1}{5}$

Sol. (d) $\frac{1}{5}$ 1

6. If one zero of a quadratic polynomial $(kx^2 + 3x + k)$ is 2, then the value of k is

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

Sol. (d) $-\frac{6}{5}$ 1

7. $2.\overline{35}$ **is**

(a) an integer **(b) a rational number**

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

Sol. (b) a rational number 1

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8. The graph of a polynomial is shown in Fig. 2, then the number of its zeroes is

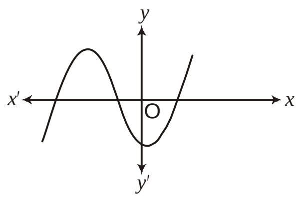

Fig. 2

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

Sol. (a) 3 1

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9. Distance of point P(3, 4) from x-axis is

(a) 3 units **(b) 4 units** **(c) 5 units** **(d) 1 unit**

Sol. (b) 4 units 1

---

10. If the distance between the points A(4, p) and B(1, 0) is 5 units, then the value(s) of p is (are)

(a) 4 only **(b) –4 only** **(c) ±4** **(d) 0**

Sol. (c) ±4 1

Q. Nos. 11 to 15, fill in the blanks.

11. If the point C(k, 4) divides the line segment joining two points A(2, 6) and B(5, 1) in ratio 2 : 3, the value of k is _______.

Sol. $\frac{16}{5}$ 1

OR

If points A(–3, 12), B(7, 6) and C(x, 9) are collinear, then the value of x is_______.

Sol. 2 1

---

12. If the equations kx – 2y = 3 and 3x + y = 5 represent two intersecting lines at unique point, then the value of k is _______.

Sol. $\neq -6$ 1

OR

If quadratic equation 3x – 4x + k = 0 has equal roots, then the value of k is _______.

Sol. $\frac{4}{3}$ 1

---

13. **The value of (sin 20° cos 70° + sin 70° cos 20°) is _______.**

Sol. 1 1

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14. **If $\tan(A + B) = \sqrt{3}$ and $\tan(A - B) = \frac{1}{\sqrt{3}}$, A > B, then the value of A is _______.**

Sol. 45° 1

---

15. **The perimeters of two similar triangles are 25 cm and 15 cm respectively. If one side of the first triangle is 9 cm, then the corresponding side of second triangle is _______.**

Sol. $\frac{27}{6}$ cm or 5.4 cm 1

In Q. Nos. 16 to 20, answer the following.

16. **If 5 tan θ = 3, then what is the value of $\left(\frac{5\sin\theta - 3\cos\theta}{4\sin\theta + 3\cos\theta}\right)$?**

Sol. $\frac{5\tan\theta - 3}{4\tan\theta + 3}$ $\frac{1}{2}$

$= 0$ $\frac{1}{2}$

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17. **The areas of two circles are in the ratio 9 : 4, then what is the ratio of their circumferences?**

Sol. $\frac{r_1^2}{r_2^2} = \frac{9}{4} \Rightarrow \frac{r_1}{r_2} = \frac{3}{2}$ $\frac{1}{2}$

$\therefore \frac{2\pi r_1}{2\pi r_2} = \frac{3}{2}$ or $3:2$ $\frac{1}{2}$

---

18. **If a pair of dice is thrown once, then what is the probability of getting a sum of 8?**

Sol. Favourable outcomes are

(3, 5); (4, 4); (5, 3); (2, 6); (6, 2) i.e., 5 $\frac{1}{2}$

$P(\text{Sum } 8) = \frac{5}{36}$ $\frac{1}{2}$

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19. In Fig. 3, in ΔABC, DE || BC such that AD = 2.4 cm, AB = 3.2 cm and AC = 8 cm, then what is the length of AE?

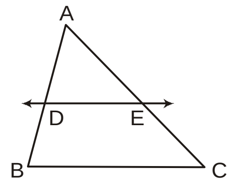

Fig. 3

Sol. $\frac{AD}{AB} = \frac{AE}{AC}$ or $\frac{2.4}{3.2} = \frac{AE}{8}$ $\frac{1}{2}$

AE = 6 cm $\frac{1}{2}$

---

20. The n^{th} term of an AP is (7 – 4n), then what is its common difference?

Sol. $T_1 = 3,\ T_2 = -1$ $\frac{1}{2}$

d = –4 $\frac{1}{2}$

SECTION B

Q. Nos, 21 to 26 carry two marks each.

21. A bag contains 5 red balls and some blue balls. If the probability of drawing a blue ball at random from the bag is three times that of a red ball, find the number of blue balls in the bag.

Sol. Let number of blue balls = x

Total balls = 5 + x $\frac{1}{2}$

P(blue ball) = $\frac{x}{5+x}$ and P(Red balls) = $\frac{5}{5+x}$ 1

$\therefore \quad \frac{x}{5+x} = \frac{3(5)}{5+x}$

$\Rightarrow$ x = 15

$\therefore$ Number of blue balls = 15 $\frac{1}{2}$

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22. Prove that $\sqrt{\dfrac{1-\sin\theta}{1+\sin\theta}}$ = sec θ – tan θ.

Sol. L.H.S. = $\sqrt{\dfrac{1-\sin\theta}{1+\sin\theta}} \cdot \sqrt{\dfrac{1-\sin\theta}{1-\sin\theta}}$ 1

$= \dfrac{1-\sin\theta}{\cos\theta} = \sec\theta - \tan\theta$ 1

OR

Prove that $\dfrac{\tan^2\theta}{1+\tan^2\theta} + \dfrac{\cot^2\theta}{1+\cot^2\theta}$ = 1.

L.H.S. $= \dfrac{\tan^2\theta}{\sec^2\theta} + \dfrac{\cot^2\theta}{\operatorname{cosec}^2\theta}$ 1

$= \sin^2\theta + \cos^2\theta$

$= 1$ 1

---

23. Two different dice are thrown together, find the probability that the sum of the numbers appeared is less than 5.

Sol. Total number of possible outcomes = 36

Favourable outcomes are = (1, 1); (1, 2); (1, 3); (2, 1); (2, 2)

(3, 1) i.e. 6 1

P(sum of numbers less than five) = $\dfrac{6}{36}$ or $\dfrac{1}{6}$ 1

OR

Find the probability that 5 Sundays occur in the month of November of a randomly selected year.

Number of days of November = 30

= 4 weeks + 2 days 1

P (5 sudays) = $\dfrac{2}{7}$ 1

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

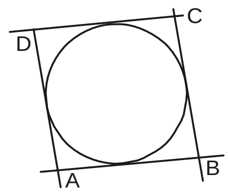


Fig. 4

Sol. The sides of quadrilateral touches a circle

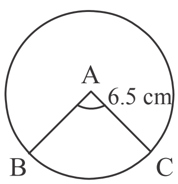
AB + DC = BC + AD 1

6 + 8 = 9 + AD

$\Rightarrow$ AD = 5 cm 1

25. **The perimeter of a sector of a circle with radius 6.5 cm is 31 cm, then find the area of the sector.**

Sol.



$AB + \widehat{BC} + AC = 31$ cm

$\Rightarrow \widehat{BC} = (31 - 13)$ cm

$l = 18$ cm $\frac{1}{2}$

$A = \frac{1}{2} lr$

$= \frac{1}{2} \times 18 \times 6.5 \text{ cm}^2$ 1

$= 58.5 \text{ cm}^2$ $\frac{1}{2}$

26. **Divide the polynomial ($4x^2 + 4x + 5$) by (2x + 1) and write the quotient and the remainder.**

Sol. 1

$$\begin{array}{r|l} & \quad\;\; 2x+1 \\ 2x+1 & 4x^2+4x+5 \\ & 4x^2+2x \\ & -\quad - \\ \hline & \quad\;\; 2x+5 \\ & \quad\;\; 2x+1 \\ & \quad\;\; -\quad + \\ \hline & \quad\quad 4 \end{array}$$

Quotient = 2x + 1, Remainder = 4 $\frac{1}{2}+\frac{1}{2}$

SECTION C

Q. Nos. 27 to 34 carry 3 marks each.

27. If α and β are the zeroes of the polynomial $f(x) = x^2 - 4x - 5$ then find the value of $\alpha^2 + \beta^2$.

Sol. $\alpha + \beta = \frac{4}{1}; \ \alpha\beta = -5$ 1

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

$= 16 + 10$ 1

$= 26$ 1

---

28. Draw a circle of radius 4 cm. From a point 7 cm away from the centre of circle. Construct a pair of tangents to the circle.

Sol. Constructing the circle of given radius 1

Constructing the tangents 2

OR

Draw a line segment of 6 cm and divide it in the ratio 3 : 2.

Drawing line segment of length 6 cm. 1

Dividing it in the ratio 3 : 2. 2

---

29. A solid metallic cuboid of dimension 24 cm × 11 cm × 7 cm is melted and recast into solid cones of base radius 3.5 cm and height 6 cm. Find the number of cones so formed

Sol. Volume of metallic cuboid = $(24 \times 11 \times 7)\ cm^3$ 1/2

Volume of Cone $= \frac{1}{3}\pi \cdot r^2 \cdot h$

$= \frac{1}{3}\pi\left(\frac{7}{2}\right)^2 \cdot 6$ 1/2

No. of Cones $= \dfrac{24 \times 11 \times 7}{\frac{1}{3} \times \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2} \times 6}$ 1

$= 24$ 1

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30. Prove that (1 + tan A – sec A) × (1 + tan A + sec A) = 2 tan A

Sol. L.H.S. $= (1 + \tan A)^2 - \sec^2 A$ 1

$= 1\ \tan^2 A + 2\ \tan A - \sec^2 A$ 1

$= \sec^2 A + 2\tan A - \sec^2 A$

$= 2 \tan A = $ R.H.S. 1

OR

Prove that $\dfrac{\text{cosec}\,\theta}{\text{cosec}\,\theta - 1} + \dfrac{\text{cosec}\,\theta}{\text{cosec}\,\theta + 1} = 2\sec^2\theta$

L.H.S. $= \dfrac{\text{cosec}\,\theta(\text{cosec}\,\theta + 1) + \text{cosec}\,\theta(\text{cosec}\,\theta - 1)}{\text{cosec}^2\,\theta - 1}$ 1

$= \dfrac{2\,\text{cosec}^2\theta}{\cot^2\theta}$ 1

$= 2\sec^2\theta = $ R.H.S. 1

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

Sol. Let $(5 + 2\sqrt{3}) = x$, where x is a rational number. $\frac{1}{2}$

$\Rightarrow \sqrt{3} = \dfrac{x - 5}{2}$ 1

L.H.S. is an irrational and R.H.S. is a rational number. 1

It is a contradiction

$\therefore$ Our assumption is wrong

$\therefore$ $5 + 2\sqrt{3}$ is a irrational number. $\frac{1}{2}$

OR

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

$612 = 2^2 \times 3^2 \times 17$ 1

$48 = 2^4 \times 3$ 1

HCF $(612, 48) = 2^2 \times 3$

$= 12$ $\frac{1}{2}$

Number of column = 12 $\frac{1}{2}$

---

32. **Prove that, in a right triangle, the square of the hypotenuse is equal to the sum of the squares of the other two sides.**

Sol. Correct figure, given, To prove and construction. $1\frac{1}{2}$

Correct Proof $1\frac{1}{2}$

Read the following passage carefully and then answer the questions given at the end.

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

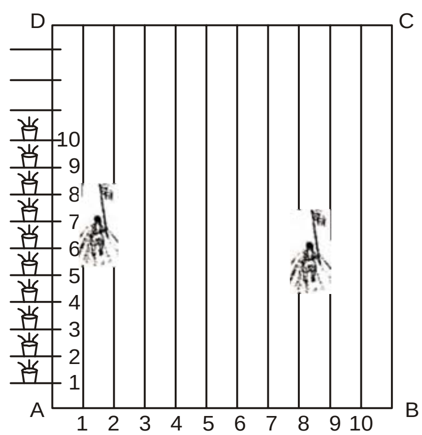

Fig. 5

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

(ii) If Rashmi has to post a blue flag exactly half way between the line segment joining the two flags, where should she post the blue flag?

Sol. Coordinate of green flag = (2, 25) $\frac{1}{2}$

Coordinate of Red flag = (8, 20) $\frac{1}{2}$

(i) Distance between the flags = $\sqrt{(-6)^2 + (5)^2}$

$= \sqrt{61}$ units 1

(ii) Mid point between = (5, 22.5) 1

green and Red flag

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34. Solve graphically: $2x + 3y = 2$, $x - 2y = 8$

Sol. Correct graph of $2x + 3y = 2$ 1

Correct graph of $x - 2y = 8$ 1

Point of intersection = (4, –2)

or $x = 4,\ y = -2$ 1

SECTION D

Q. Nos. 35 to 40 carry 4 marks each.

35. A two digit number is such that the product of its digits is 14. If 45 is added to the number; the digits interchange their places. Find the number.

Sol. Let unit digit = x

Tens digit = y

$\therefore$ Number $= 10y + x$ $\frac{1}{2}$

$10y + x + 45 = 10x + y$ 1

$\Rightarrow \quad x - y = 5 \qquad \ldots(i)$ $\frac{1}{2}$

and $\quad xy = 14 \qquad \ldots(ii)$ $\frac{1}{2}$

Solving (i) and (ii)

$x = 7,\ y = 2$ 1

$\therefore$ Number = 27 $\frac{1}{2}$

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36. If 4 times the 4th term of an AP is equal to 18 times the 18th term, then find the 22nd term.

Sol. Let first term be a and common difference = d

$\therefore \quad 4(a + 3d) = 18(a + 17d)$ 1

$\Rightarrow \quad a = -21d$ 1

22nd term $= a + 21d$ 1

$= -21d + 21d$

$= 0$ 1

OR

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

Let the number of terms be n, $d = -3$ $\frac{1}{2}$

$\therefore \frac{n}{2}\left[48 + (n-1)(-3)\right] = 78$ 1

$\Rightarrow n^2 - 17n + 52 = 0$ 1

$(n - 13)(n - 4) = 0$ 1

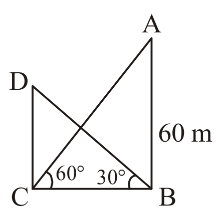
$\Rightarrow n = 13$ or 4

$\therefore$ Number of terms = 4 or 13 $\frac{1}{2}$

---

37. The angle of elevation of the top of a building from the foot of a tower is 30°. The angle of elevation of the top of the tower from the foot of the building is 60°. If the tower is 60 m high, find the height of the building.

Sol.



$\frac{AB}{BC} = \tan 60°$ Correct figure 1

$\frac{60}{BC} = \sqrt{3}$

$\Rightarrow BC = \frac{60}{\sqrt{3}}$ or $20\sqrt{3}$ m 1

Again, $\frac{DC}{CB} = \tan 30°$ 1

$\frac{DC}{20\sqrt{3}} = \frac{1}{\sqrt{3}}$

$\Rightarrow DC = 20$ m

Height of building = 20 m 1

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38. In Fig. 6, DEFG is a square in a triangle ABC right angled at A.

Prove that

(i) ΔAGF ~ ΔDBG

(ii) ΔAGF ~ ΔEFC

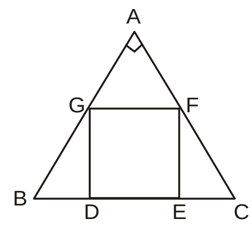
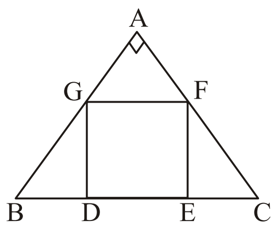


Fig.6

Sol.



GF || DE (DEFG is square)

$\therefore \angle AGF = \angle ABC$ (Corresponding angles) $\frac{1}{2}$

$\therefore \angle A = \angle GDB = 90°$

$\therefore \Delta AGF \sim \Delta DBG$ (By AA similarity) $1\frac{1}{2}$

Again DEFG being a square $\angle AFG = \angle ACB$ (corresponding angles) $\frac{1}{2}$

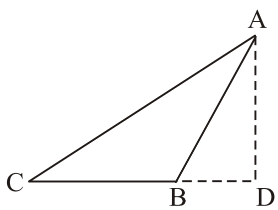
$\therefore \angle A = \angle CEF$ (each 90°)

$\Delta AGF \sim \Delta EFC$ (By AA similarity) $1\frac{1}{2}$

OR

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

Sol. In rt ΔADC — Correct figure 1



$AC^2 = AD^2 + CD^2$ $\frac{1}{2}$

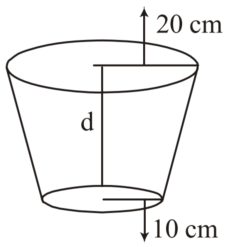
$= AD^2 + (CB + BD)^2$ 1

$= AD^2 + BD^2 + CB^2 + 2CB.BD$ 1

$= AB^2 + CB^2 + 2CB \,.\, BD$ $\because$ Δ ABD is rt angled $\frac{1}{2}$

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

Sol.



$$\text{Volume of Bucket} = \frac{\pi}{3}[400 + 100 + 200] \times 21$$

$$= 4900 \times \frac{22}{7} = 15400 \text{ cm}^3$$ 2

$$\text{Volume of milk} = \frac{15400}{1000} = 15.4 \text{ litres}$$ 1

Cost of milk = ₹ 15.4 × 40 = ₹ 616 1

OR

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

$$\text{Volume of hemisphere} = \frac{2}{3}\pi r^3$$

$$= \frac{2}{3} \times \frac{22}{7} \times \left(\frac{7}{2}\right)^3$$

$$= \frac{539}{6} \text{ cm}^3$$ $1\frac{1}{2}$

Height of cone = (9.5 – 3.5) cm = 6 cm $\frac{1}{2}$

$$\text{Volume of cone} = \frac{1}{3}\pi r^2 h$$

$$= \frac{1}{3} \times \frac{\overset{11}{\cancel{22}}}{\cancel{7}} \times \frac{\cancel{7}}{\cancel{2}} \times \frac{7}{2} \times 6 = 77 \text{ cm}^3$$ 1

Total volume of solid

$$= \frac{539}{6} + \frac{77}{1}$$

$$= \frac{539 + 462}{6} = \frac{1001}{6} \text{ cm}^3 \text{ or } 166.83 \text{ cm}^3$$ 1

40. Find the mean of the following data:

Classes	**0 – 20**	**20 – 40**	**40 – 60**	**60 – 80**	**80 – 100**	**100 – 120**
Frequency	**20**	**35**	**52**	**44**	**38**	**31**

Sol.

x	f	fx
10	20	200
30	35	1050
50	52	2600
70	44	3080
90	38	3420
110	31	3410
	220	13760

Correct Table 2

$\therefore \quad \text{Mean} = \frac{\Sigma fx}{\Sigma f} = \frac{13760}{220}$ or 62.54 2

QUESTION PAPER CODE 430/1/2
EXPECTED ANSWER/VALUE POINTS

SECTION A

Q. Nos. 1 to 10 are multiple choice questions. Select the correct option.

1. The graph of a polynomial is shown in Fig. 1, then the number of its zeroes is

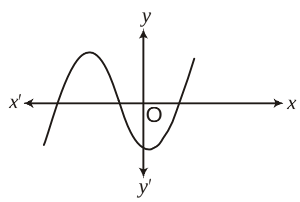


Fig.1

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

Sol. (a) 3 1

---

2. 225 can be expressed as

(a) 5×3^2 **(b)** $5^2 \times 3$ **(c)** $5^2 \times 3^2$ **(d)** $5^3 \times 3$

Sol. (c) $5^2 \times 3^2$ 1

---

3. Probability that a number selected at random from the numbers 1, 2, 3, ..., 15 is a multiple of 4 is

(a) $\frac{4}{15}$ **(b)** $\frac{2}{15}$ **(c)** $\frac{1}{15}$ **(d)** $\frac{1}{5}$

Sol. (d) $\frac{1}{5}$ 1

---

4. $2.\overline{35}$ **is**

(a) an integer **(b) a rational number**

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

Sol. (b) a rational number 1

---

5. The median and mode respectively of a frequency distribution are 26 and 29. Then its mean is

(a) 27.5 **(b) 24.5** **(c) 28.4** **(d) 25.8**

Sol. (b) 24.5 1

---

6. HCF of 144 and 198 is

(a) 9 **(b) 18** **(c) 6** **(d) 12**

Sol. (b) 18 1

---

7. If the distance between the points A(4, p) and B(1, 0) is 5 units, then the value (s) of p is (are)

(a) 4 only **(b) –4 only** **(c) ±4** **(d) 0**

Sol. (c) ±4 1

---

8. The area of a triangle with vertices A(5, 0), B(8, 0) and C(8, 4) in square units is

(a) 20 **(b) 12** **(c) 6** **(d) 16**

Sol. (c) 6 1

---

9. The sum and product of the zeroes of a quadratic polynomial are 3 and – 10 respectively. The quadratic polynomial is

(a) $x^2 - 3x + 10$ **(b)** $x^2 + 3x - 10$

(c) $x^2 - 3x - 10$ **(d)** $x^2 + 3x + 10$

Sol. (c) $x^2 - 3x - 10$ 1

---

10. From an external point Q, the length of tangent to a circle is 12 cm and the distance of Q from the centre of circle is 13 cm. The radius of circle (in cm) is

(a) 10 **(b) 5** **(c) 12** **(d) 7**

Sol. (b) 5 1

In Q. Nos. 11 to 15, fill in the blanks.

11. If $\tan(A + B) = \sqrt{3}$ **and** $\tan(A - B) = \frac{1}{\sqrt{3}}$, **A > B, then the value of A is _______.**

Sol. 45° 1

---

12. The perimeters of two similar triangle are 25 cm and 15 cm respectively. If one side of the first triangle is 9 cm, then the corresponding side of second triangle is _______.

Sol. $\frac{27}{5}$ cm or 5.4 cm 1

---

13. If the equations kx – 2y = 3 and 3x + y = 5 represent two intersecting lines at unique point, then the value of k is _______.

Sol. $\neq -6$ 1

OR

If quadratic equation $3x^2 - 4x + k = 0$ **has equal roots, then the value of k is _______.**

Sol. $\frac{4}{3}$ 1

---

14. **If the point C(k, 4) divides the line segment joining two points (A(2, 6) and B(5, 1) in ratio 2 : 3, the value of k is _______.**

Sol. $\frac{16}{5}$ 1

OR

If points A(–3, 12), B(7, 6) and C(x, 9) are collinear, then the value of x is _______.

Sol. 2 1

---

15. **The value of $\sin^2 65° + \sin^2 25°$ is _______.**

Sol. 1 1

In Q. Nos. 16 to 20, answer the following.

16. **The nth term of an AP is (7 – 4n), then what is its common difference?**

Sol. $T_1 = 3,\ T_2 = -1$ $\frac{1}{2}$

$d = -4$ $\frac{1}{2}$

---

17. **If a pair of dice is thrown once, then what is the probability of getting a sum of 8?**

Sol. Favourable outcomes are

(3, 5); (4, 4); (5, 3); (2, 6); (6, 2) i.e., 5 $\frac{1}{2}$

$\text{P(Sum 8)} = \frac{5}{36}$ $\frac{1}{2}$

---

18. **The areas of two circles are in the ratio 9 : 4, then what is the ratio of their circumferences?**

Sol. $\frac{r_1^2}{r_2^2} = \frac{9}{4} \Rightarrow \frac{r_1}{r_2} = \frac{3}{2}$ $\frac{1}{2}$

$\therefore \frac{2\pi r_1}{2\pi r_2} = \frac{3}{2}$ or $3:2$ $\frac{1}{2}$

---

19. **If 5 tan θ = 3, then what is the value of $\left(\frac{5\sin\theta - 3\cos\theta}{4\sin\theta + 3\cos\theta}\right)$?**

Sol. $\frac{5\tan\theta - 3}{4\tan\theta + 3}$ $\frac{1}{2}$

$= 0$ $\frac{1}{2}$

---

20. ΔABC is isosceles with AC = BC. If $AB^2 = 2AC^2$, then find the measure of $\angle C$.

Sol. $AB^2 = AC^2 + BC^2$ $\frac{1}{2}$

$\therefore \angle C = 90°$ $\frac{1}{2}$

SECTION B

Q. Nos, 21 to 26 carry two marks each.

21. Prove that $\sqrt{\frac{1-\sin\theta}{1+\sin\theta}}$ = sec θ – tan θ.

Sol. L.H.S. = $\sqrt{\frac{1-\sin\theta}{1+\sin\theta}} \cdot \sqrt{\frac{1-\sin\theta}{1-\sin\theta}}$ 1

$= \frac{1-\sin\theta}{\cos\theta} = \sec\theta - \tan\theta$ 1

OR

Prove that $\frac{\tan^2\theta}{1+\tan^2\theta} + \frac{\cot^2\theta}{1+\cot^2\theta}$ = 1.

L.H.S. $= \frac{\tan^2\theta}{\sec^2\theta} + \frac{\cot^2\theta}{\operatorname{cosec}^2\theta}$ 1

$= \sin^2\theta + \cos^2\theta$

$= 1$ 1

---

22. Two different dice are thrown together, find the probability that the sum of the numbers appeared is less than 5.

Sol. Total number of possible outcomes = 36

Favourable outcomes are = (1, 1); (1, 2); (1, 3); (2, 1); (2, 2)

(3, 1) i.e. 6 1

P(sum of numbers less than five) = $\frac{6}{36}$ or $\frac{1}{6}$ 1

OR

Find the probability that 5 Sundays occur in the month of November of a randomly selected year.

Number of days of November = 30

= 4 weeks + 2 days 1

P(5 sundays) = $\frac{2}{7}$ 1

---

23. A bag contains 5 red balls and some blue balls. If the probability of drawing a blue ball at random from the bag is three times that of a red ball find the number of blue balls in the bag.

Sol. Let number of blue balls = x

Total balls = 5 + x $\frac{1}{2}$

P(blue ball) = $\frac{x}{5+x}$ and P(Red balls) = $\frac{5}{5+x}$ 1

$\therefore \quad \frac{x}{5+x} = \frac{3(5)}{5+x}$

$\Rightarrow$ x = 15

$\therefore$ No. of blue balls = 15 $\frac{1}{2}$

---

24. Divide the polynomial ($9x^2$ + 12x + 10) by (3x + 2) and write the quotient and the remainder.

Sol.

$$\begin{array}{r|l} & 3x+2 \\ \hline 3x+2 & 9x^2+12x+10 \\ & \underline{-9x^2 \mp 6x} \\ & \quad 6x+10 \\ & \quad \underline{-6x \mp 4} \\ & \quad\quad 6 \end{array}$$ 1

Quotient = 3x + 2, Remainder = 6 $\frac{1}{2}+\frac{1}{2}$

---

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

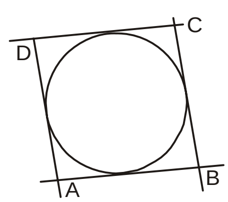


Fig. 4

Sol. The sides of quadrilateral touches a circle

AB + DC = BC + AD 1

6 + 8 = 9 + AD

$\Rightarrow$ AD = 5 cm 1

---

26. **A road which is 7 m wide surrounds a circular park whose circumference is 88 m. Find the area of the road.**

Sol. Let r be radius of circular park

$$\frac{44}{7} \times r = 88$$

$\Rightarrow$ r = 14 m $\frac{1}{2}$

radius of outer circle = 21 m $\frac{1}{2}$

Area of road = $\pi(21)^2 - \pi(14)^2$ $\frac{1}{2}$

$$= \frac{22}{7} \times 35 \times 7 = 770 \text{ m}^2$$ $\frac{1}{2}$

SECTION C

Q. Nos. 27 to 34 carry 3 marks each.

27. **Draw a circle of radius 4 cm. From a point 7 cm away from the centre of circle. Construct a pair of tangents to the circle.**

Sol. Constructing the circle of given radius 1

Constructing the tangents 2

OR

Draw a line segment of 6 cm and divide it in the ratio 3 : 2.

Drawing line segment of length 6 cm. 1

Dividing it in the ratio 3 : 2. 2

---

28. **Prove that (1 + tan A – sec A) × (1 + tan A + sec A) = 2 tan A**

Sol. L.H.S. $= (1 + \tan A)^2 - \sec^2 A$ 1

$= 1 + \tan^2 A + 2 \tan A - \sec^2 A$ 1

$= \sec^2 A + 2\tan A - \sec^2 A$

$= 2 \tan A$ = R.H.S. 1

OR

Prove that $\dfrac{\text{cosec}\,\theta}{\text{cosec}\,\theta - 1} + \dfrac{\text{cosec}\,\theta}{\text{cosec}\,\theta + 1} = 2\sec^2\theta$

L.H.S. $= \dfrac{\text{cosec}\,\theta(\text{cosec}\,\theta + 1) + \text{cosec}\,\theta(\text{cosec}\,\theta - 1)}{\text{cosec}^2\theta - 1}$ 1

$= \dfrac{2\,\text{cosec}^2\theta}{\cot^2\theta}$ 1

$= 2\sec^2\theta =$ R.H.S. 1

---

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

Sol. Let $(5 + 2\sqrt{3}) = x$, where x is a rational number $\frac{1}{2}$

$\Rightarrow \sqrt{3} = \dfrac{x - 5}{2}$ 1

L.H.S. is an irrational and R.H.S. is a rational number. 1

It is a contradiction

$\therefore$ Our assumption is wrong

$\therefore$ $5 + 2\sqrt{3}$ is a irrational number. $\frac{1}{2}$

OR

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

$612 = 2^2 \times 3^2 \times 17$ 1

$48 = 2^4 \times 3$ 1

HCF $(612, 48) = 2^2 \times 3$

$= 12$ $\frac{1}{2}$

Number of column = 12 $\frac{1}{2}$

Read the following passage carefully and then answer the questions given at the end.

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

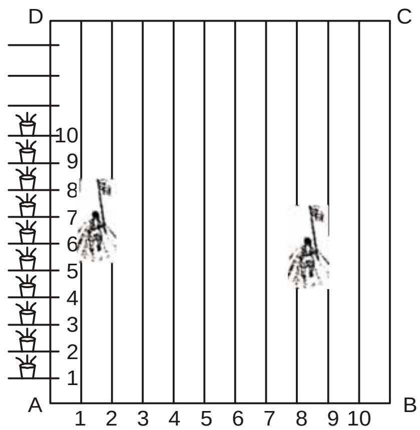


Fig. 5

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

(ii) If Rashmi has to post a blue flag exactly half way between the line segment joining the two flags, where should she post the blue flag?

Sol. Coordinate of green flag = (2, 25) $\frac{1}{2}$

Coordinate of Red flag = (8, 20) $\frac{1}{2}$

(i) Distance between the flags = $\sqrt{(-6)^2 + (5)^2}$

$= \sqrt{61}$ units 1

(ii) Mid point between = (5,22.5) 1

green and Red flag

---

31. **Solve graphically: 2x + 3y = 2, x – 2y = 8**

Sol. Correct graph of 2x + 34 = 2 1

Correct graph of x – 2y = 8 1

Point of intersection = (4, –2)

or $x = 4, \ y = -2$ 1

---

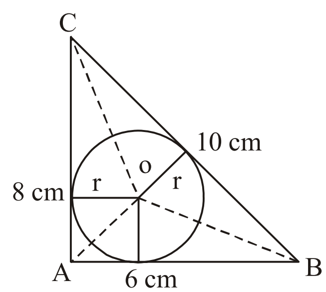
32. Prove that the tangent at any point of a circle is perpendicular to the radius through the point of contact.

Sol. Correct fig., given, to prove $1\frac{1}{2}$

Correct proof $1\frac{1}{2}$

33. A right triangle ABC, right angled at A, is circumscribing a circle. If AB = 6 cm and BC = 10 cm, find the radius of the circle.

Sol.



CA = $\sqrt{(10)^2 - (6)^2}$ Correct figure $\frac{1}{2}$

$= 8$ cm $\frac{1}{2}$

Area $\Delta ABC = \frac{8 \times 6}{2} = 24 \text{ cm}^2$ $\frac{1}{2}$

ar ΔAOC + ar ΔAOB + ar ΔBOC = 4r + 3r + 5r = 12r 1

$\therefore$ 12r = 24 $\Rightarrow$ r = 2 cm $\frac{1}{2}$

34. Find the zeroes of the quadratic polynomial $x^2 + 7x + 10$, and verity the relationship between the zeroes and the coefficients.

Sol. $x^2 + 7x + 10 = (x + 5)(x + 2)$

zeroes are –5, –2 1

Relation between zeroes

Sum of zeroes = –5 – 2 = –7, $\frac{-b}{a} = \frac{-7}{1}$ $\frac{1}{2} + \frac{1}{2}$

Product of zeroes = 10, $\frac{c}{a} = \frac{10}{1}$ $\frac{1}{2} + \frac{1}{2}$

SECTION D

Q. Nos. 35 to 40 carry 4 marks each.

35. Find the mean of the following data:

Classes	0 – 20	20 – 40	40 – 60	60 – 80	80 – 100	100 – 120
Frequency	20	35	52	44	38	31

Sol.

x	f	fx
10	20	200
30	35	1050
50	52	2600
70	44	3080
90	38	3420
110	31	3410
	220	13760

Correct Table 2

$\therefore$ Mean $= \dfrac{\Sigma fx}{\Sigma f} = \dfrac{13760}{220}$ or 62.54 2

36. In Fig. 6, DEFG is a square in a triangle ABC right angled at A.

Prove that

(i) $\Delta AGF \sim \Delta DBG$

(ii) $\Delta AGF \sim \Delta EFC$

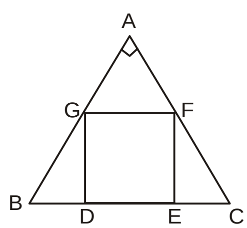
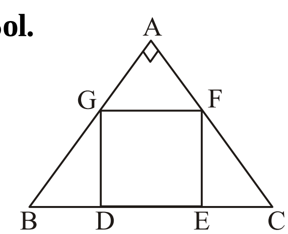


Fig.6

OR

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

Sol.



GF || DE (DEFG is square)

$\therefore \angle AGF = \angle ABC$ (Corresponding angles) $\frac{1}{2}$

$\therefore \angle A = \angle GDB = 90°$

$\therefore \Delta AGF \sim \Delta DBG$ (By AA similarity) $1\frac{1}{2}$

Again DEFG being a square $\angle AFG = \angle ACB$ (corresponding angles) $\frac{1}{2}$

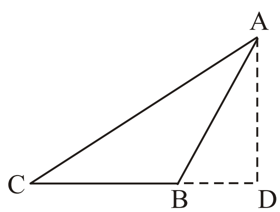
$\therefore \angle A = \angle CEF$ (each 90°)

$\Delta AGF \sim \Delta EFC$ (By AA similarity) $1\frac{1}{2}$

OR

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

Sol. In rt ΔADC — Correct figure 1



$AC^2 = AD^2 + CD^2$ $\frac{1}{2}$

$= AD^2 + (CB + BD)^2$ 1

$= AD^2 + BD^2 + CB^2 + 2CB.BD$ 1

$= AB^2 + CB^2 + 2CB \cdot BD$ $\because \Delta$ ABD is rt angled $\frac{1}{2}$

---

37. If 4 times the 4th term of an AP is equal to 18 times the 18th term, then find the 22nd term.

Sol. Let first term be a and common difference = d

$\therefore 4(a + 3d) = 18(a + 17d)$ 1

$\Rightarrow a = -21d$ 1

22nd term $= a + 21d$ 1

$= -21d + 21d$

$= 0$ 1

OR

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

Let the number of term be n, $d = -3$ $\frac{1}{2}$

$\therefore \frac{n}{2}[48 + (n-1)(-3)] = 78$ 1

$\Rightarrow n^2 - 17n + 52 = 0$ 1

$(n - 13)(n - 4) = 0$ 1

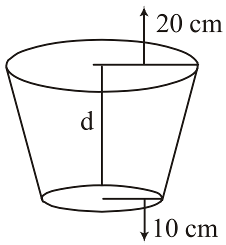
$\Rightarrow n = 13$ or 4

$\therefore$ Number of terms = 4 or 13 $\frac{1}{2}$

---

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

Sol.



Volume of Bucket = $\frac{\pi}{3}[400 + 100 + 200] \times 21$

$= 4900 \times \frac{22}{7} = 15400 \text{ cm}^3$ 2

Volume of milk = $\frac{15400}{1000} = 15.4$ litres 1

Cost of milk = ₹ 15.4 × 40 = ₹ 616 1

OR

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

Volume of hemisphere = $\frac{2}{3}\pi r^3$

$= \frac{2}{3} \times \frac{22}{7} \times \left(\frac{7}{2}\right)^3$

$= \frac{539}{6} \text{ cm}^3$ $1\frac{1}{2}$

Height of cone = (9.5 – 3.5) cm = 6 cm $\frac{1}{2}$

Volume of cone = $\frac{1}{3}\pi r^2 h$

$= \frac{1}{3} \times \frac{\cancel{22}^{11}}{\cancel{7}} \times \frac{\cancel{7}}{\cancel{2}} \times \frac{7}{2} \times 6 = 77 \text{ cm}^3$ 1

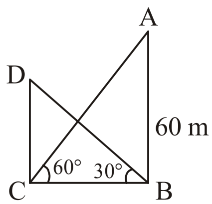
Total volume of solid

$= \frac{539}{6} + \frac{77}{1}$

$= \frac{539 + 462}{6} = \frac{1001}{6} \text{ cm}^3$ or 166.83 cm^3 1

39. The angle of elevation of the top of a building from the foot of a tower is 30°. The angle of elevation of the top of the tower from the foot of the building is 60°. If the tower is 60 m high, find the height of the building.

Sol.



$\frac{AB}{BC} = \tan 60°$ Correct figure 1

$\frac{60}{BC} = \sqrt{3}$

$\Rightarrow BC = \frac{60}{\sqrt{3}}$ or $20\sqrt{3}$ m 1

Again, $\frac{DC}{CB} = \tan 30°$ 1

$\frac{DC}{20\sqrt{3}} = \frac{1}{\sqrt{3}}$

$\Rightarrow DC = 20$ m

Height of building = 20 m 1

---

40. The difference of two natural is 5 and the difference of their reciprocals is $\frac{1}{10}$. Find the numbers.

Sol. Let two natural numbers be = x + 5, x $\frac{1}{2}$

$\therefore \frac{1}{x} - \frac{1}{x+5} = \frac{1}{10}$ 1

$\Rightarrow \frac{5}{x^2 + 5x} = \frac{1}{10}$

$\Rightarrow x^2 + 5x - 50 = 0$ 1

$\Rightarrow (x + 10)(x - 5) = 0$ 1

$\Rightarrow x = -10$ (not possible)

or $x = 5$

The numbers are 10 and 5. $\frac{1}{2}$

QUESTION PAPER CODE 430/1/3

EXPECTED ANSWER/VALUE POINTS

SECTION A

Q. Nos. 1 to 10 are multiple choice questions. Select the correct option.

1. The median and mode respectively of a frequency distribution are 26 and 29. Then its mean is

(a) 27.5 (b) 24.5 (c) 28.4 (d) 25.8

Sol. (b) 24.5 1

---

2. If the distance between the points A(4, p) and B(1, 0) is 5 units, then the value(s) of p is (are)

(a) 4 only (b) -4 only (c) ±4 (d) 0

Sol. (c) ±4 1

---

3. The graph of a polynomial is shown in Fig. 1, then the number of its zeroes is

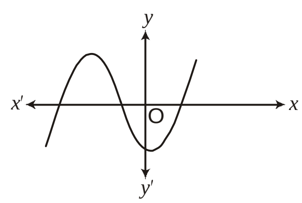


Fig. 1

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

Sol. (a) 3 1

---

4. $2.\overline{35}$ is

(a) an integer (b) a rational number

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

Sol. (b) rational number 1

---

5. HCF of 144 and 198 is

(a) 9 (b) 18 (c) 6 (d) 12

Sol. (b) 18 1

---

6. The probability that a number selected at random from the numbers 1, 2, 3, ..., 15 is a multiple of 4 is

(a) $\frac{4}{15}$ (b) $\frac{2}{15}$ (c) $\frac{1}{15}$ (d) $\frac{1}{5}$

Sol. (d) $\frac{1}{5}$ 1

---

7. **225 can be expressed as**

(a) 5×3^2 **(b)** $5^2 \times 3$ **(c)** $5^2 \times 3^2$ **(d)** $5^3 \times 3$

Sol. (c) $5^2 \times 3^2$ 1

---

8. **QP is a tangent to a circle with centre O at a point P on the circle. If ΔOPQ is isosceles, then $\angle$OQP equals.**

(a) 30° **(b)** 45° **(c)** 60° **(d)** 90°

Sol. (b) 45° 1

---

9. **If α and β are the zeroes of the polynomial $x^2 + 2x + 1$, then $\frac{1}{\alpha} + \frac{1}{\beta}$ is equal to**

(a) –2 **(b)** 2 **(c)** 0 **(d)** 1

Sol. (a) –2 1

---

10. **The coordinates of a point A on y-axis, at a distance of 4 units from x-axis and below it, are**
(a) (4, 0) **(b)** (0, 4) **(c)** (–4, 0) **(d)** (0, –4)

Sol. (d) (0, –4) 1

In Q. Nos. 11 to 15, fill in the blanks.

11. **If the equations $kx - 2y = 3$ and $3x + y = 5$ represent two intersecting lines at unique point, then the value of k is _______.**

Sol. $\neq -6$ 1

OR

If quadratic equation $3x^2 - 4x + k = 0$ has equal roots, then the value of k is _______.

Sol. $\frac{4}{3}$ 1

---

12. **If $\tan(A + B) = \sqrt{3}$ and $\tan(A - B) = \frac{1}{\sqrt{3}}$, A > B, then the value of A is _______.**

Sol. 45° 1

---

13. **The perimeters of two similar triangles arc 25 cm and 15 cm respectively, If one side of the first triangle is 9 cm, then the corresponding side of second triangle is _______.**

Sol. $\frac{27}{5}$ cm or 5.4 cm 1

---

14. If the point C(k, 4) divides the line segment joining two points A(2, 6) and B(5, 1) in ratio 2 : 3, the value of x is _______.

Sol. $\frac{16}{5}$ 1

OR

If points A(–3, 12), B(7, 6) and C(x, 9) are collinear, then the value of x is _______.

Sol. 2 1

---

15. If cot θ = $\frac{12}{5}$, then the value of sin θ is _______.

Sol. $\frac{5}{13}$ 1

In Q. Nos. 16 to 20, answer the following.

16. The nth term of an AP is (7 – 4n), then what is its common difference?

Sol. $T_1 = 3, T_2 = -1$ $\frac{1}{2}$

$d = -4$ $\frac{1}{2}$

---

17. If 5 tan θ = 3 then what is the value of $\left(\frac{5\sin\theta - 3\cos\theta}{4\sin\theta + 3\cos\theta}\right)$?

Sol. $\frac{5\tan\theta - 3}{4\tan\theta + 3}$ $\frac{1}{2}$

$= 0$ $\frac{1}{2}$

---

18. The areas of two circles are in the ratio 9 : 4, then what is the ratio of their circumferences?

Sol. $\frac{r_1^2}{r_2^2} = \frac{9}{4} \Rightarrow \frac{r_1}{r_2} = \frac{3}{2}$ $\frac{1}{2}$

$\therefore \frac{2\pi r_1}{2\pi r_2} = \frac{3}{2}$ or $3:2$ $\frac{1}{2}$

---

19. If a pair of dice is thrown once, then what is the probability of getting a sum of 8?

Sol. Favourable outcomes are

(3, 5); (4, 4); (5, 3); (2, 6); (6, 2) i.e., 5 $\frac{1}{2}$

$P(\text{Sum } 8) = \frac{5}{36}$ $\frac{1}{2}$

---

20. The areas of two similar triangles ABC and PQR are 25 cm^2 and 49 cm^2 respectively. If QR = 9.8 cm, find BC.

Sol. $\frac{ar(\Delta ABC)}{ar(\Delta PQR)} = \frac{25}{49} = \frac{BC^2}{QR^2}$ $\frac{1}{2}$

$\frac{BC}{9.8} = \frac{5}{7} \Rightarrow BC = 7 \text{ cm}$ $\frac{1}{2}$

SECTION B

Q. Nos, 21 to 26 carry two marks each.

21. Prove that $\sqrt{\frac{1-\sin\theta}{1+\sin\theta}} = \sec\theta - \tan\theta$.

Sol. L.H.S. = $\sqrt{\frac{1-\sin\theta}{1+\sin\theta}} \cdot \sqrt{\frac{1-\sin\theta}{1-\sin\theta}}$ 1

$= \frac{1-\sin\theta}{\cos\theta} = \sec\theta - \tan\theta$ 1

OR

Prove that $\frac{\tan^2\theta}{1+\tan^2\theta} + \frac{\cot^2\theta}{1+\cot^2\theta} = 1$.

L.H.S. $= \frac{\tan^2\theta}{\sec^2\theta} + \frac{\cot^2\theta}{\operatorname{cosec}^2\theta}$ 1

$= \sin^2\theta + \cos^2\theta$

$= 1$ 1

---

22. Two different dice are thrown together, find the probability that the sum of the numbers appeared is less than 5.

Sol. Total number of possible outcomes = 36

Favourable outcomes are = (1, 1); (1, 2); (1, 3); (2, 1); (2, 2)

(3, 1) i.e. 6 1

P(sum of numbers less than five) = $\frac{6}{36}$ or $\frac{1}{6}$ 1

OR

Find the probability that 5 Sundays occur in the month of November of a randomly selected year.

Number of days of November = 30

= 4 weeks + 2 days 1

P (5 sudays) = $\frac{2}{7}$ 1

---

23. **A bag contains 5 red balls and some blue balls. If the probability of drawing a blue ball at random from the bag is three times that of a red ball, find the number of blue balls in the bag.**

Sol. Let number of blue balls = x

Total balls = 5 + x $\frac{1}{2}$

P(blue ball) = $\frac{x}{5+x}$ and P(Red balls) = $\frac{5}{5+x}$ 1

$\therefore \quad \frac{x}{5+x} = \frac{3(5)}{5+x}$

$\Rightarrow$ x = 15

$\therefore$ Number of blue balls = 15 $\frac{1}{2}$

---

24. **The radii of two circles are 19 cm and 9 cm respectively. Find the radius of a circle which has circumference equal to sum of their circumferences,**

Sol. Circumference of 1st circle = $2\pi(19) = 38\pi$ cm $\frac{1}{2}$

Circumference of 2nd circle = $2\pi(9) = 18\pi$ cm $\frac{1}{2}$

Circumference of new circle = $38\pi + 18\pi = 56\pi$ cm

$2\pi R = 56\pi$ $\frac{1}{2}$

R = 28 cm $\frac{1}{2}$

---

25. Divide the polynomial $16x^2 + 24x + 15$ by $(4x + 3)$ and write the quotient and the remainder.

Sol.

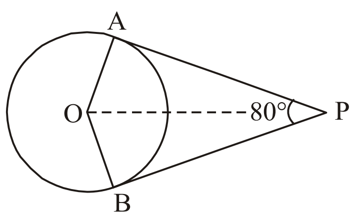
$$\begin{array}{r|l} & 4x + 3 \\ \hline 4x + 3 & 16x^2 + 24x + 15 \\ & \underline{-16x^2 - 12x} \\ & \quad 12x + 15 \\ & \quad \underline{-12x - 9} \\ & \qquad 6 \end{array}$$ 1

Quotient = 4x + 3, Remainder = 6 $\frac{1}{2}+\frac{1}{2}$

---

26. If tangents PA and PB drawn from an external point P to a circle with centre O are inclined to each other at an angle of 80°, then find ∠POA.

Sol.



Joint OP — Correct figure $\frac{1}{2}$

$\angle OPA = \frac{1}{2}\angle APB$

$= \frac{1}{2}(80°) = 40°$ 1

$\therefore\ \angle POA = 90 - 40 = 50°$ $\frac{1}{2}$

SECTION C

Q. Nos. 27 to 34 carry 3 marks each.

27. Draw a circle of radius 4 cm. From a point 7 cm away from the centre of circle. Construct a pair of tangents to the circle.

Sol. Constructing the circle of given radius 1

Constructing the tangents 2

OR

Draw a line segment of 6 cm and divide it in the ratio 3 : 2.

Drawing line segment of length 6 cm. 1

Dividing it in the ratio 3 : 2. 2

---

28. Prove that (1 + tan A – sec A) × (1 + tan A + sec A) = 2 tan A

Sol. L.H.S. $= (1 + \tan A)^2 - \sec^2 A$ 1

$= 1 + \tan^2 A + 2\tan A - \sec^2 A$ 1

$= \sec^2 A + 2\tan A - \sec^2 A$

$= 2 \tan A = \text{R.H.S.}$ 1

OR

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

L.H.S. $= \frac{\operatorname{cosec}\theta(\operatorname{cosec}\theta + 1) + \operatorname{cosec}\theta(\operatorname{cosec}\theta - 1)}{\operatorname{cosec}^2\theta - 1}$ 1

$= \frac{2\operatorname{cosec}^2\theta}{\cot^2\theta}$ 1

$= 2\sec^2\theta = \text{R.H.S.}$ 1

---

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

Sol. Let $(5 + 2\sqrt{3}) = x$, where x is the rational number $\frac{1}{2}$

$\Rightarrow \sqrt{3} = \frac{x-5}{2}$ 1

L.H.S. is an irrational and R.H.S. is a rational number. 1

It is a contradiction

$\therefore$ Our assumption is wrong

$\therefore$ $5 + 2\sqrt{3}$ is a irrational number. $\frac{1}{2}$

OR

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

$612 = 2^2 \times 3^2 \times 17$ 1

$48 = 2^4 \times 3$ 1

HCF $(612, 48) = 2^2 \times 3$

$= 12$ $\frac{1}{2}$

Number of column = 12 $\frac{1}{2}$

Read the following passage carefully and then answer the questions given at the end.

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

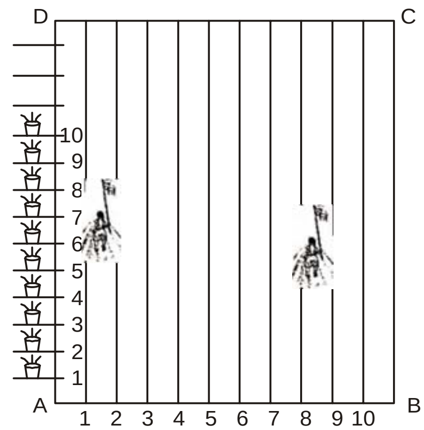


Fig. 5

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

(ii) If Rashmi has to post a blue flag exactly half way between the line segment joining the two flags, where should she post the blue flag?

Sol. Coordinate of green flag = (2, 25) $\frac{1}{2}$

Coordinate of Red flag = (8, 20) $\frac{1}{2}$

(i) Distance between the flags = $\sqrt{(-6)^2 + (5)^2}$

$= \sqrt{61}$ units 1

(ii) Mid point between 1

green and Red flag = (5, 22.5)

---

31. **Solve graphically: 2x + 3y = 2, x – 2y = 8**

Sol. Correct graph of 2x + 34 = 2 1

Correct graph of x – 2y = 8 1

Point of intersection = (4, –2)

or $x = 4, \quad y = -2$ 1

---

32. Find the zeroes of the quadratic polynomial $6x^2 - 3 - 7x$ and verify the relationship between the zeroes and the coefficients.

Sol. $6x^2 - 7x - 3 = (3x + 1)(2x - 3)$

Zeroes are $= -\frac{1}{3}, \frac{3}{2}$ 1

Sum of zeroes $= \frac{7}{6}, \; \frac{-b}{a} = \frac{7}{6}$ $\frac{1}{2}+\frac{1}{2}$

Product of zeroes $= -\frac{1}{2}, \; \frac{c}{a} = \frac{-3}{6}$ or $\frac{-1}{2}$ $\frac{1}{2}+\frac{1}{2}$

---

33. Three horses are tied each with 7 m long rope at three corners of a triangular field having sides 20 m, 34 m and 42 m. Find the area of the plot which can be grazed by the horses.

Sol. Sum of angle of 3 sectors

$= 180°$ 1

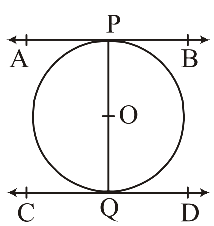
Areas of three sector $= \frac{22}{7} \times 7 \times 7 \times \frac{180°}{360°}$ $1\frac{1}{2}$

$= 77 \text{ cm}^2$ $\frac{1}{2}$

---

34. Prove that the tangents drawn at the end points of a diameter of a circle are parallel.

Sol.



Correct figure 1

$\angle OPA = \angle OQD = 90°$ 1

But they are forming alternate interior angles
$\Rightarrow$ AB || CD } 1

SECTION D

Q. Nos. 35 to 40 carry 4 marks each.

35. If 4 times the 4th term of an AP is equal to 18 times the 18th term, then find the 22nd term.

Sol. Let first term be a and common difference = d

$\therefore \; 4(a + 3d) = 18(a + 17d)$ 1

$\Rightarrow \; a = -21d$ 1

22nd term $= a + 21d$ 1

$= -21d + 21d$

$= 0$ 1

OR

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

Let the number of terms be n, d = –3 $\frac{1}{2}$

$\therefore \frac{n}{2}[48 + (n-1)(-3)] = 78$ 1

$\Rightarrow n^2 - 17n + 52 = 0$ 1

$(n - 13)(n - 4) = 0$ 1

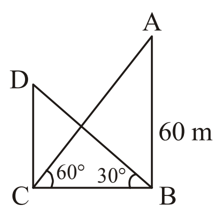
$\Rightarrow n = 13$ or 4

$\therefore$ Number of terms = 4 or 13 $\frac{1}{2}$

---

36. The angle of elevation of the top of a building from the foot of a tower is 30°. The angle of elevation of the top of the tower from the foot of the building is 60°. If the tower is 60 m high, find the height of the building.

Sol.



Correct figure 1

$\frac{AB}{BC} = \tan 60°$

$\frac{60}{BC} = \sqrt{3}$

$\Rightarrow BC = \frac{60}{\sqrt{3}}$ or $20\sqrt{3}$ m 1

Again, $\frac{DC}{CB} = \tan 30°$ 1

$\frac{DC}{20\sqrt{3}} = \frac{1}{\sqrt{3}}$

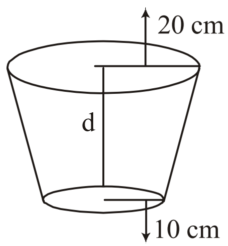
$\Rightarrow DC = 20$ m

Height of building = 20 m 1

---

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

Sol.



Volume of Bucket $= \frac{\pi}{3}[400 + 100 + 200] \times 21$

$= 4900 \times \frac{22}{7} = 15400 \text{ cm}^3$ 2

Volume of milk $= \frac{15400}{1000} = 15.4$ litres 1

Cost of milk = ₹ 15.4 × 40 = ₹ 616 1

OR

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

Volume of hemisphere $= \frac{2}{3}\pi r^3$

$= \frac{2}{3} \times \frac{22}{7} \times \left(\frac{7}{2}\right)^3$

$= \frac{539}{6} \text{ cm}^3$ $1\frac{1}{2}$

Height of cone = (9.5 – 3.5) cm = 6 cm $\frac{1}{2}$

Volume of cone $= \frac{1}{3}\pi r^2 h$

$= \frac{1}{3} \times \frac{\overset{11}{\cancel{22}}}{\cancel{7}} \times \frac{\cancel{7}}{\cancel{2}} \times \frac{7}{2} \times 6 = 77 \text{ cm}^3$ 1

Total volume of solid

$= \frac{539}{6} + \frac{77}{1}$

$= \frac{539 + 462}{6} = \frac{1001}{6} \text{ cm}^3$ or 166.83 cm^3 1

$= 166.83 \text{ cm}^3$

38. Find the mean of the following data:

Classes	**0 – 20**	**20 – 40**	**40 – 60**	**60 – 80**	**80 – 100**	**100 – 120**
Frequency	**20**	**35**	**52**	**44**	**38**	**31**

Sol.

x	f	fx
10	20	200
30	35	1050
50	52	2600
70	44	3080
90	38	3420
110	31	3410
	220	13760

Correct Table 2

$\therefore \quad \text{Mean} = \dfrac{\Sigma fx}{\Sigma f} = \dfrac{13760}{220}$ or 62.54 2

39. In Fig. 6, DEFG is a square in a triangle ABC right angled at A.

Prove that

(i) ΔAGF ~ ΔDBG

(ii) ΔAGF ~ ΔEFC

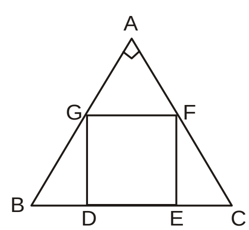
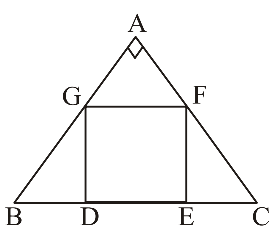


Fig.6

Sol.



GF || DE (DEFG is square)

$\therefore \angle AGF = \angle ABC$ (Corresponding angles) $\frac{1}{2}$

$\therefore \angle A = \angle GDB = 90°$

$\therefore \Delta AGF \sim \Delta DBG$ (By AA similarity) $1\frac{1}{2}$

Again DEFG being a square $\angle AFG = \angle ACB$ (corresponding angles) $\frac{1}{2}$

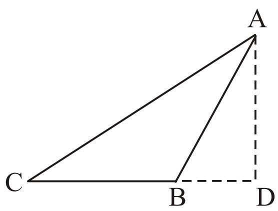
$\therefore \angle A = \angle CEF$ (each 90°)

$\Delta AGF \sim \Delta EFC$ (By AA similarity) $1\frac{1}{2}$

OR

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

Sol. In rt ΔADC Correct figure 1



$AC^2 = AD^2 + CD^2$ $\frac{1}{2}$

$= AD^2 + (CB + BD)^2$ 1

$= AD^2 + BD^2 + CB^2 + 2CB.BD$ 1

$= AB^2 + CB^2 + 2CB \,.\, BD$ $\because \Delta$ ABD is rt angled $\frac{1}{2}$

---

40. A person on tour has ₹ 4200 for his expenses. If he extends his tour for 3 days, he has to cut down his daily expenses by ₹ 70. Find the original duration of the tour.

Sol. Let the number of days of tour = x

Each day expenses = $\frac{4200}{x}$

Extended days tour = x + 3

Each day expenses = $\frac{4200}{x+3}$

$\frac{4200}{x} - \frac{4200}{x+3} = 70$ 2

$\frac{x+3-x}{x(x+3)} = \frac{1}{60}$

$\Rightarrow x^2 + 3x - 180 = 0$ 1

$(x + 15)(x - 12) = 0$

$\Rightarrow x = -15$ (not possible)

or $x = 12$

Original duration of tour = 12 days 1
