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Secondary School Examination-2020

Marking Scheme - MATHEMATICS STANDARD

Subject Code: 041 Paper Code: 30/2/1, 30/2/2, 30/2/3

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** marks as given in Question Paper) 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 30/2/1

EXPECTED ANSWER/VALUE POINTS

SECTION – A

Question numbers 1 to 10 are multiple choice questions of 1 mark each.

You have to select the correct choice :

Q.No. **Marks**

1. The sum of exponents of prime factors in the prime-factorisation of 196 is

(a) 3 **(b)** 4 **(c)** 5 **(d)** 2

Ans: (b) 4 1

2. Euclid's division Lemma states that for two positive integers a and b, there exists unique integer q and r satisfying $a = bq + r$, and

(a) $0 < r < b$ **(b)** $0 < r \leq b$ **(c)** $0 \leq r < b$ **(d)** $0 \leq r \leq b$

Ans: (c) $0 \leq r < b$ 1

3. The zeroes of the polynomial $x^2 - 3x - m(m + 3)$ are

(a) $m, m + 3$ **(b)** $-m, m + 3$ **(c)** $m, -(m + 3)$ **(d)** $-m, -(m + 3)$

Ans: (b) $-m, m + 3$ 1

4. The value of k for which the system of linear equations $x + 2y = 3$, $5x + ky + 7 = 0$ is inconsistent is

(a) $-\frac{14}{3}$ **(b)** $\frac{2}{5}$ **(c)** 5 **(d)** 10

Ans: (d) 10 1

5. The roots of the quadratic equation $x^2 - 0.04 = 0$ are

(a) ± 0.2 **(b)** ± 0.02 **(c)** 0.4 **(d)** 2

Ans: (a) ± 0.2 1

6. The common difference of the A.P. $\frac{1}{p}, \frac{1-p}{p}, \frac{1-2p}{p}, \ldots$ is

(a) 1 **(b)** $\frac{1}{p}$ **(c)** -1 **(d)** $-\frac{1}{p}$

Ans: (c) -1 1

7. The n^{th} term of the A.P. a, 3a, 5a, …… is

(a) na **(b)** $(2n - 1)a$ **(c)** $(2n + 1)a$ **(d)** 2na

Ans: (b) $(2n - 1)a$ 1

8. The point P on x-axis equidistant from the points A(–1, 0) and B(5, 0) is

(a) (2, 0) **(b)** (0, 2) **(c)** (3, 0) **(d)** (2, 2)

Ans: (a) (2, 0) 1

9. The co-ordinates of the point which is reflection of point (–3, 5) in x-axis are

(a) (3, 5) **(b)** (3, –5) **(c)** (–3, –5) **(d)** (–3, 5)

Ans: (c) (–3, –5) 1

10. If the point P (6, 2) divides the line segment joining A(6, 5) and B(4, y) in the ratio 3 : 1, then the value of y is

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

Ans: 1 mark be awarded to everyone — 1

In Q. Nos. 11 to 15, fill in the blanks. Each question is of 1 mark.

11. In fig. 1, MN || BC and AM : MB = 1 : 2, then $\frac{ar(\Delta AMN)}{ar(\Delta ABC)}$ = _________.

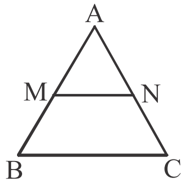


Fig. 1

Ans: $\frac{1}{9}$ — 1

12. In given Fig. 2, the length PB = _________ cm.

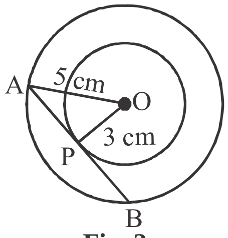


Fig. 2

Ans: 4 — 1

13. In ΔABC, AB = $6\sqrt{3}$ cm, AC = 12 cm and BC = 6 cm, then ∠B = _________.

Ans: 90° — 1

OR

Two triangles are similar if their corresponding sides are _________.

Ans: proportional — 1

14. The value of (tan 1° tan 2° …… tan 89°) is equal to _________.

Ans: 1 — 1

15. In Fig. 3, the angles of depressions from the observing positions O_1 and O_2 respectively of the object A are ______________ , _______________.

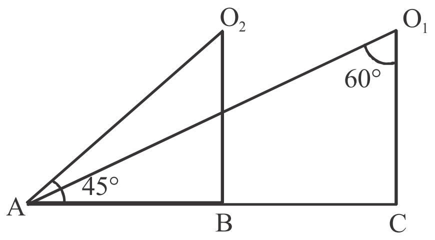


Fig. 3

Ans: 30°, 45° — $\frac{1}{2}+\frac{1}{2}$

Q. Nos. 16 to 20 are short answer type questions of 1 mark each.

16. If sin A + $\sin^2$ A = 1, then find the value of the expression ($\cos^2$ A + $\cos^4$ A).

Ans: $\left.\begin{array}{l}\sin A = 1 - \sin^2 A \\ \sin A = \cos^2 A\end{array}\right\}$ 1/2

$\cos^2 A + \cos^4 A = \sin A + \sin^2 A = 1$ 1/2

17. In Fig. 4 is a sector of circle of radius 10.5 cm. Find the perimeter of the sector. $\left(\text{Take } \pi = \frac{22}{7}\right)$

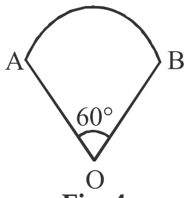


Fig. 4

Ans: Perimeter $= 2r + \frac{\pi r \theta}{180°}$

$= 2 \times 10.5 + \frac{22}{7} \times 10.5 \times \frac{60°}{180°}$ 1/2

= 21 + 11 = 32 cm 1/2

18. If a number x is chosen at random from the numbers –3, –2, –1, 0, 1, 2, 3, then find the probability of $x^2 < 4$.

Ans: Number of Favourable outcomes = 3 i.e., {–1, 0, 1} $\therefore P(x^2 < 4) = \frac{3}{7}$ 1/2+1/2

OR

What is the probability that a randomly taken leap year has 52 Sundays ?

Ans: P(52 sundays) = $\frac{5}{7}$ 1

19. Find the class-marks of the classes 10-25 and 35-55.

Ans: Class Marks $\frac{10+25}{2} = 17.5; \frac{35+55}{2} = 45$ 1/2+1/2

20. A die is thrown once. What is the probability of getting a prime number.

Ans: Number of prime numbers = 3 i.e. ; {2, 3, 5} 1/2

$P(\text{Prime Number}) = \frac{3}{6} \text{ or } \frac{1}{2}$ 1/2

SECTION – B

Q. Nos. 21 to 26 carry 2 marks each

21. A teacher asked 10 of his students to write a polynomial in one variable on a paper and then to handover the paper. The following were the answers given by the students:

$2x + 3,\ 3x^2 + 7x + 2,\ 4x^3 + 3x^2 + 2,\ x^3 + \sqrt{3x} + 7,\ 7x + \sqrt{7},\ 5x^3 - 7x + 2,$

$2x^2 + 3 - \frac{5}{x},\ 5x - \frac{1}{2},\ ax^3 + bx^2 + cx + d,\ x + \frac{1}{x}.$

Answer the following questions :

(i) How many of the above ten, are not polynomials ?

(ii) How many of the above ten, are quadratic polynomials ?

Ans: (i) 3 **1**

(ii) 1 **1**

22. In Fig. 5, ABC and DBC are two triangles on the same base BC. If AD intersects BC at O, show that

$$\frac{ar(\Delta ABC)}{ar(\Delta DBC)} = \frac{AO}{DO}$$

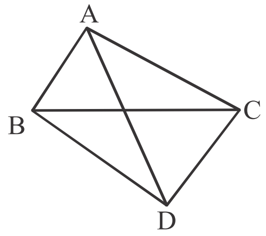
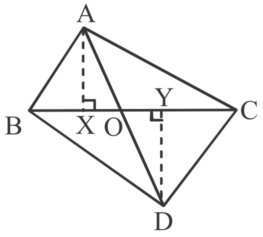


Fig. 5

Ans:



Draw AX ⊥ BC, DY ⊥ BC **1/2**

$\Delta AOX \sim \Delta DOY$

$\frac{AX}{DY} = \frac{AO}{DO}$ …(i) **1/2**

$\frac{ar(\Delta ABC)}{ar(\Delta DBC)} = \frac{\frac{1}{2} \times BC \times AX}{\frac{1}{2} \times BC \times DY}$ **1/2**

$\frac{AX}{DY} = \frac{AO}{DO}$ (From (1)) **1/2**

OR

In Fig. 6, if AD ⊥ BC, then prove that $AB^2 + CD^2 = BD^2 + AC^2$.

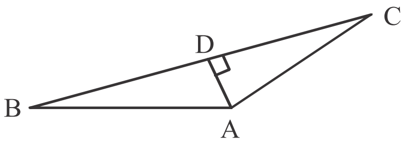


Fig. 6

Ans: In rt ΔABD $AB^2 = BD^2 + AD^2$ … (i) **1/2**

In rt ΔADC $CD^2 = AC^2 - AD^2$ … (ii) **1/2**

Adding (i) & (ii)

$AB^2 + CD^2 = BD^2 + AC^2$ **1**

23. Prove that $1+\frac{\cot^2\alpha}{1+\operatorname{cosec}\alpha}=\operatorname{cosec}\alpha$

Ans: L.H.S = $1+\frac{\operatorname{cosec}^2\alpha-1}{1+\operatorname{cosec}\alpha}$ **1/2**

$=1+\frac{(\operatorname{cosec}\alpha-1)(\operatorname{cosec}\alpha+1)}{\operatorname{cosec}\alpha+1}$ **1**

$=\operatorname{cosec}\alpha$ = R.H.S **1/2**

OR

Show that $\tan^4\theta+\tan^2\theta=\sec^4\theta-\sec^2\theta$

Ans: L.H.S = $\tan^4\theta+\tan^2\theta$

$=\tan^2\theta\,(\tan^2\theta+1)$ **1/2**

$=(\sec^2\theta-1)\,(\sec^2\theta)=\sec^4\theta-\sec^2\theta$ = R.H.S **1+1/2**

24. The volume of a right circular cylinder with its height equal to the radius is $25\frac{1}{7}$ cm^3. Find the height of the cylinder. $\left(\text{Use }\pi=\frac{22}{7}\right)$

Ans: Let height and radius of cylinder = x cm **1/2**

$V=\frac{176}{7}\text{cm}^3$

$\frac{22}{7}\times x^2\times x=\frac{176}{7}$ **1/2**

$x^3=8\quad\Rightarrow x=2$ **1/2**

$\therefore$ height of cylinder = 2 cm **1/2**

25. A child has a die whose six faces show the letters as shown below :

$\boxed{A}\,\boxed{B}\,\boxed{C}\,\boxed{D}\,\boxed{E}\,\boxed{A}$

The die is thrown once. What is the probability of getting (i) A, (ii) D ?

Ans: (i) $P(A)=\frac{2}{6}$ or $\frac{1}{3}$ (ii) $P(D)=\frac{1}{6}$ **1+1**

26. Compute the mode for the following frequency distribution :

Size of items (in cm)	0 – 4	4 – 8	8 – 12	12 – 16	16 – 20	20 – 24	24 – 28
Frequency	5	7	9	17	12	10	6

Ans: $l=12\quad f_0=9\quad f_1=17\quad f_2=12\quad h=4$ **1/2**

$\text{Mode}=12+\frac{17-9}{34-9-12}\times4=14.46\text{ cm (Approx)}$ $1+\frac{1}{2}$

SECTION – C

Question numbers 27 to 34 carry 3 marks each.

27. If $2x + y = 23$ and $4x - y = 19$, find the value of $(5y - 2x)$ and $\left(\frac{y}{x} - 2\right)$

Ans: $2x + y = 23$, $4x - y = 19$

Solving, we get $x = 7$, $y = 9$ **1+1**

$5y - 2x = 31$, $\frac{y}{x} - 2 = \frac{-5}{7}$ **1/2+1/2**

OR

Solve for x : $\frac{1}{x+4} - \frac{1}{x+7} = \frac{11}{30}$, $x \# -4, 7$

Ans: $\frac{1}{x+4} - \frac{1}{x-7} = \frac{11}{30} \Rightarrow \frac{-11}{(x+4)(x-7)} = \frac{11}{30}$ **1**

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

$\Rightarrow (x - 2)\,(x - 1) = 0$ **1/2**

$\Rightarrow x = 2, 1$ **1/2**

The Following solution should also be accepted

$\frac{1}{x+4} - \frac{1}{x+7} = \frac{11}{30} \Rightarrow \frac{x+7-x-4}{(x+4)(x-7)} = \frac{11}{30}$ **1**

$\Rightarrow 11\,x^2 + 121x + 218 = 0$ $\mathbf{1\frac{1}{2}}$

Here, D = 5049

$x = \frac{-121 \pm \sqrt{5049}}{22}$ **1/2**

28. Show that the sum of all terms of an A.P. whose first term is a, the second term is b and the last term is c is equal to $\frac{(a+c)(b+c-2a)}{2(b-a)}$

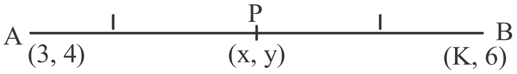
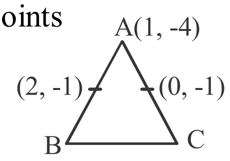
Ans: Here $d = b - a$ **1/2**

Let c be the nth term

$\therefore\ c = a + (n - 1)\,(b - a)$ **1/2**

$\Rightarrow\ n = \frac{c+b-2a}{b-a}$ **1**

$\Rightarrow\ S_n = \frac{c+b-2a}{2(b-a)}(a+c)$ **1**

	OR	
	Solve the equation : 1 + 4 + 7 + 10 + … + x = 287.	
	Ans: Let sum of n terms = 287	
	$\frac{n}{2}[2\times1+(n-1)3] = 287$	1/2
	$3n^2 - n - 574 = 0$	1/2
	$(3n + 41)(n - 14) = 0$	1/2
	$n = 14 \left(\text{Reject } n = \frac{-41}{3}\right)$	1/2
	$x = a_{14} = 1 + 13 \times 3 = 40$	1
29.	In a flight of 600 km, an aircraft was slowed down due to bad weather. The average speed of the trip was reduced by 200 km/hr and the time of flight increased by 30 minutes. Find the duration of flight.	
	Ans: Let actual speed = x km/hr A.T.Q	
	$\frac{600}{x-200} - \frac{600}{x} = \frac{1}{2}$	1
	$x^2 - 200x - 240000 = 0$	
	$(x - 600)(x + 400) = 0$	1
	$x = 600$ ($x = -400$ Rejected)	1/2
	Duration of flight $= \frac{600}{600} = 1$ hr	1/2
30.	If the mid-point of the line segment joining the points A(3, 4) and B(k, 6) is P (x, y) and x + y – 10 = 0, find the value of k.	
	Ans: 	
	$x = \frac{3+k}{2} \quad y = 5$	1/2+1/2
	$x + y - 10 = 0 \Rightarrow \frac{3+k}{2} + 5 - 10 = 0$	1
	$\Rightarrow k = 7$	1
	OR	
	Find the area of triangle ABC with A (1, –4) and the mid-points of sides through A being (2, –1) and (0, –1). 	
	Ans: B(3, 2), C(–1, 2)	1/2+1/2
	Area $= \frac{1}{2}\lvert 1(2-2)+3(2+4)-1(-4-2)\rvert = 12$ sq.units	1+1

31. In Fig. 7, if ΔABC ~ ΔDEF and their sides of lengths (in cm) are marked along them, then find the lengths of sides of each triangle.

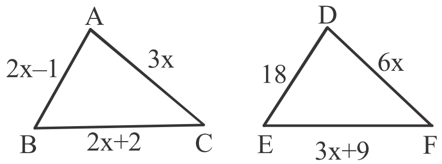


Fig. 7

Ans: As ΔABC ~ ΔDEF

$$\frac{2x-1}{18} = \frac{3x}{6x}$$ 1

$x = 5$ 1

AB = 9 cm DE = 18 cm

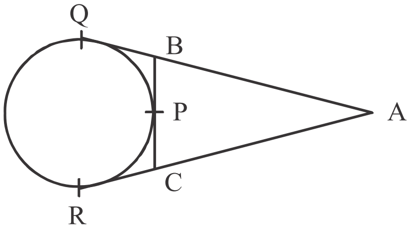
BC = 12 cm EF = 24 cm 1/2+1/2

CA = 15 cm FD = 30 cm

32. If a circle touches the side BC of a triangle ABC at P and extended sides AB and AC at Q and R, respectively, prove that

$$AQ = \frac{1}{2}(BC + CA + AB)$$

Ans:



Correct Fig 1/2

$AQ = \frac{1}{2}\ (2AQ)$ 1/2

$= \frac{1}{2}\ (AQ + AQ)$

$= \frac{1}{2}\ (AQ + AR)$

$= \frac{1}{2}\ (AB + BQ + AC + CR)$ 1

$= \frac{1}{2}\ (AB + BC + CA)$ 1

$\because$ [BQ = BP, CR = CP]

33. If $\sin\theta + \cos\theta = \sqrt{2}$, prove that $\tan\theta + \cot\theta = 2$.

Ans: $\sin\theta + \cos\theta = \sqrt{2}$ 1

$\tan\theta + 1 = \sqrt{2}\ \sec\theta$

Sq. both sides

$\tan^2\theta + 1 + 2\tan\theta = 2\sec^2\theta$

$\tan^2\theta + 1 + 2\tan\theta = 2(1 + \tan^2\theta)$ 1

$\tan^2\theta + 1 + 2\tan\theta = 2 + 2\tan^2\theta$

$2\tan\theta = \tan^2\theta + 1$ 1

$2 = \tan\theta + \cot\theta$

34. The area of a circular play ground is 22176 cm^2. Find the cost of fencing this ground at the rate of ₹ 50 per metre.

Ans: Let the radius of playground be r cm

$\pi r^2 = 22176\ \text{cm}^2$ **1**

$r = 84$ cm

Circumference $= 2\pi r = 2 \times \frac{22}{7} \times 84 = 528$ cm **1**

Cost of fencing $= \frac{50}{100} \times 528 =$ ₹ 264 **1**

SECTION – D

Question numbers 35 to 40 carry 4 marks each.

35. Prove that $\sqrt{5}$ is an irrational number.

Ans: Let $\sqrt{5}$ be a rational number.

$\sqrt{5} = \frac{p}{q}$, p & q are coprimes & $q \neq 0$ **1**

$5q^2 = p^2 \Rightarrow 5$ divides $p^2 \Rightarrow 5$ divides p also Let $p = 5a$, for some integer a **1**

$5q^2 = 25a^2 \Rightarrow q^2 = 5a^2 \Rightarrow 5$ divides $q^2 \Rightarrow 5$ divides q also

$\therefore$ 5 is a common factor of p, q, which is not possible as p, q are coprimes. **1**

Hence assumption is wrong $\sqrt{5}$ is irrational no. **1**

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

Ans: Let time taken by pipe of larger diameter to fill the tank be x hr

Let time taken by pipe of smaller diameter to fill the tank be y hr

A.T.Q

$\frac{1}{x} + \frac{1}{y} = \frac{1}{12}, \frac{4}{x} + \frac{9}{y} = \frac{1}{2}$ **1+1**

Solving we get $x = 20$ hr $y = 30$ hr **1+1**

37. Draw a circle of radius 2 cm with centre O and take a point P outside the circle such that OP = 6.5 cm. From P, draw two tangents to the circle.

Ans: Correct construction of circle of radius 2 cm **1**

Correct construction of tangents. **3**

OR

Construct a triangle with sides 5 cm, 6 cm and 7 cm and then construct another triangle whose sides are $\frac{3}{4}$ times the corresponding sides of the first triangle.

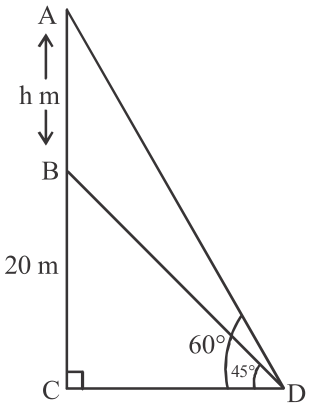
Ans: Correct construction of given triangle **1**

Construction of Similar triangle **3**

38. From a point on the ground, the angles of elevation of the bottom and the top of a tower fixed at the top of a 20 m high building are 45° and 60° respectively. Find the height of the tower.

Ans: Let height of tower = h m

In rt. ΔBCD $\tan 45° = \frac{BC}{CD}$ **corr fig. 1**



$$1 = \frac{20}{CD}$$

$$CD = 20 \text{ m}$$ **1**

In rt. ΔACD $\tan 60° = \frac{AC}{CD}$

$$\sqrt{3} = \frac{20+h}{20}$$ **1**

$$h = 20\left(\sqrt{3}-1\right)\text{m}$$ **1**

39. Find the area of the shaded region in Fig. 8, if PQ = 24 cm, PR = 7 cm and O is the centre of the circle.

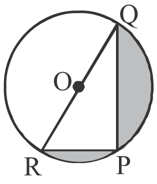


Fig. 8

Ans: $\angle P = 90°$ $RQ = \sqrt{(24)^2 + 7^2} = 25$ cm, $r = \frac{25}{2}$ cm **$1\frac{1}{2}$**

Area of shaded portion = Area of semi circle – ar(ΔPQR)

$$= \frac{1}{2} \times \frac{22}{7} \times \left(\frac{25}{2}\right)^2 - 84$$ **2**

$= 161.54 \text{ cm}^2$ **1/2**

OR

Find the curved surface area of the frustum of a cone, the diameters of whose circular ends are 20 m and 6 m and its height is 24 m.

Ans: R = 10 m r = 3 m h = 24 m **1/2+1/2**

$l = \sqrt{(24)^2 + (10-3)^2} = 25$ m **1**

CSA = $\pi(10+3)25 = 325\,\pi$ m^2 **1+1**

40. The mean of the following frequency distribution is 18. The frequency f in the class interval 19 – 21 is missing. Determine f.

Class interval	11 – 13	13 – 15	15 – 17	17 – 19	19 – 21	21 – 23	23 – 25
Frequency	3	6	9	13	f	5	4

Ans:

C.I	f	x	xf	
11-13	3	12	36	
13-15	6	14	84	
15-17	9	16	144	
17-19	13	18	234	
19-21	f	20	20f	
21-23	5	22	110	
23-25	4	24	96	
	40+f		704 + 20f	2

$$\text{Mean} = \frac{\sum xf}{\sum f} \Rightarrow 18 = \frac{704+20f}{40+f} \Rightarrow f = 8$$ 2

OR

The following table gives production yield per hectare of wheat of 100 farms of a village :

Production yield	40-45	45-50	50-55	55-60	60-65	65-70
No. of farms	4	6	16	20	30	24

Change the distribution to a 'more than' type distribution and draw its ogive.

Ans:

Production yield	**Number of farms**
More than or equal to 40	100
More than or equal to 45	96
More than or equal to 50	90
More than or equal to 55	74
More than or equal to 60	54
More than or equal to 65	24

2

Plotting of points (40, 100) (45, 96) (50, 90) (55, 74) (60, 54) (65, 24) join to get ogive. 2

QUESTION PAPER CODE 30/2/2

EXPECTED ANSWER/VALUE POINTS

SECTION – A

Question numbers 1 to 10 are multiple choice questions of 1 mark each.

You have to select the correct choice :

Q.No.		Marks
1.	The value of k for which the system of linear equations $x + 2y = 3$, $5x + ky + 7 = 0$ is inconsistent is **(a)** $-\frac{14}{3}$ **(b)** $\frac{2}{5}$ **(c)** 5 **(d)** 10 **Ans:** (d) 10	1
2.	The zeroes of the polynomial $x^2 - 3x - m(m + 3)$ are **(a)** $m, m + 3$ **(b)** $-m, m + 3$ **(c)** $m, -(m + 3)$ **(d)** $-m, -(m + 3)$ **Ans:** (b) $-m, m + 3$	1
3.	Euclid's division Lemma states that for two positive integers a and b, there exists unique integer q and r satisfying $a = bq + r$, and **(a)** $0 < r < b$ **(b)** $0 < r \leq b$ **(c)** $0 \leq r < b$ **(d)** $0 \leq r \leq b$ **Ans:** (c) $0 \leq r < b$	1
4.	The sum of exponents of prime factors in the prime-factorisation of 196 is **(a)** 3 **(b)** 4 **(c)** 5 **(d)** 2 **Ans:** (b) 4	1
5.	If the point P (6, 2) divides the line segment joining A(6, 5) and B(4, y) in the ratio 3 : 1, then the value of y is **(a)** 4 **(b)** 3 **(c)** 2 **(d)** 1 **Ans:** 1 mark be awarded to everyone	1
6.	The co-ordinates of the point which is reflection of point (–3, 5) in x-axis are **(a)** (3, 5) **(b)** (3, –5) **(c)** (–3, –5) **(d)** (–3, 5) **Ans:** (c) (–3, –5)	1
7.	The point P on x-axis equidistant from the points A(–1, 0) and B(5, 0) is **(a)** (2, 0) **(b)** (0, 2) **(c)** (3, 0) **(d)** (2, 2) **Ans:** (a) (2, 0)	1
8.	The n^{th} term of the A.P. a, 3a, 5a, …… is **(a)** na **(b)** $(2n - 1)a$ **(c)** $(2n + 1)a$ **(d)** 2na **Ans:** (b) $(2n - 1)a$	1
9.	The common difference of the A.P. $\frac{1}{p}, \frac{1-p}{p}, \frac{1-2p}{p}, \ldots$ is **(a)** 1 **(b)** $\frac{1}{p}$ **(c)** -1 **(d)** $-\frac{1}{p}$ **Ans:** (c) -1	1

10. The roots of the quadratic equation $x^2 - 0.04 = 0$ are

(a) ± 0.2 **(b)** ± 0.02 **(c)** 0.4 **(d)** 2

Ans: (a) ± 0.2 1

In Q. Nos. 11 to 15, fill in the blanks. Each question is of 1 mark.

11. In Fig. 1, the angles of depressions from the observing positions O_1 and O_2 respectively of the object A are ______________ , _______________.

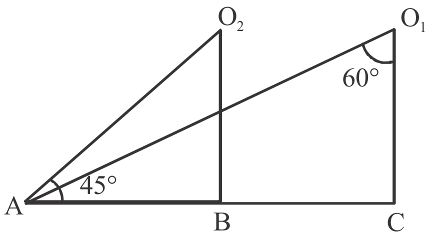


Fig. 1

Ans: 30°, 45° $\frac{1}{2}+\frac{1}{2}$

12. In Fig. 2, MN || BC and AM : MB = 1 : 2, then $\frac{\text{ar}(\Delta AMN)}{\text{ar}(\Delta ABC)}$ = _________.

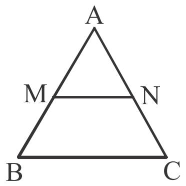


Fig. 2

Ans: $\frac{1}{9}$ 1

13. In given Fig. 3, the length PB = _________ cm.

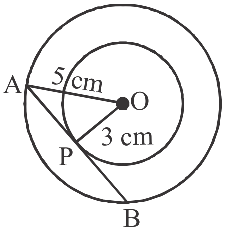


Fig. 3

Ans: 4 1

14. In ΔABC, AB = $6\sqrt{3}$ cm, AC = 12 cm and BC = 6 cm, then ∠B = _________.

Ans: 90° 1

OR

Two triangles are similar if their corresponding sides are _________.

Ans: proportional 1

15. The value of sin 23° cos 67° + cos 23° sin 67° is _________.

Ans: 1 1

Q. Nos. 16 to 20 are short answer type questions of 1 mark each.

16. In Fig. 4 is a sector of circle of radius 10.5 cm. Find the perimeter of the sector. $\left(\text{Take } \pi = \frac{22}{7}\right)$

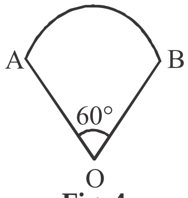


Fig. 4

Ans: Perimeter $= 2r + \frac{\pi r \theta}{180°}$

$= 2 \times 10.5 + \frac{22}{7} \times 10.5 \times \frac{60°}{180°}$ 1/2

$= 21 + 11 = 32$ cm 1/2

17. If a number x is chosen at random from the numbers –3, –2, –1, 0, 1, 2, 3, then find the probability of $x^2 < 4$.

Ans: Number of Favourable outcomes = 3 i.e., {–1, 0, 1} $\therefore P(x^2 < 4) = \frac{3}{7}$ 1/2+1/2

OR

What is the probability that a randomly taken leap year has 52 Sundays ?

Ans: P(52 sundays) = $\frac{5}{7}$ 1

18. A die is thrown once. What is the probability of getting a prime number.

Ans: Number of prime numbers = 3 i.e. ; {2, 3, 5} 1/2

$P(\text{Prime Number}) = \frac{3}{6} \text{ or } \frac{1}{2}$ 1/2

19. If tan A = cot B, then find the value of (A + B).

Ans: tan A = tan (90° – B) 1/2

$\therefore$ A + B = 90° 1/2

20. Find the class marks of the classes 15 – 35 and 45 – 60.

Ans: $\frac{15+35}{2} = 25$ 1/2

$\frac{45+60}{2} = 52.5$ 1/2

SECTION – B

Q. Nos. 21 to 26 carry 2 marks each

21. A teacher asked 10 of his students to write a polynomial in one variable on a paper and then to handover the paper. The following were the answers given by the students:

$2x + 3, 3x^2 + 7x + 2, 4x^3 + 3x^2 + 2, x^3 + \sqrt{3x} + 7, 7x + \sqrt{7}, 5x^3 - 7x + 2,$

$2x^2 + 3 - \frac{5}{x}, 5x - \frac{1}{2}, ax^3 + bx^2 + cx + d, x + \frac{1}{x}.$

Answer the following questions :

(i) How many of the above ten, are not polynomials ?

(ii) How many of the above ten, are quadratic polynomials ?

Ans: (i) 3 **1**

(ii) 1 **1**

22. Compute the mode for the following frequency distribution :

Size of items (in cm)	0 – 4	4 – 8	8 – 12	12 – 16	16 – 20	20 – 24	24 – 28
Frequency	5	7	9	17	12	10	6

Ans: $l = 12$ $f_0 = 9$ $f_1 = 17$ $f_2 = 12$ $h = 4$ **1/2**

$$\text{Mode} = 12 + \frac{17-9}{34-9-12} \times 4 = 14.46 \text{ cm (Approx)}$$ **$1 + \frac{1}{2}$**

23. In Fig. 5, ABC and DBC are two triangles on the same base BC. If AD intersects BC at O, show that

$$\frac{ar(\Delta ABC)}{ar(\Delta DBC)} = \frac{AO}{DO}$$

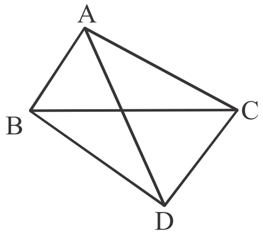
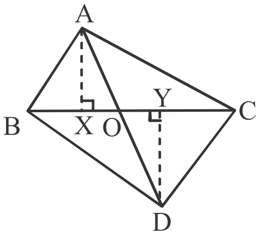


Fig. 5

Ans:



Draw AX ⊥ BC, DY ⊥ BC **1/2**

$\Delta AOX \sim \Delta DOY$

$\frac{AX}{DY} = \frac{AO}{DO}$ ...(i) **1/2**

$$\frac{ar(\Delta ABC)}{ar(\Delta DBC)} = \frac{\frac{1}{2} \times BC \times AX}{\frac{1}{2} \times BC \times DY}$$ **1/2**

$\frac{AX}{DY} = \frac{AO}{DO}$ (From (1)) **1/2**

OR

In Fig. 6, if AD ⊥ BC, then prove that $AB^2 + CD^2 = BD^2 + AC^2$.

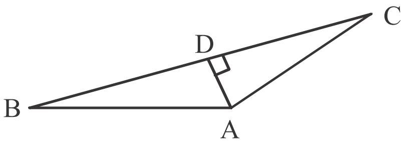


Fig. 6

	Ans: In rt ΔABD $\quad AB^2 = BD^2 + AD^2 \quad \ldots$ (i)	1/2
	In rt ΔADC $\quad CD^2 = AC^2 - AD^2 \quad \ldots$ (ii)	1/2
	Adding (i) & (ii)	
	$AB^2 + CD^2 = BD^2 + AC^2$	1
24.	Prove that $1+\dfrac{\cot^2\alpha}{1+\operatorname{cosec}\alpha} = \operatorname{cosec}\alpha$	
	Ans: L.H.S = $1+\dfrac{\operatorname{cosec}^2\alpha - 1}{1+\operatorname{cosec}\alpha}$	1/2
	$= 1+\dfrac{(\operatorname{cosec}\alpha - 1)(\operatorname{cosec}\alpha + 1)}{\operatorname{cosec}\alpha + 1}$	1
	$= \operatorname{cosec}\alpha$ = R.H.S	1/2
	OR	
	Show that $\tan^4\theta + \tan^2\theta = \sec^4\theta - \sec^2\theta$	
	Ans: L.H.S = $\tan^4\theta + \tan^2\theta$	
	$= \tan^2\theta\,(\tan^2\theta + 1)$	1/2
	$= (\sec^2\theta - 1)(\sec^2\theta) = \sec^4\theta - \sec^2\theta$ = R.H.S	1+1/2
25.	A child has a die whose six faces show the letters as shown below :	
	$\boxed{A}\boxed{A}\boxed{B}\boxed{C}\boxed{C}\boxed{C}$	
	The die is thrown once. What is the probability of getting (i) A, (ii) D ?	
	Ans: (i) $P(A) = \dfrac{2}{6}$ or $\dfrac{1}{3}$ $\qquad$ (ii) $P(D) = \dfrac{3}{6}$ or $\dfrac{1}{2}$	1+1
26.	A solid is in the shape of a cone mounted on a hemisphere of same base radius. If the curved surface areas of the hemispherical part and the conical part are equal, then find the ratio of the radius and the height of the conical part.	
	Ans: CSA of conical part = CSA of hemispherical part	
	$\pi r l = 2\pi r^2$	1/2
	$\sqrt{r^2 + h^2} = 2r$	1/2
	$h^2 = 3r^2$	1/2
	$\dfrac{r}{h} = \dfrac{1}{\sqrt{3}} \Rightarrow$ ratio is $1:\sqrt{3}$	1/2

SECTION – C

Question numbers 27 to 34 carry 3 marks each.

27. In Fig. 7, if $\Delta ABC \sim \Delta DEF$ and their sides of lengths (in cm) are marked along them, then find the lengths of sides of each triangle.

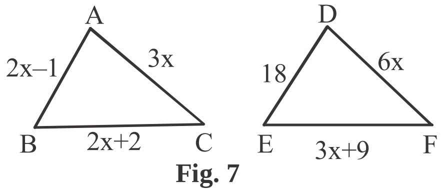


Fig. 7

Ans: As $\Delta ABC \sim \Delta DEF$

$$\frac{2x-1}{18} = \frac{3x}{6x}$$ **1**

$$x = 5$$ **1**

AB = 9 cm DE = 18 cm

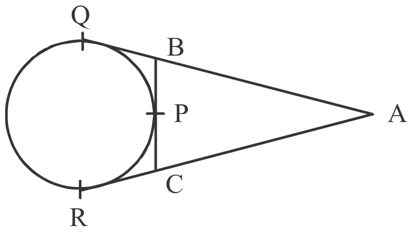
BC = 12 cm EF = 24 cm **1/2+1/2**

CA = 15 cm FD = 30 cm

28. If a circle touches the side BC of a triangle ABC at P and extended sides AB and AC at Q and R, respectively, prove that

$$AQ = \frac{1}{2}(BC + CA + AB)$$

Ans:



Correct Fig **1/2**

$$AQ = \frac{1}{2}(2AQ)$$ **1/2**

$$= \frac{1}{2}(AQ + AQ)$$

$$= \frac{1}{2}(AQ + AR)$$

$$= \frac{1}{2}(AB + BQ + AC + CR)$$ **1**

$$= \frac{1}{2}(AB + BC + CA)$$ **1**

$\because$ [BQ = BP, CR = CP]

29. The area of a circular play ground is 22176 cm^2. Find the cost of fencing this ground at the rate of ₹ 50 per metre.

Ans: Let the radius of playground be r cm

$$\pi r^2 = 22176 \text{ cm}^2$$ **1**

$$r = 84 \text{ cm}$$

$$\text{Circumference} = 2\pi r = 2 \times \frac{22}{7} \times 84 = 528 \text{ cm}$$ **1**

$$\text{Cost of fencing} = \frac{50}{100} \times 528 = ₹\,264$$ 1

30. If 2x + y = 23 and 4x – y = 19, find the value of (5y – 2x) and $\left(\frac{y}{x} - 2\right)$

Ans: $2x + y = 23$, $4x - y = 19$

Solving, we get $x = 7$, $y = 9$ 1+1

$5y - 2x = 31$, $\frac{y}{x} - 2 = \frac{-5}{7}$ 1/2+1/2

OR

Solve for x : $\frac{1}{x+4} - \frac{1}{x+7} = \frac{11}{30}$, x # –4, 7

Ans: $\frac{1}{x+4} - \frac{1}{x-7} = \frac{11}{30} \Rightarrow \frac{-11}{(x+4)(x-7)} = \frac{11}{30}$ 1

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

$\Rightarrow (x-2)(x-1) = 0$ 1/2

$\Rightarrow x = 2, 1$ 1/2

The Following solution should also be accepted

$\frac{1}{x+4} - \frac{1}{x+7} = \frac{11}{30} \Rightarrow \frac{x+7-x-4}{(x+4)(x-7)} = \frac{11}{30}$ 1

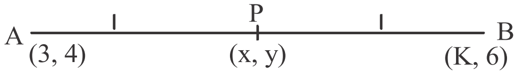
$\Rightarrow 11x^2 + 121x + 218 = 0$ $1\frac{1}{2}$

Here, D = 5049

$x = \frac{-121 \pm \sqrt{5049}}{22}$ 1/2

31. If the mid-point of the line segment joining the points A(3, 4) and B(k, 6) is P (x, y) and x + y – 10 = 0, find the value of k.

Ans:



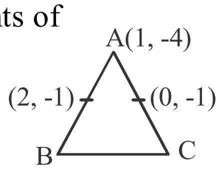
$x = \frac{3+k}{2}$ $y = 5$ 1/2+1/2

$x + y - 10 = 0 \Rightarrow \frac{3+k}{2} + 5 - 10 = 0$ 1

$\Rightarrow k = 7$ 1

OR

Find the area of triangle ABC with A (1, –4) and the mid-points of sides through A being (2, –1) and (0, –1).



Ans: B(3, 2), C(–1, 2) 1/2+1/2

$\text{Area} = \frac{1}{2}\left|1(2-2) + 3(2+4) - 1(-4-2)\right| = 12 \text{ sq.units}$ 1+1

32. If in an A.P., the sum of first m terms is n and the sum of its first n terms is m, then prove that the sum of its first (m + n) terms is – (m + n).

Ans: $S_m = n$ and $S_n = m$

$2a+(m-1)d=\frac{2n}{m}\ \ldots(i) \qquad 2a+(n-1)d=\frac{2m}{n}\ \ldots(ii)$ **1**

Solving (i) & (ii), $a=\frac{m^2+n^2+mn-n-m}{mn}$ & $d=\frac{-2(n-m)}{mn}$ **1**

$S_{m+n}=\frac{m+n}{2}\left[\frac{2\times m^2+n^2+mn-n-m}{mn}\right]+(m+n-1)\left\{\frac{-2(n+m)}{mn}\right\}$ **1/2**

$=(-1)(m+n)$ **1/2**

OR

Find the sum of all 11 terms of an A.P. whose middle term is 30.

Ans: Middle term $=\left(\frac{11+1}{2}\right)^{th}$ term $= a_6 = 30$ **1**

$S_{11}=\frac{11}{2}[2a+10d]$ **1/2**

$= 11(a + 5d)$ **1/2**

$= 11\,a_6 = 11 \times 30 = 330$ **1**

33. A fast train takes 3 hours less than a slow train for a journey of 600 km. If the speed of the slow train is 10 km/h less than that of the fast train, find the speed of each train.

Ans: Let the speeds of fast train & slow train be x km/hr & (x – 10) km/hr respectively.

A.T.Q.

$\frac{600}{x-10}-\frac{600}{x}=3$ **1**

$x^2 - 10x - 2000 = 0$ **1**

$(x - 50)(x + 40) = 0$

$x = 50$ or -40

Speed is always positive, So, x = 50 **1/2**

∴ Speed of fast train & slow train are 50 km/hr & 40 km/hr respectively. **1/2**

34. If $1 + \sin^2\theta = 3\sin\theta\cos\theta$, prove that $\tan\theta = 1$ or $\frac{1}{2}$

Ans: $\frac{1+\sin^2\theta}{\cos^2\theta}=\frac{3\sin\theta\cdot\cos\theta}{\cos^2\theta}$ (Dividing both sides by $\cos^2\theta$) **1/2**

$\sec^2\theta + \tan^2\theta = 3\tan\theta$ **1/2**

$(1 + \tan^2\theta) + \tan^2\theta = 3\tan\theta$ **1/2**

$2\tan^2\theta - 3\tan\theta + 1 = 0$ **1/2**

$(\tan\theta - 1)(2\tan\theta - 1) = 0$ **1/2**

$\tan\theta = 1 \;\text{ or }\; \frac{1}{2}$ 1/2

SECTION – D

Question numbers 35 to 40 carry 4 marks each.

35. The mean of the following frequency distribution is 18. The frequency f in the class interval 19 – 21 is missing. Determine f.

Class interval	11 – 13	13 – 15	15 – 17	17 – 19	19 – 21	21 – 23	23 – 25
Frequency	3	6	9	13	f	5	4

Ans:

C.I	f	x	xf
11-13	3	12	36
13-15	6	14	84
15-17	9	16	144
17-19	13	18	234
19-21	f	20	20f
21-23	5	22	110
23-25	4	24	96
	40+f		704 + 20f

2

$$\text{Mean} = \frac{\sum xf}{\sum f} \;\Rightarrow\; 18 = \frac{704+20f}{40+f} \;\Rightarrow\; f = 8$$ 2

OR

The following table gives production yield per hectare of wheat of 100 farms of a village :

Production yield	40-45	45-50	50-55	55-60	60-65	65-70
No. of farms	4	6	16	20	30	24

Change the distribution to a 'more than' type distribution and draw its ogive.

Ans:

Production yield	**Number of farms**
More than or equal to 40	100
More than or equal to 45	96
More than or equal to 50	90
More than or equal to 55	74
More than or equal to 60	54
More than or equal to 65	24

2

Plotting of points (40, 100) (45, 96) (50, 90) (55, 74) (60, 54) (65, 24) join to get ogive. 2

36. Find the area of the shaded region in Fig. 8, if PQ = 24 cm, PR = 7 cm and O is the centre of the circle.

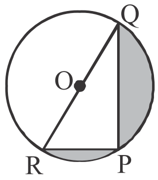


Fig. 8

Ans: $\angle P = 90°$ $RQ = \sqrt{(24)^2 + 7^2} = 25$ cm, $r = \frac{25}{2}$ cm $1\frac{1}{2}$

Area of shaded portion = Area of semi circle – ar(ΔPQR)

$$= \frac{1}{2} \times \frac{22}{7} \times \left(\frac{25}{2}\right)^2 - 84$$ 2

$= 161.54$ cm^2 1/2

OR

Find the curved surface area of the frustum of a cone, the diameters of whose circular ends are 20 m and 6 m and its height is 24 m.

Ans: R = 10 m r = 3 m h = 24 m 1/2+1/2

$l = \sqrt{(24)^2 + (10-3)^2} = 25$ m 1

CSA = $\pi(10 + 3)25 = 325\,\pi$ m^2 1+1

37. Prove that $\sqrt{5}$ is an irrational number.

Ans: Let $\sqrt{5}$ be a rational number.

$\sqrt{5} = \frac{p}{q}$, p & q are coprimes & $q \neq 0$ 1

$5q^2 = p^2 \Rightarrow 5$ divides $p^2 \Rightarrow 5$ divides p also Let p = 5a, for some integer a 1

$5q^2 = 25a^2 \Rightarrow q^2 = 5a^2 \Rightarrow 5$ divides $q^2 \Rightarrow 5$ divides q also

∴ 5 is a common factor of p, q, which is not possible as p, q are coprimes. 1

Hence assumption is wrong $\sqrt{5}$ is irrational no. 1

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

Ans: Let time taken by pipe of larger diameter to fill the tank be x hr

Let time taken by pipe of smaller diameter to fill the tank be y hr

A.T.Q

$\frac{1}{x} + \frac{1}{y} = \frac{1}{12}, \frac{4}{x} + \frac{9}{y} = \frac{1}{2}$ 1+1

Solving we get x = 20 hr y = 30 hr 1+1

39. Draw two tangents to a circle of radius 4 cm, which are inclined to each other at an angle of 60°.

Ans: Correct construction of circle of radius 4 cm **1**

Correct construction of tangents **3**

OR

Construct a triangle ABC with sides 3 cm, 4 cm and 5 cm. Now, construct another triangle whose sides are $\frac{4}{5}$ times the corresponding sides of ΔABC.

Ans: Correct construction of triangle with sides 3 cm, 4 cm & 5 cm **1**

Correct construction of similar triangle **3**

40. The angle of elevation of the top of a building from the foot of a tower is 30° and the angle of elevation of the top of a tower from the foot of the building is 60°. If the tower is 50 m high, then find the height of the building.

Ans: Correct figure **1**

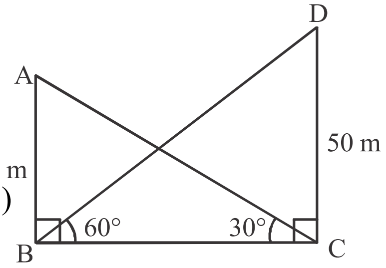
Let the height of building be h m

In rt. ΔBCD, $\tan 60° = \frac{50}{BC}$

$$\Rightarrow \quad BC = \frac{50}{\sqrt{3}} \quad \ldots \text{(i)}$$ **1**

In rt. ΔABC, $\tan 30° = \frac{h}{BC}$

$$\Rightarrow \quad \frac{1}{\sqrt{3}} = \frac{h}{50/\sqrt{3}} \quad \text{(from (i))}$$ **1**



$$\therefore \quad h = \frac{50}{3} \text{ or } 16\frac{2}{3} \text{ or } 16.67 \text{ m}$$ **1**

QUESTION PAPER CODE 30/2/3

EXPECTED ANSWER/VALUE POINTS

SECTION – A

Question numbers 1 to 10 are multiple choice questions of 1 mark each.

You have to select the correct choice :

Q.No. **Marks**

1. The point P on x-axis equidistant from the points A(–1, 0) and B(5, 0) is

(a) (2, 0) **(b)** (0, 2) **(c)** (3, 0) **(d)** (2, 2)

Ans: (a) (2, 0) 1

2. The co-ordinates of the point which is reflection of point (–3, 5) in x-axis are

(a) (3, 5) **(b)** (3, –5) **(c)** (–3, –5) **(d)** (–3, 5)

Ans: (c) (–3, –5) 1

3. If the point P (6, 2) divides the line segment joining A(6, 5) and B(4, y) in the ratio 3 : 1, then the value of y is

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

Ans: 1 mark be awarded to everyone 1

4. The sum of exponents of prime factors in the prime-factorisation of 196 is

(a) 3 **(b)** 4 **(c)** 5 **(d)** 2

Ans: (b) 4 1

5. Euclid's division Lemma states that for two positive integers a and b, there exists unique integer q and r satisfying a = bq + r, and

(a) $0 < r < b$ **(b)** $0 < r \leq b$ **(c)** $0 \leq r < b$ **(d)** $0 \leq r \leq b$

Ans: (c) $0 \leq r < b$ 1

6. The zeroes of the polynomial $x^2 - 3x - m(m + 3)$ are

(a) m, m + 3 **(b)** –m, m + 3 **(c)** m, –(m + 3) **(d)** –m, –(m + 3)

Ans: (b) –m, m + 3 1

7. The value of k for which the system of linear equations x + 2y = 3, 5x + ky + 7 = 0 is inconsistent is

(a) $-\frac{14}{3}$ **(b)** $\frac{2}{5}$ **(c)** 5 **(d)** 10

Ans: (d) 10 1

8. The roots of the quadratic equation $x^2 - 0.04 = 0$ are

(a) ± 0.2 **(b)** ± 0.02 **(c)** 0.4 **(d)** 2

Ans: (a) ± 0.2 1

9. The common difference of the A.P. $\frac{1}{p}, \frac{1-p}{p}, \frac{1-2p}{p}, \ldots$ is

(a) 1 **(b)** $\frac{1}{p}$ **(c)** –1 **(d)** $-\frac{1}{p}$

Ans: (c) –1 1

10. The n^{th} term of the A.P. a, 3a, 5a, …… is

(a) na **(b)** (2n – 1)a **(c)** (2n + 1) a **(d)** 2na

Ans: (b) (2n – 1)a **1**

In Q. Nos. 11 to 15, fill in the blanks. Each question is of 1 mark.

11. In Fig. 1, the angles of depressions from the observing positions O_1 and O_2 respectively of the object A are ______________ , _______________.

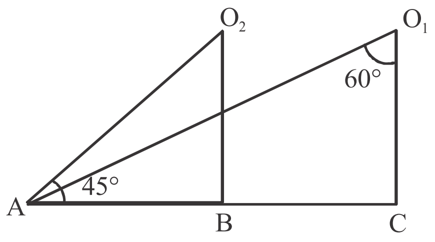


Fig. 1

Ans: 30°, 45° $\frac{1}{2}+\frac{1}{2}$

12. In ΔABC, AB = $6\sqrt{3}$ cm, AC = 12 cm and BC = 6 cm, then ∠B = _________.

Ans: 90° **1**

OR

Two triangles are similar if their corresponding sides are _________.

Ans: proportional **1**

13. In given Fig. 2, the length PB = _________ cm.

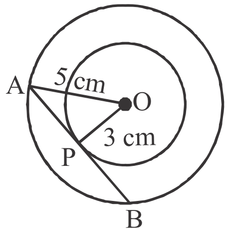


Fig. 2

Ans: 4 **1**

14. In Fig. 3, MN || BC and AM : MB = 1 : 2, then $\frac{ar(\Delta AMN)}{ar(\Delta ABC)}$ = _________.

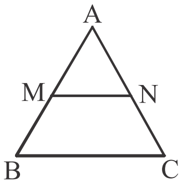


Fig. 3

Ans: $\frac{1}{9}$ **1**

15. The value of sin 32° cos 58° + cos 32° sin 58° is

Ans: 1 **1**

OR

The value of $\frac{\tan 35°}{\tan 55°} + \frac{\cot 78°}{\tan 12°}$ is ________.

Ans: 2 **1**

Q. Nos. 16 to 20 are short answer type questions of 1 mark each.

16. A die is thrown once. What is the probability of getting a prime number.

Ans: Number of prime numbers = 3 i.e. ; {2, 3, 5} **1/2**

$$P(\text{Prime Number}) = \frac{3}{6} \text{ or } \frac{1}{2}$$ **1/2**

17. If a number x is chosen at random from the numbers –3, –2, –1, 0, 1, 2, 3, then find the probability of $x^2 < 4$.

Ans: Number of Favourable outcomes = 3 i.e., {–1, 0, 1} $\therefore P(x^2 < 4) = \frac{3}{7}$ **1/2+1/2**

OR

What is the probability that a randomly taken leap year has 52 Sundays ?

Ans: $P(52 \text{ sunday}) = \frac{5}{7}$ **1**

18. If $\sin A + \sin^2 A = 1$, then find the value of the expression $(\cos^2 A + \cos^4 A)$.

Ans: $\left.\begin{array}{l}\sin A = 1 - \sin^2 A \\ \sin A = \cos^2 A\end{array}\right\}$ **1/2**

$\cos^2 A + \cos^4 A = \sin A + \sin^2 A = 1$ **1/2**

19. Find the area of the sector of a circle of radius 6 cm whose central angle is 30°. (Take $\pi = 3.14$)

Ans: $\text{Area} = 3.14 \times (6)^2 \times \frac{30°}{360°}$ **1/2**

$= 9.42 \text{ cm}^2$ **1/2**

20. Find the class marks of the classes 20 – 50 and 35 – 60.

Ans: $\frac{20+50}{2} = 35$ **1/2**

$\frac{35+60}{2} = 47.5$ **1/2**

SECTION – B

Q. Nos. 21 to 26 carry 2 marks each

21. A teacher asked 10 of his students to write a polynomial in one variable on a paper and then to handover the paper. The following were the answers given by the students:

$2x + 3$, $3x^2 + 7x + 2$, $4x^3 + 3x^2 + 2$, $x^3 + \sqrt{3x} + 7$, $7x + \sqrt{7}$, $5x^3 - 7x + 2$,

$2x^2 + 3 - \frac{5}{x}$, $5x - \frac{1}{2}$, $ax^3 + bx^2 + cx + d$, $x + \frac{1}{x}$.

Answer the following questions :

(i) How many of the above ten, are not polynomials ?

(ii) How many of the above ten, are quadratic polynomials ?

Ans: (i) 3 — 1

(ii) 1 — 1

22. A child has a die whose six faces show the letters as shown below :

$\boxed{A}\boxed{B}\boxed{C}\boxed{D}\boxed{E}\boxed{A}$

The die is thrown once. What is the probability of getting (i) A, (ii) D ?

Ans: (i) $P(A) = \frac{2}{6}$ or $\frac{1}{3}$ (ii) $P(D) = \frac{1}{6}$ — 1+1

23. In Fig. 4, ABC and DBC are two triangles on the same base BC. If AD intersects BC at O, show that

$$\frac{ar(\Delta ABC)}{ar(\Delta DBC)} = \frac{AO}{DO}$$

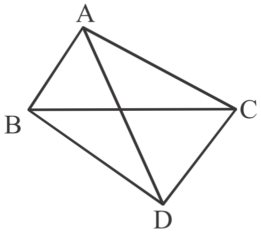
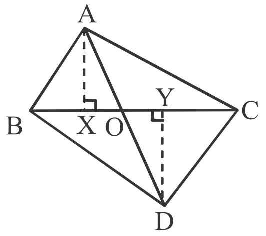


Fig. 4

Ans:



Draw AX ⊥ BC, DY ⊥ BC — 1/2

$\Delta AOX \sim \Delta DOY$

$$\frac{AX}{DY} = \frac{AO}{DO} \quad \ldots(i)$$ — 1/2

$$\frac{ar(\Delta ABC)}{ar(\Delta DBC)} = \frac{\frac{1}{2} \times BC \times AX}{\frac{1}{2} \times BC \times DY}$$ — 1/2

$$\frac{AX}{DY} = \frac{AO}{DO} \text{ (From (1))}$$ — 1/2

OR

In Fig. 5, if AD ⊥ BC, then prove that $AB^2 + CD^2 = BD^2 + AC^2$.

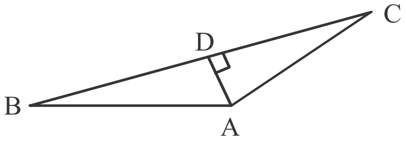


Fig. 5

Ans: In rt ΔABD $\quad AB^2 = BD^2 + AD^2 \quad \ldots$ (i) — 1/2

In rt ΔADC $\quad CD^2 = AC^2 - AD^2 \quad \ldots$ (ii) — 1/2

Adding (i) & (ii)

$AB^2 + CD^2 = BD^2 + AC^2$ — 1

24. Prove that $1+\dfrac{\cot^2\alpha}{1+\operatorname{cosec}\alpha}=\operatorname{cosec}\alpha$

Ans: L.H.S = $1+\dfrac{\operatorname{cosec}^2\alpha-1}{1+\operatorname{cosec}\alpha}$ **1/2**

$= 1+\dfrac{(\operatorname{cosec}\alpha-1)(\operatorname{cosec}\alpha+1)}{\operatorname{cosec}\alpha+1}$ **1**

= cosec α = R.H.S **1/2**

OR

Show that $\tan^4\theta + \tan^2\theta = \sec^4\theta - \sec^2\theta$

Ans: L.H.S = $\tan^4\theta + \tan^2\theta$

$= \tan^2\theta\,(\tan^2\theta + 1)$ **1/2**

$= (\sec^2\theta - 1)\,(\sec^2\theta) = \sec^4\theta - \sec^2\theta$ = R.H.S **1+1/2**

25. Find the mode of the following frequency distribution :

Class	15-20	20-25	25-30	30-35	35-40	40-45
Frequency	3	8	9	10	3	2

Ans: Modal class = 30-35, $l = 30$, $f_0 = 9$, $f_1 = 10$, $f_2 = 3$, $h = 5$ **1/2**

Mode = $30+\left(\dfrac{10-9}{2\times10-9-3}\right)\times5$ **1**

$= 30.625$ or 30.62 or 30.63 **1/2**

26. From a solid right circular cylinder of height 14 cm and base radius 6 cm, a right circular cone of same height and same base radius is removed. Find the volume of the remaining solid.

Ans: Volume of remaining solid = $\pi(6)^2 \times 14 - \dfrac{1}{3}\pi(6)^2 \times 14$ **1**

$= 336\,\pi\ \text{cm}^3$ or $1056\ \text{cm}^3$ **1**

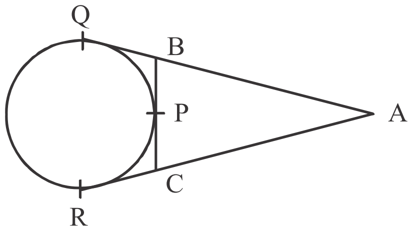
SECTION – C

Question numbers 27 to 34 carry 3 marks each.

27. If a circle touches the side BC of a triangle ABC at P and extended sides AB and AC at Q and R, respectively, prove that

$AQ = \dfrac{1}{2}(BC + CA + AB)$

Ans: Correct Fig **1/2**



$$AQ = \frac{1}{2}(2AQ)$$ **1/2**

$$= \frac{1}{2}(AQ + AQ)$$

$$= \frac{1}{2}(AQ + AR)$$

$$= \frac{1}{2}(AB + BQ + AC + CR)$$ **1**

$$= \frac{1}{2}(AB + BC + CA)$$ **1**

$\because$ [BQ = BP, CR = CP]

28. The area of a circular play ground is 22176 cm^2. Find the cost of fencing this ground at the rate of ₹ 50 per metre.

Ans: Let the radius of playground be r cm

$\pi r^2 = 22176$ cm^2 **1**

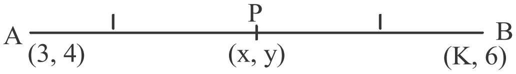
r = 84 cm

Circumference = $2\pi r = 2 \times \frac{22}{7} \times 84 = 528$ cm **1**

Cost of fencing = $\frac{50}{100} \times 528$ = ₹ 264 **1**

29. If the mid-point of the line segment joining the points A(3, 4) and B(k, 6) is P (x, y) and x + y – 10 = 0, find the value of k.

Ans:



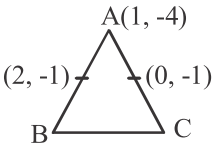
$x = \frac{3+k}{2}$ $y = 5$ **1/2+1/2**

$x + y - 10 = 0 \Rightarrow \frac{3+k}{2} + 5 - 10 = 0$ **1**

$\Rightarrow k = 7$ **1**

OR

Find the area of triangle ABC with A (1, –4) and the mid-points of sides through A being (2, –1) and (0, –1).



Ans: B(3, 2), C(–1, 2) **1/2+1/2**

Area = $\frac{1}{2}\left|1(2-2)+3(2+4)-1(-4-2)\right| = 12$ sq.units **1+1**

30. In Fig. 6, if ΔABC ~ ΔDEF and their sides of lengths (in cm) are marked along them, then find the lengths of sides of each triangle.

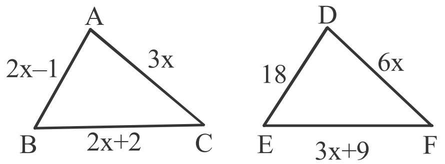


Fig. 6

Ans: As ΔABC ~ ΔDEF

$$\frac{2x-1}{18} = \frac{3x}{6x}$$ **1**

$$x = 5$$ **1**

AB = 9 cm   DE = 18 cm

BC = 12 cm   EF = 24 cm   **1/2+1/2**

CA = 15 cm   FD = 30 cm

31. If 2x + y = 23 and 4x – y = 19, find the value of (5y – 2x) and $\left(\frac{y}{x} - 2\right)$

Ans: $2x + y = 23$, $4x - y = 19$

Solving, we get $x = 7$, $y = 9$ **1+1**

$5y - 2x = 31$, $\frac{y}{x} - 2 = \frac{-5}{7}$ **1/2+1/2**

OR

Solve for x : $\frac{1}{x+4} - \frac{1}{x+7} = \frac{11}{30}$, x # –4, 7

Ans: $\frac{1}{x+4} - \frac{1}{x-7} = \frac{11}{30} \Rightarrow \frac{-11}{(x+4)(x-7)} = \frac{11}{30}$ **1**

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

$\Rightarrow (x-2)(x-1) = 0$ **1/2**

$\Rightarrow x = 2, 1$ **1/2**

The Following solution should also be accepted

$\frac{1}{x+4} - \frac{1}{x+7} = \frac{11}{30} \Rightarrow \frac{x+7-x-4}{(x+4)(x-7)} = \frac{11}{30}$ **1**

$\Rightarrow 11\,x^2 + 121x + 218 = 0$ **$1\frac{1}{2}$**

Here, D = 5049

$x = \frac{-121 \pm \sqrt{5049}}{22}$ **1/2**

32.	Which term of the A.P. $20, 19\frac{1}{4}, 18\frac{1}{2}, 17\frac{3}{4} \ldots$ is the first negative term.	
	Ans: $a = 20$ & $d = 19\frac{1}{4} - 20 = -\frac{3}{4}$	1/2
	$a_n < 0$	1/2
	$20+(n-1)\left(-\frac{3}{4}\right) < 0$	1
	$n > 27\frac{2}{3}$	1/2
	∴ 28^{th} term of the given A. P. is first negative term	1/2
	OR	
	Find the middle term of the A.P. 7, 13, 19, …., 247.	
	Ans: $a = 7$ & $d = 13 - 7 = 6$	1/2
	$247 = 7 + (n-1)6$	1
	$n = 41$	1/2
	Middle term $= \left(\frac{41+1}{2}\right)^{th} = 21^{st}$ term.	1/2
	$a_{21} = 7 + 20 \times 6 = 127$	1/2
33.	Water in a canal, 6 m wide and 1.5 m deep, is flowing with a speed of 10 km/h. How much area will it irrigate in 30 minutes, if 8 cm standing water is required ?	
	Ans: Volume of water in canal in 1 hr = $10000 \times 6 \times 1.5 = 90000\ m^3$	1
	Volume of water in canal in 30 mins = $\frac{1}{2} \times 90000 = 45000\ m^3$	1/2
	Area = $\frac{45000}{8/100}$	1
	$= 562500\ m^2$	1/2
34.	Show that :	
	$\frac{\cos^2(45°+\theta)+\cos^2(45°-\theta)}{\tan(60°+\theta)\tan(30°-\theta)} = 1$	
	Ans: L.H.S = $\frac{\cos^2(45°+\theta)+\sin^2(90°-45°+\theta)}{\tan(60°+\theta)\cdot\cot(90°-30°+\theta)}$	1
	$= \frac{\cos^2(45°+\theta)+\sin^2(45°+\theta)}{\tan(60°+\theta)\cdot\cot(60°+\theta)}$	1
	$= \frac{1}{1} = 1 = \text{R.H.S}$	1

SECTION – D

Question numbers 35 to 40 carry 4 marks each.

35. The mean of the following frequency distribution is 18. The frequency f in the class interval 19 – 21 is missing. Determine f.

Class interval	11 – 13	13 – 15	15 – 17	17 – 19	19 – 21	21 – 23	23 – 25
Frequency	3	6	9	13	f	5	4

Ans:

C.I	f	x	xf
11-13	3	12	36
13-15	6	14	84
15-17	9	16	144
17-19	13	18	234
19-21	f	20	20f
21-23	5	22	110
23-25	4	24	96
	40 + f		704 + 20f

2

$$\text{Mean} = \frac{\sum xf}{\sum f} \Rightarrow 18 = \frac{704+20f}{40+f} \Rightarrow f = 8$$ 2

OR

The following table gives production yield per hectare of wheat of 100 farms of a village :

Production yield	40-45	45-50	50-55	55-60	60-65	65-70
No. of farms	4	6	16	20	30	24

Change the distribution to a 'more than' type distribution and draw its ogive.

Ans:

Production yield	**Number of farms**
More than or equal to 40	100
More than or equal to 45	96
More than or equal to 50	90
More than or equal to 55	74
More than or equal to 60	54
More than or equal to 65	24

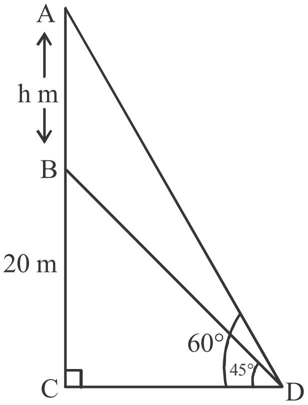
2

Plotting of points (40, 100) (45, 96) (50, 90) (55, 74) (60, 54) (65, 24) join to get ogive. 2

36. From a point on the ground, the angles of elevation of the bottom and the top of a tower fixed at the top of a 20 m high building are 45° and 60° respectively. Find the height of the tower.

Ans: Let height of tower = h m

In rt. ΔBCD $\tan 45° = \frac{BC}{CD}$



corr fig. 1

$$\left.\begin{aligned} 1 &= \frac{20}{CD} \\ CD &= 20 \text{ m} \end{aligned}\right\}$$ 1

In rt. ΔACD $\tan 60° = \frac{AC}{CD}$

$$\sqrt{3} = \frac{20+h}{20}$$ 1

$$h = 20\left(\sqrt{3}-1\right)\text{m}$$ 1

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

Ans: Let time taken by pipe of larger diameter to fill the tank be x hr

Let time taken by pipe of smaller diameter to fill the tank be y hr

A.T.Q

$$\frac{1}{x}+\frac{1}{y}=\frac{1}{12}, \frac{4}{x}+\frac{9}{y}=\frac{1}{2}$$ 1+1

Solving we get x = 20 hr y = 30 hr 1+1

38. Prove that $\sqrt{5}$ is an irrational number.

Ans: Let $\sqrt{5}$ be a rational number.

$\sqrt{5}=\frac{p}{q}$, p & q are coprimes & $q \neq 0$ 1

$5q^2 = p^2 \Rightarrow 5$ divides $p^2 \Rightarrow 5$ divides p also Let p = 5a, for some integer a 1

$5q^2 = 25a^2 \Rightarrow q^2 = 5a^2 \Rightarrow 5$ divides $q^2 \Rightarrow 5$ divides q also

$\therefore$ 5 is a common factor of p, q, which is not possible as p, q are coprimes. 1

Hence assumption is wrong $\sqrt{5}$ is irrational no. 1

39. Draw a circle of radius 3.5 cm. From a point P, 6 cm from its centre, draw two tangents to the circle.

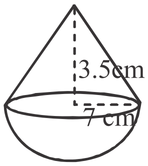
Ans: Correct construction of circle of radius 3.5 cm 1

Correct construction of tangents. 3

OR

Construct a ΔABC with AB = 6 cm, BC = 5 cm and $\angle B = 60°$.

Now construct another triangle whose sides are $\frac{2}{3}$ times the corresponding sides of ΔABC.

	Ans: Correct construction of given triangle	1
	Construction of Similar triangle	3
40.	A solid is in the shape of a hemisphere surmounted by a cone. If the radius of hemisphere and base radius of cone is 7 cm and height of cone is 3.5 cm, find the volume of the solid. $\left(\text{Take } \pi = \frac{22}{7}\right)$	
	Ans: Volume of solid $= \frac{1}{3} \times \frac{22}{7} \times (7)^2 \times 3.5 + \frac{2}{3} \times \frac{22}{7} \times (7)^3$	2
	$= \frac{22}{7} \times (7)^2 \times \left[\frac{3.5}{3} + \frac{2}{3} \times 7\right]$ 	1
	$= 898\frac{1}{3}$ or 898.33 cm^3	1