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Secondary School Examination-2020

Marking Scheme - Mathematics 30/1/1, 30/1/2, 30/1/3

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 __________(example 0-100 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 30/1/1

EXPECTED ANSWER/VALUE POINTS

SECTION – A

Q. No. 1 to 10 are multiple choice type question of 1 mark each.
Select the correct option.

Q.No.		Marks
1.	If one of the zeroes of the quadratic polynomial $x^2 + 3x + k$ is 2, then the value of k is **(a)** 10 **(b)** –10 **(c)** –7 **(d)** –2 **Ans:** (b) –10	1
2.	The total number of factors of a prime number is **(a)** 1 **(b)** 0 **(c)** 2 **(d)** 3 **Ans:** (c) 2	1
3.	The quadratic polynomial, the sum of whose zeroes is –5 and their product is 6, is **(a)** $x^2 + 5x + 6$ **(b)** $x^2 - 5x + 6$ **(c)** $x^2 - 5x - 6$ **(d)** $-x^2 + 5x + 6$ **Ans:** (a) $x^2 + 5x + 6$	1
4.	The value of k for which the system of equations $x + y - 4 = 0$ and $2x + ky = 3$ has no solution, is **(a)** –2 **(b)** $\neq 2$ **(c)** 3 **(d)** 2 **Ans:** (d) 2	1
5.	The HCF and the LCM of 12, 21, 15 respectively are **(a)** 3,140 **(b)** 12,420 **(c)** 3,420 **(d)** 420,3 **Ans:** (c) 3,420	1
6.	The value of x for which 2x,(x + 10) and (3x + 2) are the three consecutive terms of an AP, is **(a)** 6 **(b)** –6 **(c)** 18 **(d)** –18 **Ans:** (a) 6	1
7.	The first term of an AP is p and the common difference is q, then its 10^{th} term is **(a)** q + 9p **(b)** p – 9q **(c)** p + 9q **(d)** 2p + 9q **Ans:** (c) p + 9q	1
8.	The distance between the points $(a \cos\theta + b \sin\theta, 0)$ and $(0, a \sin\theta - b \cos\theta)$, is **(a)** $a^2 + b^2$ **(b)** $a^2 - b^2$ **(c)** $\sqrt{a^2+b^2}$ **(d)** $\sqrt{a^2-b^2}$ **Ans:** (c) $\sqrt{a^2+b^2}$	1
9.	If the point P(k, 0) divides the line segment joining the points A(2, –2) and B(–7, 4) in the ratio 1 : 2, then the value of k is, **(a)** 1 **(b)** 2 **(c)** –2 **(d)** –1 **Ans:** (d) –1	1
10.	The value of p, for which the points A(3, 1), B(5, p) and C(7, –5) are collinear, is **(a)** –2 **(b)** 2 **(c)** –1 **(d)** 1 **Ans:** (a) –2	1

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

11. In Fig. 1, ΔABC is circumscribing a circle, the length of BC is _______cm.

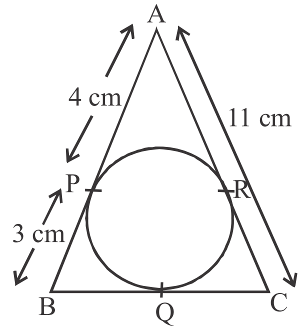


Fig. 1

Ans: 10 — **1**

12. Given $\Delta ABC \sim \Delta PQR$, if $\frac{AB}{PQ} = \frac{1}{3}$, then $\frac{ar(\Delta ABC)}{ar(\Delta PQR)} =$ __________.

Ans: $\frac{1}{9}$ — **1**

13. ABC is an equilateral triangle of side 2a, then length of one of its altitude is _______.

Ans: $\sqrt{3}$ a — **1**

14. $\frac{\cos 80°}{\sin 10°} + \cos 59° \operatorname{cosec} 31° =$ _______.

Ans: 2 — **1**

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

Ans: 1 — **1**

OR

The value of $(1 + \tan^2\theta)(1 - \sin\theta)(1 + \sin\theta) =$_______.

Ans: 1 — **1**

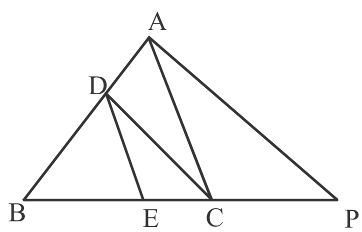
Q. Nos. 16 to 20 are short answer type questions of 1 mark each.

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

Ans: $\tan\theta = \frac{1}{\sqrt{3}} \Rightarrow \theta = 30°$ — **1/2+1/2**

17. Two cones have their heights in the ratio 1:3 and radii in the ratio 3:1. What is the ratio of their volumes?

Ans: $\frac{r_1}{r_2} = \frac{3}{1}, \frac{h_1}{h_2} = \frac{1}{3}$ — **1/2**

	$\therefore$ Ratio of volumes $= \dfrac{\frac{1}{3}\pi r_1^2 h_1}{\frac{1}{3}\pi r_2^2 h_2} = 3:1$	1/2
18.	A letter of English alphabet is chosen at random. What is the probability that the chosen letter is a consonant.	
	Ans: P (consonant) $= \dfrac{21}{26}$	1
19.	A die is thrown once. What is the probability of getting a number less than 3?	
	Ans: P (number less than 3) $= \dfrac{2}{6}$ or $\dfrac{1}{3}$	1
	OR	
	If the probability of winning a game is 0.07, what is the probability of losing it?	
	Ans: P (losing) = 1 – 0.07	1/2
	= 0.93	1/2
20.	If the mean of first n natural number is 15, then find n.	
	Ans: $\dfrac{\frac{n(n+1)}{2}}{n} = 15$	1/2
	$\therefore$ n = 29	1/2
	SECTION – B	
	Q. Nos. 21 to 26 carry 2 marks each.	
21.	Show that $(a-b)^2$, (a^2+b^2) and $(a+b)^2$ are in AP.	
	Ans: $(a^2+b^2)-(a-b)^2 = 2ab$	1
	$(a+b)^2-(a^2+b^2) = 2ab$	1
	Common difference is same. $\therefore$ given terms are in AP	
22.	In Fig. 2 DE||AC and DC||AP. Prove that $\dfrac{BE}{EC} = \dfrac{BC}{CP}$.	
	 Fig 2	
	Ans: In ΔABC, DE || AC, $\therefore \dfrac{BD}{DA} = \dfrac{BE}{EC}$ ... (i)	1
	In ΔABP, DC || AP, $\therefore \dfrac{BD}{DA} = \dfrac{BC}{CP}$ ... (ii)	1/2
	From (i) & (ii), $\dfrac{BE}{EC} = \dfrac{BC}{CP}$	1/2

OR

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

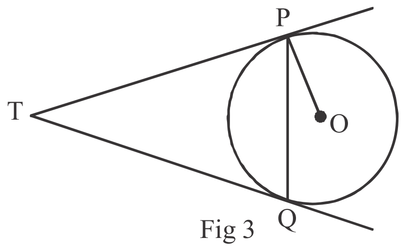


Fig 3

Ans: Let $\angle OPQ = \theta$

$\therefore \angle TPQ = \angle TQP = 90° - \theta$ 1/2

In ΔTPQ, $2(90° - \theta) + \angle PTQ = 180°$ 1

$\therefore \angle PTQ = 2\theta$ 1/2

$= 2\angle OPQ$

23. The rod AC of a TV disc antenna is fixed at right angle to the wall AB and a rod CD is supporting the disc as shown in Fig. 4. If AC = 1.5m long and CD = 3m, find (i) $\tan\theta$ (ii) $\sec\theta + \text{cosec}\theta$.

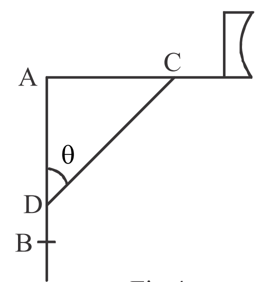


Fig 4

Ans: $\dfrac{AC}{CD} = \sin\theta \Rightarrow \sin\theta = \dfrac{1}{2} \Rightarrow \theta = 30°$ 1/2

(i) $\tan\theta = \tan 30° = \dfrac{1}{\sqrt{3}}$ 1/2

(ii) $\sec\theta + \text{cosec}\theta = \sec 30° + \text{cos ec}30°$

$= \dfrac{2}{\sqrt{3}} + 2 \text{ or } \dfrac{2(3+\sqrt{3})}{3}$ 1

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

$\left(Use\ \pi = \dfrac{22}{7}\right)$

Ans: $2 \times \dfrac{22}{7} \times r \times \dfrac{60°}{360°} = 22$ 1

$\therefore r = 21$ cm 1

25. If a number x is chosen at random from the numbers –3, –2, –1, 0, 1, 2, 3. What is the probability that $x^2 \le 4$?

Ans: Total number of outcomes = 7

Favourable outcomes are –2, –1, 0, 1, 2, i.e., 5 1

$\therefore \quad P(x^2 \le 4) = \dfrac{5}{7}$ 1

26.	Find the mean of the following distribution:	

Class:	3-5	5-7	7-9	9-11	11-13
Frequency:	5	10	10	7	8

Ans:

Classes	x_i	f_i	$f_x x_i$
3 – 5	4	5	20
5 – 7	6	10	60
7 – 9	8	10	80
9 – 11	10	7	70
11 – 13	12	8	96
Total		40	326

1½

$$\bar{x} = \frac{\sum f_i x_i}{\sum f_i} = \frac{326}{40} = 8.15$$

1/2

OR

Find the mode of the following data:

Class:	0-20	20-40	40-60	60-80	80-100	110-120	120-140
Frequency:	6	8	10	12	6	5	3

Ans: Modal class : 60 – 80 1/2

$$\text{Mode} = \ell + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times h = 60 + \frac{12 - 10}{24 - 10 - 6} \times 20$$ 1

$= 60 + 5 = 65$ 1/2

SECTION – C

Question numbers 27 to 34 carry 3 marks each.

27. Find the quadratic polynomial whose zeroes are reciprocal of the zeroes of the polynomial $f(x) = ax^2 + bx + c$, $a \neq 0$, $c \neq 0$.

Ans: $f(x) = ax^2 + bx + c$

$$\alpha + \beta = -\frac{b}{a}, \ \alpha\beta = \frac{c}{a}$$ 1/2

$$\text{New sum of zeroes} = \frac{1}{\alpha} + \frac{1}{\beta} = -\frac{b}{c}$$ 1

$$\text{New product of zeroes} = \frac{1}{\alpha} \times \frac{1}{\beta} = \frac{a}{c}$$ 1

$\therefore$ Required quardratic polynomial = $x^2 + \frac{b}{c}x + \frac{a}{c}$ or $\left(cx^2 + bx + a\right)$ 1/2

OR

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

Ans:

$$-x^2 + x - 1 \overline{\big)\, -x^3 + 3x^2 - 3x + 5 \,\big(}\; x - 2$$
$$-x^3 + x^2 - x$$
$$+ \quad - \quad +$$
$$\overline{\quad 2x^2 - 2x + 5 \quad}$$
$$2x^2 - 2x + 2$$
$$- \quad + \quad -$$
$$\overline{\quad\quad 3 \quad\quad}$$

2

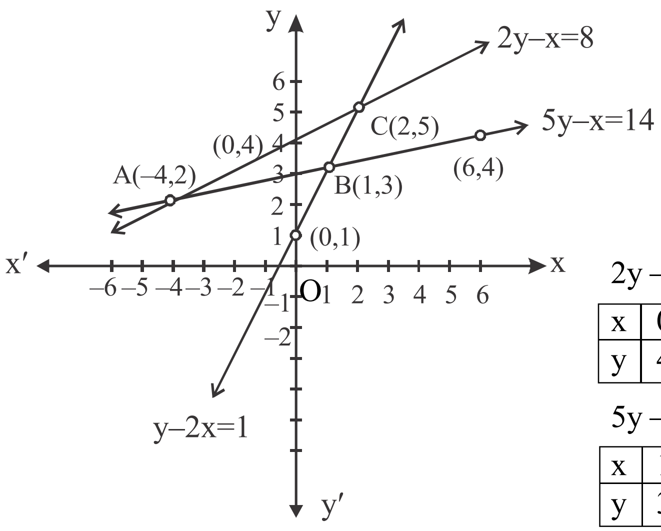
Divisor × Quotient + Remainder

$= (-x^2 + x - 1)(x - 2) + 3$

$= -x^3 + 3x^2 - 3x + 5 = \text{Dividend}$ 1

28. Determine graphically the coordinates of the vertices of a triangle, the equations of whose sides are given by $2y - x = 8$, $5y - x = 14$ and $y - 2x = 1$.

Ans:



$2y - x = 8$

x	0	2	–4
y	4	5	2

$5y - x = 14$

x	1	6	–4
y	3	4	2

$y - 2x = 1$

x	1	2	0
y	3	5	1

Drawing 3 lines $1\frac{1}{2}$

Coordinates of the vertices of the triangle are A(–4, 2),

B(1, 3) and C(2, 5) $1\frac{1}{2}$

OR

If 4 is the zero of the cubic polynomial $x^3 - 3x^2 - 10x + 24$, find its other two zeroes.

Ans: $x - 4$ is a factor of given polynomial.

$$x - 4 \,\big)\, x^3 - 3x^2 - 10x + 24 \,\big(\, x^2 + x - 6$$
$$\underline{\;x^3 - 4x^2\;}$$
$$\quad - \quad +$$
$$x^2 - 10x + 24$$
$$\underline{\;x^2 - 4x\;}$$
$$\quad - \quad +$$
$$-6x + 24$$
$$\underline{\;-6x + 24\;}$$
$$\quad + \quad -$$
$$0$$

2

$x^2 + x - 6 = (x + 3)(x - 2)$

$\therefore$ Other than zeroes are –3 and 2. **1**

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

Ans: Let the speed of aircraft be x km/hr

$$\therefore \frac{600}{x - 200} - \frac{600}{x} = \frac{30}{60}$$ **1**

$$\Rightarrow x^2 - 200x - 240000 = 0$$ **1**

$(x - 600)(x + 400) = 0$

$x = 600, -400$ (Rejected) **1/2**

Speed of aircraft = 600 km/hr

$\therefore$ Duration of flight = 1 hr **1/2**

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

Ans: $\text{ar}(PQR) = \frac{1}{2}\left[-5(-5-5) - 4(5-7) + 4(7+5)\right]$ sq. units **2**

$= \frac{1}{2}[50 + 8 + 48]$ sq. units

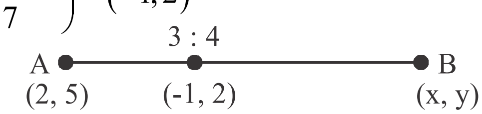
$= 53$ sq. units **1**

OR

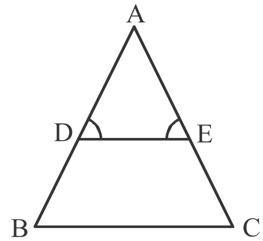
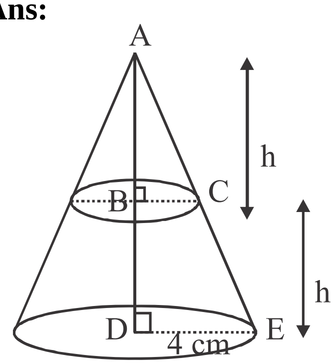
If the point C(–1, 2) divides internally the line segment joining A(2, 5) and B(x, y) in the ratio 3 : 4, find the coordinates of B.

Ans: Coordinates of C arc $\left(\frac{3x+8}{7}, \frac{3y+20}{7}\right) = (-1, 2)$ **$1\frac{1}{2}$**

$\Rightarrow x = -5, y = -2$ **1**



$\therefore$ Coordinates of B are (–5, –2) **1/2**

31.	In Fig.5, $\angle D = \angle E$ and $\frac{AD}{DB} = \frac{AE}{EC}$, prove that BAC is an isosceles triangle.  Fig 5	
	Ans: $\angle D = \angle E \Rightarrow AE = AD$	1
	$\therefore \frac{AD}{DB} = \frac{AE}{EC} \Rightarrow DB = EC$	1/2
	$\Rightarrow AD + DB = AE + EC$	1
	$\therefore AB = AC$	1/2
	Hence ΔBAC is an isosceles triangle.	
32.	In a triangle, if square of one side is equal to the sum of the squares of the other two sides, then prove that the angle opposite to the first side is a right angle.	
	Ans: For correct given, To prove, construction and figure.	$1\frac{1}{2}$
	For correct proof.	$1\frac{1}{2}$
33.	If $\sin\theta + \cos\theta = \sqrt{3}$, then prove that $\tan\theta + \cot\theta = 1$.	
	Ans: $\sin\theta + \cos\theta = \sqrt{3} \Rightarrow (\sin\theta + \cos\theta)^2 = \left(\sqrt{3}\right)^2$	1
	$\sin^2\theta + \cos^2\theta + 2\sin\theta\cos\theta = 3 \Rightarrow \sin\theta\cos\theta = 1$	1
	$\text{L.H.S} = \tan\theta + \cot\theta = \frac{\sin\theta}{\cos\theta} + \frac{\cos\theta}{\sin\theta} = \frac{1}{\cos\theta\sin\theta} = 1 = \text{R.H.S}$	1
34.	A cone of base radius 4 cm is divided into two parts by drawing a plane through the mid-point of its height and parallel to its base. Compare the volume of the two parts.	
	Ans:  $\Delta ABC \sim \Delta ADE$, $\frac{h}{2h} = \frac{BC}{4}$	cor. fig 1/2
	$\therefore BC = 2$ cm	1
	Ratio of volumes of two parts	
	$= \dfrac{\frac{1}{3}\pi \times 2^2 \times h}{\frac{1}{3}\pi \times (2^2 + 4^2 + 2\times 4) \times h}$	1
	$= \frac{4}{28} = \frac{1}{7}$ or 1 : 7 (accept 7 : 1 also)	1/2

	SECTION – D	
	Question numbers 35 to 40 carry 4 marks each.	
35.	Show that the square of any positive integer cannot be of form (5q + 2) or (5q +3) for any integer q.	
	Ans: Let a be any positive integer. Take b = 5 as the divisor.	
	$\therefore$ a = 5m + r , r = 0,1,2,3,4	1
	Case-1 : $a = 5m \Rightarrow a^2 = 25m^2 = 5(5m^2) = 5q$	1/2
	Case-2 : $a = 5m+1 \Rightarrow a^2 = 5(5m^2 + 2m) + 1 = 5q + 1$	for
	Case-3 : $a = 5m+2 \Rightarrow a^2 = 5(5m^2 + 4m) + 4 = 5q + 4$	each
	Case-4 : $a = 5m+3 \Rightarrow a^2 = 5(5m^2 + 6m + 1) + 4 = 5q + 4$	case
	Case-5 : $a = 5m+4 \Rightarrow a^2 = 5(5m^2 + 8m + 3) + 1 = 5q + 1$	$= 2\frac{1}{2}$
	Hence square of any positive integer cannot be of the form (5q + 2) or (5q + 3) for any integer q.	1/2
	OR	
	Prove that one of every three consecutive positive integers is divisible by 3.	
	Ans: Let n be any positive integer. Divide it by 3.	
	$\therefore$ n = 3q + r, r = 0, 1, 2	1
	Case-1 : n = 3q (divisible by 3)	
	n + 1 = 3q + 1, n + 2 = 3q + 2	1 for
	Case-2 : $n = 3q + 1 \Rightarrow n + 1 = 3q + 2, n + 2 = 3q + 3$ (divisible by 3)	each
	Case-3 : $n = 3q + 2 \Rightarrow n + 1 = 3q + 3$ (divisible by 3), n + 2 = 3q + 4	case = 3
36.	The sum of four consecutive numbers in AP is 32 and the ratio of product of the first and last terms to the product of two middle terms is 7:15. Find the numbers.	
	Ans: Let four consecutive number be a – 3d, a – d, a + d, a + 3d	1/2
	Sum = 32 $\therefore$ $4a = 32 \Rightarrow a = 8$	1/2
	$\frac{(a-3d)(a+3d)}{(a-d)(a+d)} = \frac{7}{15} \Rightarrow 15(64-9d^2) = 7(64-d^2)$	1
	$\therefore d^2 = 4 \Rightarrow d = \pm 2$	1
	Four numbers are 2, 6, 10, 14.	1
	OR	
	Solve: 1+ 4 + 7 + 10 +…+ x = 287	
	Ans: $x = a_n = 1 + 3n - 3 = 3n - 2$	1
	$S_n = 287 \Rightarrow \frac{n}{2}[1 + 3n - 2] = 287$	1
	$\therefore 3n^2 - n - 574 = 0$	1/2
	$(n-14)(3n+41) = 0 \Rightarrow n = 14$	1
	$\therefore$ x = 3n – 2 = 40	1/2

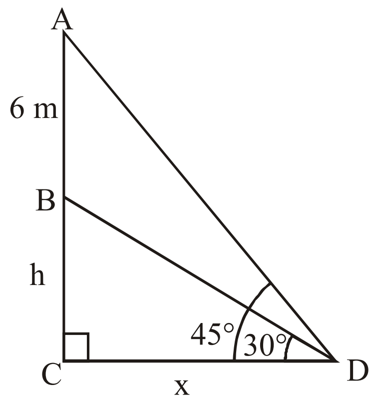
37. Draw a line segment AB of length 7 cm. Taking A as centre, draw a circle of radius 3 cm and taking B as centre, draw another circle of radius 2 cm. Construct tangents to each circle from the centre of the other circle.

Ans: Constructing the circles of radii 3 cm and 2 cm. **1**

Constructing the tangents. **3**

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

Ans: **cor. fig 1**



$\frac{h}{x} = \tan 30°$ **1**

$\Rightarrow x = h\sqrt{3}$

$\frac{6+h}{x} = \tan 45° \Rightarrow 6 + h = x$ **1**

$\therefore h = \frac{6}{\sqrt{3}-1} = 3(\sqrt{3}+1) = 3 \times 2.73$ m

= 8.19 m **1**

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

Ans: Capacity of bucket $= \frac{1}{3}\pi h\left(r_1^2 + r_2^2 + r_1 r_2\right)$

$= \frac{1}{3} \times \frac{22}{7} \times 30\left(10^2 + 20^2 + 10 \times 20\right) cm^3$ **1**

= 22000 cm^3 **$1\frac{1}{2}$**

= 22*l* **1/2**

Cost of milk = ₹ 40 × 22 = ₹ 880 **1**

40. The following table gives production yield per hectare (in quintals) of wheat of 100 farms of a village:

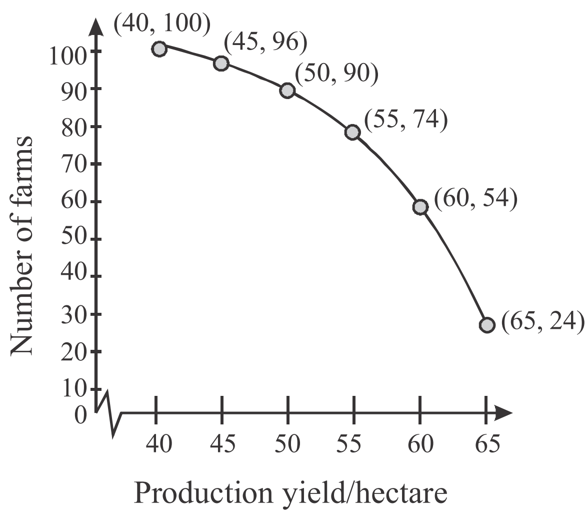
Production yield/hect.	40-45	45-50	50-55	55-60	60-65	65-70
No. of farms	4	6	16	20	30	24

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

Ans:

Production yield/hectare	No. of forms
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
Total	

2



2

OR

The median of the following data is 525. Find the values of x and y, if total frequency is 100:

Class :	0-100	100-200	200-300	300-400	400-500	500-600	600-700	700-800	800-900	900-1000
Frequency:	2	5	x	12	17	20	y	9	7	4

Ans:

Classes	Frequency	Cumulative frequency
0-100	2	2
100-200	5	7
200-300	x	7 + x
300-400	12	19 + x
400-500	17	36 + x
500-600	20	56 + x → Median class
600-700	y	56 + x + y
700-800	9	65 + x+ y
800-900	7	72 + x+ y
900-1000	4	76 + x+ y
Total	100	

2

$76 + x + y = 100 \Rightarrow x + y = 24$ ... (i) **1/2**

500 – 600 is the median class

Median = $\ell + \dfrac{\frac{n}{2} - cf}{f} \times h$

$\Rightarrow 525 = 500 + \dfrac{50 - 36 - x}{20} \times 100$

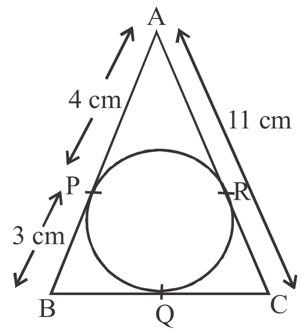
Solving we get, x = 9 **1**

From (i), y = 15 **1/2**

QUESTION PAPER CODE 30/1/2
EXPECTED ANSWER/VALUE POINTS
SECTION – A

Q. NO. 1 to 10 are multiple choice type question of 1 mark each. Select the correct option.

Q.No.		Marks
1.	The HCF and the LCM of 12, 21, 15 respectively are **(a)** 3,140 **(b)** 12,420 **(c)** 3,420 **(d)** 420,3 **Ans:** (c) 3,420	1
2.	The value of x for which 2x,(x + 10) and (3x + 2) are the three consecutive terms of an AP, is **(a)** 6 **(b)** –6 **(c)** 18 **(d)** –18 **Ans:** (a) 6	1
3.	The value of k for which the system of equations $x + y - 4 = 0$ and $2x + ky = 3$ has no solution, is **(a)** –2 **(b)** $\neq 2$ **(c)** 3 **(d)** 2 **Ans:** (d) 2	1
4.	The first term of an AP is p and the common difference is q, then its 10th term is **(a)** $q + 9p$ **(b)** $p - 9q$ **(c)** $p + 9q$ **(d)** $2p + 9q$ **Ans:** (c) $p + 9q$	1
5.	The quadratic polynomial, the sum of whose zeroes is –5 and their product is 6, is **(a)** $x^2 + 5x + 6$ **(b)** $x^2 - 5x + 6$ **(c)** $x^2 - 5x - 6$ **(d)** $-x^2 + 5x + 6$ **Ans:** (a) $x^2 + 5x + 6$	1
6.	The distance between the points $(a \cos \theta + b \sin \theta, 0)$ and $(0, a \sin \theta - b \cos \theta)$, is **(a)** $a^2 + b^2$ **(b)** $a^2 - b^2$ **(c)** $\sqrt{a^2+b^2}$ **(d)** $\sqrt{a^2-b^2}$ **Ans:** (c) $\sqrt{a^2+b^2}$	1
7.	The total number of factors of a prime number is **(a)** 1 **(b)** 0 **(c)** 2 **(d)** 3 **Ans:** (c) 2	1
8.	If the point P(k, 0) divides the line segment joining the points A(2, –2) and B(–7, 4) in the ratio 1 : 2, then the value of k is, **(a)** 1 **(b)** 2 **(c)** –2 **(d)** –1 **Ans:** (d) –1	1
9.	The value of p, for which the points A(3, 1), B(5, p) and C(7, –5) are collinear, is **(a)** –2 **(b)** 2 **(c)** –1 **(d)** 1 **Ans:** (a) –2	1
10.	If one of the zeroes of the quadratic polynomial $x^2 + 3x + k$ is 2, then the value of k is **(a)** 10 **(b)** –10 **(c)** –7 **(d)** –2 **Ans:** (b) –10	1

	In Q. Nos. 11 to 15, fill in the blanks. Each question is of 1 mark.	
11.	ABC is an equilateral triangle of side 2a, then length of one of its altitude is _______.	
	Ans: $\sqrt{3}$ a	1
12.	In Fig. 1, ΔABC is circumscribing a circle, the length of BC is _______cm.  Fig. 1	
	Ans: 10	1
13.	The value of $\left(\sin^2\theta + \frac{1}{1+\tan^2\theta}\right) =$ _________.	
	Ans: 1	1
	OR	
	The value of $(1 + \tan^2\theta)\ (1 - \sin\theta)\ (1 + \sin\theta) =$_______.	
	Ans: 1	1
14.	$\left(\frac{\sin 35°}{\cos 55°}\right)^2 + \left(\frac{\cos 43°}{\sin 47°}\right)^2 - 2\cos 60° =$ _____________.	
	Ans: 1	1
15.	ABC and BDE are two equilateral triangles such that D is the mid-point of BC. Ratio of the areas of triangles ABC and BDE is _____________.	
	Ans: 4 : 1	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 number less than 3?	
	Ans: P (number less than 3) = $\frac{2}{6}$ or $\frac{1}{3}$	1
	OR	
	If the probability of winning a game is 0.07, what is the probability of losing it?	
	Ans: P (losing) = 1 – 0.07	1/2
	= 0.93	1/2
17.	If the mean of first n natural number is 15, then find n.	
	Ans: $\dfrac{\frac{n(n+1)}{2}}{n} = 15$	1/2
	$\therefore$ n = 29	1/2

18. Two cones have their heights in the ratio 1:3 and radii in the ratio 3:1. What is the ratio of their volumes?

Ans: $\frac{r_1}{r_2} = \frac{3}{1}, \frac{h_1}{h_2} = \frac{1}{3}$ — 1/2

$\therefore$ Ratio of volumes $= \dfrac{\frac{1}{3}\pi r_1^2 h_1}{\frac{1}{3}\pi r_2^2 h_2} = 3:1$ — 1/2

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

Ans: $\tan\theta = \frac{1}{\sqrt{3}} \Rightarrow \theta = 30°$ — 1/2+1/2

20. A die is thrown once. What is the probabiliy of getting an even prime number?

Ans: Number of even prime numbers on a die is 1 (i.e. 2) — 1/2

$\therefore$ P (even prime number) = $\frac{1}{6}$ — 1/2

SECTION – B

Q. Nos. 21 to 26 carry 2 marks each.

21. In Fig. 2 DE || AC and DC || AP. Prove that $\frac{BE}{EC} = \frac{BC}{CP}$.

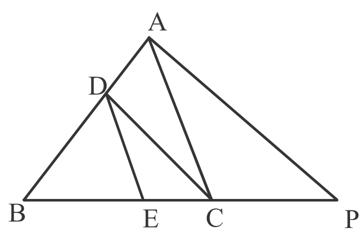


Fig 2

Ans: In ΔABC, DE || AC, $\therefore \frac{BD}{DA} = \frac{BE}{EC}$ ... (i) — 1

In ΔABP, DC || AP, $\therefore \frac{BD}{DA} = \frac{BC}{CP}$ ... (ii) — 1/2

From (i) & (ii), $\frac{BE}{EC} = \frac{BC}{CP}$ — 1/2

OR

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

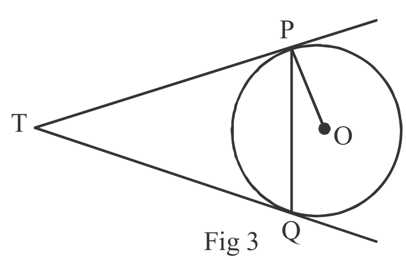


Fig 3

Ans: Let $\angle OPQ = \theta$

$\therefore \angle TPQ = \angle TQP = 90° - \theta$ **1/2**

In ΔTPQ, $2(90° - \theta) + \angle PTQ = 180°$ **1**

$\therefore \angle PTQ = 2\theta$ **1/2**

$= 2\angle OPQ$

22. The rod AC of a TV disc antenna is fixed at right angle to the wall AB and a rod CD is supporting the disc as shown in Fig. 4. If AC = 1.5m long and CD = 3m, find (i) $\tan\theta$ (ii) $\sec\theta + \text{cosec}\theta$.

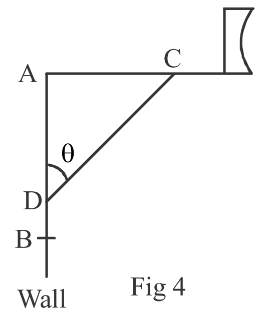


Fig 4

Ans: $\frac{AC}{CD} = \sin\theta \Rightarrow \sin\theta = \frac{1}{2} \Rightarrow \theta = 30°$ **1/2**

(i) $\tan\theta = \tan 30° = \frac{1}{\sqrt{3}}$ **1/2**

(ii) $\sec\theta + \text{cosec}\theta = \sec 30° + \text{cosec} 30°$ **1**

$= \frac{2}{\sqrt{3}} + 2$ or $\frac{2(3+\sqrt{3})}{3}$

23. If a number x is chosen at random from the numbers –3, –2, –1, 0, 1, 2, 3. What is the probability that $x^2 \le 4$?

Ans: Total number of outcomes = 7

Favourable outcomes are –2, –1, 0, 1, 2, i.e., 5 **1**

$\therefore \quad P(x^2 \le 4) = \frac{5}{7}$ **1**

24. Find the mean of the following distribution:

Class:	3-5	5-7	7-9	9-11	11-13
Frequency:	5	10	10	7	8

Ans: **1½**

Classes	x_i	f_i	$f_x x_i$
3 – 5	4	5	20
5 – 7	6	10	60
7 – 9	8	10	80
9 – 11	10	7	70
11 – 13	12	8	96
Total		40	326

$$\bar{x} = \frac{\sum f_i x_i}{\sum f_i} = \frac{326}{40} = 8.15$$ **1/2**

OR

Find the mode of the following data:

Class:	0-20	20-40	40-60	60-80	80-100	110-120	120-140
Frequency:	6	8	10	12	6	5	3

Ans: Modal class : 60 – 80 **1/2**

$$\text{Mode} = \ell + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times h = 60 + \frac{12-10}{24-10-6} \times 20$$ **1**

$= 60 + 5 = 65$ **1/2**

25. Find the sum of first 20 terms of the following AP:
1, 4, 7, 10, …

Ans: $S_{20} = \frac{20}{2}[2 \times 1 + 19 \times 3]$ **$1\frac{1}{2}$**

$= 10 \times 59 = 590$ **1/2**

26. The perimeter of a sector of a circle of radius 5.2 cm is 16.4 cm. Find the area of the sector.

Ans: $2 \times 5.2 + \frac{2\pi(5.2)\theta}{360°} = 16.4 \Rightarrow \theta = \frac{360 \times 6}{2\pi \times 5.2}$ **1**

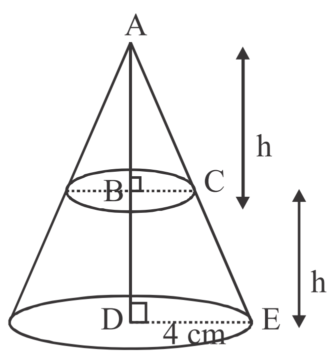
Area of sector $= \frac{\pi \times (5.2)^2}{360°} \times \frac{360 \times 6}{2\pi \times 5.2} = 15.6 \text{ cm}^2$ **1**

SECTION – C

Question numbers 27 to 34 carry 3 marks each.

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

Ans: **cor. fig 1/2**



$\Delta ABC \sim \Delta ADE$, $\frac{h}{2h} = \frac{BC}{4}$

$\therefore BC = 2$ cm **1**

Ratio of volumes of two parts

$$= \frac{\frac{1}{3}\pi \times 2^2 \times h}{\frac{1}{3}\pi \times (2^2 + 4^2 + 2 \times 4) \times h}$$ **1**

$= \frac{4}{28} = \frac{1}{7}$ or 1 : 7 (accept 7 : 1 also) **1/2**

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

Ans: For correct given, To prove, construction and figure. $1\frac{1}{2}$

For correct proof. $1\frac{1}{2}$

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

Ans: $ar(PQR) = \frac{1}{2}\left[-5(-5-5)-4(5-7)+4(7+5)\right]$ sq. units **2**

$= \frac{1}{2}[50+8+48]$ sq. units

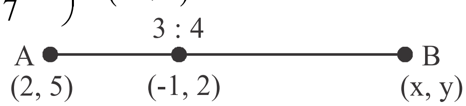
$= 53$ sq. units **1**

OR

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

Ans: Coordinates of C are $\left(\frac{3x+8}{7}, \frac{3y+20}{7}\right) = (-1, 2)$ $1\frac{1}{2}$

$\Rightarrow x = -5, y = -2$ **1**



$\therefore$ Coordinates of B are (–5, –2) **1/2**

30. Find the quadratic polynomial whose zeroes are reciprocal of the zeroes of the polynomial $f(x) = ax^2 + bx + c$, $a \neq 0$, $c \neq 0$.

Ans: $f(x) = ax^2 + bx + c$

$\alpha + \beta = -\frac{b}{a}, \ \alpha\beta = \frac{c}{a}$ **1/2**

New sum of zeroes $= \frac{1}{\alpha} + \frac{1}{\beta} = -\frac{b}{c}$ **1**

New product of zeroes $= \frac{1}{\alpha} \times \frac{1}{\beta} = \frac{a}{c}$ **1**

$\therefore$ Required quardratic polynomial $= x^2 + \frac{b}{c}x + \frac{a}{c}$ or $(cx^2 + bx + a)$ **1/2**

OR

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

Ans: **2**

$$
\begin{array}{r|l}
-x^2+x-1 \ ) & -x^3+3x^2-3x+5 \ (\ x-2 \\
 & -x^3+x^2-x \\
 & + \quad - \quad + \\
\hline
 & 2x^2-2x+5 \\
 & 2x^2-2x+2 \\
 & - \quad + \quad - \\
\hline
 & 3 \\
\hline
\end{array}
$$

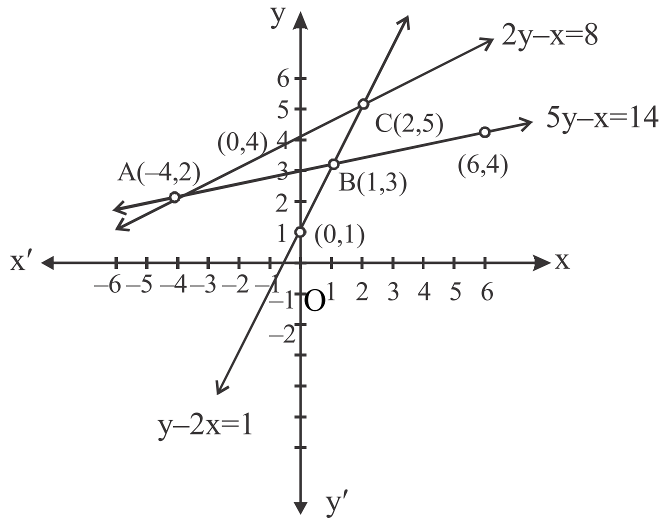
Divisor × Quotient + Remainder

$= (-x^2 + x - 1)(x - 2) + 3$

$= -x^3 + 3x^2 - 3x + 5 = \text{Dividend}$ **1**

31. Determine graphically the coordinates of the vertices of a triangle, the equations of whose sides are given by 2y – x = 8, 5y – x = 14 and y – 2x = 1.

Ans:



2y – x = 8

x	0	2	–4
y	4	5	2

5y – x = 14

x	1	6	–4
y	3	4	2

y – 2x = 1

x	1	2	0
y	3	5	1

Drawing 3 lines **$1\frac{1}{2}$**

Coordinates of the vertices of the triangle are A(–4, 2),

B(1, 3) and C(2, 5) **$1\frac{1}{2}$**

OR

If 4 is the zero of the cubic polynomial $x^3 - 3x^2 - 10x + 24$, find its other two zeroes.

Ans: x – 4 is a factor of given polynomial.

$$x - 4 \overline{\smash{)}\, x^3 - 3x^2 - 10x + 24\,}\,(x^2 + x - 6$$

$$\underline{\begin{array}{l} x^3 - 4x^2 \\ - \quad + \end{array}}$$

$$\underline{\begin{array}{l} x^2 - 10x + 24 \\ x^2 - 4x \\ - \quad + \end{array}}$$

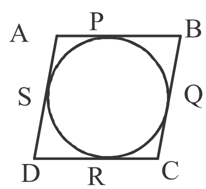
$$\underline{\begin{array}{l} -6x + 24 \\ -6x + 24 \\ + \quad - \end{array}}$$

$$0$$

2

$x^2 + x - 6 = (x + 3)(x - 2)$

∴ Other than zeroes are –3 and 2. **1**

32.	A train covers a distance of 480 km at a uniform speed. If the speed had been 8 km/h less, then it would have taken 3 hours more to cover the same distance. Find the original speed of the train.	
	Ans: Let the speed of train be x km/hr	
	$\therefore \frac{480}{x-8} - \frac{480}{x} = 3$	1
	$\Rightarrow x^2 - 8x - 1280 = 0$	1
	$(x - 40)(x + 32) = 0$	
	$x = 40, -32$ (Rejected)	1
	$\therefore$ Speed of train = 40 km/hr	
33.	Prove that the parallelogram circumscribing a circle is a rhombus.	
	Ans: AP = AS, BP = BQ, DR = DS, CR = CQ 	1
	Adding, we get (AP + BP) + (DR + CR) + (AS + DS) + (BQ + CQ)	
	$\Rightarrow$ AB + CD = BC + AD	1
	Since ABCD is a ||gm $\therefore$ 2AB = 2 BC	
	$\Rightarrow$ AB = BC	1
34.	Prove that : $2(\sin^6\theta + \cos^6\theta) - 3(\sin^4\theta + \cos^4\theta) + 1 = 0$	
	Ans: $2(\sin^6\theta + \cos^6\theta) - 3(\sin^4\theta + \cos^4\theta) + 1$	
	$= 2\left[(\sin^2\theta)^3 + (\cos^2\theta)^3\right] - 3(\sin^4\theta + \cos^4\theta) + 1$	1
	$= 2\left[(\sin^2\theta + \cos^2\theta)(\sin^4\theta + \cos^4\theta - \sin^2\theta\cos^2\theta)\right] - 3(\sin^4\theta + \cos^4\theta) + 1$	1
	$= -(\sin^4\theta + \cos^4\theta) - 2\sin^2\theta\cos^2\theta + 1$	
	$= -\left[(\sin^2\theta + \cos^2\theta)^2 - 2\sin^2\theta\cos^2\theta\right] - 2\sin^2\theta\cos^2\theta + 1$ $= -1 + 1 = 0$	1
	SECTION – D	
	Question numbers 35 to 40 carry 4 marks each.	
35.	The following table gives production yield per hectare (in quintals) of wheat of 100 farms of a village:	

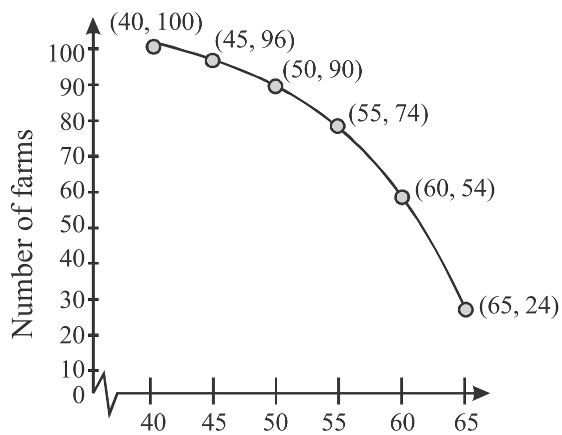
Production yield/hect.	40-45	45-50	50-55	55-60	60-65	65-70
No. of farms	4	6	16	20	30	24

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

Ans:

Production yield/hectare	No. of forms
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
Total	

2



2

OR

The median of the following data is 525. Find the values of x and y, if total frequency is 100:

Class :	0-100	100-200	200-300	300-400	400-500	500-600	600-700	700-800	800-900	900-1000
Frequency:	2	5	x	12	17	20	y	9	7	4

Ans:

Classes	Frequency	Cumulative frequency
0-100	2	2
100-200	5	7
200-300	x	7 + x
300-400	12	19 + x
400-500	17	36 + x
500-600	20	56 + x → Median class
600-700	y	56 + x + y
700-800	9	65 + x+ y
800-900	7	72 + x+ y
900-1000	4	76 + x+ y
Total	100	

2

$76 + x + y = 100 \Rightarrow x + y = 24$ ... (i) — 1/2

500 – 600 is the median class

$$\text{Median} = \ell + \frac{\frac{n}{2} - cf}{f} \times h$$

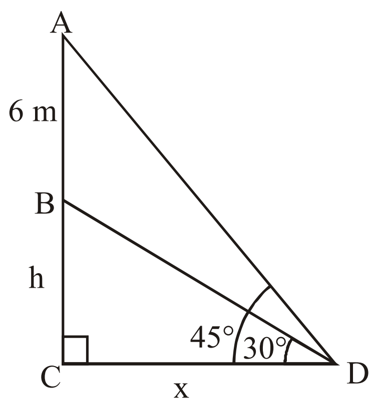
$$\Rightarrow 525 = 500 + \frac{50 - 36 - x}{20} \times 100$$

Solving we get, x = 9 — 1

From (i), y = 15 — 1/2

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

Ans: — cor. fig 1



$$\frac{h}{x} = \tan 30°$$ — 1

$$\Rightarrow x = h\sqrt{3}$$

$$\frac{6 + h}{x} = \tan 45° \Rightarrow 6 + h = x$$ — 1

$$\therefore h = \frac{6}{\sqrt{3} - 1} = 3(\sqrt{3} + 1) = 3 \times 2.73 \text{ m}$$

$$= 8.19 \text{ m}$$ — 1

37. Show that the square of any positive integer cannot be of form (5q + 2) or (5q +3) for any integer q.

Ans: Let a be any positive integer. Take b = 5 as the divisor.

$\therefore$ a = 5m + r , r = 0, 1, 2, 3, 4 — 1

Case-1 : $a = 5m \Rightarrow a^2 = 25m^2 = 5(5m^2) = 5q$

Case-2 : $a = 5m+1 \Rightarrow a^2 = 5(5m^2 + 2m) + 1 = 5q + 1$

Case-3 : $a = 5m+2 \Rightarrow a^2 = 5(5m^2 + 4m) + 4 = 5q + 4$

Case-4 : $a = 5m+3 \Rightarrow a^2 = 5(5m^2 + 6m + 1) + 4 = 5q + 4$

Case-5 : $a = 5m+4 \Rightarrow a^2 = 5(5m^2 + 8m + 3) + 1 = 5q + 1$

— 1/2 for each case $= 2\frac{1}{2}$

Hence square of any positive integer cannot be of the form (5q + 2) or (5q + 3) for any integer q. — 1/2

	OR	
	Prove that one of every three consecutive positive integers is divisible by 3.	
	Ans: Let n be any positive integer. Divide it by 3.	
	$\therefore$ n = 3q + r, r = 0, 1, 2	**1**
	Case-1 : n = 3q (divisible by 3)	
	n + 1 = 3q + 1, n + 2 = 3q + 2	**1 for**
	Case-2 : n = 3q+1 $\Rightarrow$ n+1 = 3q + 2, n+2 = 3q+3 (divisible by 3)	**each**
	Case-3 : n = 3q+2 $\Rightarrow$ n+1 = 3q + 3 (divisible by 3), n + 2 = 3q + 4	**case = 3**
38.	The sum of four consecutive numbers in AP is 32 and the ratio of product of the first and last terms to the product of two middle terms is 7:15. Find the numbers.	
	Ans: Let four consecutive number be a – 3d, a – d, a + d, a + 3d	**1/2**
	Sum = 32 $\therefore$ 4a = 32 $\Rightarrow$ a = 8	**1/2**
	$\frac{(a-3d)(a+3d)}{(a-d)(a+d)} = \frac{7}{15} \Rightarrow 15(64-9d^2) = 7(64-d^2)$	**1**
	$\therefore d^2 = 4 \Rightarrow d = \pm 2$	**1**
	Four numbers are 2, 6, 10, 14.	**1**
	OR	
	Solve: 1+ 4 + 7 + 10 +…+ x = 287	
	Ans: $x = a_n = 1 + 3n - 3 = 3n - 2$	**1**
	$S_n = 287 \Rightarrow \frac{n}{2}[1 + 3n - 2] = 287$	**1**
	$\therefore\ 3n^2 - n - 574 = 0$	**1/2**
	$(n-14)(3n+41) = 0 \Rightarrow n = 14$	**1**
	$\therefore$ x = 3n – 2 = 40	**1/2**
39.	A bucket in the form of a frustum of a cone of height 16 cm with radii of its lower and upper circular ends as 8 cm and 20 cm respectively. Find cost of milk which can completely fill the bucket, at the rate of ₹ 40 per litre. (Use π = 3.14)	
	Ans: Capacity of bucket = $\frac{1}{3}\pi h\left(r_1^2 + r_2^2 + r_1 r_2\right)$	**1**
	$= \frac{1}{3} \times 3.14 \times 16\left(8^2 + 20^2 + 8 \times 20\right) cm^3$	$\mathbf{1\frac{1}{2}}$
	= 10449.92 cm^3	
	= 10.45 *l* (approx.)	**1/2**
	Cost of milk = ₹ 40 × 10.45 = ₹ 418	**1**

40.	Construct a triangle with sides 4 cm, 5 cm and 6 cm. Then construct another triangle whose sides are $\frac{2}{3}$ times the corresponding sides of the first triangle.	
	Ans: Construction of ΔABC with given dimensions	**1**
	Construction of similar triangle	**3**

QUESTION PAPER CODE 30/1/3
EXPECTED ANSWER/VALUE POINTS
SECTION – A

Q. NO. 1 to 10 are multiple choice type question of 1 mark each.
Select the correct option.

Q.No.		Marks
1.	The value of k for which the system of equations $x + y - 4 = 0$ and $2x + ky = 3$ has no solution, is	
	(a) –2 **(b)** ≠2 **(c)** 3 **(d)** 2	
	Ans: (d) 2	1
2.	The HCF and the LCM of 12, 21, 15 respectively are	
	(a) 3,140 **(b)** 12,420 **(c)** 3,420 **(d)** 420,3	
	Ans: (c) 3,420	1
3.	The value of x for which 2x,(x + 10) and (3x + 2) are the three consecutive terms of an AP, is	
	(a) 6 **(b)** –6 **(c)** 18 **(d)** –18	
	Ans: (a) 6	1
4.	The first term of an AP is p and the common difference is q, then its 10^{th} term is	
	(a) q + 9p **(b)** p – 9q **(c)** p + 9q **(d)** 2p + 9q	
	Ans: (c) p + 9q	1
5.	If one of the zeroes of the quadratic polynomial $x^2 + 3x + k$ is 2, then the value of k is	
	(a) 10 **(b)** –10 **(c)** –7 **(d)** –2	
	Ans: (b) –10	1
6.	The total number of factors of a prime number is	
	(a) 1 **(b)** 0 **(c)** 2 **(d)** 3	
	Ans: (c) 2	1
7.	The quadratic polynomial, the sum of whose zeroes is –5 and their product is 6, is	
	(a) $x^2 + 5x + 6$ **(b)** $x^2 - 5x + 6$ **(c)** $x^2 - 5x - 6$ **(d)** $-x^2 + 5x + 6$	
	Ans: (a) $x^2 + 5x + 6$	1
8.	The value of p, for which the points A(3, 1), B(5, p) and C(7, –5) are collinear, is	
	(a) –2 **(b)** 2 **(c)** –1 **(d)** 1	
	Ans: (a) –2	1
9.	The distance between the points $(a \cos \theta + b \sin \theta, 0)$ and $(0, a \sin \theta - b \cos \theta)$, is	
	(a) $a^2 + b^2$ **(b)** $a^2 - b^2$ **(c)** $\sqrt{a^2+b^2}$ **(d)** $\sqrt{a^2-b^2}$	
	Ans: (c) $\sqrt{a^2+b^2}$	1
10.	If the point P(k, 0) divides the line segment joining the points A(2, –2) and B(–7, 4) in the ratio 1 : 2, then the value of k is,	
	(a) 1 **(b)** 2 **(c)** –2 **(d)** –1	
	Ans: (d) –1	1

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

11. Given $\Delta ABC \sim \Delta PQR$, if $\frac{AB}{PQ} = \frac{1}{3}$, then $\frac{ar(\Delta ABC)}{ar(\Delta PQR)} =$ ________.

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

12. In Fig. 1, ΔABC is circumscribing a circle, the length of BC is _______cm.

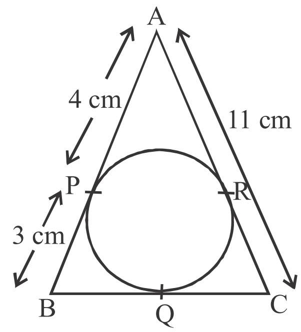


Fig. 1

Ans: 10 **1**

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

Ans: 1 **1**

OR

The value of $(1 + \tan^2\theta)(1 - \sin\theta)(1 + \sin\theta) =$ _______.

Ans: 1 **1**

14. A ladder 10 m long reaches a window 8 m above the ground. The distance of the foot of the ladder from the base of the wall is _________ m.

Ans: 6 **1**

15. $\frac{2\cos 67°}{\sin 23°} - \frac{\tan 40°}{\cot 50°} - \cos 0° =$ ____________.

Ans: 0 **1**

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

16. If the mean of first n natural number is 15, then find n.

Ans: $\frac{\frac{n(n+1)}{2}}{n} = 15$ **1/2**

$\therefore n = 29$ **1/2**

17. A die is thrown once. What is the probability of getting a number less than 3?

Ans: P (number less than 3) = $\frac{2}{6}$ or $\frac{1}{3}$ **1**

OR

If the probability of winning a game is 0.07, what is the probability of losing it?

Ans: P (losing) = 1 – 0.07 = 0.93 — **1**

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

Ans: $\tan\theta = \frac{1}{\sqrt{3}} \Rightarrow \theta = 30°$ — **1/2+1/2**

19. Two cones have their heights in the ratio 1:3 and radii in the ratio 3:1. What is the ratio of their volumes?

Ans: $\frac{r_1}{r_2} = \frac{3}{1}, \frac{h_1}{h_2} = \frac{1}{3}$ — **1/2**

$\therefore$ Ratio of volumes = $\frac{\frac{1}{3}\pi r_1^2 h_1}{\frac{1}{3}\pi r_2^2 h_2} = 3:1$ — **1/2**

20. A pair of dice is thrown once. What is the probabiliy of getting a doublet?

Ans: Number of favourable outcomes are 6

i.e. {(1, 1), (2, 2), (3, 3), (4, 4), (5, 5), (6, 6) — **1/2**

$\therefore$ P (doublet) = $\frac{6}{36}$ or $\frac{1}{6}$ — **1/2**

SECTION – B

Q. Nos. 21 to 26 carry 2 marks each.

21. In Fig. 2 DE||AC and DC||AP. Prove that $\frac{BE}{EC} = \frac{BC}{CP}$.

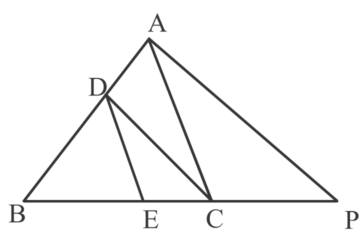


Fig 2

Ans: In ΔABC, DE || AC, $\therefore \frac{BD}{DA} = \frac{BE}{EC}$ ... (i) — **1**

In ΔABP, DC || AP, $\therefore \frac{BD}{DA} = \frac{BC}{CP}$ ... (ii) — **1/2**

From (i) & (ii), $\frac{BE}{EC} = \frac{BC}{CP}$ — **1/2**

OR

In Fig. 3, two tangents TP and TQ are drawn to a circle with centre O from an external point T. Prove that ∠PTQ = 2∠OPQ.

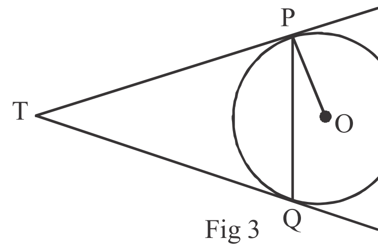


Fig 3

Ans: Let ∠OPQ = θ

∴ ∠TPQ = ∠TQP = 90° – θ **1/2**

In ΔTPQ, 2(90° – θ) + ∠PTQ = 180° **1**

∴ ∠PTQ = 2θ **1/2**

= 2∠OPQ

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

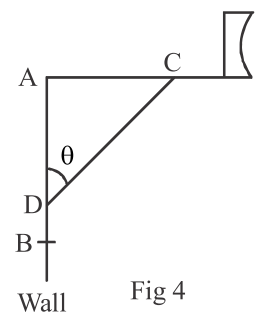


Fig 4

Ans: $\frac{AC}{CD} = \sin\theta \Rightarrow \sin\theta = \frac{1}{2} \Rightarrow \theta = 30°$ **1/2**

(i) $\tan\theta = \tan 30° = \frac{1}{\sqrt{3}}$ **1/2**

(ii) $\sec\theta + \text{cosec}\theta = \sec 30° + \text{cosec} 30°$ **1**

$= \frac{2}{\sqrt{3}} + 2 \text{ or } \frac{2(3+\sqrt{3})}{3}$

23. If a number x is chosen at random from the numbers –3, –2, –1, 0, 1, 2, 3. What is the probability that $x^2 \leq 4$?

Ans: Total number of outcomes = 7

Favourable outcomes are –2, –1, 0, 1, 2, i.e., 5 **1**

∴ $P(x^2 \leq 4) = \frac{5}{7}$ **1**

24. Find the mean of the following distribution:

Class:	3-5	5-7	7-9	9-11	11-13
Frequency:	5	10	10	7	8

Ans:

Classes	x_i	f_i	$f_x x_i$
3 – 5	4	5	20
5 – 7	6	10	60
7 – 9	8	10	80
9 – 11	10	7	70
11 – 13	12	8	96
Total		40	326

1½

$$\overline{x} = \frac{\sum f_i x_i}{\sum f_i} = \frac{326}{40} = 8.15$$ 1/2

OR

Find the mode of the following data:

Class:	0-20	20-40	40-60	60-80	80-100	110-120	120-140
Frequency:	6	8	10	12	6	5	3

Ans: Modal class : 60 – 80 1/2

$$\text{Mode} = \ell + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times h = 60 + \frac{12-10}{24-10-6} \times 20$$ 1

$= 60 + 5 = 65$ 1/2

25. The minute hand of a clock is 12 cm long. Find the area of the face of the clock described by the minute hand in 35 minutes.

Ans: Angle swept in 35 min $= \frac{360}{60} \times 35 = 210°$ 1

Area of face of clock $= \frac{22}{7} \times 12 \times 12 \times \frac{210}{360} = 264\,\text{cm}^2$ 1

Accept: Area $= \frac{22}{7} \times (12)^2 \times \frac{35}{60} = 264\,\text{cm}^2$ 1+1

26. The sum of the first 7 terms of an AP is 63 and that of its next 7 terms is 161. Find the AP.

Ans: $S_7 = 63 \Rightarrow \frac{7}{2}(2a + 6d) = 63$

$\therefore$ a + 3d = 9 …(i) 1/2

$S_{14} - S_7 = \frac{14}{2}(2a + 13d) - 63 = 161$

$\Rightarrow$ 2a + 13d = 32 …(ii) 1/2

Solving (i) and (ii), a = 3, d = 2 1/2

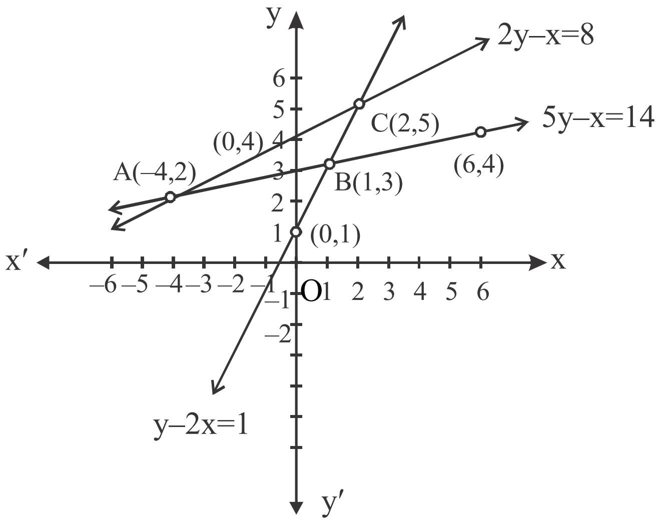
$\therefore$ AP is 3, 5, 7 … 1/2

SECTION – C

Question numbers 27 to 34 carry 3 marks each.

27. Determine graphically the coordinates of the vertices of a triangle, the equations of whose sides are given by $2y - x = 8$, $5y - x = 14$ and $y - 2x = 1$.

Ans:



$2y - x = 8$

x	0	2	–4
y	4	5	2

$5y - x = 14$

x	1	6	–4
y	3	4	2

$y - 2x = 1$

x	1	2	0
y	3	5	1

Drawing 3 lines $1\frac{1}{2}$

Coordinates of the vertices of the triangle are A(–4, 2),

B(1, 3) and C(2, 5) $1\frac{1}{2}$

OR

If 4 is the zero of the cubic polynomial $x^3 - 3x^2 - 10x + 24$, find its other two zeroes.

Ans: $x - 4$ is a factor of given polynomial.

$$x - 4 \overline{)\, x^3 - 3x^2 - 10x + 24 \,}(x^2 + x - 6$$
$$\underline{\cancel{x^3} - 4x^2}$$
$$- \quad +$$
$$\underline{\cancel{x^2} - 10x + 24}$$
$$\underline{\cancel{x^2} - 4x}$$
$$- \quad +$$
$$-6x + 24$$
$$\underline{-6x + 24}$$
$$+ \quad -$$
$$\underline{0}$$

2

$x^2 + x - 6 = (x + 3)(x - 2)$

$\therefore$ Other than zeroes are –3 and 2. 1

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

Ans: $\text{ar(PQR)} = \frac{1}{2}\left[-5(-5-5)-4(5-7)+4(7+5)\right]$ sq. units — **2**

$= \frac{1}{2}[50+8+48]$ sq. units

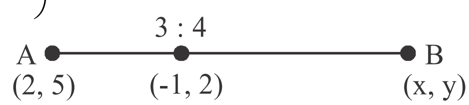
= 53 sq. units — **1**

OR

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

Ans: Coordinates of C arc $\left(\frac{3x+8}{7}, \frac{3y+20}{7}\right) = (-1, 2)$ — **$1\frac{1}{2}$**

$\Rightarrow x = -5,\ y = -2$ — **1**



$\therefore$ Coordinates of B are (–5, –2) — **1/2**

29. Find the quadratic polynomial whose zeroes are reciprocal of the zeroes of the polynomial $f(x) = ax^2 + bx + c,\ a \neq 0,\ c \neq 0$.

Ans: $f(x) = ax^2 + bx + c$

$\alpha + \beta = -\frac{b}{a},\ \alpha\beta = \frac{c}{a}$ — **1/2**

New sum of zeroes $= \frac{1}{\alpha} + \frac{1}{\beta} = -\frac{b}{c}$ — **1**

New product of zeroes $= \frac{1}{\alpha} \times \frac{1}{\beta} = \frac{a}{c}$ — **1**

$\therefore$ Required quardratic polynomial $= x^2 + \frac{b}{c}x + \frac{a}{c}$ or $(cx^2 + bx + a)$ — **1/2**

OR

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

Ans: — **2**

$$\begin{array}{r|l} -x^2+x-1 & -x^3+3x^2-3x+5 \quad (x-2 \\ & \underline{-x^3+x^2-x} \\ & \quad\ \ \ + \quad - \quad + \\ & \quad 2x^2-2x+5 \\ & \quad \underline{2x^2-2x+2} \\ & \quad\ \ - \quad + \quad - \\ & \qquad\qquad 3 \end{array}$$

Divisor × Quotient + Remainder

$= (-x^2+x-1)(x-2)+3$

$= -x^3+3x^2-3x+5 =$ Dividend — **1**

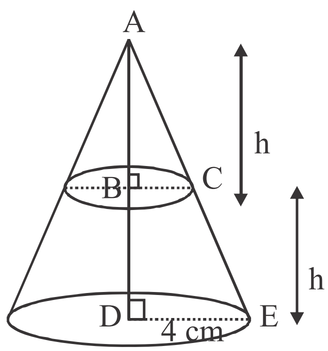
30. In a triangle, if square of one side is equal to the sum of the squares of the other two sides, then prove that the angle opposite to the first side is a right angle.

Ans: For correct given, To prove, construction and figure. $1\frac{1}{2}$

For correct proof. $1\frac{1}{2}$

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

Ans: cor. fig 1/2



$\Delta ABC \sim \Delta ADE$, $\frac{h}{2h} = \frac{BC}{4}$

$\therefore$ BC = 2 cm 1

Ratio of volumes of two parts

$$= \frac{\frac{1}{3}\pi \times 2^2 \times h}{\frac{1}{3}\pi \times (2^2 + 4^2 + 2 \times 4) \times h}$$ 1

$= \frac{4}{28} = \frac{1}{7}$ or 1 : 7 (accept 7 : 1 also) 1/2

32. A man can row a boat downstream 20 km in 2 hours and upstream 4 km in 2 hours. Find his speed of rowing in still water. Also find the speed of the stream.

Ans: Let the speed of rowing in still water x km/hr
and speed of stream be y km/hr.

$\frac{20}{x+y} = 2 \Rightarrow x + y = 10$ (i) 1

$\frac{4}{x-y} = 2 \Rightarrow x - y = 2$ (ii) 1/2

Solving (i) & (ii), x = 6, y = 4 1

$\therefore$ Speed of rowing in still water = 6 km/hr
and speed of stream = 4 km/hr } 1/2

33. In given Fig. 5, two circles touch each other at the point C. Prove that the common tangent to the circles at C, bisects the common tangent at P and Q.

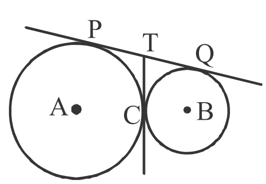


Figure 5

Ans: PT = TC 1

and TQ = TC 1

∴ PT = TQ

Hence TC bisects PQ 1

34. Prove that : $\dfrac{\cot\theta + \text{cosec }\theta - 1}{\cot\theta - \text{cosec }\theta + 1} = \dfrac{1+\cos\theta}{\sin\theta}$

Ans: $\dfrac{\cot\theta + \text{cosec }\theta - 1}{\cot\theta - \text{cosec }\theta + 1} = \dfrac{(\cot\theta + \text{cosec }\theta) - (\text{cosec}^2\,\theta - \cot^2\theta)}{\cot\theta - \text{cosec }\theta + 1}$ 1

$= \dfrac{(\text{cosec }\theta + \cot\theta\,)(1 - \text{cosec}\,\theta + \cot\theta)}{(\cot\theta - \text{cosec}\,\theta + 1)}$ 1

$= \text{cosec}\,\theta + \cot\theta = \dfrac{1+\cos\theta}{\sin\theta}$ 1

SECTION – D

Question numbers 35 to 40 carry 4 marks each.

35. The following table gives production yield per hectare (in quintals) of wheat of 100 farms of a village:

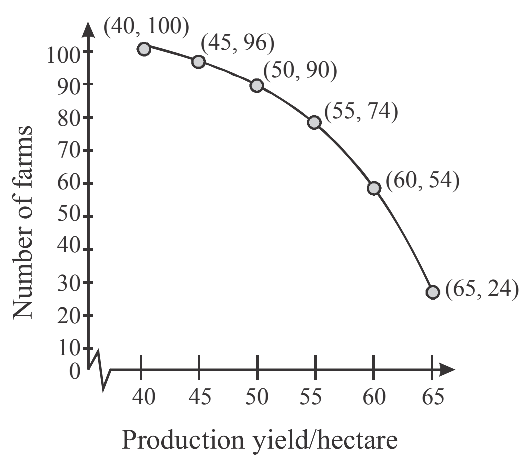
Production yield/hect.	40-45	45-50	50-55	55-60	60-65	65-70
No. of farms	4	6	16	20	30	24

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

Ans:

Production yield/hectare	**No. of forms**
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
Total	

2



2

OR

The median of the following data is 525. Find the values of x and y, if total frequency is 100:

Class :	0-100	100-200	200-300	300-400	400-500	500-600	600-700	700-800	800-900	900-1000
Frequency:	2	5	x	12	17	20	y	9	7	4

Ans:

Classes	Frequency	Cumulative frequency
0-100	2	2
100-200	5	7
200-300	x	7 + x
300-400	12	19 + x
400-500	17	36 + x
500-600	20	56 + x → Median class
600-700	y	56 + x + y
700-800	9	65 + x+ y
800-900	7	72 + x+ y
900-1000	4	76 + x+ y
Total	100	

2

$76 + x + y = 100 \Rightarrow x + y = 24$ ... (i) **1/2**

500 – 600 is the median class

Median = $\ell + \dfrac{\frac{n}{2} - cf}{f} \times h$

$\Rightarrow\ 525 = 500 + \dfrac{50 - 36 - x}{20} \times 100$

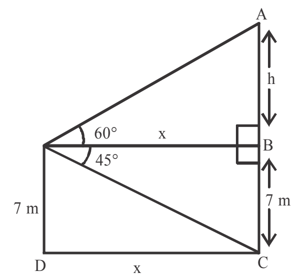
Solving we get, x = 9 **1**

From (i), y = 15 **1/2**

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

Ans: Capacity of bucket = $\frac{1}{3}\pi h\left(r_1^2 + r_2^2 + r_1 r_2\right)$

	$= \frac{1}{3}\times\frac{22}{7}\times 30\left(10^2+20^2+10\times 20\right)\text{cm}^3$	1
	$= 22000\ \text{cm}^3$	$1\frac{1}{2}$
	$= 22l$	1/2
	Cost of milk = ₹ 40 × 22 = ₹ 880	1
37.	Show that the square of any positive integer cannot be of form (5q + 2) or (5q +3) for any integer q.	
	Ans: Let a be any positive integer. Take b = 5 as the divisor.	
	$\therefore$ a = 5m + r , r = 0,1,2,3,4	1
	Case-1 : $a = 5m \Rightarrow a^2 = 25m^2 = 5(5m^2) = 5q$	1/2
	Case-2 : $a = 5m+1 \Rightarrow a^2 = 5(5m^2 + 2m) + 1 = 5q + 1$	for
	Case-3 : $a = 5m+2 \Rightarrow a^2 = 5(5m^2 + 4m) + 4 = 5q + 4$	each
	Case-4 : $a = 5m+3 \Rightarrow a^2 = 5(5m^2 + 6m + 1) + 4 = 5q + 4$	case
	Case-5 : $a = 5m+4 \Rightarrow a^2 = 5(5m^2 + 8m + 3) + 1 = 5q + 1$	$= 2\frac{1}{2}$
	Hence square of any positive integer cannot be of the form (5q + 2) or (5q + 3) for any integer q.	1/2
	OR	
	Prove that one of every three consecutive positive integers is divisible by 3.	
	Ans: Let n be any positive integer. Divide it by 3.	
	$\therefore$ n = 3q + r, r = 0,1,2	1
	Case-1 : n = 3q (divisible by 3)	
	n +1 = 3q + 1, n + 2 = 3q + 2	1 for
	Case-2 : $n = 3q+1 \Rightarrow n+1 = 3q + 2$, n+2 = 3q+3 (divisible by 3)	each
	Case-3 : $n = 3q+2 \Rightarrow n+1 = 3q + 3$ (divisible by 3), n + 2 = 3q + 4	case = 3
38.	The sum of four consecutive numbers in AP is 32 and the ratio of product of the first and last terms to the product of two middle terms is 7:15. Find the numbers.	
	Ans: Let four consecutive number be a – 3d, a – d, a + d, a + 3d	1/2
	Sum = 32 $\therefore$ $4a = 32 \Rightarrow a = 8$	1/2
	$\frac{(a-3d)(a+3d)}{(a-d)(a+d)} = \frac{7}{15} \Rightarrow 15(64-9d^2) = 7(64-d^2)$	1
	$\therefore$ $d^2 = 4 \Rightarrow d = \pm 2$	1
	Four numbers are 2,6,10,14.	1

	OR	
	Solve: 1+ 4 + 7 + 10 +…+ x = 287	
	Ans: $x = a_n = 1 + 3n - 3 = 3n - 2$	**1**
	$S_n = 287 \Rightarrow \frac{n}{2}[1 + 3n - 2] = 287$	**1**
	$\therefore\ 3n^2 - n - 574 = 0$	**1/2**
	$(n - 14)(3n + 41) = 0 \Rightarrow n = 14$	**1**
	$\therefore\ x = 3n - 2 = 40$	**1/2**
39.	Draw a ΔABC with BC = 7 cm, $\angle B = 45°$ and $\angle A = 105°$. Then construct another triangle whose sides are $\frac{3}{4}$ times the corresponding sides of ΔABC.	
	Ans: Construction ΔABC with given measurement.	**1**
	Construction of similar triangle	**3**
40.	From the top of a 7 m high building the angle of elevation of the top of a tower is 60° and the angle of depression of its foot is 45°. Determine the height of the tower.	
		**cor. fig 1**
	Ans: From the figure, $\frac{h}{x} = \tan 60°$	
	$\Rightarrow\ h = x\sqrt{3}\quad \ldots(i)$	**1**
	and $\frac{7}{x} = \tan 45°$	
	$\Rightarrow\ x = 7$	**1**
	From (i), $h = 7\sqrt{3}$	
	$\therefore$ Height of tower = $\left(7\sqrt{3} + 7\right)$m or $7\left(\sqrt{3} + 1\right)$m	**1**