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ಕರ್ನಾಟಕ ಪ್ರೌಢ ಶಿಕ್ಷಣ ಪರೀಕ್ಷಾ ಮಂಡಳಿ, ಮಲ್ಲೇಶ್ವರಂ, ಬೆಂಗಳೂರು – 560 003

KARNATAKA SECONDARY EDUCATION EXAMINATION BOARD, MALLESWARAM, BANGALORE – 560 003

ಎಸ್.ಎಸ್.ಎಲ್.ಸಿ. ಪರೀಕ್ಷೆ, ಜೂನ್ — 2019

S. S. L. C. EXAMINATION, JUNE, 2019

ಮಾದರಿ ಉತ್ತರಗಳು

MODEL ANSWERS

ದಿನಾಂಕ : 21. 06. 2019] ಸಂಕೇತ ಸಂಖ್ಯೆ : **81-E**

Date : 21. 06. 2019] CODE NO. : **81-E**

ವಿಷಯ : ಗಣಿತ

Subject : MATHEMATICS

(ಹಳೆ ಪಠ್ಯಕ್ರಮ / Old Syllabus)

(ಪುನರಾವರ್ತಿತ ಖಾಸಗಿ ಅಭ್ಯರ್ಥಿ / Private Repeater)

(ಇಂಗ್ಲಿಷ್ ಭಾಷಾಂತರ / English Version)

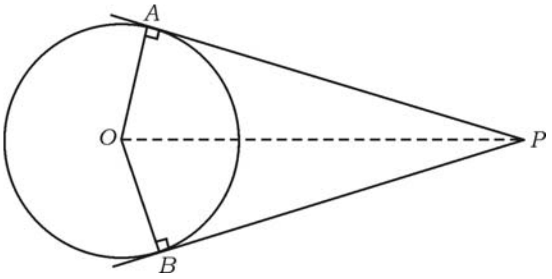
[ಗರಿಷ್ಠ ಅಂಕಗಳು : **100**

[Max. Marks : 100

Qn. Nos.	**Ans. Key**	**Value Points**	**Marks allotted**
I. 1.		If A and B are two non-empty subsets of a universal set, then De-Morgan's law is given by (A) $(A \cup B)' = A' \cup B'$ (B) $(A \cup B)' = A' \cap B'$ (C) $(A \cap B)' = A' \cap B'$ (D) $(A \cup B)' = (A \cap B)'$ *Ans.* :	
	(B)	$(A \cup B)' = A' \cap B'$	1

Qn. Nos.	**Ans. Key**	**Value Points**	**Marks allotted**
2.		The value of ${}^{n}C_{0} \times {}^{n}C_{1}$ is (A) 1 (B) n (C) $n\,!$ (D) 0 *Ans.* :	
	(B)	n	1
3.		A fair die, the faces of which are numbered from 1 to 6 is rolled once. The probability of getting 4 on its top face is (A) $\frac{4}{6}$ (B) $\frac{3}{6}$ (C) $\frac{2}{6}$ (D) $\frac{1}{6}$ *Ans.* :	
	(D)	$\frac{1}{6}$	1
4.		If the mean of a collection of data is 13 and standard deviation is 5·2 then the coefficient of variation of the same data is (A) 20 (B) 30 (C) 40 (D) 50 *Ans.* :	
	(C)	40	1
5.		A quadratic equation whose roots are $3+2\sqrt{5}$ and $3-2\sqrt{5}$ is (A) $x^2 - 6x - 11 = 0$ (B) $x^2 + 6x - 11 = 0$ (C) $x^2 + 6x + 11 = 0$ (D) $x^2 - 11x + 6 = 0$ *Ans.* :	
	(A)	$x^2 - 6x - 11 = 0$	1

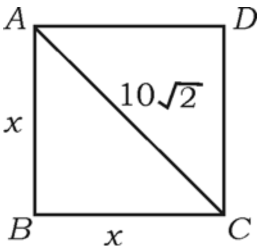
Qn. Nos.	**Ans. Key**	**Value Points**	**Marks allotted**
6.		If $\tan A = \frac{3}{4}$ then $\sin A$ is (A) $\frac{3}{5}$ (B) $\frac{4}{3}$ (C) $\frac{4}{5}$ (D) $\frac{5}{3}$ *Ans.* :	
	(A)	$\frac{3}{5}$	1
7.		The distance between the origin and point (x, y) is (A) $\sqrt{x^2 - y^2}$ (B) $\sqrt{(x+y)^2}$ (C) $\sqrt{(x-y)^2}$ (D) $\sqrt{x^2 + y^2}$ *Ans.* :	
	(D)	$\sqrt{x^2 + y^2}$	1
8.		If P is the mid-point of the line joining $A(1, 4)$ and $B(3, 6)$ then the co-ordinates of P is (A) $(4, 10)$ (B) $(2, 10)$ (C) $(2, 5)$ (D) $(4, 5)$ *Ans.* :	
	(C)	$(2, 5)$	1

Qn. Nos.	Value Points	Marks allotted
II.	Answer the following : 6 × 1 = 6 (Question Numbers 9 to 14, give full marks to direct answers)	
9.	Write the formula to find the Harmonic mean between two positive integers a and b. *Ans.* : Harmonic Mean = $\frac{2ab}{a+b}$	1
10.	State Euclid's Division Lemma. *Ans.* : Given positive integers a and b there exist unique integers q and r satisfying $a = bq + r, \quad 0 \leq r < b$.	1
11.	Write the nature of the roots of a quadratic equation whose discriminant is 0 [*i.e.* $\Delta = 0$]. *Ans.* : The roots are real and equal.	1
12.	In the figure, PA and PB are the tangents to the circle with centre O and $\lfloor\underline{APB} = 80°$. Find $\lfloor\underline{AOP}$.  *Ans.* : $\lfloor\underline{AOB} = 180° - 80°$ $= 100°$ ½ $\lfloor\underline{AOP} = \frac{1}{2}\lfloor\underline{AOB}$ $= \frac{1}{2} \times 100°$ ½ $\lfloor\underline{AOP} = 50°$	1

Qn. Nos. **Value Points** **Marks allotted**

13. If the length of the diagonal of a square is $10\sqrt{2}$ cm, find the length of the side.

Ans. :



$AC^2 = AB^2 + BC^2$ ½

$(10\sqrt{2})^2 = AB^2 + AB^2$

$200 = 2AB^2$

$AB^2 = \frac{200}{2}$

$AB^2 = 100$

$AB = 10$ cm, Length of the side = 10 cm ½ 1

14. Write the formula to find the volume of the sphere whose radius is r units.

Ans. :

Volume of sphere $= \frac{4}{3}\pi r^3$ cubic units 1

III. 15. If $A = \{1, 2, 7\}$ and $B = \{5, 7, 12\}$ are two sets then verify $A \cup B = B \cup A$. 2

Ans. :

$A = \{1, 2, 7\}, \quad B = \{5, 7, 12\}$

$A \cup B = \{1, 2, 7\} \cup \{5, 7, 12\}$

$A \cup B = \{1, 2, 5, 7, 12\}$ ... (i) ½

$B \cup A = \{5, 7, 12\} \cup \{1, 2, 7\}$

Qn. Nos. | **Value Points** | **Marks allotted**

$B \cup A = \{ 1, 2, 5, 7, 12 \}$ ... (ii) ½

From (i) and (ii)

$A \cup B = B \cup A$ 1 | 2

16. Define Arithmetic progression. Write the general form of arithmetic progression. 2

Ans. :

An arithmetic progression is a sequence in which each term is obtained by adding a fixed number to the preceding term (except the first term). 1

The general form of AP is $a, \ a + d, \ a + 2d, \ a + 3d$, ... 1 | 2

17. In a Harmonic progression 5th term is $\frac{1}{12}$ and 11th term is $\frac{1}{15}$. Then find the 25th term. 2

Ans. :

$$T_5 = \frac{1}{12}$$

$$T_{11} = \frac{1}{15}$$

$$T_{25} = ?$$

Corresponding terms in A.P. will be

$T_5 = 12$

$T_{11} = 15$ ½

$$d = \frac{T_p - T_q}{p - q}$$

$$= \frac{T_5 - T_{11}}{5 - 11}$$

$$= \frac{12 - 15}{-6}$$

$$= \frac{-3}{-6}$$

Qn. Nos.	Value Points	Marks allotted
	$d = \frac{1}{2}$ ½	
	Now $T_5 = 12$	
	$a + 4d = 12$	
	$a + 4\left(\frac{1}{2}\right) = 12$	
	$a = 12 - 2$	
	$a = 10$ ½	
	Now $T_n = a + (n-1)d$	
	$T_{25} = a + 24d$	
	$= 10 + 24\left(\frac{1}{2}\right)$	
	$= 10 + 12$ ½	
	$T_{25} = 22$	
	Corresponding term in Harmonic Progression is	
	$T_{25} = \frac{1}{22}$	2
	Alternate method :	
	In A.P. $T_5 = 12$	
	$T_{11} = 15$	
	$T_n = a(n-1)d$	
	$\therefore \quad T_5 = a + 4d$	
	i.e. $12 = a + 4d$ … (i)	
	Similarly $T_{11} = a + 10d$	
	$15 = a + 10d$ … (ii) ½	

Qn. Nos.	Value Points	Marks allotted
	Solving (i) and (ii) $a + 4d = 12$ $a + 10d = 15$ $(-)\quad(-)\qquad(-)$ $-\ 6d = -\ 3$ $d = \frac{1}{2}$ ½ From (i) $a + 4d = 12$ $a + 4\ (\frac{1}{2}) = 12$ $a + 2 = 12$ $a = 12 - 2$ ½ $a = 10$ Now $T_{25} = a + 24d$ $= 10 + 24\ (\frac{1}{2})$ $= 10 + 12$ $T_{25} = 22$ ∴ Corresponding term in H.P. is $T_{25} = \frac{1}{22}$ ½	2
18.	Prove that $5 - \sqrt{3}$ is an irrational number. 2 *Ans.* : Let us assume $5 - \sqrt{3}$ is a rational number $\Rightarrow \quad 5 - \sqrt{3} = \frac{p}{q}$, where $p, q \in z$, $q \neq 0$ ½ $5 - \frac{p}{q} = \sqrt{3}$ $\Rightarrow \quad \frac{5q - p}{q} = \sqrt{3}$	

$\Rightarrow$ $\sqrt{3}$ is a rational number, $\because$ $\dfrac{5q - p}{q}$ is rational. ½

But we know that $\sqrt{3}$ is not a rational number.

This leads to contradiction. ½

$\therefore$ Our assumption that $5 - \sqrt{3}$ is a rational number is wrong.

$\Rightarrow$ $5 - \sqrt{3}$ is an irrational number. ½ 2

19. Find, how many three-digit even numbers can be formed using the digits 3, 5, 7, 8 and 9, without repeating any digit. 2

Ans. :

Hundred place	*Ten place*	*Unit place*
4 ways $\left[\begin{matrix} or \\ {}^4P_1 \end{matrix}\right]$	3 ways $\left[\begin{matrix} or \\ {}^3P_1 \end{matrix}\right]$	1 way { 8]

1

To form 3-digit even number, unit place can be filled only in one way *i.e.* by 8.

Hundred place can be filled in 4 ways

Ten's place can be filled in 3 ways

$\therefore$ By F.P.C., number of three digit even number that can be formed using the digits 3, 5, 7, 8 and 9 is ½

$= 4 \times 3 \times 1$ or ${}^4P_1 \times {}^3P_1 \times 1$

$= 12$

$\therefore$ Totally 12, 3 digit even numbers can be formed. ½ 2

20. There are eight teachers in a school, including headmaster. Find in how many ways, can a committee of 5 members be formed so as to include headmaster in the committee. 2

Ans. :

Qn. Nos.	Value Points	Marks allotted

There are 8 teachers including Headmaster

A committee of 5 members is to be formed and headmaster is one of the members.

$\therefore$ Only 4 members are to be selected from remaining 7 teachers. ½

$\therefore$ The possible number of such committees $= 1 \times {}^7C_4$

$$= \frac{7 \times 6 \times 5 \times 4}{4\,!}$$

$$= \frac{7 \times \cancel{6} \times 5 \times \cancel{4}}{\cancel{4} \times \cancel{3} \times \cancel{2} \times 1} \quad 1$$

$= 35$ ways.

$\therefore$ The committee can be formed in 35 ways. ½ 2

21. 500 lottery tickets are sold. Of these 5 tickets are allotted prizes. Sanjay purchased one lottery ticket. What is the probability that Sanjay gets lottery prize ? 2

Ans. :

500 lottery tickets are sold

$\therefore \quad n(S) = 500$ ½

Sanjay purchased 1 ticket.

Let A be the event of Sanjay getting lottery prize.

Then $n(A) = {}^5C_1 = 5$ ½

$\therefore \quad P(A) = \frac{n(A)}{n(S)}$ ½

$P(A) = \frac{5}{500}$ ½

OR $P(A) = \frac{1}{100}$

$\therefore$ The probability of Sanjay getting prize is $\frac{5}{500}$ or $\frac{1}{100}$ 2

Qn. Nos.	**Value Points**	**Marks allotted**
22.	Find the sum of $2\sqrt{a}$, $7\sqrt{a}$, $-3\sqrt{a}$. 2	
	Ans. :	
	$2\sqrt{a} + 7\sqrt{a} - 3\sqrt{a}$ ½	
	$= 9\sqrt{a} - 3\sqrt{a}$ 1	
	$= 6\sqrt{a}$. ½	2
23.	Rationalise the denominator and simplify $\dfrac{2}{\sqrt{5}-\sqrt{3}}$. 2	
	Ans. :	
	$\dfrac{2}{\sqrt{5}-\sqrt{3}}$ R.F. of $\sqrt{5}-\sqrt{3}$ is $\sqrt{5}+\sqrt{3}$ ½	
	$\dfrac{2}{\sqrt{5}-\sqrt{3}} = \dfrac{2}{\sqrt{5}-\sqrt{3}} \times \dfrac{\sqrt{5}+\sqrt{3}}{\sqrt{5}+\sqrt{3}}$ ½	
	$= \dfrac{2(\sqrt{5}+\sqrt{3})}{(\sqrt{5})^2-(\sqrt{3})^2}$ $\therefore$ $(a+b)(a-b) = a^2 - b^2$	
	$= \dfrac{2(\sqrt{5}+\sqrt{3})}{5-3}$ ½	
	$= \dfrac{\cancel{2}(\sqrt{5}+\sqrt{3})}{\cancel{2}}$	
	$= \sqrt{5} + \sqrt{3}$ ½	2
24.	Find the remainder obtained when $P(x) = x^3 + 3x^2 - 5x + 8$ is divided by $g(x) = (x-1)$. 2	
	Ans. :	
	$P(x) = x^3 + 3x^2 - 5x + 8$, $g(x) = x - 1$	
	By remainder theorem, remainder is $P(1)$ ½	

$P(x) = x^3 + 3x^2 - 5x + 8$

$P(1) = 1^3 + 3(1)^2 - 5(1) + 8$ ½

$= 1 + 3 - 5 + 8$

$= 12 - 5$

$P(1) = 7$ ½

∴ The remainder is 7 ½ 2

Alternate method :

$$\begin{array}{rl}
x - 1\ ) & x^3 + 3x^2 - 5x + 8\ (\ x^2 + 4x - 1 \\
 & x^3 - x^2 \qquad \tfrac{1}{2} \\
 & \underline{(-)\quad (+)\qquad\qquad\qquad} \\
 & \quad 4x^2 - 5x + 8 \\
 & \quad 4x^2 - 4x \qquad \tfrac{1}{2} \\
 & \quad \underline{(-)\quad (+)\qquad\qquad} \\
 & \qquad\quad -x + 8 \\
 & \qquad\quad -x + 1 \qquad \tfrac{1}{2} \\
 & \qquad\quad \underline{(+)\quad (-)} \\
 & \qquad\qquad\quad 7
\end{array}$$

∴ The remainder is 7. ½ 2

25. Divide $3x^3 + 11x^2 + 34x + 106$ by ($x - 3$), using synthetic division and find the quotient and remainder. 2

OR

Qn. Nos.	**Value Points**		**Marks allotted**
	If $(x - 5)$ is a factor of $x^3 - 3x^2 + ax - 10$, then find the value of a.		
	Ans. :		
	$\begin{array}{c\|cccc} 3 & 3 & 11 & 34 & 106 \\ \hline & \downarrow & 9 & 60 & 282 \\ \hline & 3 & 20 & 94 & \boxed{388} \end{array}$	1	
	$\therefore$ The quotient is $3x^2 + 20x + 94$	½	
	and the remainder is 388	½	2
	OR		
	$(x - 5)$ is a factor of $P(x) = x^3 - 3x^2 + ax - 10$		
	$\Rightarrow P(5) = 0$	½	
	Now $P(x) = x^3 - 3x^2 + ax - 10$		
	$P(5) = 5^3 - 3(5)^2 + 5.a - 10$		
	$0 = 125 - 75 - 5.a - 10$		
	$0 = 40 + 5a$		
	$\therefore 5a = -40$		
	$a = \frac{-40}{5}$	1	
	$\therefore a = -8$		
	$\therefore a = -8$	½	2

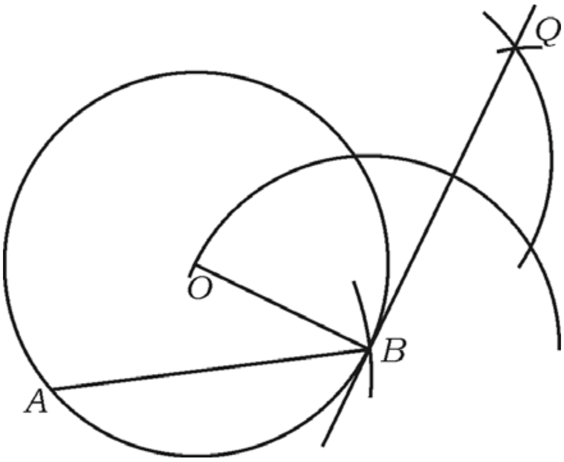
Qn. Nos.	Value Points	Marks allotted

26. Draw a chord *AB* of length 5 cm in a circle of radius 3 cm. Construct a tangent at the point *B*. 2

Ans. :

$r = 3$ cm

$AB = 5$ cm



BQ is the required tangent

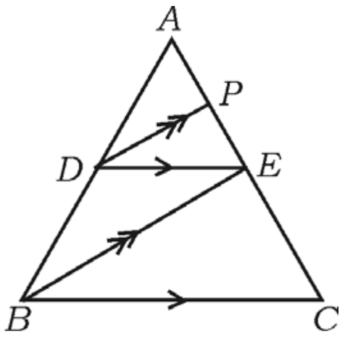
Circle — ½

Chord — ½

Tangent — 1 2

27. In the figure if $DE \parallel BC$ and $DP \parallel BE$ then prove that

$AE^2 = AP . AC .$ 2



OR

If the areas of two similar triangles are equal, then prove that they are congruent.

Ans. :

Given : $DE \parallel BC$

$DP \parallel BE$

To prove : $AE^2 = AP \cdot AC$

Proof : $\Delta ADP \sim \Delta ABE$

$\because \quad \underline{|A} = \underline{|A}$

and $\underline{|ADP} = \underline{|ABE}$ as $DP \parallel BE$

$\therefore \quad \frac{AD}{AB} = \frac{AP}{AE}$ ... (i) $\because$ Thales theorem ½

Similarly $\Delta ADE \sim \Delta ABC$

$\therefore \quad \underline{|A} = \underline{|A}$

$\underline{|ADE} = \underline{|ABC}$ as $DE \parallel BC$

$\therefore \quad \frac{AD}{AB} = \frac{AE}{AC}$ ... (ii) $\because$ Thales theorem ½

From (i) and (ii)

$\frac{AP}{AE} = \frac{AE}{AC}$ ½

$AE^2 = AP \cdot AC$ ½

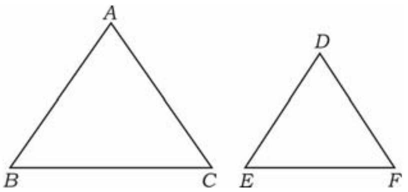
Direct proof may be given full marks. 2

OR

Let $\Delta ABC \sim \Delta DEF$

Given that $ar(\Delta ABC) = ar(\Delta DEF)$

To prove : $\Delta ABC \cong \Delta DEF$



Qn. Nos.	**Value Points**	**Marks allotted**
	Proof : $\Delta ABC \sim \Delta DEF$	
	$\Rightarrow \quad \frac{ar(\Delta ABC)}{ar(\Delta DEF)} = \frac{BC^2}{EF^2}$ ½	
	$\therefore \quad \frac{ar(\Delta ABC)}{ar(\Delta ABC)} = \frac{BC^2}{EF^2}$ $\because$ Data ½	
	$1 = \frac{BC^2}{EF^2}$	
	$\therefore \quad BC^2 = EF^2$	
	$\Rightarrow \quad BC = EF$ ½	
	Similarly $AB = DE$ and $AC = DF$	
	$\therefore \quad \Delta ABC \cong \Delta DEF$ $\because$ S.S.S. criteria ½	2
28.	If $A = 60°$, $B = 30°$ then prove that	
	$\cos(A + B) = \cos A \,.\, \cos B - \sin A \,.\, \sin B.$ 2	
	Ans. :	
	$A = 60°$	
	$B = 30°$	
	To prove : $\cos(A + B) = \cos A \,.\, \cos B - \sin A \,.\, \sin B$	
	Consider $\cos(A + B)$	
	$= \cos(60° + 30°)$	
	$= \cos(90°)$	
	$= 0$ ... (i) ½	
	Now $\cos A \,.\, \cos B - \sin A \,.\, \sin B$	
	$= \cos 60° \,.\, \cos 30° - \sin 60° \,.\, \sin 30°$	
	$= \frac{1}{2} \cdot \frac{\sqrt{3}}{2} - \frac{\sqrt{3}}{2} \cdot \frac{1}{2}$	

Qn. Nos.	**Value Points**		**Marks allotted**
	$= \frac{\sqrt{3}}{4} - \frac{\sqrt{3}}{4}$	1	
	$= 0$ ... (ii)		
	From (i) and (ii)		
	$\cos(A+B) = \cos A \cdot \cos B - \sin A \cdot \sin B$	½	2
29.	The distance between the points (3, 1) and (0, x) is 5 units. Find x.	2	
	Ans. :		
	$(3, 1) \Rightarrow (x_1, y_1)$		
	$(0, x) \Rightarrow (x_2, y_2)$		
	$d = 5$ units		
	$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$	½	
	$5 = \sqrt{(0-3)^2 + (x-1)^2}$		
	$5 = \sqrt{9 + x^2 + 1 - 2x}$		
	Squaring on both the sides		
	$25 = 10 + x^2 - 2x$	½	
	i.e. $x^2 - 2x - 15 = 0$		
	$\therefore \quad x^2 - 5x + 3x - 15 = 0$		
	$x(x-5) + 3(x-5) = 0$		
	$(x-5)(x+3) = 0$	½	
	$x - 5 = 0$ or $x + 3 = 0$		
	$x = 5$ or $x = -3$		
	$\therefore \quad x = 5$ or $x = -3$	½	2

Qn. Nos.	Value Points		Marks allotted
30.	Draw a plan using following information : (Scale 20 m = 1 cm)	2	

	To D (in metres)	
	200	
	140	60 to C
To E 60	120	
	40	30 to B
	From A	

Ans. :

Scale : 20 m = 1 cm

$\therefore \quad 40 \text{ m} = \frac{40}{20} = 2 \text{ cm}$

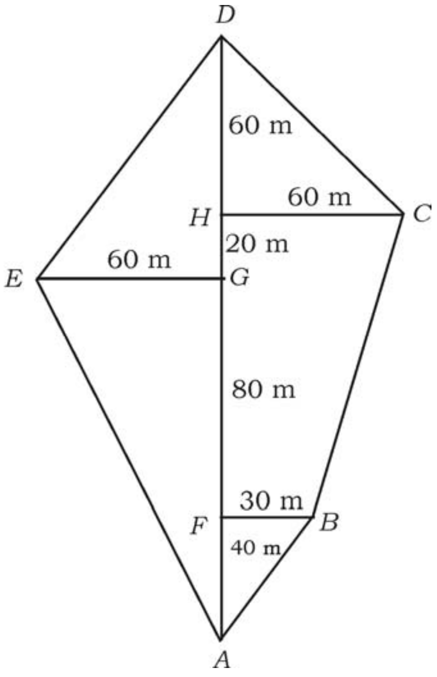
$120 \text{ m} = \frac{120}{20} = 6 \text{ cm}$

$140 \text{ m} = \frac{140}{20} = 7 \text{ cm}$

$200 \text{ m} = \frac{200}{20} = 10 \text{ cm}$

$60 \text{ m} = \frac{60}{20} = 3 \text{ cm}$

$30 \text{ m} = \frac{30}{20} = 1{\cdot}5 \text{ cm}$ ½

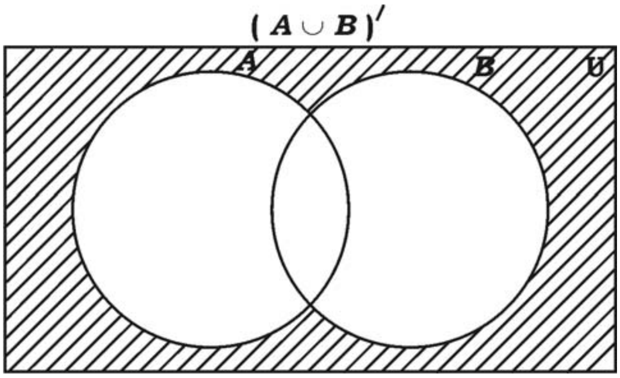


1½ 2

Qn. Nos. | **Value Points** | **Marks allotted**

31. If A and B are subsets of universal set, draw the Venn diagram to represent $(A \cup B)^{\prime}$. Consider A and B as non-disjoint sets. 2

Ans. :



Drawing 2 circles (intersecting circles) — 1

Shading — 1 | 2

32. Find the sum of 1 + 2 + 4 + ... up to 10 terms. 2

Ans. :

1 + 2 + 4 + ... up to 10 terms

The terms are in Geometric progression

$a = 1$

$r = \frac{T_2}{T_1} = \frac{2}{1} = 2$

$n = 10$ ½

$S_{10} = ?$

$S_n = \frac{a(r^n - 1)}{r - 1}$ ½

$S_{10} = \frac{1(2^{10} - 1)}{2 - 1}$ ½

$= 1024 - 1$

$S_{10} = 1023$ ½

$\therefore$ 1 + 2 + 3 + ... up to 10 terms = 1023 | 2

Qn. Nos.	Value Points	Marks allotted
33.	Using Euclid's division algorithm, find the HCF of 45 and 60. 2	
	Ans. :	
	$a = 60, \quad b = 45$	
	According Euclid's division lemma $a = bq + r$ ½	
	i) $\therefore \; 60 = 45 \times 1 + 15$ ½	
	ii) $45 = \boxed{15} \times 3 + 0$ ½	
	$\therefore$ HCF of 45 and 60 is 15 ½	2
34.	The following table shows how the students come to school. Draw a pie chart to represent the data : 2	

Walk	*Bicycle*	*Bus*	*School Van*
12	8	6	10

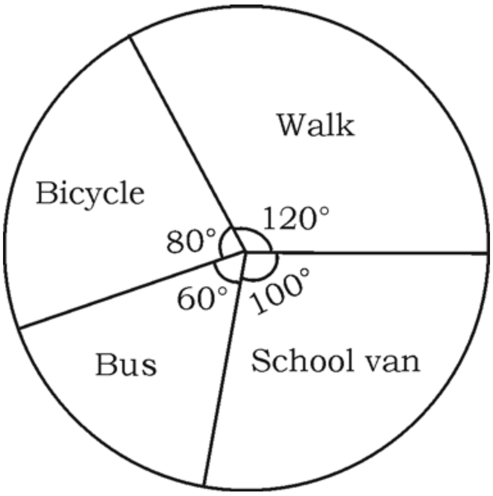
Ans. :

Students come to school by	*Number of students*	*Central angle*
Walk	12	$12 \times 10° = 120°$
Bicycle	8	$8 \times 10° = 80°$
Bus	6	$6 \times 10° = 60°$
School van	10	$10 \times 10° = 100°$
	36	360°

1

36 students corresponds to 360°

$\Rightarrow$ 1 student corresponds to $\frac{360^\circ}{36} = 10^\circ$



Drawing circle — ½

Plotting — ½ 2

35. If $f(x) = 2x^3 + 3x^2 + 8x - 5$ then find the values of

i) $f(0)$ ii) $f(1)$. 2

Ans. :

$f(x) = 2x^3 + 3x^2 + 8x - 5$

i) $f(0) = 2(0)^3 + 3(0)^2 + 8(0) - 5$ ½

$= 0 + 0 + 0 - 5$

$f(0) = -5$ ½

ii) $f(1) = 2(1)^3 + 3(1)^2 + 8(1) - 5$ ½

$= 2 + 3 + 8 - 5$

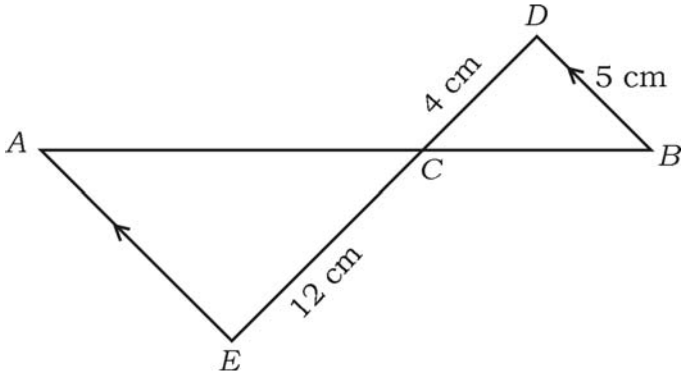
$f(1) = 8$ ½ 2

36. Solve the equation using formula :

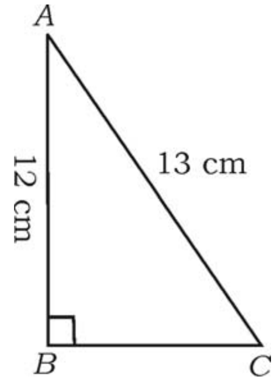
$x^2 - 3x + 2 = 0.$ 2

Ans. :

Qn. Nos.	Value Points	Marks allotted
	$x^2 - 3x + 2 = 0$	
	$a = 1, \quad b = -3 \quad c = 2$	
	$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ ½	
	$= \frac{-(-3) \pm \sqrt{(-3)^2 - 4(1)(2)}}{2(1)}$ ½	
	$= \frac{3 \pm \sqrt{9-8}}{2}$ ½	
	$x = \frac{3 \pm 1}{2}$	
	$\therefore \quad x = \frac{4}{2} = 2, \quad$ or $\quad x = \frac{2}{2} = 1$ ½	2
37.	In the given figure, $AE \parallel DB$, $DC = 4$ cm, $CE = 12$ cm and $BD = 5$ cm. Find the length of AE. 2	



Qn. Nos.	Value Points	Marks allotted
	Ans. :	
	In ΔAEC and ΔBDC	
	$\angle ACE = \angle BCD \quad \because$ Vertically opposite angles	
	$\angle A = \angle B \quad \because$ Alternate angle	
	$\therefore \quad \Delta AEC \sim \Delta BDC \quad \because$ AA criteria ½	
	$\therefore \quad \frac{AE}{BD} = \frac{EC}{CD}$ ½	

Qn. Nos.	Value Points		Marks allotted
	$\frac{AE}{5} = \frac{12}{4}$	½	
	$AE = \frac{12 \times 5}{4}$		
	$= 3 \times 5$		
	$AE = 15$ cm	½	2
	$\therefore \quad AE = 15$ cm		
38.	In right angled triangle ABC, $\lfloor\underline{B} = 90^\circ$, $AB = 12$ cm and $AC = 13$ cm. Find BC.	2	
			
	Ans. :		
	In ⊿ ABC		
	$AC^2 = AB^2 + BC^2$	½	
	$13^2 = 12^2 + BC^2$		
	$BC^2 = 13^2 - 12^2$	½	
	$= 169 - 144$		
	$BC^2 = 25$	½	
	$BC = \sqrt{25}$		
	$BC = 5$ cm	½	2

Qn. Nos.	**Value Points**	**Marks allotted**
39.	Find the value of $\frac{\sin 36^\circ}{\cos 54^\circ} - \frac{\sin 54^\circ}{\cos 36^\circ}$. 2	
	Ans. :	
	$\frac{\sin 36^\circ}{\cos 54^\circ} - \frac{\sin 54^\circ}{\cos 36^\circ}$	
	$= \frac{\cos(90^\circ - 36^\circ)}{\cos 54^\circ} - \frac{\cos(90^\circ - 54^\circ)}{\cos 36^\circ}$ ½	
	$\because \sin A = \cos(90^\circ - A)$	
	$= \frac{\cos 54^\circ}{\cos 54^\circ} - \frac{\cos 36^\circ}{\cos 36^\circ}$ ½	
	$= 1 - 1$ ½	
	$= 0$ ½	2
40.	Find the distance between the points (2, 3) and (6, 6), using the formula. 2	
	Ans. :	
	$(2, 3) \Rightarrow (x_1, y_1)$	
	$(6, 6) \Rightarrow (x_2, y_2)$	
	$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ ½	
	$= \sqrt{(6-2)^2 + (6-3)^2}$ ½	
	$= \sqrt{4^2 + 3^2}$	
	$= \sqrt{16+9}$ ½	
	$= \sqrt{25}$ $\therefore$ $d = 5$ units ½	2

Qn. Nos. **Value Points** **Marks allotted**

IV. 41. Find three positive integers in Arithmetic progression such that their sum is 24 and product is 480. 3

OR

If the 4th and 8th terms of a Geometric progression are 24 and 384 respectively, find the first term and common ratio.

Ans. :

Let the three positive integers in A.P. be $a-d, \; a, \; a+d$ ½

Given that $a-d+a+a+d = 24$

$$3a = 24$$

$$a = 8$$ ½

Also, $(a-d)(a)(a+d) = 480$ ½

$$a(a^2-d^2) = 480$$

$$a^2-d^2 = \frac{480}{a}$$

$$8^2-d^2 = \frac{480}{8}$$

$$64-d^2 = 60$$

$$d^2 = 64-60$$

$$d^2 = 4$$

$$d = \pm 2$$ ½

If $a = 8$, $d = +2$

∴ Three terms are 6, 8, 10 1

OR

If $a = 8$, $d = -2$

∴ Three terms are 10, 8, 6 3

OR

Qn. Nos.	**Value Points**		**Marks allotted**
	$T_4 = 24$		
	$T_8 = 384$		
	$a = ?$		
	$r = ?$		
	In G.P. $T_n = ar^{n-1}$	½	
	Consider $\frac{T_8}{T_4} = \frac{384}{24}$	½	
	$\frac{\cancel{a}r^7}{\cancel{a}r^3} = \frac{\cancel{384}^{16}}{\cancel{24}_1}$	½	
	$r^4 = 16$		
	$r^4 = 2^4$		
	$\therefore \quad r = 2$	½	
	We know that $T_4 = 24$	½	
	i.e. $ar^3 = 24$		
	$a(2)^3 = 24$		
	$a = \frac{24}{8} = 3$		
	$a = 3$	½	3
	$\therefore$ The first term is $a = 3$		
	The common ratio is $r = 2$		
42.	Calculate the standard deviation of the following scores :	3	
	2, 4, 6, 8, 10.		
	Ans. :		

i) Direct method :

x	x^2
2	4
4	16
6	36
8	64
10	100
$\sum x = 30$	$\sum x^2 = 220$

1½

$n = 5$

Standard deviation $\sigma = \sqrt{\frac{\sum x^2}{n} - \left(\frac{\sum x}{n}\right)^2}$ ½

$$\sigma = \sqrt{\frac{220}{5} - \left(\frac{30}{5}\right)^2}$$

$$= \sqrt{44 - 36}$$

$\sigma = \sqrt{8}$ ½

$\sigma \simeq 2{\cdot}8$ ½ 3

ii) Actual mean method :

x	$d = x - \bar{x}$	d^2
2	-4	16
4	-2	4
6	0	0
8	2	4
10	4	16
$\sum x = 30$		$\sum d^2 = 40$

1

$n = 5$

Qn. Nos.	Value Points		Marks allotted
	Mean $= \bar{x} = \frac{\sum x}{n}$		
	$= \frac{30}{5}$		
	$\bar{x} = 6$	½	
	Standard deviation $\sigma = \sqrt{\frac{\sum d^2}{n}}$	½	
	$= \sqrt{\frac{40}{5}}$		
	$= \sqrt{8}$	½	
	$\sigma \approx 2{\cdot}8$	½	3
	iii) Assumed Mean method :		

x	$d = x - \mathrm{A}$	d^2
2	– 4	16
4	– 2	4
6	0	0
8	2	4
10	4	16
	$\sum d = 0$	$\sum d^2 = 40$

1

Let us assume $A = 6$ ½

$n = 5$

$$\sigma = \sqrt{\frac{\sum d^2}{n} - \left(\frac{\sum d}{n}\right)^2}$$ ½

$$= \sqrt{\frac{40}{5} - \left(\frac{0}{5}\right)^2}$$

$$= \sqrt{8}$$ ½

$\sigma \approx 2{\cdot}8$ ½ 3

Qn. Nos.	Value Points	Marks allotted

iv) Step deviation method :

x	$d = x - A$	*Step deviation* $d = \frac{x-A}{c}$	d^2
2	– 4	– 2	4
4	– 2	– 1	1
6	0	0	0
8	2	1	1
10	4	2	4
		$\sum d = 0$	$\sum d^2 = 10$

1

Let $A = 6$

Common factor $c = 2$ ½

$n = 5$

$$\sigma = \sqrt{\frac{\sum d^2}{n} - \left(\frac{\sum d}{n}\right)^2} \times c$$ ½

$$= \sqrt{\frac{10}{5} - 0} \times 2$$

$$= \sqrt{2 - 0} \times 2$$

$$= 2\sqrt{2}$$ ½

$$\sigma \approx 2{\cdot}8$$ ½ 3

43\. If one root of the quadratic equation $x^2 - 6x + q = 0$ is twice the other, find the value of q. 3

OR

If m and n are the roots of equation $x^2 - 3x + 1 = 0$, find the value of

i) $m^2 n + mn^2$

ii) $\frac{1}{m} + \frac{1}{n}$.

Qn. Nos.	**Value Points**	**Marks allotted**
	Ans. :	
	$x^2 - 6x + q = 0$	
	$a = 1, \qquad b = -6, \qquad c = q$	
	Let m and n be the roots and $m = 2n$ ½	
	Sum of the roots $m + n = \frac{-b}{a}$ ½	
	$2n + n = \frac{-(-6)}{1}$	
	$3n = 6$	
	$n = 2$ ½	
	$\therefore \quad m = 2n$	
	$m = 2(2)$	
	$m = 4$ ½	
	$m \cdot n = \frac{c}{a}$ ½	
	$(2n)(n) = \frac{q}{1}$	
	$2n^2 = q$	
	$2(2)^2 = q$	
	$\therefore \quad q = 8$ ½	3
	OR	
	$x^2 - 3x + 1 = 0$	
	$a = 1, \qquad b = -3, \qquad c = 1$	
	Sum of the roots $m + n = \frac{-b}{a}$	
	$m + n = \frac{-(-3)}{1}$	
	$m + n = 3$ ½	
	Product of the roots $= mn = \frac{c}{a}$	

Qn. Nos. | **Value Points** | **Marks allotted**

$mn = \frac{1}{1}$

$mn = 1$ ½

i) $m^2n + mn^2$

$= mn(m + n)$

$= 1(3) = 3$

$\therefore \quad m^2n + mn^2 = 3$ 1

ii) $\frac{1}{m} + \frac{1}{n}$

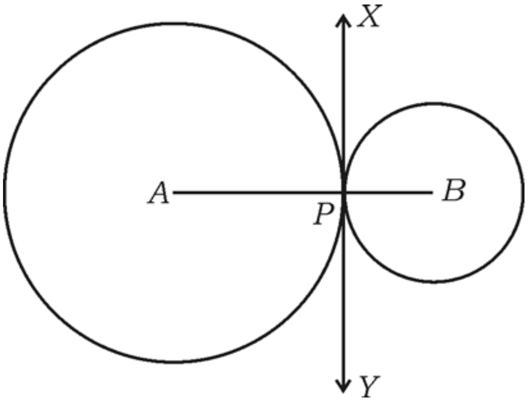
$= \frac{m + n}{mn}$

$= \frac{3}{1} = 3$

$\therefore \quad \frac{1}{m} + \frac{1}{n} = 3$ 1 3

44. Prove that "if two circles touch each other externally, the centres and the point of contact are collinear". 3

Ans. :



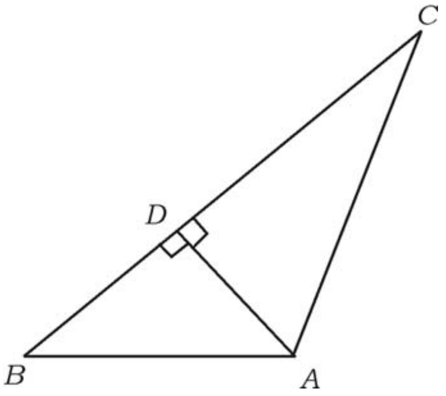
½

Data : *A* and *B* are the centres of touching circles. *P* is the point of contact. ½

To prove : *A, P* and *B* are collinear. ½

Construction : Draw the tangent *XPY* ½

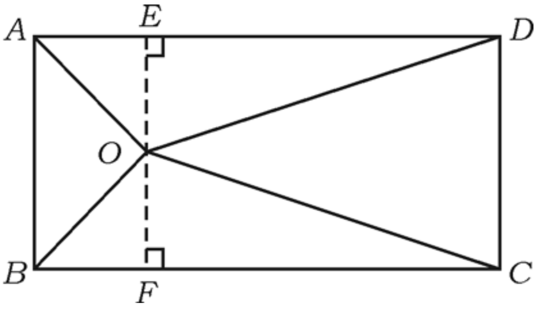
Qn. Nos.	Value Points	Marks allotted
	Proof : In the figure $\angle APX = 90°$ $\therefore$ Radius drawn at the point of contact $\angle BPX = 90°$ is perpendicular to the tangent ½ $\angle APX + \angle BPX = 90° + 90°$ $\angle APX + \angle BPX = 180°$ $\angle APB = 180°$ $\therefore$ APB is a straight line. $\therefore$ A, P and B are collinear. ½	3
45.	In the figure if $AD \perp BC$, prove that $AB^2 + CD^2 = BD^2 + AC^2$. 3	



OR

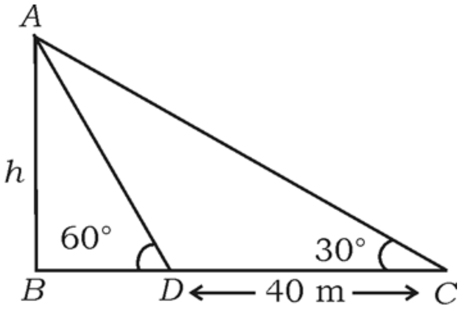
In the figure, O is any point inside a rectangle $ABCD$. Prove that

$OB^2 + OD^2 = OA^2 + OC^2$.



Ans. :

Qn. Nos.	**Value Points**		**Marks allotted**
	In ◺ ABD,		
	$AB^2 = BD^2 + AD^2$	½	
	$AD^2 = AB^2 - BD^2$ ... (i)	½	
	In ◺ ADC,		
	$AC^2 = AD^2 + CD^2$	½	
	$AD^2 = AC^2 - CD^2$ ... (ii)	½	
	From (i) and (ii)		
	$AB^2 - BD^2 = AC^2 - CD^2$		
	$AB^2 + CD^2 = AC^2 + BD^2$	1	3
	OR		
	$EF \parallel DC$		
	$\therefore$ $EF \perp AD$ and $EF \perp BC$		
	In ◺ OEA, $OA^2 = AE^2 + OE^2$ ... (i)	½	
	In ◺ OBF, $OB^2 = BF^2 + OF^2$ ... (ii)	½	
	In ◺ OFC, $OC^2 = OF^2 + CF^2$ ... (iii)	½	
	In ◺ OED, $OD^2 = OE^2 + DE^2$ ... (iv)	½	
	Adding (ii) and (iv)		
	$OB^2 + OD^2 = BF^2 + OF^2 + OE^2 + DE^2$	½	
	$= AE^2 + OF^2 + OE^2 + FC^2$ $\because$ $BF = AE$ $DE = FC$		
	$= AE^2 + OE^2 + OF^2 + FC^2$		
	$= OA^2 + OC^2$	½	
	$\therefore$ $OB^2 + OD^2 = OA^2 + OC^2$		3

Qn. Nos.	Value Points		Marks allotted
46.	Prove that $\frac{\cos A}{1+\sin A} + \frac{1+\sin A}{\cos A} = 2\sec A$.	3	
	OR		
	The shadow of a tower when sun's altitude is 30°, is 40 m longer than its shadow when the sun's altitude was 60°. Find the height of the tower.  		
	Ans. :		
	L.H.S. $= \frac{\cos A}{1+\sin A} + \frac{1+\sin A}{\cos A}$		
	$= \frac{\cos A(\cos A) + (1+\sin A)(1+\sin A)}{\cos A(1+\sin A)}$	½	
	$= \frac{\cos^2 A + (1+\sin A)^2}{\cos A(1+\sin A)}$		
	$= \frac{\cos^2 A + 1 + \sin^2 A + 2\sin A}{\cos A(1+\sin A)}$	½	
	$= \frac{2+2\sin A}{\cos A(1+\sin A)}$	½	
	$= \frac{2\cancel{[1+\sin A]}}{\cos A\cancel{[1+\sin A]}}$	½	
	$= \frac{2}{\cos A}$	½	
	$= 2\sec A =$ RHS	½	
	$\therefore \quad \frac{\cos A}{1+\sin A} + \frac{1+\sin A}{\cos A} = 2\sec A.$		3
	OR		

Qn. Nos.	Value Points		Marks allotted
	$\tan 60^\circ = \dfrac{AB}{BD}$	½	
	$\sqrt{3} = \dfrac{h}{BD}$		
	$\therefore \quad BD = \dfrac{h}{\sqrt{3}} \qquad \ldots \text{(i)}$	½	
	$\tan 30^\circ = \dfrac{AB}{BC}$		
	$\dfrac{1}{\sqrt{3}} = \dfrac{h}{BD + DC}$	½	
	$\dfrac{1}{\sqrt{3}} = \dfrac{h}{\dfrac{h}{\sqrt{3}} + 40}$		
	$\dfrac{1}{\sqrt{3}} = \dfrac{\sqrt{3}\,h}{h + \sqrt{3}\,.\,(40)}$	½	
	$h + 40\sqrt{3} = 3h$		
	$40\sqrt{3} = 3h - h$	½	
	$2h = 40\sqrt{3}$		
	$h = 20\sqrt{3}$ m	½	
	$\therefore$ Height of the tower is $20\sqrt{3}$ m		3
V. 47.	Solve graphically : $x^2 + x - 2 = 0$.	4	
	Ans. :		
	$y = x^2 + x - 2$		

$y = x^2 + x - 2$

x	0	1	2	3	– 1	– 2	– 3
y	– 2	0	4	10	– 2	0	4

Table —	2	
Drawing parabola —	1	
Identifying roots —	1	4

Qn. Nos.	Value Points	Marks allotted

Alternate method :

$$y = x^2$$

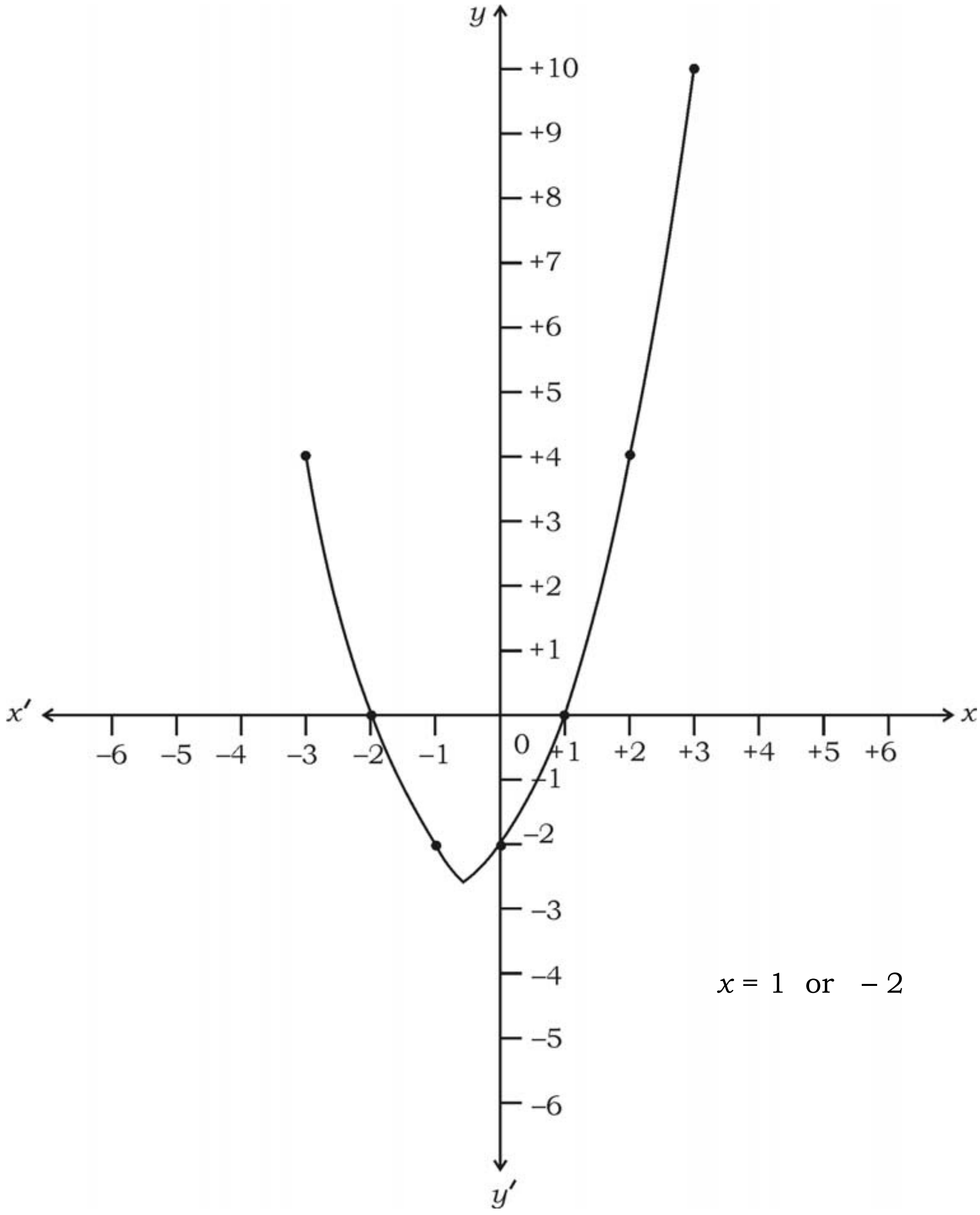
x	0	1	2	3	– 1	– 2	– 3
y	0	1	4	9	1	4	9

$$y = 2 - x$$

x	0	1	2	3	– 1	– 2	– 3
y	2	1	0	– 1	3	4	5

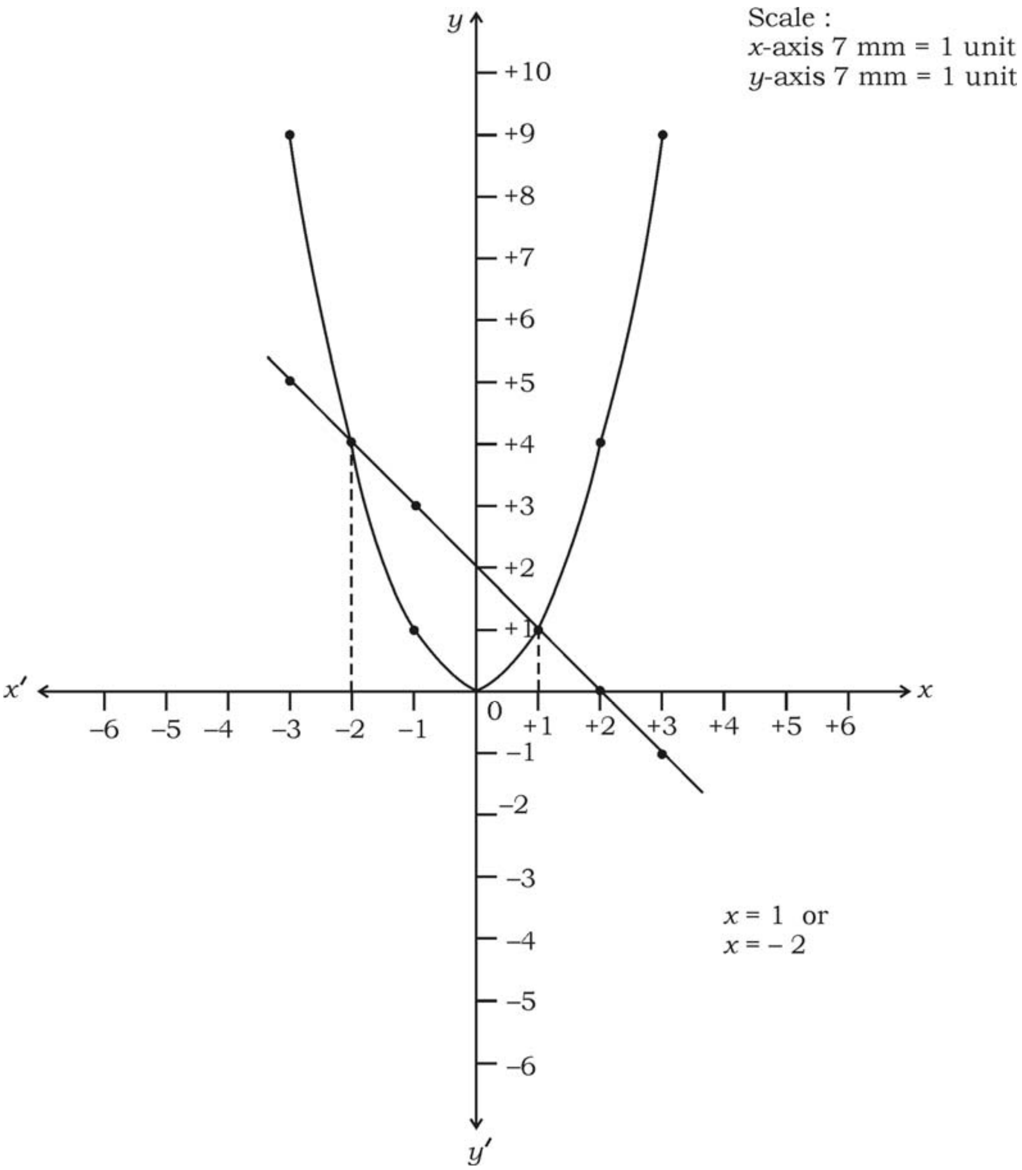
Table —	2	
Drawing line —	½	
Drawing parabola —	1	
Identifying roots —	½	4

Qn. Nos.	Value Points	Marks allotted



$x = 1$ or -2

Qn. Nos.	Value Points	Marks allotted



$x = 1$ or
$x = -2$

Qn. Nos.	Value Points	Marks allotted
48.	Construct a direct common tangent to two circles of radii 4 cm and 2 cm whose centres are 8 cm apart. 4	

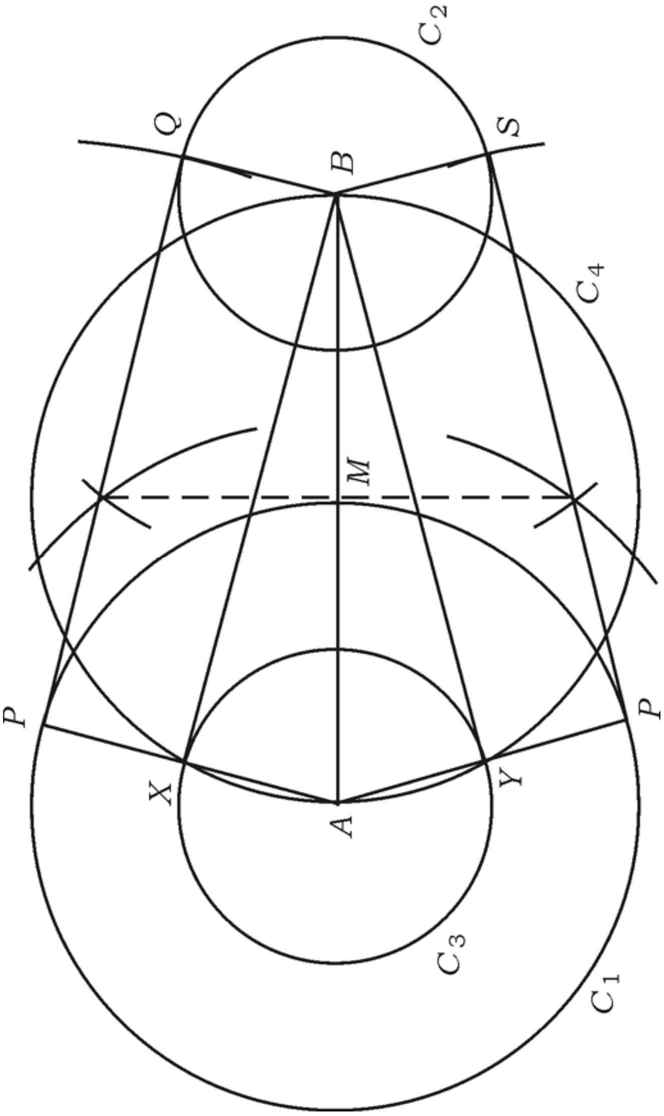
Ans. :

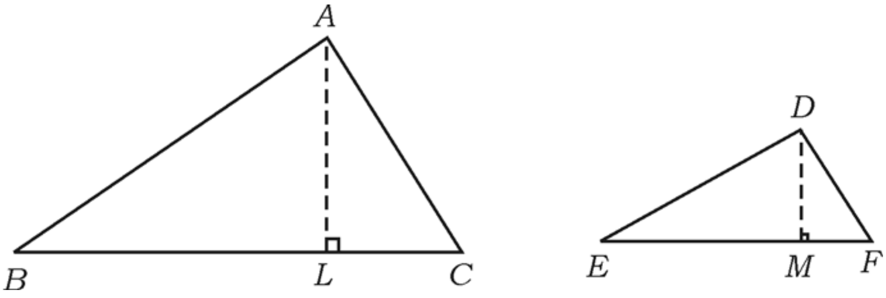
$R = 4$ cm

$r = 2$ cm

$d = 8$ cm

$R - r = 4 - 2 = 2$ cm



Qn. Nos.	**Value Points**	**Marks allotted**
	PQ and *RS* are required tangents	
	Drawing *AB*, marking mid-point — ½	
	Drawing C_1, C_2, C_3, C_4 — 2	
	Joining *BX* / *BY* — ½	
	Joining *PQ* / *RS* — 1	4
49.	Prove that, "the areas of similar triangles are proportional to the squares of their corresponding sides". 4	
	Ans. :	
	 ½	
	Data : $\Delta ABC \sim \Delta DEF$ $\frac{AB}{DE} = \frac{BC}{EF} = \frac{AC}{DF}$ ½	
	To prove : $\frac{ar(\Delta ABC)}{ar(\Delta DEF)} = \frac{BC^2}{EF^2}$ ½	
	Construction : Draw $AL \perp BC$, $DM \perp EF$ ½	
	Proof : In ⊿ *ALB* and ⊿ *DME*	
	$\angle ABL = \angle DEM$ ∵ Data	
	$\angle ALB = \angle DME = 90°$ ∵ Construction	

Qn. Nos.	Value Points	Marks allotted
	$\therefore \quad \triangle ALB \sim \triangle DME$ ½	
	$\Rightarrow \quad \dfrac{AL}{DM} = \dfrac{AB}{DE}$	
	But $\dfrac{BC}{EF} = \dfrac{AB}{DE}$	
	$\therefore \quad \dfrac{AL}{DM} = \dfrac{BC}{EF}$ … (i) ½	
	Now $\dfrac{ar\,(\,\Delta\, ABC\,)}{ar\,(\,\Delta\, DEF\,)} = \dfrac{\frac{1}{2} \times BC \times AL}{\frac{1}{2} \times EF \times DM}$ ½	
	$= \dfrac{BC \times AL}{EF \times DM}$	
	$= \dfrac{BC}{EF} \times \dfrac{BC}{EF} \quad \because$ From (i)	
	$= \dfrac{BC^2}{EF^2}$ ½	
	$\therefore \quad \dfrac{ar\,(\,\Delta\, ABC\,)}{ar\,(\,\Delta\, DEF\,)} = \dfrac{BC^2}{EF^2}$	4
	Hence the theorem is proved.	
50.	A 20 m deep well with diameter 7 m is dug and the mud from digging is evenly spread out to form a platform of cuboid shape, of length 22 m and breadth 14 m. Find the height of the platform. 4	
	OR	

Qn. Nos.	**Value Points**	**Marks allotted**
	A cylindrical vessel of height 32 cm and base radius 18 cm is completely filled with sand. Then the sand in the vessel is poured on the plane ground to form a conical heap of sand of height 24 cm. Find the base radius of conical heap of sand.	
	Ans. :	
	Shape of the well is a cylinder with h_{cy} = 20 m and $r = \frac{7}{2}$ m	
	$\therefore$ Amount of mud obtained by digging well is $\pi r^2 h$. ½	
	This mud is spread to form cuboid shaped platform and volume of cuboid is $l \times b \times h$ ½	
	$\therefore$ Volume of mud in both the cases is same	
	$\therefore \quad \pi r^2 h = l \times b \times h$ 1	
	$\frac{22}{7} \times \frac{7}{2} \times \frac{7}{2} \times 50 = 22 \times 14 \times h$ 1	
	$\therefore \quad h = \frac{7 \times 5}{14}$	
	$h = \frac{5}{2}$ m ½	
	$h = 2{\cdot}5$ m	
	$\therefore$ Height of the platform is 2·5 m. ½	4
	OR	
	$h_{cy} = 32$ cm	
	$r_{cy} = 18$ cm	
	$h_{cone} = 24$ cm	
	$r_{cone} = ?$	

Qn. Nos.	Value Points		Marks allotted
	Volume of sand in cylindrical vessel =		
	Volume of sand in conical shape	½	
	∴ $\pi r_{cy}^2 h_{cy} = \frac{1}{3} \pi . r_{cone}^2 . h_{cone}$	1	
	$18 \times 18 \times 32 = \frac{1}{\cancel{3}} \times r_{cone}^2 \times \overset{8}{\cancel{24}}$	1	
	$r_{cone}^2 = \frac{18 \times 18 \times \overset{4}{\cancel{32}}}{\cancel{8}}$	½	
	$r_{cone}^2 = 18^2 \times 2^2$		
	∴ $r = \sqrt{18^2 \times 2^2}$		
	$r = 36$ cm		
	∴ Radius of cone is 36 cm	1	4