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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 ಶಾಲಾ ಅಭ್ಯರ್ಥಿ / Regular Repeater)

(ಇಂಗ್ಲಿಷ್ ಭಾಷಾಂತರ / English Version)

[ಗರಿಷ್ಠ ಅಂಕಗಳು : **80**

[Max. Marks : 80

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) $(A \cup B)^l = A^l \cup B^l$ (B) $(A \cup B)^l = A^l \cap B^l$	
		(C) $(A \cap B)^l = A^l \cap B^l$ (D) $(A \cup B)^l = (A \cap B)^l$	
		Ans. :	
	(B)	$(A \cup B)^l = A^l \cap B^l$	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 : $6 \times 1 = 6$

(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 = $\dfrac{2ab}{a+b}$ — 1

10. State Euclid's Division Lemma.

Ans. :

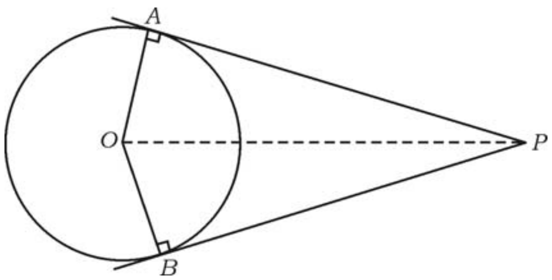
Given positive integers a and b there exist unique integers q and r satisfying $a = bq + r$, $0 \leq r < b$. — 1

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 $\angle APB = 80°$. Find $\angle AOP$.



Ans. :

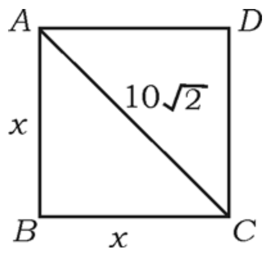
$\angle AOB = 180° - 80°$

$= 100°$ — ½

$\angle AOP = \dfrac{1}{2} \angle AOB$

$= \dfrac{1}{2} \times 100°$ — ½

$\angle AOP = 50°$ — 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. :		
	$A = \{1, 2, 7\}$, $B = \{5, 7, 12\}$		
	$A \cup B = \{1, 2, 7\} \cup \{5, 7, 12\}$		
	$A \cup B = \{1, 2, 5, 7, 12\}$ ... (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)		
	$a + 4d = 12$		
	$a + 10d = 15$		
	(–) (–) (–)		
	$-6d = -3$		
	$d = \frac{1}{2}$	½	
	From (i) $a + 4d = 12$		
	$a + 4\left(\frac{1}{2}\right) = 12$		
	$a + 2 = 12$		
	$a = 12 - 2$	½	
	$a = 10$		
	Now $T_{25} = a + 24d$		
	$= 10 + 24\left(\frac{1}{2}\right)$		
	$= 10 + 12$		
	$T_{25} = 22$		
	∴ 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		
	$\Rightarrow$ $5 - \sqrt{3} = \frac{p}{q}$, where $p, q \in z$, $q \neq 0$	½	
	$5 - \frac{p}{q} = \sqrt{3}$		
	$\Rightarrow$ $\frac{5q - p}{q} = \sqrt{3}$		

Qn. Nos.	Value Points		Marks allotted
	$\Rightarrow$ $\sqrt{3}$ 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. :

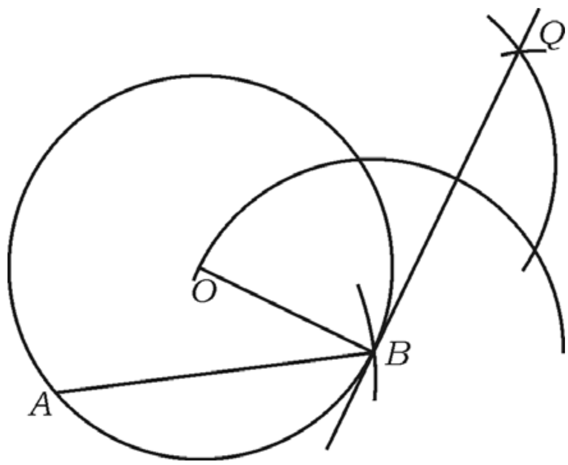
Qn. Nos.	Value Points		Marks allotted
	There are 8 teachers including Headmaster		
	A committee of 5 members is to be formed and headmaster is one of the members.		
	∴ Only 4 members are to be selected from remaining 7 teachers.	½	
	∴ The possible number of such committees $= 1 \times {}^7C_4$		
	$= \dfrac{7 \times 6 \times 5 \times 4}{4\,!}$		
	$= \dfrac{7 \times \cancel{6} \times 5 \times \cancel{4}}{\cancel{4} \times \cancel{3} \times \cancel{2} \times 1}$	1	
	$=$ 35 ways.		
	∴ 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		
	∴ $n(S) = 500$	½	
	Sanjay purchased 1 ticket.		
	Let A be the event of Sanjay getting lottery prize.		
	Then $n(A) = {}^5C_1 = 5$	½	
	∴ $P(A) = \dfrac{n(A)}{n(S)}$	½	
	$P(A) = \dfrac{5}{500}$	½	
	OR $P(A) = \dfrac{1}{100}$		
	∴ The probability of Sanjay getting prize is $\dfrac{5}{500}$ or $\dfrac{1}{100}$		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 $\frac{2}{\sqrt{5}-\sqrt{3}}$.	2	
	Ans. :		
	$\frac{2}{\sqrt{5}-\sqrt{3}}$ R.F. of $\sqrt{5}-\sqrt{3}$ is $\sqrt{5}+\sqrt{3}$	½	
	$\frac{2}{\sqrt{5}-\sqrt{3}} = \frac{2}{\sqrt{5}-\sqrt{3}} \times \frac{\sqrt{5}+\sqrt{3}}{\sqrt{5}+\sqrt{3}}$	½	
	$= \frac{2(\sqrt{5}+\sqrt{3})}{(\sqrt{5})^2-(\sqrt{3})^2}$ $\therefore$ $(a+b)(a-b) = a^2 - b^2$		
	$= \frac{2(\sqrt{5}+\sqrt{3})}{5-3}$	½	
	$= \frac{\cancel{2}(\sqrt{5}+\sqrt{3})}{\cancel{2}}$		
	$= \sqrt{5}+\sqrt{3}$	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	

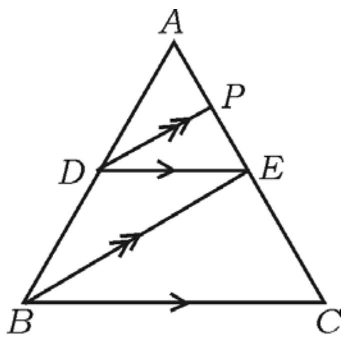
Qn. Nos.	Value Points		Marks allotted
	$P(x) = x^3 + 3x^2 - 5x + 8$		
	$P(1) = 1^3 + 3(1)^2 - 5(1) + 8$	½	
	$= 1 + 3 - 5 + 8$		
	$= 12 - 5$		
	$P(1) = 7$	½	
	$\therefore$ The remainder is 7	½	2
	Alternate method :		
	$x - 1)\ x^3 + 3x^2 - 5x + 8\ (\ x^2 + 4x - 1$		
	$x^3 - x^2$	½	
	(–) (+)		
	$4x^2 - 5x + 8$		
	$4x^2 - 4x$	½	
	(–) (+)		
	$- x + 8$		
	$- x + 1$	½	
	(+) (–)		
	7		
	$\therefore$ 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

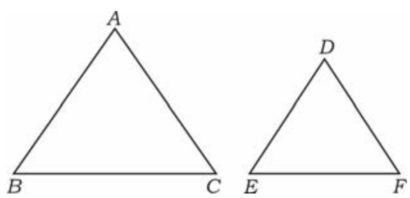
Qn. Nos.	Value Points	Marks allotted
26.	Draw a chord AB of length 5 cm in a circle of radius 3 cm. Construct a tangent at the point B. 2	
	Ans. :	
	$r = 3$ cm	
	$AB = 5$ cm	



	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	
	$AE^2 = AP \cdot AC$. 2	



OR

Qn. Nos.	Value Points	Marks allotted
	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 : $\Delta ADP \sim \Delta ABE$	
	$\because \quad \angle A = \angle A$	
	and $\angle ADP = \angle ABE$ as $DP \parallel BE$	
	$\therefore \quad \frac{AD}{AB} = \frac{AP}{AE}$ ... (i) $\because$ Thales theorem ½	
	Similarly $\Delta ADE \sim \Delta ABC$	
	$\therefore \quad \angle A = \angle A$	
	$\angle ADE = \angle ABC$ 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 : $\Delta\, ABC \sim \Delta\, DEF$		
	$\Rightarrow \quad \dfrac{ar\,(\Delta\, ABC)}{ar\,(\Delta\, DEF)} = \dfrac{BC^2}{EF^2}$	½	
	$\therefore \quad \dfrac{ar\,(\Delta\, ABC)}{ar\,(\Delta\, ABC)} = \dfrac{BC^2}{EF^2}$ $\quad\because$ Data	½	
	$1 = \dfrac{BC^2}{EF^2}$		
	$\therefore \quad BC^2 = EF^2$		
	$\Rightarrow \quad BC = EF$	½	
	Similarly $AB = DE$ and $AC = DF$		
	$\therefore \quad \Delta\, ABC \cong \Delta\, DEF$ $\quad\because$ 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 $\cos(A + B)$		
	$= \cos(60° + 30°)$		
	$= \cos(90°)$		
	$= 0$ $\quad\ldots$ (i)	½	
	Now $\cos A \,.\, \cos B - \sin A \,.\, \sin B$		
	$= \cos 60° \,.\, \cos 30° - \sin 60° \,.\, \sin 30°$		
	$= \dfrac{1}{2} \cdot \dfrac{\sqrt{3}}{2} - \dfrac{\sqrt{3}}{2} \cdot \dfrac{1}{2}$		

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 : 2

(Scale 20 m = 1 cm)

	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

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

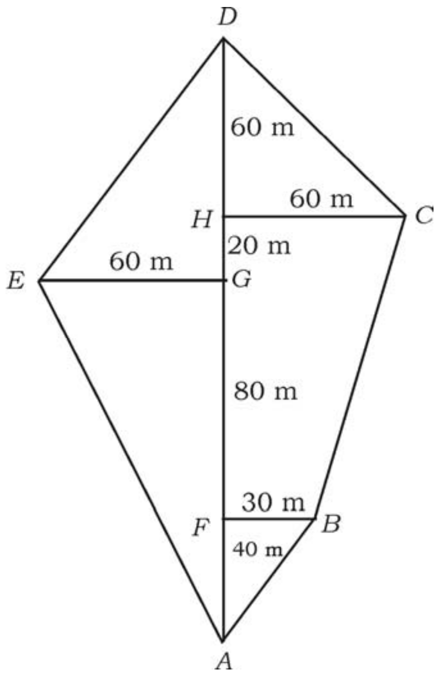
$120 \text{ m} = \frac{120}{20} = 6 \text{ cm}$

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

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

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

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



1½ 2

Qn. Nos.	Value Points	Marks allotted
IV. 31.	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 $r = 2$		
32.	Calculate the standard deviation of the following scores :	3	
	2, 4, 6, 8, 10.		
	Ans. :		

Qn. Nos.	Value Points	Marks allotted

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	$d = x - A$	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

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

OR

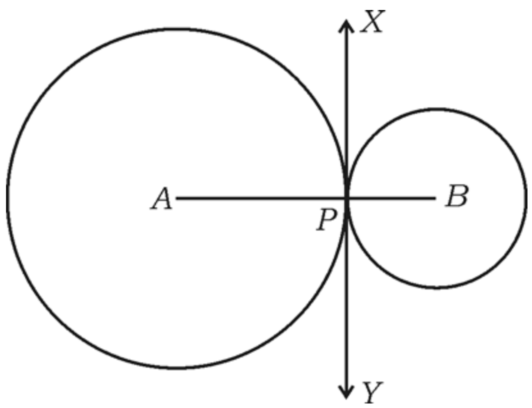
If m and n are the roots of equation $x^2 - 3x + 1 = 0$, find the values of

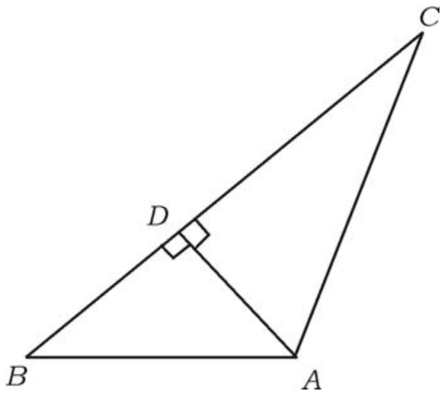
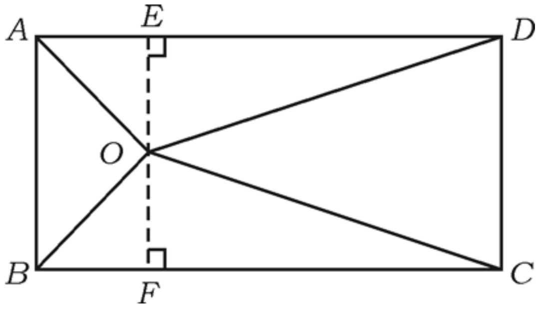
i) $m^2 n + mn^2$

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

Ans. :

Qn. Nos.	Value Points		Marks allotted
	$x^2 - 6x + q = 0$		
	$a = 1, \quad b = -6, \quad c = q$		
	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		
	$x^2 - 3x + 1 = 0$		
	$a = 1, \quad b = -3, \quad c = 1$		
	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
34.	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	

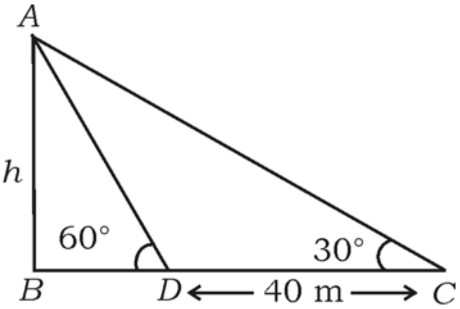
Qn. Nos.	Value Points		Marks allotted
	Proof : In the figure		
	$\angle APX = 90°$ $\therefore$ Radius drawn at the point of contact		
	$\angle BPX = 90°$ is perpendicular to the tangent	½	
	$\angle APX + \angle BPX = 90° + 90°$		
	$\angle APX + \angle BPX = 180°$		
	$\angle APB = 180°$		
	$\therefore$ APB is a straight line.		
	$\therefore$ A, P and B are collinear.	½	3
35.	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
36.	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. :

$$\text{L.H.S.} = \frac{\cos A}{1+\sin A} + \frac{1+\sin A}{\cos A}$$

$$= \frac{\cos A(\cos A) + (1+\sin A)(1+\sin A)}{\cos A(1+\sin A)} \quad \text{½}$$

$$= \frac{\cos^2 A + (1+\sin A)^2}{\cos A(1+\sin A)}$$

$$= \frac{\cos^2 A + 1 + \sin^2 A + 2\sin A}{\cos A(1+\sin A)} \quad \text{½}$$

$$= \frac{2+2\sin A}{\cos A(1+\sin A)} \quad \text{½}$$

$$= \frac{2\,[1+\sin A]}{\cos A\,[1+\sin A]} \quad \text{½}$$

$$= \frac{2}{\cos A} \quad \text{½}$$

$$= 2\sec A = \text{RHS} \quad \text{½}$$

$$\therefore \quad \frac{\cos A}{1+\sin A} + \frac{1+\sin A}{\cos A} = 2\sec A.$$

3

OR

Qn. Nos.	Value Points		Marks allotted
	$\tan 60° = \frac{AB}{BD}$	½	
	$\sqrt{3} = \frac{h}{D}$		
	$\therefore \quad BD = \frac{h}{\sqrt{3}}$ ... (i)	½	
	$\tan 30° = \frac{AB}{BC}$		
	$\frac{1}{\sqrt{3}} = \frac{h}{BD + DC}$	½	
	$\frac{1}{\sqrt{3}} = \frac{h}{\frac{h}{\sqrt{3}} + 40}$		
	$\frac{1}{\sqrt{3}} = \frac{\sqrt{3}\,h}{h + \sqrt{3}\,.\,(40)}$	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. 37.	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 :

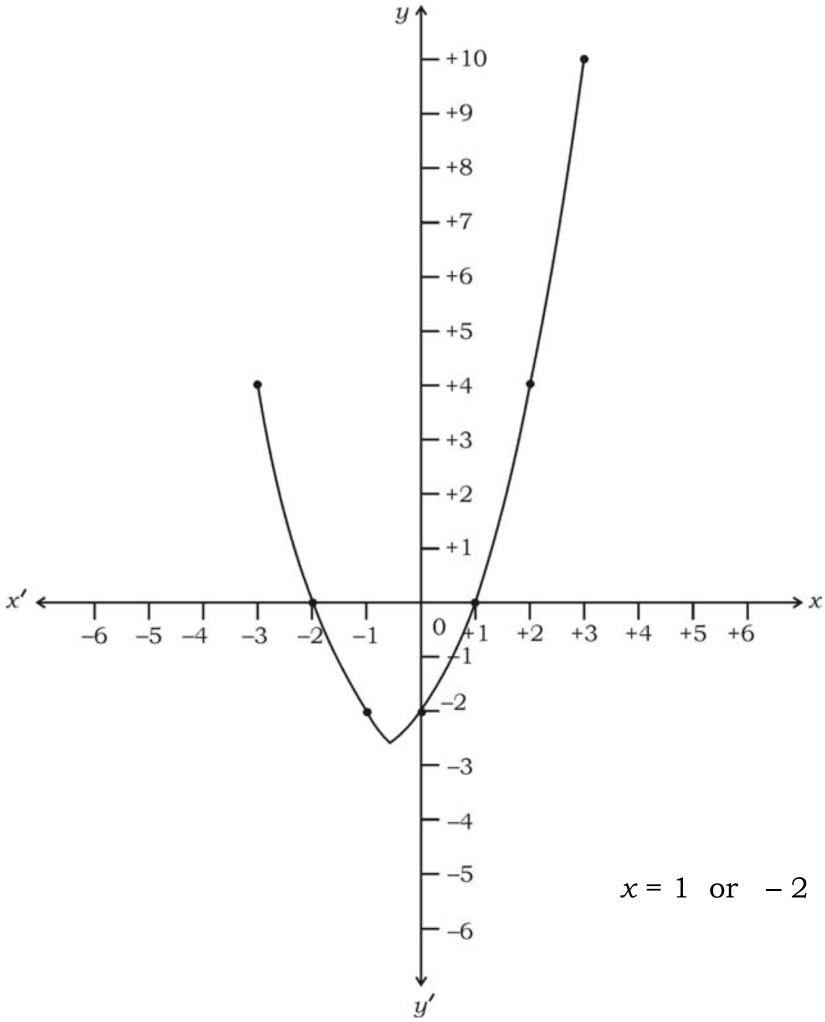
$y = x^2$

x	0	1	2	3	– 1	– 2	– 3
y	0	1	4	9	1	4	9

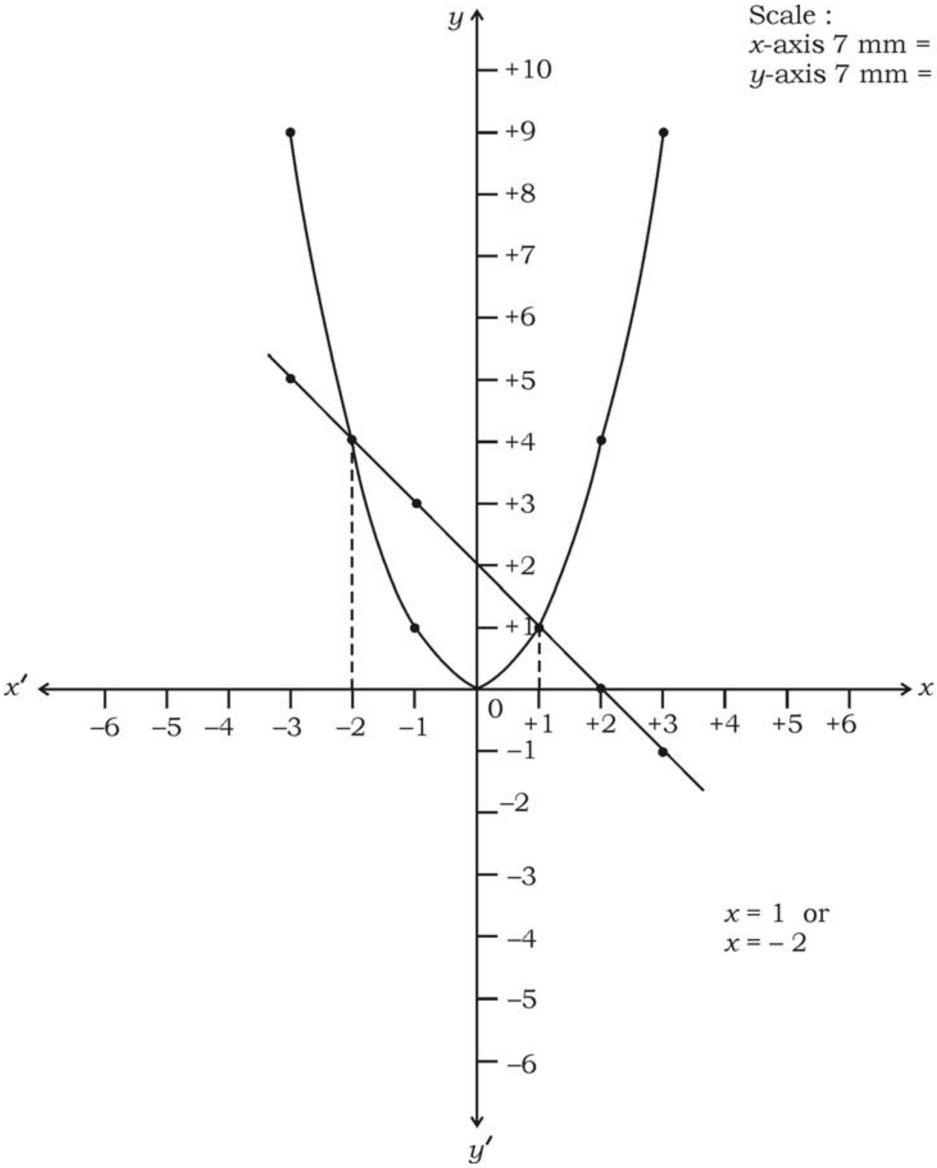
$y = 2 - x$

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



$x = 1$ or -2

Qn. Nos.	Value Points	Marks allotted
		

Scale :
x-axis 7 mm = 1 unit
y-axis 7 mm = 1 unit

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

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

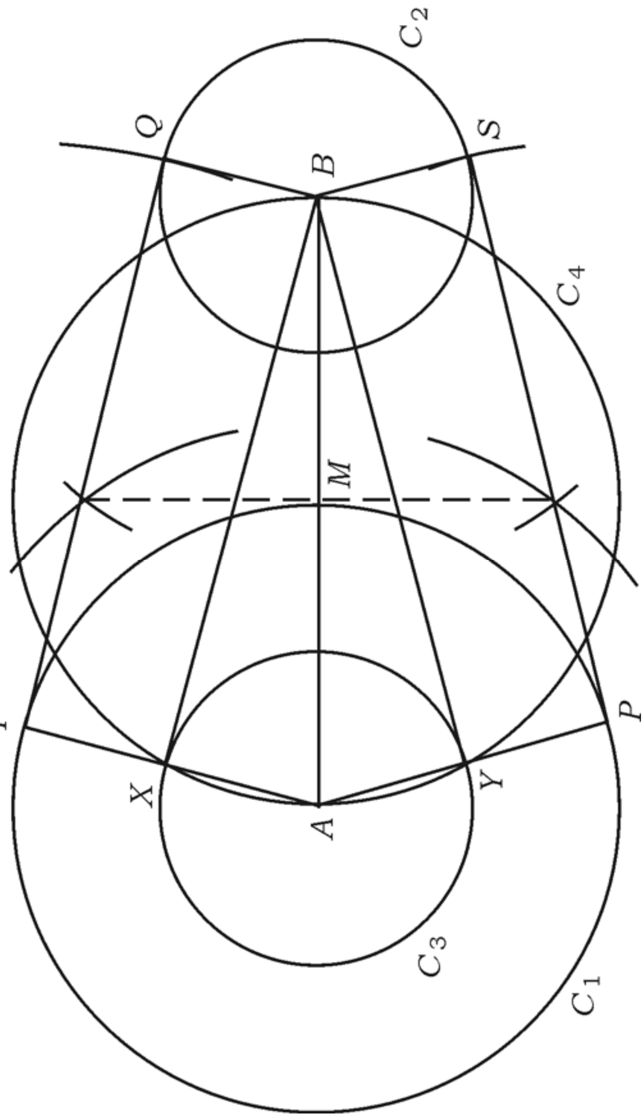
Ans. :

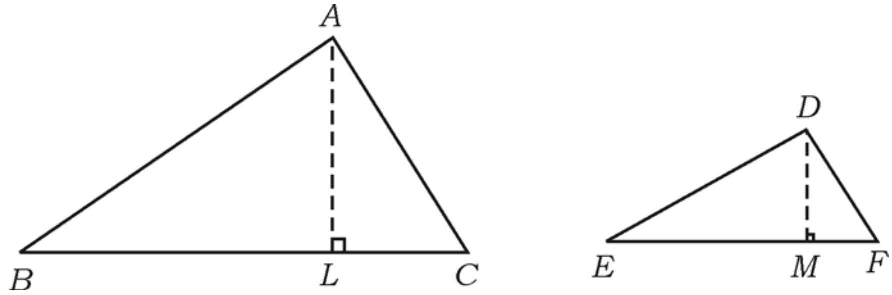
$R = 4$ cm

$r = 2$ 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
39.	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

$= \dfrac{BC \times AL}{EF \times DM}$

$= \dfrac{BC}{EF} \times \dfrac{BC}{EF}$ $\because$ 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.

40. 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		
	∴ 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	
	∴ Volume of mud in both the cases is same		
	∴ $\pi r^2 h = l \times b \times h$	1	
	$\frac{22}{7} \times \frac{7}{2} \times \frac{7}{2} \times 50 = 22 \times 14 \times h$	1	
	∴ $h = \frac{7 \times 5}{14}$		
	$h = \frac{5}{2}$ m	½	
	$h = 2{\cdot}5$ m		
	∴ Height of the platform is 2·5 m.	½	4
	OR		

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