Q.P. SET CODE
D

MT - z

Seat No. | | | | | | | |

2013 ___ ___ 1100 - **MT - z** - MATHEMATICS (71) ALGEBRA - SET - D (E)

Time : 2 Hours **(Pages 3)** **Max. Marks : 40**

Note :

(i) All questions are compulsory.

(ii) Use of calculator is not allowed.

Q.1. Solve ANY Five of the following : **5**

(i) 2 coins are tossed, write sample space and n(s).

(ii) Is following list of number an Arithmetic Progression? Justify.
3, 6, 12, 24, ...

(iii) Write D_x for the following simultaneous equation. :
$5x = 10 - 2y$; $y = 3x - 11$

(iv) Write the quadratic equation in standard from $ax^2 + bx + c = 0$
$-x^2 - 5 = 16x$

(v) If (a, 3) is the point lying on the graph of the equation $5x + 2y = -4$, then find a.

(vi) If A = 45, $\bar{d}$ = 1.08, h = 5 then find mean.

Q.2. Solve ANY FOUR of the following : **8**

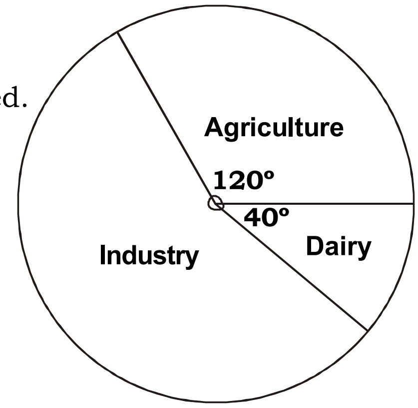
(i) Solve the following quadratic equation by factorization method.
$3x^2 - 10x + 8 = 0$

(ii) There is an auditorium with 35 rows of seats. There are 20 seats in the first row, 22 seats in the second row, 24 seats in the third row, and so on. Find the number of seats in the twenty fifth row.

(iii) The following diagram represents the sectorwise loan amount in crores of Rs. distributed by a bank. From the information answer the following questions :

(a) If the dairy sector received Rs. 20 crores, then find the total loan disbursed.

(b) Find the loan amount for agriculture sector and also for industrial sector.



(iv) One card is drawn from a well- shuffled deck of 52 cards. Find the probability of getting king of red colour

(v) Find t_{11} from the following A.P. 4, 9, 14, ...

(vi) Without actually solving the simultaneous equations given below, decide whether simultaneous equations have unique solution, no solution or infinitely many solutions.
$8y = x - 10; 2x = 3y + 7$

Q.3. Solve ANY THREE of the following : 9

(i) Solve the following simultaneous equations using Cramer's rule :
$3x + 2y + 11 = 0; 7x - 4y = 9$

(ii) How many three digit natural numbers are divisible by 4 ?

(iii) In the following experiment write the sample space S, number of sample points n (S), events P, Q, R using set and n (P), n (Q) and n (R). Find among the events defined above which are : complementary events, mutually exclusive events and exhaustive events.
There are 3 red, 3 white and 3 green balls in a bag. One ball is drawn at random from a bag :
P is the event that ball is red.
Q is the event that ball is not green.
R is the event that ball is red or white.

(iv) Electricity used by farmers during different parts of a day for irrigation is as follows. Draw pie diagram :

Part of day	Morning	Afternoon	Evening	Night
Percentage of electricity used	30	40	20	10

(v) Represent the following data by histogram.

Price of sugar per kg (in ₹)	18 - 20	20 - 22	22 - 24	24 - 26	26 - 28	Total
Number of weeks	4	8	22	12	6	52

Q.4. Solve ANY TWO of the following : 8

(i) A box contains 20 cards marked with the numbers 1 to 20. One card is drawn from this box. What is the probability that number on the card is
(a) a prime number
(b) perfect square
(c) multiple of 5

(ii) In winter, the temperature at a hill station from Monday to Friday is in A.P. The sum of the temperatures of Monday, Tuesday and Wednesday is zero and the sum of the temperatures of Thursday and Friday is 15. Find the temperature of each of the five days.

(iii) Solve the following equation :
$(x^2 + 2x)(x^2 + 2x - 11) + 24 = 0$

Q.5. Solve ANY TWO of the following : 10

(i) On the first day of the sale of tickets of a drama, 35 tickets in all were sold. If the rates of the tickets were Rs.20 and Rs.40 per ticket and the total collection was Rs. 900. Find the number of tickets sold of each rate.

(ii) Below is given frequency distribution of marks (out of 100) obtained by the students. Find mean marks scored by ' Step Deriation Method'.

Marks	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100
No. of Students	3	5	7	10	12	15	12	6	2	8

(iii) Around a square pool there is a footpath of width 2m. if the area of the footpath is $\frac{5}{4}$ times that of the pool. Find the area of the pool.

Best Of Luck 👍

A.P. SET CODE
D

MT - z

2013 ___ __ 1100 - **MT - z** - MATHEMATICS (71) ALGEBRA - SET - D (E)

Time : 2 Hours **Preliminary Model Answer Paper** **Max. Marks : 40**

A.1.	**Attempt ANY SIX of the following :**	
(i)	When 2 coins are tossed S = { HH, HT, TH, TT } n(S) = 4	**1**
(ii)	$t_1 = 3,\ t_2 = 6,\ t_3 = 12,\ t_4 = 24$ $t_2 - t_1 = 6 - 3 = 3$ $t_3 - t_2 = 12 - 6 = 6$ $t_4 - t_3 = 24 - 12 = 12$ ∵ The difference between any two consecutive terms is not constant. ∴ The sequence is not an A.P.	**1**
(iii)	$5x = 10 - 2y$ ∴ $5x + 2y = 10$ $y = 3x - 11$ ∴ $-3x + y = -11$ $D_x = \begin{vmatrix} 10 & 2 \\ -11 & 1 \end{vmatrix}$	**1**
(iv)	$-x^2 - 5 = 16x$ ∴ $0 = x^2 + 16x + 5$ ∴ $x^2 + 16x + 5 = 0$	**1**
(v)	∵ (a, 3) is a point lying on the graph of the equation 5x + 2y = – 4, it satisfies the equation. ∴ Substituting x = a and y = 3 in the equation we get, $5(a) + 2(3) = -4$ ∴ $5a + 6 = -4$ ∴ $5a = -4 - 6$ ∴ $5a = -10$	

	$\therefore \quad a = \frac{-10}{5}$	
	$\therefore \quad a = -2$	1
(vi)	mean $(\overline{x}) = A + \overline{d}$	
	$= 45 + 1.08$	
	mean $(\overline{x}) = 46.08$ units	1
A.2.	**Solve ANY Four of the following :**	
(i)	$3x^2 - 10x + 8 = 0$	
	$\therefore \quad 3x^2 - 6x - 4x + 8 = 0$	
	$\therefore \quad 3x(x-2) - 4(x-2) = 0$	
	$\therefore \quad (x-2)(3x-4) = 0$	
	$\therefore \quad x - 2 = 0$ or $3x - 4 = 0$	1
	$\therefore \quad x = 2$ or $3x = 4$	
	$\therefore \quad x = 2$ or $x = \frac{4}{3}$	1
	$\therefore$ 2 and $\frac{4}{3}$ are the roots of given quadratic equation.	
(ii)	Since the no. of seats in each row of the auditorium are 20, 22, 24, ...	
	The no. of seats in each row form an A.P.	
	No. of seats in first row (a) = 20	
	Difference in no. of seats in two successive rows is (d) = 2	
	No. of seats in 25th row = t_{25} = ?	
	$t_n = a + (n + 1) d$	1
	$\therefore \quad t_{25} = a + (25 - 1) d$	
	$\therefore \quad t_{25} = 20 + 24 (2)$	
	$\therefore \quad t_{25} = 20 + 48$	
	$\therefore \quad t_{25} = 68$	
	$\therefore$ There are 68 seats in 25^{th} row.	1
(iii)	(a) Let the total loan disbursed be Rs. x crores	
	The measure of central angle for dairy sector is 40°.	
	$\because$ Dairy sector received Rs. 20 crores of the total loan i.e. x	
	$\therefore \quad \frac{40}{360} \times x = 20$ crores	
	$\therefore \quad x = \frac{20 \text{ crores} \times 360}{40}$	
	$\therefore \quad x = 180$ crores.	1

	$\therefore$ Total loan disbursed is Rs. 180 crores. (b) Measure of central angle for agriculture sector is 120° $\therefore$ Amount disbursed for agriculture sector $= \frac{120}{360} \times 180$ = Rs. 60 crores Measure of central angle for industrial sector is 200° $\therefore$ Amount disbursed for industrial sector $= \frac{200}{360} \times 180$ = Rs. 100 crores.	1
(iv)	There are 52 cards in a pack $\therefore$ $n(S) = 52$ Let A be the event that card drawn is a king of red colour $\because$ There are 2 kings of red colour $n(A) = 2$ $P(A) = \frac{n(A)}{n(S)}$ $\therefore$ $P(A) = \frac{2}{52}$ $\therefore$ $P(A) = \frac{1}{26}$	1 1
(v)	For the A.P. 4, 9, 14, ... $a = 4, d = 5$ $t_n = a + (n - 1) d$ $\therefore$ $t_{11} = 4 + (11 - 1) 5$ $\therefore$ $t_{11} = 4 + 50$ $\therefore$ $t_{11} = 54$	1 1
(vi)	$8y = x - 10$ $\therefore$ $-x + 8y = -10$ Comparing with $a_1x + b_1y = c_1$ we get, $a_1 = -1$, $b_1 = 8$, $c_1 = -10$ $2x = 3y + 7$ $\therefore$ $2x - 3y = 7$ Comparing with $a_2x + b_2y = c_2$ we get, $a_2 = 2$, $b_2 = -3$, $c_2 = 7$ $\therefore$ $\frac{a_1}{a_2} = \frac{-1}{2}$ $\therefore$ $\frac{b_1}{b_2} = \frac{8}{-3} = \frac{-8}{3}$ $\therefore$ $\frac{c_1}{c_2} = \frac{-10}{7}$	1

	$\because \frac{a_1}{a_2} \neq \frac{b_1}{b_2}$	
	$\therefore$ The simultaneous equations 8y = x – 10 and 2x = 3y + 7 have unique solution.	1
A.3.	**Solve ANY THREE of the following :**	
(i)	3x + 2y + 11 = 0	
	$\therefore$ 3x + 2y = – 11	
	7x – 4y = 9	
	$D = \begin{vmatrix} 3 & 2 \\ 7 & -4 \end{vmatrix} = (3 \times -4) - (2 \times 7) = -12 - 14 = -26$	
	$D_x = \begin{vmatrix} -11 & 2 \\ 9 & -4 \end{vmatrix} = (-11 \times -4) - (2 \times 9) = 44 - 18 = 26$	
	$D_y = \begin{vmatrix} 3 & -11 \\ 7 & 9 \end{vmatrix} = (3 \times 9) - (-11 \times 7) = 27 - (-77) = 27 + 77 = 104$	1
	By Cramer's rule,	
	$x = \frac{D_x}{D} = \frac{26}{-26} = -1$	1
	$y = \frac{D_y}{D} = \frac{104}{-26} = -4$	
	$\therefore$ x = – 1 and y = – 4 is the solution of given simultaneous equations.	1
(ii)	The three digit natural numbers that are divisible by 4 are as follows	
	100, 104, 108, ... 996.	
	These numbers form an A.P. with $a = t_1 = 100$,	
	$d = t_2 - t_1 = 104 - 100 = 4$.	1
	Let, $t_n = 996$	
	We know that for an A.P.	
	$t_n = a + (n - 1) d$	
	$\therefore 996 = 100 + (n - 1) 4$	
	$\therefore 996 = 100 + 4n - 4$	1
	$\therefore 996 = 96 + 4n$	
	$\therefore 4n = 996 - 96$	
	$\therefore 4n = 900$	
	$\therefore n = \frac{900}{4}$	
	$\therefore n = 225$	
	$\therefore$ There are 225 three digit natural numbers that are divisible by 4.	1

(iii) Let 3 red balls, 3 white balls and 3 green balls be denoted as $R_1, R_2, R_3, W_1, W_2, W_3$ and G_1, G_2, G_3 respectively.

$\therefore$ S = $\{R_1, R_2, R_3, W_1, W_2, W_3, G_1, G_2, G_3\}$

$\therefore$ n(S) = 9 **1**

P is the event that the ball is red

P = $\{R_1, R_2, R_3\}$

$\therefore$ n (P) = 3

Q is the event that the ball is not green **1**

Q = $\{R_1, R_2, R_3, W_1, W_2, W_3\}$

$\therefore$ n (Q) = 6

R is the event that the ball is red or white

R = $\{R_1, R_2, R_3, W_1, W_2, W_3\}$

$\therefore$ n (R) = 6 **1**

(iv)

Part of day	Percentage of electricity used	Measure of central angle
Morning	30	$\frac{30}{100} \times 360^\circ = 108^\circ$
Afternoon	40	$\frac{40}{100} \times 360^\circ = 144^\circ$
Evening	20	$\frac{20}{100} \times 360^\circ = 72^\circ$
Night	10	$\frac{10}{100} \times 360^\circ = 36^\circ$
Total	**100**	**360°**

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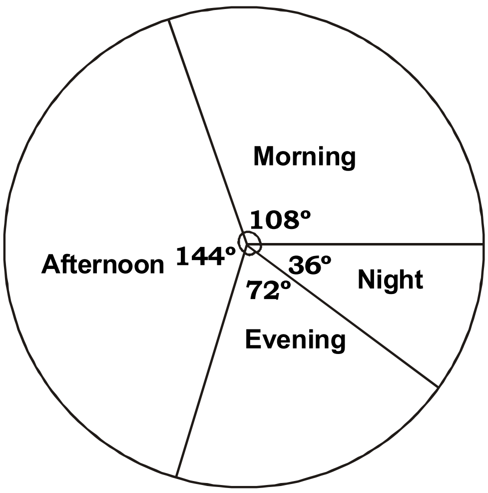

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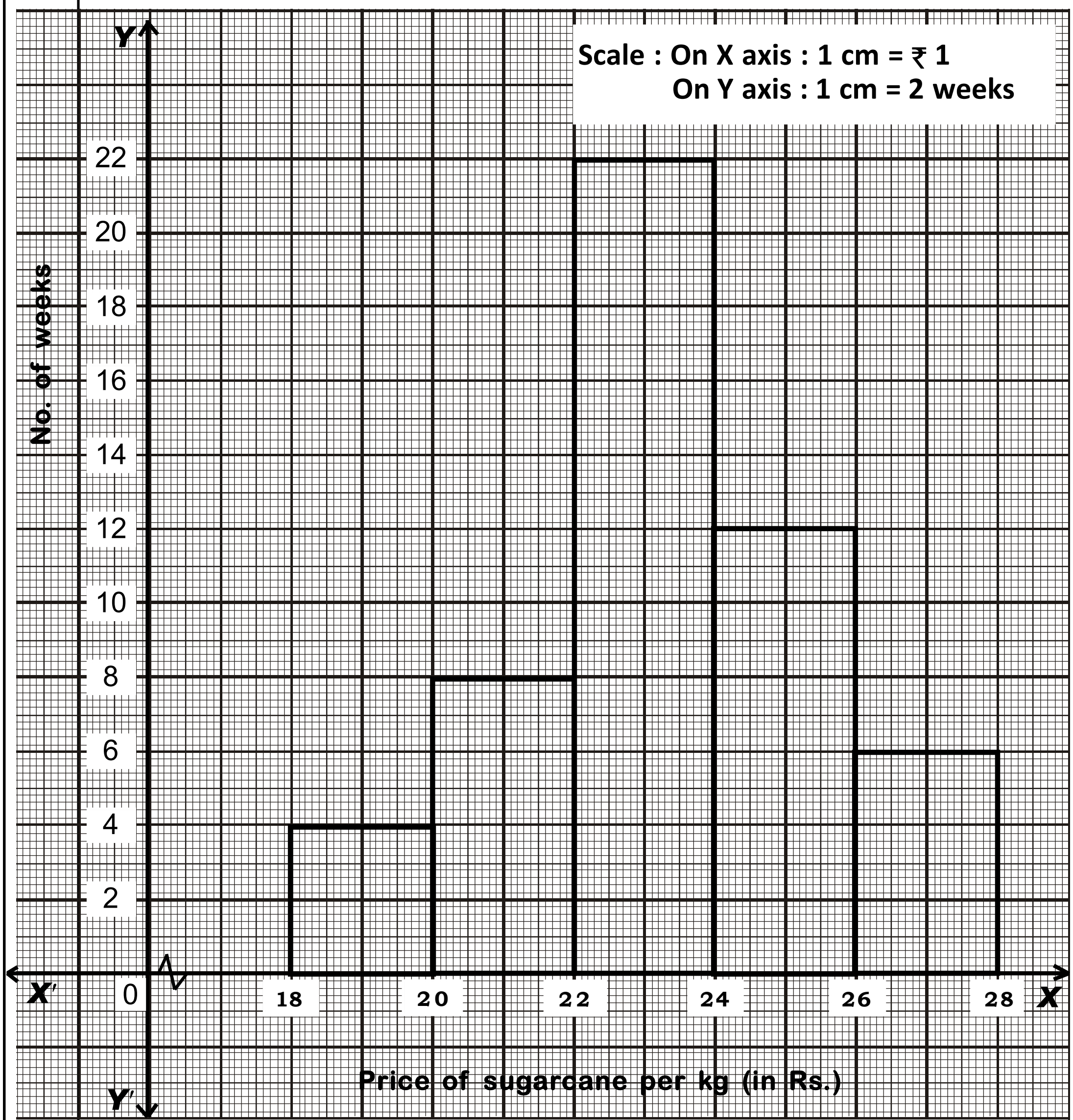
Price of sugar per kg (in Rs.)	No. of weeks
18 - 20	4
20 - 22	8
22 - 24	22
24 - 26	12
26 - 28	6
Total	**52**



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A.4.	**Solve ANY TWO of the following :**	
(i)	The sample space for box containing 20 card $\therefore$ S = { 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20 } $\therefore$ n (S) = 20	1
	(a) Let A be the event that number on the card is prime number. A = { 2, 3, 5, 7, 11, 13, 17, 19 } n (A) = 8 $P(A) = \frac{n(A)}{n(S)}$ $\therefore P(A) = \frac{8}{20}$ $\therefore P(A) = \frac{2}{5}$	1
	(b) Let B be the event that number on the card is a perfect square B = { 1, 4, 9, 16 } n (B) = 4 $P(B) = \frac{n(B)}{n(S)}$ $\therefore P(B) = \frac{4}{20}$ $\therefore P(B) = \frac{1}{5}$	1
	(c) Let C be the event that number on the card is multiple of 5 C = { 5, 10, 15, 20 } n (C) = 4 $P(C) = \frac{n(C)}{n(S)}$ $\therefore P(C) = \frac{4}{20}$ $\therefore P(C) = \frac{1}{5}$	1
(ii)	Let the temperatures of hill station from Monday to Friday which form are A.P. be a – 2d, a – d, a, a + d, a + 2d respectively.	1
	As per the first condition,	

	$a - 2d + a - d + a = 0$ $\therefore\ 3a - 3d = 0$ $\therefore\ 3(a - d) = 0$ $\therefore\ a - d = 0$ $\therefore\ a = d$	**1**
	As per the second condition, $a + d + a + 2d = 15$ $\therefore\ 2a + 3d = 15$ $\therefore\ 2a + 3a = 15 \quad [\because a = d]$ $\therefore\ 5a = 15$ $\therefore\ a = 3$	**1**
	$\therefore\ d = 3 \quad [\because d = a]$ $\therefore\ a - 2d = 3 - 2(3) = 3 - 6 = -3$ $\therefore\ a - d = 3 - 3 = 0$ $\therefore\ a + d = 3 + 3 = 6$ $\therefore\ a + 2d = 3 + 2(3) = 3 + 6 = 9$ $\therefore$ The temperatures from Monday to Friday are – 3, 0, 3, 6 and 9 respectively.	**1**
(iii)	$(x^2 + 2x)(x^2 + 2x - 11) + 24 = 0$ Substituting $x^2 + 2x = m$ we get, $m(m - 11) + 24 = 0$ $\therefore\ m^2 - 11m + 24 = 0$	**1**
	$\therefore\ m^2 - 8m - 3m + 24 = 0$ $\therefore\ m(m - 8) - 3(m - 8) = 0$ $\therefore\ (m - 8)(m - 3) = 0$ $\therefore\ m - 8 = 0$ or $m - 3 = 0$ $\therefore\ m = 8$ or $m = 3$ Resubstituting $m = x^2 + 2x$ we get, $x^2 + 2x = 8$ or $x^2 + 2x = 3$ $\therefore\ x^2 + 2x - 8 = 0$ .... (i) or $x^2 + 2x - 3 = 0$ ......(ii)	**1**
	From (i), $x^2 + 2x - 8 = 0$ $\therefore\ x^2 + 4x - 2x - 8 = 0$ $\therefore\ x(x + 4) - 2(x + 4) = 0$ $\therefore\ (x + 4)(x - 2) = 0$ $\therefore\ x + 4 = 0$ or $x - 2 = 0$ $\therefore\ x = -4$ or $x = 2$	**1**
	From (ii), $x^2 + 2x - 3 = 0$ $\therefore\ x^2 + 3x - x - 3 = 0$ $\therefore\ x(x + 3) - 1(x + 3) = 0$ $\therefore\ (x + 3)(x - 1) = 0$	

∴ $x + 3 = 0$ or $x - 1 = 0$
∴ $x = -3$ or $x = 1$
∴ $x = -4$ or $x = 2$ or $x = -3$ or $x = 1$. **1**

A.5. Solve ANY TWO of the following :

(i) Let the no. of tickets sold at Rs. 20 each be x and Rs. 40 each be y.
As per first given condition,
$x + y = 35$ ......(i) **1**
As per second given condition,
$20x + 40y = 900$
Dividing throughout by 20,
$x + 2y = 45$ ......(ii) **1**
Subtracting (ii) from (i),
$x + y = 35$
$x + 2y = 45$
(–) (–) (–)
$-y = -10$
∴ $y = 10$ **1**
Substituting y = 10 in (i),
$x + 10 = 35$
∴ $x = 35 - 10$
∴ $x = 25$ **1**
∴ The no. of tickets sold at Rs. 20 each and Rs. 40 each are 25 tickets and 10 tickets respectively. **1**

(ii) Class width (h) = 10, Assumed mean (A) = 45

Class mark	**Class Mark (x_i)**	**$d_i = x_i - A$**	**$u_i = \frac{d_i}{h}$**	**No. of students (f_i)**	**$f_i u_i$**
0 - 10	5	– 40	– 4	3	– 12
10 - 20	15	– 30	– 3	5	– 15
20 - 30	25	– 20	– 2	7	– 14
30 - 40	35	– 10	– 1	10	– 10
40 - 50	45 →A	0	0	12	0
50 - 60	55	10	1	15	15
60 - 70	65	20	2	12	24
70 - 80	75	30	3	6	18
80 - 90	85	40	4	2	8
90 - 100	95	50	5	8	40
Total				**80**	**54**

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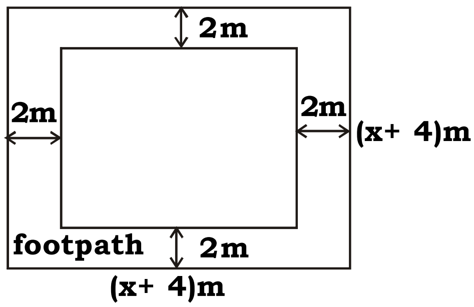
	$\bar{u} = \dfrac{\Sigma f_i u_i}{\Sigma f_i}$	
	$\therefore \bar{u} = \dfrac{54}{80}$	
	$\therefore \bar{u} = 0.675$	1
	Mean $(\bar{x}) = A + h\bar{u}$ $= 45 + 10\ (0.675)$ $= 45 + 6.75$ $= 51.75$	
	$\therefore$ Mean of marks obtained by students is 51.75 marks.	1
(iii)	Let the side of inner square i.e. pool be x m. $\because$ The width of foot path around the pool is 2 m $\therefore$ The side of outer square is (x + 4) m $\because$ Area of square = $(\text{side})^2$ As per the given condition,  	1
	(Area of outer square) = (Area of inner square) + (Area of footpath)	
	$(x + 4)^2 = x^2 + \dfrac{5}{4} x^2$	1
	$\therefore x^2 + 8x + 16 = x^2 + \dfrac{5}{4} x^2$	
	$\therefore 8x + 16 = \dfrac{5}{4} x^2$	
	Multiplying throughout by 4 we get, $32x + 64 = 5x^2$	
	$\therefore 5x^2 - 32x - 64 = 0$	1
	$\therefore 5x^2 - 40x + 8x - 64 = 0$ $\therefore 5x\ (x - 8) + 8\ (x - 8) = 0$ $\therefore (x - 8)\ (5x + 8) = 0$ $\therefore x - 8 = 0$ or $5x + 8 = 0$ $\therefore x = 8$ or $5x = -8$	
	$\therefore x = 8$ or $x = \dfrac{-8}{5}$	1

$x = \frac{-8}{5}$ is not acceptable because side of pool cannot be negative.

$\therefore \quad x = 8$

$\therefore \quad x^2 = 8^2$

$\therefore \quad x^2 = 64$

$\therefore$ Area of pool is 64 sq. m. **1**

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