SUB. : Mathematics Part - I
STD. : 10 (English)
TIME: 2 hrs
DATE: 21-Sep-2021

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Q.1 A) Solve Multiple choice questions. **(4)**

1) Taxable value of a television set is 25,000. if rate of G.S.T. is 28% calculate the amount payable by the consumer.

a. Rs. 25,000 b. Rs. 7,000 c. Rs. 32,000 d. Rs. 31,500

Ans. Option c.

2) If the equation $2x^2 - 5x + (k + 3) = 0$ has equal roots then the value of K is

a. $\frac{9}{8}$ b. $-\frac{9}{8}$ c. $\frac{1}{8}$ d. $-\frac{1}{8}$

Ans. Option c.

3) The 11th term of the A.P. $-3, -\frac{1}{2}, 2, ...$ is

a. 28 b. 22 c. -38 d. $-48\frac{1}{2}$

Ans. Option b.
Hint : Use t_n formula

4) If the probability of an event is p, then the probability of its complementary event will be

a. p - 1 b. p c. 1 - p d. $1 - \frac{1}{p}$

Ans. Option c.

B) Solve the following questions. **(4)**

1) Courier service agent charged total Rs. 590 to courier a parcel from Nashik to Nagpur. In the tax invoice taxable value is Rs. 500 on which CGST is Rs. 45 and SGST is Rs. 45. Find the rate of GST charged for this service.

Ans. Total GST = CGST + SGST = 45 + 45 = Rs. 90.

Rate of GST = $\frac{90}{500} \times 100 = 18\%$

$\therefore$ Rate of GST charged by agent is 18%.

2) If two coins are tossed simultaneously, find the probability of getting a head on both the coins.

Ans. S = {HH, HT, TH, TT}, n(S) = 4
If event A is getting a head on both coins.
A = {HH}, n(A) = 1
$P(A) = \frac{n(A)}{n(S)} = \frac{1}{4}$

3) Find the first term and common difference for each of the A.P.
5, 1, - 3, - 7

Ans. Here $t_1 = a = 5$,
$t_2 = 1, t_3 = -3, t_4 = -7$
for an A.P, $t_{n+1} - t_n = d$

$\therefore$ $d = t_2 - t_1 = 1 - 5 = -4$,
$d = t_3 - t_2 = -3 - 1 = -4$.
$\therefore$ First term (a) is 5 and common difference (d) is - 4.

4) Write the quadratic equation whose roots are - 3 and - 11.

Ans. Let $\alpha = -3$ and $\beta = -11$.
Then $\alpha + \beta = -3 - 11 = -14$ and $\alpha\beta = (-3) \times (-11) = 33$.
The required quadratic equation is
$x^2 - (\alpha + \beta)x + \alpha\beta = 0$
$\therefore$ $x^2 - (-14)x + 33 = 0$ ... (Substituting the values)
$\therefore$ $x^2 + 14x + 33 = 0$
The required quadratic equation is $x^2 + 14x + 33 = 0$

Q.2 A) Complete the following Activities. (Any Two) **(4)**

1) Write the correct number in the given boxes from the following A.P.
- 3, - 8, - 13, - 18 .....

Here $t_1 = -3$, $t_2 = -8$, $t_3 =$ ______, $t_4 = -18$
$t_2 - t_1 =$ ______, $t_3 - t_2 =$ ______
$\therefore$ a = ______, d = ______

Ans. Write the correct number in the given boxes from the following A.P.
- 3, - 8, - 13, - 18 .....

Here $t_1 = -3$, $t_2 = -8$, $t_3 = -13$, $t_4 = -18$
$t_2 - t_1 = -5$, $t_3 - t_2 = -5$
$\therefore$ $a = -3$, $d = -5$

2) Form the quadratic equation from its roots. 0 and 7

Let $\propto$ and β be the roots of the quadratic equation.
Let $\propto =$ ______ and $\beta = 7$
$\therefore$ $\propto + \beta =$ ______ $= 7$ and
$\propto \times \beta = 0 \times 7 = 0$
Then required quadratic equation is
$\therefore$ $x^2 -$ ______ $x +$ ______ $= 0$
$\therefore$ $x^2 -$ ______$x + 0 = 0$

Ans. Form the quadratic equation from its roots. 0 and 7

Let $\propto$ and β be the roots of the quadratic equation.
Let $\propto = 0$ and $\beta = 7$
$\therefore$ $\propto + \beta = 0 + 7 = 7$ and
$\propto \times \beta = 0 \times 7 = 0$
Then required quadratic equation is
$\therefore$ $x^2 - (\propto + \beta)x + \propto\beta = 0$
$\therefore$ $x^2 - 7x + 0 = 0$

3) Complete the following activity to solve the simultaneous equations $3x + 2y = 6$ and $2x + 4y = 12$ by Cramer's method.

$D = \begin{vmatrix} 3 & 2 \\ 2 & 4 \end{vmatrix} = 8$

$Dx = \begin{vmatrix} 6 & 2 \\ 12 & 4 \end{vmatrix}$

= ______
= 0

Dy

$= \begin{vmatrix} 3 & 6 \\ 2 & 12 \end{vmatrix}$

= ______

= 36 - 12

= 24

x $= \frac{Dx}{D} = \frac{0}{8} =$ ______

y $= \frac{Dy}{D} = \frac{24}{8} =$ ______

Ans. Complete the following activity to solve the simultaneous equations 3x + 2y = 6 and 2x + 4y = 12 by Cramer's method.

D $= \begin{vmatrix} 3 & 2 \\ 2 & 4 \end{vmatrix} = 8$

Dx $= \begin{vmatrix} 6 & 2 \\ 12 & 4 \end{vmatrix}$

$= 6 \times 4 - 12 \times 2$

= 0

Dy $= \begin{vmatrix} 3 & 6 \\ 2 & 12 \end{vmatrix}$

$= 12 \times 3 - 6 \times 2$

= 36 - 12

= 24

x $= \frac{Dx}{D} = \frac{0}{8} = 0$

y $= \frac{Dy}{D} = \frac{24}{8} = 3$

B) Solve the following questions. (Any four) **(8)**

1) Krishna Electricals had bought a TV from a wholesaler at Rs. 36,000. The marked price on it in Krishna Electricals was Rs. 50,000. If it was sold to Kalyan Deshmukh at 10% discount, calculate the input GST and output GST for Krishna Electricals if the rate of GST is 18%.

Ans. For Krishna Electronics :

Marked price of TV set = Rs. 50,000

Discount = $50,000 \times \frac{10}{100}$ = Rs. 5000

The taxable value of the TV set = 50000 - 5000 = Rs. 45000

Input Tax = $36000 \times \frac{18}{100}$ = Rs. 6480

Output tax = $45000 \times \frac{18}{100}$ = Rs. 8100

2) A card is drawn at random from a pack of well shuffled 52 playing cards. Find the probability that the card drawn is -

(1) an ace. (2) a spade.

Ans. One card is drawn from a pack of 52 cards.

$\therefore$ n(S) = 52

A is the event of getting an ace.

There are 4 ace cards.

$\therefore$ n(A) = 4

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

$\therefore$ P(A) $= \frac{4}{52} = \frac{1}{13}$

B is the event of getting a spade.

There are 13 spade cards.

$\therefore$ n(B) = 13

$\therefore$ P(B) = $\frac{n(B)}{n(S)}$

$\therefore$ P(B) = $\frac{13}{52} = \frac{1}{4}$

3) If x = 5 and y = 3 is the solution of 3x + ky = 3. find the value of k.

Ans. Substitute x = 5 and y = 3 in the equation 3x + ky = 3.

$$3(5) + ky = 3$$
$$3(5) + k(3) = 3$$
$$5 + k = 1 \quad \text{..... (Dividing both the sides by 3)}$$
$$k = 1 - 5$$
$$k = -4$$

The value of k is -4.

4) Determine whether the gives values of x is the root of given quadratic equation $6x^2 - x - 2 = 0$, x = $\frac{3}{2}$

Ans. By putting x = $\frac{3}{2}$

in L.H.S we get

L.H.S = $6 \times \left(\frac{3}{2}\right)^2 - \frac{3}{2} - 2$

$= 6x\frac{9}{4} - \frac{3}{2} - 2$

$= \frac{27}{2} - \frac{3}{2} - 2$

$= \frac{24}{2} - 2$

= 12 - 2

= 10

L.H.S ≠ R.H.S.

So $\frac{3}{2}$ is not the root of the given quadratic equation.

5) Find the sum of first n odd natural numbers.

Ans. First n natural numbers 1, 3, 5, 7, . . . , (2n - 1).

a= t_1 = 1 and tn = (2n - 1), d = 2

Sn =$\frac{n}{2}$ [t_1 + tn]

$= \frac{n}{2}$ [1+ (2n - 1)]

$= \frac{n}{2}$ [1+ 2n - 1]

$= \frac{n}{2} \times 2n$

$= n^2$

Q.3 A) Complete the following Activity (Any one) **(3)**

1) Out of a group of swans, $\frac{7}{2}$ times the square root of number of swans are playing on the shore of the tank. Remaining two are quarreling in the water. Calculate number of Swans.

Let us denote number of swans by x.

Then the number of swans playing on the shore of the tank = ______

There are two swans quarreling in the water

By given condition,

$x = \frac{7}{2}\sqrt{x} + 2$

∴ $x - 2 = \frac{7}{2}\sqrt{x}$

∴ $(x - 2)^2 = \left(\frac{7}{2}\right)^2 \times x$

∴ 4 ______ = 49x

∴ $4x^2 - 65x + 16 = 0$

∴ ______ = 0

∴ $4x^2 - 64x - x + 16 = 0$

∴ $4x(x - 16) - 1(x - 16) = 0$

∴ $(x - 16)(4x - 1) = 0$

∴ $(x - 16) = 0$ or $(4x - 1) = 0$

∴ x = ______ or x = ______

We reject x = ______ and take x = 16

Hence the total number of swans is ______

Ans. Out of a group of swans, $\frac{7}{2}$ times the square root of number of swans are playing on the shore of the tank. Remaining two are quarreling in the water. Calculate number of Swans.

Let us denote number of swans by x.

Then the number of swans playing on the shore of the tank = $\frac{7}{2}\sqrt{x}$

There are two swans quarreling in the water

By given condition,

$x = \frac{7}{2}\sqrt{x} + 2$

∴ $x - 2 = \frac{7}{2}\sqrt{x}$

∴ $(x - 2)^2 = \left(\frac{7}{2}\right)^2 \times x$

∴ $4(x^2 - 4x + 4) = 49x$

$4x^2 - 16x - 49x + 16 = 0$

∴ $4x^2 - 65x + 16 = 0$

∴ $4x^2 - 64x - x + 16 = 0$

∴ $4x^2 - 64x - x + 16 = 0$

∴ $4x(x - 16) - 1(x - 16) = 0$

∴ $(x - 16)(4x - 1) = 0$

∴ $(x - 16) = 0$ or $(4x - 1) = 0$

∴ x = 16 or $x = \frac{1}{4}$

We reject $x = \frac{1}{4}$ and take x = 16

Hence the total number of swans is 16.

2) The sum of the measures of angles of a triangle is 180º, of a quadrilateral is 360º, of a pentagon is 540º, and so on. Assuming this pattern, find the sum of the measures of angles of a dodecagon (i.e. polygon with 12 sides).

Term number (n)	1	2	3	...	10	...
Sides of the polygon	3	4	5	...	12	...
Sum of the measures of angles	180°	360°	540°	...	...	...

Thus we have the first term a = _____
The second term _____ = 360, i.e. 180 + 180,
The third term _____ = 540, i.e. 180 + 2 x 180,
Thus we get each tern by adding 180 to the preceding term, here d = 180.
We have $t_n = a + (n – 1) d$.
∴ t_{10} = _____
= _____
∴ = _____
Thus the sum of the measures of angles of a dodecagon in _____

Ans. The sum of the measures of angles of a triangle is 180º, of a quadrilateral is 360º, of a pentagon is 540º, and so on. Assuming this pattern, find the sum of the measures of angles of a dodecagon (i.e. polygon with 12 sides).

Term number (n)	1	2	3	...	10	...
Sides of the polygon	3	4	5	...	12	...
Sum of the measures of angles	180°	360°	540°	...	...	...

Thus we have the first term a = 180
The second term a + d = 360, i.e. 180 + 180,
The third term a + 2d = 540, i.e. 180 + 2 x 180,
Thus we get each tern by adding 180 to the preceding term, here d = 180.
We have $t_n = a + (n – 1) d$.
∴ t_{10} = 180 + (10 – 1) x 180
= 180 + 9 x 180
∴ = 1800
Thus the sum of the measures of angles of a dodecagon in 1800º.

B) Solve the following questions. (Any two) **(6)**

1) Solve the following simultaneous equations using Cramer's method.
3x - 4y = 10 ; 4x + 3y = 5

Ans. 3x - 4y = 10
4x + 3y = 5

$$D = \begin{vmatrix} 3 & -4 \\ 4 & 3 \end{vmatrix}$$

= (3 × 3) - (-4 × 4)
= 9 - (-16)
= 9 + 16
∴ **D = 25**

$$Dx = \begin{vmatrix} 10 & -4 \\ 5 & 3 \end{vmatrix}$$

= (10 × 3) - (-4 × 5)
= 30 - (-20)
= 30 + 20
∴ **Dx = 50**

$$Dy = \begin{vmatrix} 3 & 10 \\ 4 & 5 \end{vmatrix}$$

= (3 × 5) - (10 × 4)
= 15 - 40
∴ **Dy = - 25**
By Cramer's rule
$x = \frac{\mathrm{Dx}}{\mathrm{D}} = \frac{50}{25}$ = 2 and

$y = \frac{Dy}{D} = \frac{-25}{25}$ = -1

∴ x = 2 and y = -1 is the solution of given simultaneous equations.

2) Find the median rainfall:

Rainfall (in mm)	100 - 150	150 - 200	200 - 250	250 - 300
Number of cities	4	8	12	6

Ans.

Rainfall (in mm)	**Number of cities (f)**	**c.f. (less than type)**
100 - 150	4	4
150 - 200	8	4 + 8 = 12 → c.f.
200 - 250 median class	**12 → f**	**12 + 12 = 24**
250 - 300	6	24 + 6 = 30
Total	30	

Here, N = 30 ∴ $\frac{N}{2}$= 15, c.f. which is just greater than 15 to 24.

∴ the corresponding class 200 - 250 is the median class.

L = 200, f = 12, c.f. = 12, h = width of the class = 50

Median = L + $\left(\frac{N}{2} - c.f\right)\frac{h}{f}$ ... (Formula)

= 200 + (15 - 12) × $\frac{50}{12}$ ... (Substituting the values)

= 200 + 3 × $\frac{50}{12}$

= 200 + 12.5 = 212.5

The median rainfall is **212.5 mm.**

3) Three coins are tossed simultaneously. Find the probability of following events.

i. Getting exactly two heads.
ii. Getting at least two heads.
iii. Getting no head.
iv. Getting at the most two tails.

Ans. S is the sample space

∴ S = {HHH, HHT, HTH, THH, HTT, HTT, TTH, TTT}

∴ n(S) = 8

i. Let A be the event of getting exactly two heads.

∴ A = {HHT, HTH, THH}

∴ n(A) = 3

∴ P(A) = $\frac{n(A)}{n(S)} = \frac{3}{8}$

ii. Let B be event of getting at least two heads (i.e. two or more heads)

∴ B = {HHH, HHT, HTH, THH}

∴ n(B) = 4

∴ P(B) = $\frac{n(B)}{n(S)} = \frac{4}{8} = \frac{1}{2}$

iii. Let C be the event of getting no head.

∴ C = {TTT}

∴ n(C) = 1

∴ P(C) = $\frac{n(C)}{n(S)} = \frac{1}{8}$

iv. Let D be the event of getting at the most two tails (i.e. two or less than two)

$\therefore$ D = {HHH, HHT, HTH, THH, HTT, THT, TTH}

$\therefore$ n(B) = 7

$\therefore$ $P(D) = \frac{n(D)}{n(S)} = \frac{7}{8}$

4) The roots of each of the following quadratic equations are real and equal, find k.

kx (x - 2) + 6 = 0

Ans. kx (x - 2) + 6 = 0

$\therefore$ $kx^2 - 2kx + 6 = 0$ ... (In the standard form)

Here, a = k, b = - 2k, c = 6

$\Delta = b^2 - 4ac$

$= (-2k)^2 - 4(k)(6)$

$= 4k^2 - 24k$

The roots are real and equal ... (Given)

$\therefore$ $\Delta = 0$

$\therefore$ $4k^2 - 24k = 0$

$\therefore$ 4k (k - 6) = 0

$\therefore$ 4k = 0 or k - 6 = 0 $\therefore$ k = 0 or k = 6

k = 0 is unacceptable, because if k = 0, the equation becomes meaningless.

$\therefore$ k = 6

Ans.: The value of k is **6.**

Q.4 Solve the following questions. (Any two) (8)

1) Two years ago, my age was $4\frac{1}{2}$ times the age of my son. Six years ago, my age was twice the square of the age of my son. What is the present age of my son?

Ans. Let the present age of my son be x years.

Then 2 years ago, his age was (x - 2) years.

Form the first condition,

2 years ago my age was $\frac{9}{2}$(x - 2) years

$\therefore$ my present age is $\left[\frac{9}{2}\left(x-2\right)+2\right]$ years.

6 years ago, my son's age was (x - 6) years and my age was

$\left[\frac{9}{2}\left(x-2\right)+2-6\right] = \left[\frac{9(x-2)}{2}-4\right]$ years.

From the second condition,

$\frac{9(x-2)}{2} - 4 = 2(x-6)^2$

$\therefore$ $\frac{9x-18-8}{2} = 2(x^2 - 12x + 36)$

$\therefore$ $9x - 26 = 4(x^2 - 12x + 36)$

$\therefore$ $9x - 26 = 4x^2 - 48x + 144$

$\therefore$ $4x^2 - 48x - 9x + 144 + 26 = 0$

$\therefore$ $4x^2 - 57x + 170 = 0$

$\therefore$ $4x^2 - 40x - 17x + 170 = 0$ ... [$4 \times 170 = 4 \times 17 \times 10 = 40 \times 17$]

$\therefore$ 4x(x - 10) - 17(x - 10) = 0

$\therefore$ (x - 10)(4x - 17) = 0

$\therefore$ x - 10 = 0 or 4x - 17 = 0

$\therefore$ x = 10 or $x = \frac{17}{4} = 4\frac{1}{4}$

If $x = 4\frac{1}{4}$ years, then 6 years ago the son was not born.

$\therefore$ $x \neq 4\frac{1}{4}$ x = 10

The present age of my son **10 years**.

2) Find three consecutive terms in an A.P. whose sum is - 3 and the product of their cubes is 512.

Ans. Let the three consecutive terms in an A.P. be a - d, a and a + d.

From the first condition,

$(a - d) + a + (a + d) = - 3$

$\therefore$ $3a = - 3$ $\therefore$ $a = - 1$.

From the second condition,

$(a - d)^3 \times a^3 \times (a + d)^3 = 512$

$\therefore$ $(- 1 - d)^3 \times (- 1)^3 \times (- 1 + d)^3 = 512$ ... [Substituting a = - 1]

$\therefore$ $[(- 1) (- 1 - d)]^3 (- 1 + d)^3 = 512$

$\therefore$ $(1 + d)^3 (- 1 + d)^3 = (8)^3$

$\therefore$ $(1 + d) (- a + d) = 8$ ... (Taking cube root of both the sides)

$\therefore$ $d^2 - 1 = 8$ $\therefore d^2 = 9$ $\therefore d = \pm 3$.

Taking a = - 1 and d = 3,

$(a - d) = - 1 - 3 = - 4$;

$(a + d) = - 1 + 3 = 2$

$\therefore$ The terms are - 4, - 1 and 2

Taking a = - 1 and d = - 3,

$(a - d) = - 1 - (- 3) = - 1 + 3 = 2$;

$a = - 1$

$a + d = -1 - 3 = - 4$

$\therefore$ the terms are 2, -1, -4.

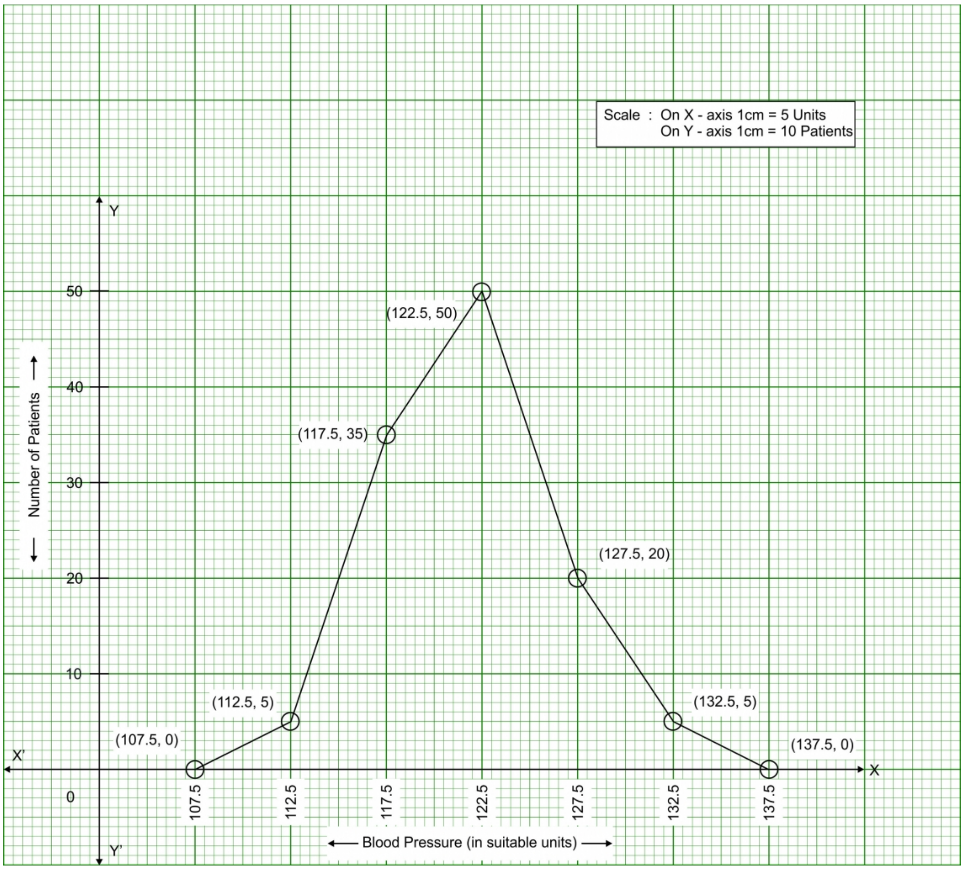
The three consecutive terms are **- 4, - 1** and **2** OR **2, - 1** and **-4.**

3) The following is the frequency distribution of blood pressure measured for patients Draw a frequency polygon.

Blood pressure (in suitable units)	110 - 115	115 - 120	120 - 125	125 - 130	130 - 135
Number of patients	5	35	50	20	5

Ans.

Blood pressure (in suitable units)	105 - 110	110 - 115	115 - 120	120 - 125	125 - 130	130 - 135	135 - 140
Class mark	107.5	112.5	117.5	122.5	127.5	132.5	137.5
Number of patients	0	5	35	50	20	5	0



Q.5 Solve the following questions. (Any one) (3)

1) i. Write an A.P. in which a = 10 and d is any natural number.
ii. Find the sum of the first ten terms using formula.
iii. Can - 80 be a term of this A.P. ? Justify.

Ans. i. Here, a = 10. Let d = 5.
The A.P. is 10, 15, 20, ...
ii. The sum of the first ten terms.

$$S_n = \frac{n}{2}[2a + (n - 1)d] \quad \text{... Formula}$$

$$\therefore \quad S_{10} = \frac{10}{2}[2 \times 10 - (10 - 1) \times 5] \quad \text{... (substituting the values)}$$

$$= 5\,(20 + 9 \times 5)$$

$$= 5 \times (20 + 45) = 5 \times 65 = 325.$$

iii. − 80 cannot be a term in this A.P.
Justification : Here, the values of a and d are natural numbers.
so all the terms of this A.P. are natural numbers.
− 80 is not a natural number.

2) On Diwali eve, two candles, one of which is 3 cm longer than the other are lighted. The longer one is lighted at 5.30 p.m. and the shorter at 7 p.m. At 9.30p.m. they both are of the same length. The longer one burns out at 11.30p.m. and the shorter one at 11 p.m. How long was each candle originally?

Ans. Let the longer candle shorten at the rate of x cm/hr in burning case and the smaller candle shorter at the rate of y cm/hr.
In burning case the longer candle burns out completely in 6 hours and that the smaller candle in 4 hours.
∴ Their lengths are 6x cm and 4y cm respectively
According to first condition of given problem,

$$6x = 4y + 3$$

$$6x - 4y = 3 \quad \text{.....(1)}$$

At 9.30 p.m. the length of longer candle

= (6x -4x)cm = 2x cm

At 9.30 p.m. the length of smaller candle

= $(4y - \frac{5}{2}y)$cm

= $\frac{8y - 5y}{2}$ cm

= $\frac{3y}{2}$ cm

As According to second condition o given problem,

$\therefore$ $2x = \frac{3}{2}y$

(Both candles have same length at 9.30p.m.)

4x = 3y

4x - 3y = 0 ..... (2)

Multiplying equation (1) by 3 and equation (2) by 4

$$\begin{array}{r} 18x - 12y = 9 \\ 16x - 12y = 0 \\ \underline{- \quad\quad + \quad\quad -} \\ 2x \quad\quad = 9 \end{array}$$

$\therefore$ $x = \frac{9}{2}$

= 4. 5 cm/hr

Substituting the value of x in equation (2), we get

$4 \times 4.5 - 3y = 0$

18 - 3y = 0

18 = 3y

$y = \frac{18}{3}$

y = 6 cm/hr.

Hence, length of longer candle = 6x = 6×4.5 cm = 27 cm.

Length of smaller candle = 4y cm = 4×6cm = 24 cm