MKCL Creating a Knowledge Lit World www.mkcl.org	Subject – Algebra	Model Answer Set – I

Q.1A Solve Any FOUR of the following:

1) Mr. Mayank's age = 27 years < 60 years
Mr. Anil's age = 66 years > 60 years
Since, they have the same taxable income.
∴ Mr. Anil will have to pay less income tax.

2) $5\sqrt{8} \times 2\sqrt{8} = 5 \times 2 \times 8 = 80$

3) Given data in ascending order: 60, 90, 95, 99, 100, 100, 100 The observation repeated maximum number of times = 100
∴ The mode of the given data is **100**

4) Here, $p(x) = x^4 + 3x^2 - 5x + 1$
Substituting x = 1 in p(x), we get
$p(1) = (1)^4 + 3(1)^2 - 5(1) + 1$
$= 1 + 3 - 5 + 1 = 0$
∴ By factor theorem, **$(x-1)$ is a factor of $x^4 + 3x^2 - 5x + 1$**

5) Ratio $= \frac{72}{60} = \frac{12\times6}{12\times5}$
$= \frac{6}{5}$
$=$ **6 : 5**

6) Here, U = all the students of a class.
A = Students who secured 50% or more marks in Maths.
∴ A = Students who secured less than 50% marks in Maths.

Q.1B Solve Any TWO of the following:

1) A = Even prime numbers
∴ A = {2}
B = {x | 7x – 1 = 13}
Here, 7x – 1 = 13
∴ 7x = 14
∴ x = 2
∴ B = {2}
∴ A and B **are equal sets.**

2) $p(y) = y^3 - 5y^2 + 7y + m$
Divisor = y + 2
∴ By remainder theorem,
Remainder = p(−2)
∴ $50 = (-2)^3 - 5(-2)^2 + 7(-2) + m$
∴ $50 = -8 - 20 - 14 + 20$
∴ $50 = -42 + m$
∴ **m = 92**

3)

Age (Year)	Frequency (No. of students)	Equal to lower limit or more than lower limit.
10–12	09	50
12–14	$\boxed{23}$	$\boxed{50}$ – 9 = 41
14–16	$\boxed{18}$	41 – 23 = $\boxed{18}$
16–18	05	$\boxed{18}$ – 13 = $\boxed{05}$
	Total N = 50	

Q.2A Choose the correct alternative:

1) A
2) B
3) C
4) A

Q.2B Solve Any TWO of the following.

1) The data is classified into classes 100 to 200.
200 – 300……and the table showing cumulative frequency less than the upper class limit is prepared in the following table.

Class	Tally marks	Frequency	Cumulative frequency (less than the upper limit)
100 to 200	卌 卌 I	11	11
200 to 300	卌 卌 卌 II	17	11 + 17 = 28
300 to 400	卌 I	6	28 + 6 = 34
400 to 500	卌 I	6	34 + 6 = 40
	Total	**40**	

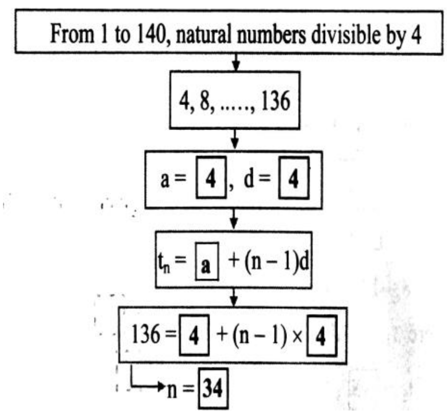
2) There are total six colour on the disc.
Sample space,
S = {Red, Orange, Yellow, Blue, Green, Purple}
∴ n(S) = 6
∴ Arrow may stop on any one of the six colours.

3) We have –
$a_3 = a + (3 - 1)d = a + 2d = 5$ ……..(i)
and $a_7 = a + (7 - 1)d = a + 6d = 9$……..(ii)
Solving the pair of linear equation.

$$\begin{array}{rrrrr} & a & + 2d & = & 5 \\ - & \underset{-}{a} & \underset{-}{+}\ 6d & = & \underset{-}{9} \\ \hline & & -4d & = & -4 \quad \text{(Subtract)} \end{array}$$

∴ d = 1
As difference is 1. i.e. d = 1
$a = 3$
Hence the required A.P. is 3, 4, 5, 6,…….

Q.3A Solve Any THREE of the following

1)


2) FV = ₹ 10, Premium = ₹ 2

$\therefore$ MV = $\boxed{\text{FV}}$ + $\boxed{\textbf{Premium}}$

= $\boxed{10}$ + $\boxed{2}$ = $\boxed{₹12}$

$\therefore$ No. of shares = $\frac{\text{Total investment}}{\text{MV}} = \frac{12000}{\boxed{12}} = \boxed{1000}$ shares

$\therefore$ Smita has purchased $\boxed{1000}$ shares.

3) $\sqrt{2}x^2 + 7x + 5\sqrt{2} = 0$

$\therefore \sqrt{2}x^2 + \boxed{5x} + \boxed{2x}\ 5\sqrt{2} = 0$

$\therefore x\ \boxed{(\sqrt{2}x + 5)} + \sqrt{2}\ \boxed{(\sqrt{2}x + 5)} = 0$

$\therefore\ \boxed{(\sqrt{2}x + 5)}\ (x + \sqrt{2}) = 0$

$\therefore\ \boxed{(\sqrt{2}x + 5)} = 0$ or $(x + \sqrt{2}) = 0$

$\therefore x = \boxed{\frac{-5}{\sqrt{2}}}$ or $x = -\sqrt{2}$

$\therefore\ \boxed{\frac{-5}{\sqrt{2}}}$ and $-\sqrt{2}$ are roots of the equation.

Q.3B Solve Any TWO of the following

1) Let us first split the middle term $-5x$ as
$-2x - 3x$ as $(-2x) \times (-3x) = 6x^2$
$\therefore 2x^2 - 5x + 3 = 2x^2 - 2x - 3x + 3$
$= 2x(x - 1) - 3(x - 1)$
$= (2x - 3)(x - 1)$
Now we can write as $(2x - 3)(x - 1) = 0$
So the values of x for which $2x^2 - 5x + 3 = 0$
Are the same for which $(2x - 3)(x - 1) = 0$
i.e. either $2x - 3 = 0$ or $x - 1 = 0$
Now $2x - 3 = 0$
$\therefore x = \frac{3}{2}$ and $x - 1 = 0$ $\quad \therefore x = 1$
So $x = \frac{3}{2}$ and $x = 1$ are the solution of the equation.
In other words, 1 and $\frac{3}{2}$ are the roots of the equation $2x^2 - 5x + 3 = 0$

2) Here the maximum class frequency is 8 and the class corresponding to this frequency is 3 – 5.
So the modal class is 3 – 5.
Lower class limit (ℓ) of modal class = 3
Class size (h) = 2
$f_1 = 8$, $f_0 = 7$, $f_2 = 2$
Using formula
Mode = $\ell + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) \times h$
$= 3 + \left(\frac{8 - 7}{2 \times 8 - 7 - 2}\right) \times 2$
$= 3 + \frac{2}{7} = 3.286$
$\therefore$ Mode of the data = **3.286**

3) Sample space,

S = {H1, H2, H3, H4, H5, H6, T1, T2, T3, T4, T5, T6}

∴ n(S) = 12

Condition for event A: To get a head or tail and an even number.

∴ A = {H2, H4, H6, T2, T4, T6}

∴ n(A) = 6

Q.4 Solve Any THREE of the following

1) If the roots of the quadratic equation are irrational and occur in pair then they are conjugate of each other.

If one of the root is $(h + 2\sqrt{6})$ then the other roots is $(h - 2\sqrt{6})$

Let α and β be the roots of the given quadratic equation.

∴ $\alpha = (h + 2\sqrt{6})$ and $\beta = (h - 2\sqrt{6})$

Comparing the equations with $ax^2 + bx + c = 0$

We have, $a = 1$, $b = -10$, $c = 2k$

$\alpha + \beta = -\frac{b}{a} = \frac{-(-10)}{1} = 10$ ......(i)

$\alpha\beta = \frac{c}{a} = \frac{2k}{1} = 2k$ ……(ii)

Now $a + \beta = h + 2\sqrt{6} + h - 2\sqrt{6}$

$= h + h$

$= 2h$ …….(iii)

∴ $2h = 10$

∴ $h = 5$

Now $\alpha\beta = (h + 2\sqrt{6})(h - 2\sqrt{6})$

$= (h)^2 - \left(2\sqrt{6}\right)^2$ $(a + b)(a - b)$

$= h^2 - 4 \times 6$ $= a^2 - b^2$

$= h^2 - 24$ ……..(iv)

∴ $h^2 - 2h = 2k$ from (ii) & (iv)

∴ $5^2 - 24 = 2k$

∴ $25 - 24 = 2k$

∴ $1 = 2k$

∴ $k = \frac{1}{2}$

∴ In one of the roots of the quadratic equation

$x^2 - 10x + 2k = 0$ is $(h + 2\sqrt{6})$, then $h = 5$, $k = \frac{1}{2}$

2) Area of the rectangular garden = length × breadth = 77 × 50

∴ Area of the rectangular garden = 3850 sq.m.

Radius of the lake = $\frac{14}{2}$ = 7 m

Area of circular lake = πr^2

$= \frac{22}{7} \times 7 \times 7$

∴ Area of circular lake = 154 sq.m.

∴ Probability that the towel fell in the lake = $\frac{\text{Area of the lake}}{\text{Area of the garden}}$

$= \frac{154}{3850} = \frac{1}{25}$

∴ The probability of the event that the towel fell in the lake is $\frac{1}{25}$.

3) Total number of students = 1000

According to the pie diagram-

Let ‘x’ be the no. of students who like cricket

a) The measure of sector showing for the students

Who like cricket =

$\frac{\text{No.of students who like Cricket}}{\text{Total no.of Students}} \times 360°$

$81° = \frac{x}{1000} \times 360°$

$\therefore x = \frac{81 \times 1000}{360} = 225$

b) Let 'y' be the number of students who like football

$\therefore y = \frac{63 \times 1000}{360°} = 175$

c) Let 'z' be the number of students who like other games.

$Z = \frac{72 \times 100}{360°} = 200$

$\therefore$ a) Number of students like cricket = 225

number of students who like football = 175

number of students who like other games. = 200

4) The instalments are in A.P.

Amount repaid in 12 instalments (S_{12})

= Amount borrowed + total interest

= 8000 + 1360

$\therefore S_{12} = 9360$

Number of instalments (n) = 12

Each instalment is less than the preceding one by Rs. 40

$\therefore d = -40$

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

$\therefore S_{12} = \frac{12}{2}[2a + (12 - 1)(-40)]$

$\therefore 9360 = 6[2a + (11)(-40)]$

$\therefore 9360 = 6(2a - 440)$

$\therefore \frac{9360}{6} = 2a - 440$

$\therefore 1560 = 2a - 440$

$\therefore 1560 + 440 = 2a$

$\therefore 2000 = 2a$

$\therefore a = \frac{2000}{2}$

$\therefore a = 1000$

$\therefore$ **Amount of the first instalment is Rs. 1000.**

Q.5 Solve Any ONE of the following:

1) $D_x = \begin{vmatrix} -11 & a \\ 9 & -4 \end{vmatrix} = 44 - 9a$

$D_y = \begin{vmatrix} 3 & -11 \\ b & 9 \end{vmatrix} = 27 + 11b$

$D = \begin{vmatrix} 3 & 2 \\ 7 & -4 \end{vmatrix} = -12 - 14 = -26$

By Cramer's rule, we get

$x = \frac{D_x}{D}$ and $y = \frac{D_y}{D}$

$\therefore -1 = \frac{44-9a}{-26}$ and $-4 = \frac{27 + 11b}{-26}$

$\therefore 44 - 9a = 26$ and $104 = 27 + 11b$

$\therefore 9a = 18$ and $11b = 77$

$\therefore a = 2$ and $b = 7$

Now, $D_x = \begin{vmatrix} -11 & 2 \\ 9 & -4 \end{vmatrix}$, $D_y = \begin{vmatrix} 3 & -11 \\ b & 9 \end{vmatrix}$, $D = \begin{vmatrix} 3 & 2 \\ 7 & -4 \end{vmatrix}$

Comparing these determinants with

$D_x = \begin{vmatrix} c_1 & b_1 \\ c_2 & b_2 \end{vmatrix}$, $D_y = \begin{vmatrix} a_1 & c_1 \\ a_2 & c_2 \end{vmatrix}$, $D = \begin{vmatrix} a_1 & b_1 \\ a_2 & b_2 \end{vmatrix}$, we get

$a_1 = 3$, $b_1 = 2$, $c_1 = -11$ and

$a_2 = 7$, $b_2 = -4$, $c_2 = 9$

$\therefore$ The required equations are

$3x + 2y = -11$ and $7x - 4y = 9$

2) Sum invested = Rs. 1,25,250.

Brokerage = 0.2%

GST rate = 18%

$\therefore$ Brokerage per share = $125 \times \frac{0.2}{100}$ = Rs. 0.25

GST per share on brokerage = 18% of 0.25

= Rs. 0.045

$\therefore$ Cost of 1 share = MV + Brokerage + GST

= 125 + 0.25 + 0.045

= Rs. 125.295

$\therefore$ No. of shares = $\frac{125250}{125.25}$ = 1000

Total brokerage = brokerage per share $\times$ No. of shares

$\therefore$ Total brokerage = 0.25×1000 = Rs. 250

Total GST = 1000×0.045 = Rs. 45

$\therefore$ (1) 1000 shares were purchased

(2) Brokerage paid was Rs. 250

(3) GST paid was Rs. 45

Q.6 Solve Any ONE of the following

1) Taxable value = Rs. 64,500

Rate of GST = 18%

Company has paid GST = 1550 Rs.

ITC = ? CGST = ? SGST = ?

Tax which company has paid = Rs. 1550

$\therefore$ ITC = Rs. 1550

Let total tax payable be x

$\frac{18}{100} = \frac{x}{64500}$

$\therefore x = \frac{18 \times 64500}{100}$ = 11610 Rs.

$\therefore$ GST payable = output tax – ITC

= Rs. 11610 – Rs 1550

= Rs. 10,060

$\therefore$ Payable CGST = $\frac{10,060}{2}$ = Rs. 5030

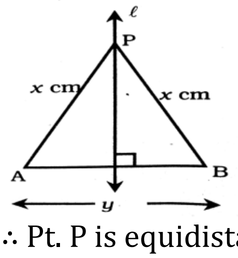
Payable SGST = $\frac{10,060}{2}$ = Rs. 5030.

$\therefore$ Amount of ITC = Rs. 1550

Amount of CGST = Rs. 5030

Amount of SGST = Rs. 5030

2) Let line 'ℓ' be the perpendicular bisector of segment AB. 'P' is the point on line 'ℓ' such that AP = AB + 7 cm. 'P' lies on the perpendicular bisector of seg AB.



$\therefore$ Pt. P is equidistant from the end

Points A and B of seg AB.

$\therefore$ PA = PB.

Let PA = PB = x cm and

AB = y cm

Then, from the given condition.

$x = y + 7$ ....(1)

The perimeter of $\Delta ABP = AB + PA + PB$

$= (y + x + x)$ cm

$= (y + 2x)$ cm

From the 2nd condition,

$y + 2x = 38$ ……….(2)

Substituting $x = y + 7$ in equation (2)

$y + 2(y + 7) = 38$

$\therefore y + 2y + 14 = 38$

$\therefore 3y = 38 - 14$ $\therefore 3y = 24$

$y = 8$

Substituting $y = 8$ in equation (1)

$x = 8 + 7$ $\therefore x = 15$

The sides of ΔABP are $AB = 8$ cm.

And $PA = PB = 15$ cm.