**Solution**

**ALGEBRA**

**Class 10 - Mathematics - I**

1. (i) Choose the correct alternative from given :

   i. **(d)** 1

   **Explanation:**

   Putting $x = 3$ in $kx^2 - 7x + 12 = 0$, we get

   $k(3)^2 - 7(3) + 12 = 0$

   $\therefore 9k - 21 + 12 = 0$

   $\therefore 9k - 9 = 0$

   $\therefore 9k = 9$

   $\therefore k = 1$

   ii. **(a)** 3

   **Explanation:**

   Substituting x = 1 in 4x + 5y = 19, we get

   $4(1) + 5y = 19$

   $\therefore 5y = 19 - 4 = 15$

   $\therefore y = \frac{15}{5} = 3$

   iii. **(a)** $-2, -4, -6, -8$

   **Explanation:**

   $a = t_1 = -2$

   $d = -2$

   $t_2 = t_1 + d = -2 - 2 = -4$

   $t_3 = t_2 + d = -4 - 2 = -6$

   $t_4 = t_3 + d = -6 - 2 = -8$

   iv. **(d)** 15

   **Explanation:**

   15

   (ii) i. Using Cramer's rule, we get

   $x = \frac{D_x}{D} = \frac{25}{5} = 5$

   ii. $a = t_1 = -2, d = -2$

   $\therefore t_2 = t_1 + d = -2 - 2 = -4$

   $t_3 = t_2 + d = -4 - 2 = -6$

   iii. Rate of CGST $= 9\%$

   But, rate of SGST = rate of CGST

   $\therefore$ Rate of SGST $= 9\%$

   iv. **(a)** $\frac{1}{6}$

   **Explanation:**

   Sample space $(S) = \{1, 2, 3, 4, 5, 6\}$

   $n(S) = 6$

   Let $A$ be the event that the number appearing on upper face of the die is less than 2.

   $\therefore A = \{1\}$

   $\therefore n(A) = 1$

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

   $\therefore P(A) = \frac{1}{6}$

2. (i) Complete the following activities and rewrite it (any two) :

   i. The given sequence is $-12, -5, 2, 9, 16, 23, 30, ...$

   Here, $t_1 = -12, t_2 = -5, t_3 = 2, t_4 = 9$

   $\therefore t_2 - t_1 = -5 - (-12) = -5 + 12 = 7$

SATISH SCIENCE ACADEMY

$t_3 - t_2 = 2 - (-5) = 2 + 5 = 7$

$t_4 - t_3 = 9 - 2 = 7$

$\therefore t_2 - t_1 = t_3 - t_2 = \ldots = 7 = d =$ constant

The difference between two consecutive terms is constant.

$\therefore$ The given sequence is an A.P.

$t_n = a + (n-1)d$

$\therefore t_{20} = -12 + (20-1)7 \ldots [\because a = -12,\ d = 7]$

$= -12 + 19 \times 7$

$= -12 + 133$

$\therefore t_{20} = 121$

$\therefore 20^{th}$ term of the given A.P. is 121.

ii. $x^2 + x - 20 = 0$

$\therefore x^2 + 5x - 4x - 20 = 0$

$\therefore x(x+5) - 4(x+5) = 0$

$\therefore (x+5)(x-4) = 0$

−20

5 −4

$5 \times -4 = -20$

$5 - 4 = 1$

By using the property, if the product of two numbers is zero, then at least one of them is zero, we get

$x + 5 = 0$ or $x - 4 = 0$

$\therefore x = -5$ or $x = 4$

$\therefore$ The roots of the given quadratic equation are -5 and 4.

iii. S is the sample space.

$S = \{\boxed{1, 2, 3, 4, 5, 6}\}$

$\therefore n(S) = 6$

Event A: Getting a prime number on the upper face.

$A = \{\boxed{2, 3, 5}\}$

$\therefore n(A) = 3$

$P(A) = \frac{n(A)}{\boxed{n(S)}}$ ...[Formula]

$\therefore P(A) = \boxed{\frac{1}{2}}$

(ii) Solve the following subquestions (any four) :

i. $3x - y = 2$

$2x + y = 8$

$\boxed{5}\,x = \boxed{10}$

$\therefore x = \frac{\boxed{10}}{5}$

$\therefore x = \boxed{2}$

ii. $2y = 10 - y^2$

$\therefore y^2 + 2y - 10 = 0$

Comparing the above equation with

$ay^2 + by + c = 0$, we get

$a = 1, b = 2, c = -10$

iii. The given A.P. is $9, 4, -1, -6, -11, \ldots$

Here, $a = 9, d = 4 - 9 = -5$

Since $t_n = a + (n-1)d$

$\therefore t_{23} = 9 + (23-1)(-5)$

$= 9 + 22(-5)$

$= 9 - 110$

ATISH SCIENCE ACADEMY

$\therefore t_{23} = -101$

$\therefore$ 23rd term of the given A.p. is - 101.

iv. Sample space,

$S = \{23, 25, 32, 35, 52, 53\}$

$\therefore n(S) = 6$

v.

| **Class** | $18-19$ | $19-20$ | $20-21$ | $\boxed{21-22}$ |
|---|---|---|---|---|
| **Class Mark** | 18.5 | 19.5 | $\boxed{20.5}$ | 21.5 |
| **Frequency** | 4 | $\boxed{13}$ | 15 | 19 |
| **Co-ordinates of point** | $\boxed{18.5, 4}$ | $(19.5, 13)$ | $(20.5, 15)$ | $(21.5, 19)$ |

3. (i) Complete the following activity and rewrite it (any one) :

i. i. The modal class is $74.5 - 79.5$ because the maximum frequency is 82.

ii. Total frequency $= N = 200$

$\therefore \frac{N}{2} = \frac{200}{2} = 100$

Cumulative frequency which is just greater than (or equal) to 100 is 102.

$\therefore$ The median class is $69.5 - 74.5$.

iii. 44 is the cumulative frequency of the class preceding the median class.

iv. Class interval (h) = upper limit of median class - lower limit of median class

= 74.5 - 69.5

= 5

ii. $FV = ₹10, MV = ₹25,$ Number of shares $= 50$

i. Sum invested $=$ Number of shares $\times MV$

$= 50 \times 25 = ₹1250$

ii. Dividend per share = 30 $\%of FV$

$= \frac{30}{100} \times 10 = ₹3$

$\therefore$ Total dividend received $= 50 \times 3 = ₹150$

iii. Rate of return $= \frac{\text{Total dividend}}{\text{Sum invested}} \times 100$

$= \frac{150}{1250} \times 100 = 12\%$

(ii) Solve the following subquestions (any two) :

i. $x^2 + 10x + 2 = 0$

Comparing the above equation with

$ax^2 + bx + c = 0$, we get

$a = 1,\ b = 10, c = 2$

$b^2 - 4ac = (10)^2 - 4 \times 1 \times 2$

$= 100 - 8 = 92$

$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$= \frac{-10 \pm \sqrt{92}}{2(1)}$

$= \frac{-10 \pm \sqrt{4 \times 23}}{2}$

$= \frac{-10 \pm 2\sqrt{23}}{2}$

$= \frac{2(-5 \pm \sqrt{23})}{2}$

$= -5 \pm \sqrt{23}$

$\therefore x = -5 + \sqrt{23}$ or $x = -5 - \sqrt{23}$

$\therefore$ The roots of the given quadratic equation are $-5 + \sqrt{23}$ and $-5 - \sqrt{23}$.

ii. The given simultaneous equations are

x + y = 5

$\therefore$ y = 5 - x

| $x$ | 0 | 5 | 2 | 3 |
|---|---|---|---|---|
| $y$ | 5 | 0 | 3 | 2 |

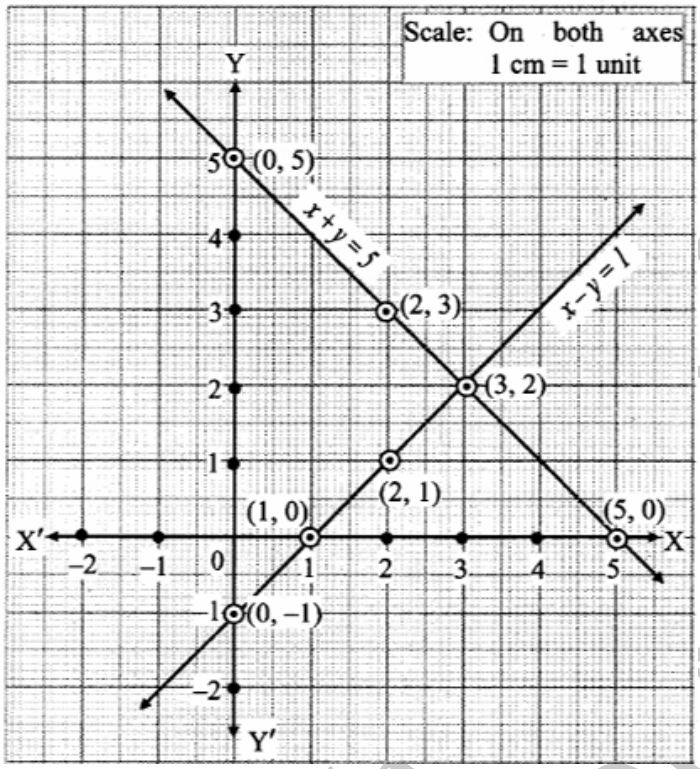
SATISH SCIENCE ACADEMY

| $(x, y)$ | $(0, 5)$ | $(5, 0)$ | $(2, 3)$ | $(3, 2)$ |
|---|---|---|---|---|

x + y = 1

$\therefore$ y = x - 1

| $x$ | 0 | 1 | 2 | 3 |
|---|---|---|---|---|
| $y$ | -1 | 0 | 1 | 2 |
| $(x, y)$ | $(0, -1)$ | $(1, 0)$ | $(2, 1)$ | $(3, 2)$ |




The two lines intersect at point $(3, 2)$.

$\therefore x = 3$ and $y = 2$ is the solution of the simultaneous equations $x + y = 5$ and $x - y = 1$.

iii.

| **Tax invoice of services provided (sample)** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Food Junction, Khed-Shivapur, Pune Invoice No. 58 Invoice No. 58 | | | | | | | | |
| Mob. No.7588580000, email-ahar.khed@yahoo.com<br>GSTIN : 27AAAAA5555B1ZA<br>Invoice Date: 25 Feb, 2020 | | | | | | | | |
| SAC | Food items | Qty | Rate (in ₹) | Taxable amount | CGST | | SGST | |
| 9963 | Coffee | 1 | 20 | 20.00 | 2.5% | ₹ 0.50 | 2.5% | ₹0.50 |
| 9963 | Masala Tea | 1 | 10 | 10.00 | 120% | ₹ 0.25 | 2.5% | ₹0.50 |
| 9963 | Masala Dosa | 2 | 60 | 120 | 2.5% | ₹3 | 2.5% | ₹3.00 |
| | | | Total | 150.00 | | ₹3.75 | | ₹ 3.75 |
| | | | | | | **Grand Total** | | **= ₹ 157.50** |

iv. S is the sample space.

$n(S) = 52$

Event A: Card drawn is a red card.

Total number of red cards

= 13 hearts + 13 diamonds

$\therefore n(A) =$ 26

SATISH ACADEMY

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

$$\therefore P(A) = \frac{\boxed{26}}{52}$$

$$\therefore P(A) = \boxed{\frac{1}{2}}$$

4. Solve the following subquestions (any two) :

(i) Let the five consecutive natural numbers be $x, x+1, x+2, x+3$ and $x+4$.

According to the given condition, sum of the squares of five consecutive natural numbers is 1455.

$\therefore x^2 + (x+1)^2 + (x+2)^2 + (x+3)^2 + (x+4)^2 = 1455$

$\therefore x^2 + x^2 + 2x + 1 + x^2 + 4x + 4 + x^2 + 6x + 9 + x^2 + 8x + 16 = 1455$

$\therefore 5x^2 + 20x + 30 - 1455 = 0$

$\therefore 5x^2 + 20x - 1425 = 0$

$\therefore x^2 + 4x - 285 = 0$

$\therefore x^2 + 19x - 15x - 285 = 0$

$\therefore x(x+19) - 15(x+19) = 0$

$\therefore (x+19)(x-15) = 0$

$-285$

$19 \quad -15$

$19 \times (-15) = -285$

$19 - 15 = 4$

$\therefore x + 19 = 0$ or $x - 15 = 0$

$\therefore x = -19$ or $x = 15$

But, natural number cannot be negative.

$\therefore x = 15$

$x + 1 = 15 + 1 = 16$ ,

$x + 2 = 15 + 2 = 17$

$x + 3 = 15 + 3 = 18$ ,

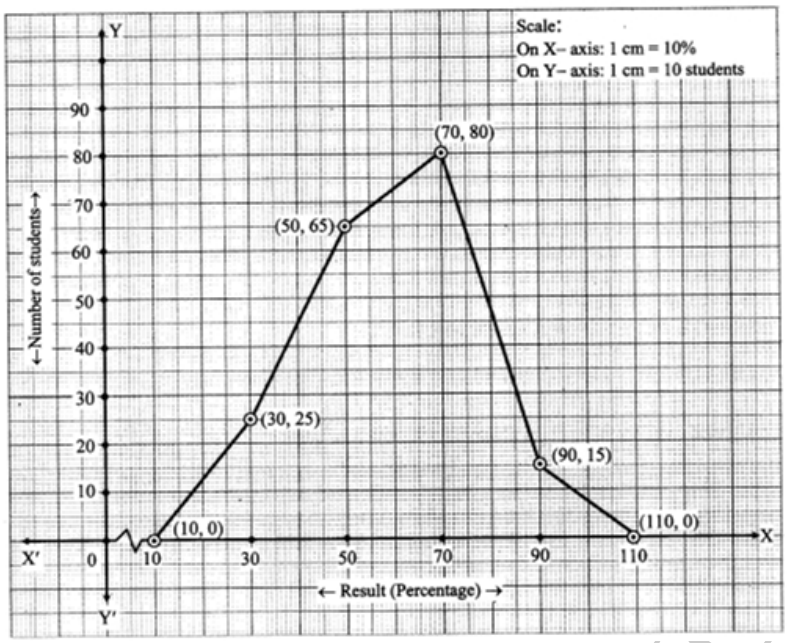
$x + 4 = 15 + 4 = 19$

$\therefore$ The five consecutive natural numbers are $15, 16, 17, 18$ and 19.

(ii)

| Class<br>Result (%) | $0-20$ | $20-40$ | $40-60$ | $60-80$ | $80-100$ | $100-120$ |
|---|---|---|---|---|---|---|
| Class mark | 10 | 30 | 50 | 70 | 90 | 110 |
| Frequency<br>(Number of students) | 0 | 25 | 65 | 80 | 15 | 0 |
| Co-ordinates of points | $(10, 0)$ | $(30, 25)$ | $(50, 65)$ | $(70, 80)$ | $(90, 15)$ | $(110, 0)$ |

SATISH SCIENCE ACADEMY




(iii) p times the p$^{th}$ term of an A.P. $= pt_p$.

q times the q$^{th}$ term of an A.P. $= qt_q$.

According to the given condition,

$pt_p = qt_q$

$\therefore p[a + (p-1)d] = q[a + (q-1)d]$

$\therefore pa + pd(p-1) = qa + qd(q-1)$

$\therefore pa + p^2d - pd = qa + q^2d - qd$

$\therefore pa + p^2d - pd - qa - q^2d + qd = 0$

$\therefore (pa - qa) + (p^2d - q^2d) - (pd - qd) = 0$

$\therefore a(p-q) + d(p^2 - q^2) - d(p-q) = 0$

$\therefore a(p-q) + d(p+q)(p-q) - d(p-q) = 0$

$\therefore (p-q)[a + d(p+q) - d] = 0$

$\therefore (p-q)[a + (p+q-1)d] = 0$

$\therefore [a + (p+q-1)d] = 0$

...[Dividing both sides by $(p-q)$]

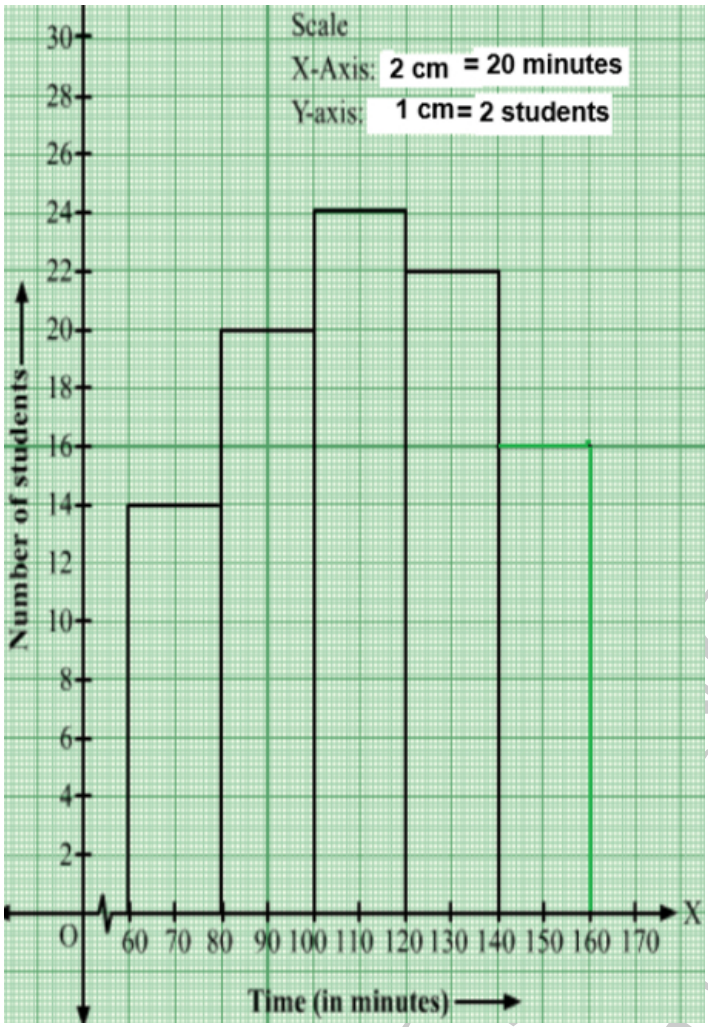
$\therefore t_{(p+q)} = 0$

$\therefore$ The $(p+q)^{th}$ term of the A.P. is zero.

5. Solve the following subquestions (any one) :

SATISH SCIENCE ACADEMY

(i)




(ii) Let the greater number be $x$ and the smaller number be $y$.

According to the first condition, two numbers differ by 3.

$\therefore x - y = 3$ ...(i)

According to the second condition, the sum of twice the smaller number and thrice the greater number is 19.

$\therefore 3x + 2y = 19$ ...(ii)

Multiplying equation (i) by 2, we get

$2x - 2y = 6$ ...(iii)

Adding equations (ii) and (iii), we get

$$\begin{array}{r} 3x + 2y = 19 \\ +2x - 2y = 6 \\ \hline 5x = 25 \end{array}$$

$\therefore x = \frac{25}{5}$

$\therefore x = 5$

Substituting $x = 5$ in equation (i), we get

$x - y = 3$

$\therefore 5 - y = 3$

$\therefore 5 - 3 = y$

$\therefore y = 2$

$\therefore$ The required numbers are 5 and 2.

SATISH SCIENCE ACADEMY