Solution

ALGEBRA

Class 10 - Mathematics - I

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

   i. **(c)** $a = 1,\ b = 10, c = -7$

   Explanation:

   Given quadratic equation is $x^2 + 10x - 7 = 0$

   Comparing the above equation with

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

   $\therefore a = 1, b = 10, c = -7$

   ii. **(c)** 1

   Explanation:

   $\begin{vmatrix} 5 & 3 \\ -7 & -4 \end{vmatrix} = 5 \times (-4) - 3 \times (-7)$

   $= -20 + 21 = 1$

   iii. **(c)** 55

   Explanation:

   First 10 natural numbers are $1, 2, 3, \ldots, 9, 10$.

   The above sequence is an A.P.

   $\therefore t_1 = 1, t_{10} = 10$

   $\therefore S_n = \frac{n}{2}(t_1 + t_{10}) = \frac{10}{2}(1 + 10)$

   $= 5(11)$

   $= 55$

   iv. **(d)** CGST

   Explanation:

   CGST

   (ii) i. Let the present ages of father and son be x years and y years respectively.

   According to the given condition, the sum of father's age and twice the age of his son is 70.

   $\therefore \boldsymbol{x} + 2y = 70$

   ii. The given A.P. is $127, 135, 143, 151, \ldots$

   Here, $t_1 = 127, t_2 = 135$

   $\therefore a = t_1 = 127$ and

   $d = t_2 - t_1 = 135 - 127 = 8$

   $\therefore$ first term (a) $= 127$,

   common difference (d) $= 8$

   iii. Rate of GST $= 12\%$

   $\therefore$ Rate of CGST $=$ Rate of SGST

   $= \frac{\text{Rate of GST}}{2} = \frac{12}{2} = 6\%$

   $\therefore$ Rate of CGST $=$ Rate of SGST $= 6\%$

   iv. **(b)** 4

   Explanation:

   $S = \{HH, HT, TH, TT\}, n(S) = 4$

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

   i. Given A.P. : 7, 13, 19, 25, ...

   Here first term $a = 7; d = 13 - 7 = 6; t_{19} =$?

   $t_n = a + (\boxed{n - 1})d$

   $\therefore t_{19} = 7 + (19 - 1)\boxed{6}$

   $\therefore t_{19} = 7 + \boxed{108}$

   $\therefore t_{19} = \boxed{115}$

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ii. $2y^2 - y + 2 = 0$

Comparing the above equation with

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

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

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

$= 1 - 16$

$\therefore b^2 - 4ac = -15$

iii. If two coins are tossed simultaneously,

$S = \{HH, HT, TH, TT\}$

i. Event A : at least getting one head.

$\therefore A = \{HH, HT, TH\}$

ii. Event B : to get no head.

$B = \{TT\}$

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

i. Opposite sides of a rectangle are equal.

$\therefore 2x + y + 8 = 4x - y$

$\therefore 8 = 4x - 2x - y - y$

$\therefore 2x - 2y = 8$

$\therefore x - y = 4 \ldots$ [Dividing both sides by 2]

Also, $x + 4 = 2y$

$\therefore x - 2y = -4$

$\therefore$ The required simultaneous equations are $x - y = 4$ and $x - 2y = -4$.

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

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

$= 9 + 22(-5)$

$= 9 - 110$

$\therefore t_{23} = -101$

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

iv. $S = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$

$n(S) = 9$

$A = \{2, 4, 6, 8\}$

$n(A) = 4$

v. Measure of central angle $(\theta) = \frac{\text{Percentage of components}}{100} \times 360^\circ$

Causes of noise pollluiton	Percentage	Measure of central angle (θ)
Construction	10%	$\frac{10}{100} \times 360 = 36^\circ$
Traffic	50%	$\frac{50}{100} \times 360 = 180^\circ$
Aircraft take offs	15%	$\frac{15}{100} \times 360 = 54^\circ$
Industry	25%	$\frac{25}{100} \times 360 = 90^\circ$
Total	100%	360°

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

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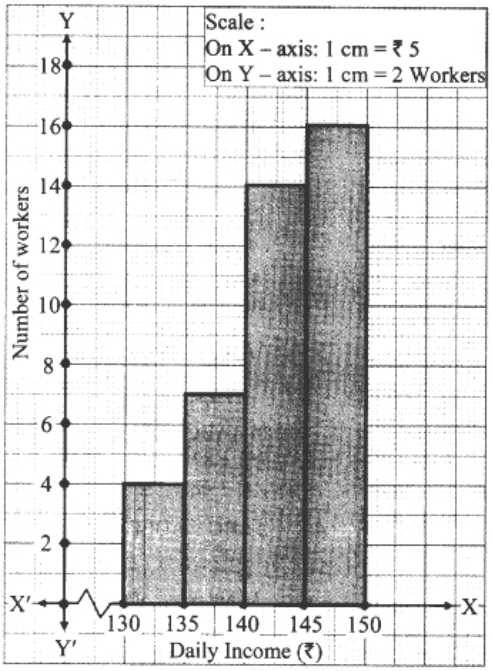
i.



ii.

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 GSTIN : 27AAAAA5555B1ZA 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**

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

i. Word problem:

The product of two consecutive natural numbers is 420. Find the numbers.

Let the first natural number be x.

The second consecutive natural number =x + 1

∴ According to the given condition, the product of two consecutive natural numbers is 420.

$\therefore x(x+1) = 420$

$\therefore x^2 + x = 420$

$\therefore x^2 + x - 420 = 0$

$\therefore x^2 + 21x - 20x - 420 = 0$

$\therefore x(x+21) - 20(x+21) = 0$

$\therefore (x+21)(x-20) = 0$

–420

21 –20

21 × –20 = –420

21 – 20 = 1

$\therefore x + 21 = 0$ or $x - 20 = 0$

$\therefore x = -21$ or $x = 20$

But, natural number cannot be negative.

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$\therefore x = 20$ and $x + 1 = 20 + 1 = 21$

$\therefore$ The two consecutive natural numbers are 20 and 21.

ii. Let the numerator of the fraction be x and the denominator be y.

$\therefore$ Fraction $= \frac{x}{y}$

According to the first condition, denominator of a fraction is 4 more than twice its numerator.

$\therefore y = 2x + 4$

$\therefore 2x - y = -4$ ...(i)

According to the second condition, denominator becomes 12 times the numerator, if both are reduced by 6.

$\therefore (y - 6) = 12(x - 6)$

$\therefore y - 6 = 12x - 72$

$\therefore 12x - y = 72 - 6$

$\therefore 12x - y = 66$ ...(ii)

Subtracting equation (i) from (ii), we get

$$\begin{array}{r} 12x - y = 66 \\ 2x - y = -4 \\ - \quad + \quad + \\ \hline 10x \quad = 70 \end{array}$$

$\therefore x = \frac{70}{10} = 7$

Substituting $x = 7$ in equation (i), we get

$2x - y = -4$

$\therefore 2(7) - y = -4$

$\therefore 14 - y = -4$

$\therefore 14 + 4 = y$

$\therefore y = 18$

$\therefore$ Fraction $= \frac{x}{y} = \frac{7}{18}$

$\therefore$ The required fraction is $\frac{7}{18}$.

iii. Output tax $= 5\%$ of 90,000

$= \frac{5}{100} \times 90,000$

$=$ ₹$4,500$

Input tax $= 5\%$ of $85,000$

$= \frac{5}{100} \times 85,000$

$=$ ₹$4,250$

ITC $=$ ₹ 4,250.

GST payable $=$ Output tax - ITC

$= 4,500 - 4,250$

$\therefore$ GST payable $=$ ₹250

$\therefore$ ITC of Smt. Malhotra is ₹$4,250$ and amount of GST payable by her is ₹250.

iv. Let M_1, M_2, M_3 be three men and $W_1,\ W_2$ be two women. Out of these men and women environment committee of the 2 persons is to be formed.

$S = \{M_1M_2, M_1M_3, M_2M_3, M_1\ W_1,\ \ M_1\ W_2, M_2\ W_1, M_2\ W_2, M_3\ W_1, M_3\ W_2, \boxed{W_1W_2}\}$

$\therefore n(S) = 10$

Event A: There must be at least one woman member.

A $=\{M_1W_1, M_1W_2, \boxed{M_2W_1}, M_2\ W_2,\ M_3\ W_1, M_3\ W_2,\ W_1\ W_2\}$

$\therefore n(A) = \boxed{7}$

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

$\therefore P(A) = \frac{\boxed{7}}{10}$

Event B: Committee of one man and one woman to be formed.

B = $\{M_1W_1, M_1W_2, M_2W_1, \boxed{M_2W_2}, M_3W_1, M_3W_2\}$

$\therefore n(B) = 6$

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

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$\therefore P(B) = \frac{6}{10}$

$\therefore P(B) = \frac{3}{\boxed{5}}$

4. Solve the following subquestions (any two) :

(i) Let the divisor be x.

Quotient is 2 more than nine times the divisor.

$\therefore$ Quotient $= 9x + 2$

Also, Dividend $= 460$ and Remainder $= 5$

Dividend = Divisor $\times$ Quotient + Remainder

$\therefore 460 = x \times (9x + 2) + 5$

$\therefore 460 = 9x^2 + 2x + 5$

$\therefore 9x^2 + 2x + 5 - 460 = 0$

$\therefore 9x^2 + 2x - 455 = 0$

$\therefore 9x^2 + 65x - 63x - 455 = 0$

$\therefore x(9x + 65) - 7(9x + 65) = 0$

$\therefore (9x + 65)(x - 7) = 0$

$\therefore 9x + 65 = 0$ or $x - 7 = 0$

$\therefore x = -\frac{65}{9}$ or $x = 7$

9×-455

$= -4095$

$65 \quad -63$

$65 \times -63 = -4095$

$65 - 63 = 2$

But, natural number cannot be negative.

$\therefore x = 7$

$\therefore$ Quotient $= 9x + 2$

$= 9(7) + 2$

$= 63 + 2$

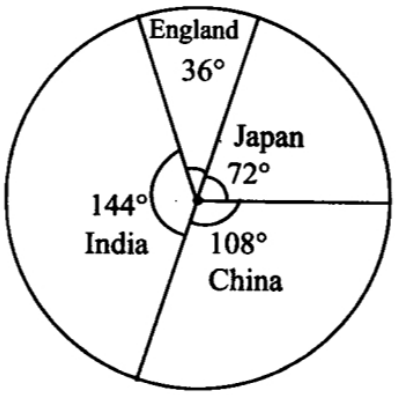
$= 65$

$\therefore$ Quotient is 65 and Divisor is 7.

(ii) Total percentage of world population $= 100$

Measure of central angle $(\theta) = \frac{\text{Percentage of components}}{100} \times 360^\circ$

Country	**Percentage of total population**	**Measure of central angle (θ)**
Japan	20	$\frac{20}{100} \times 360^\circ = 72^\circ$
England	10	$\frac{10}{100} \times 360^\circ = 36^\circ$
India	40	$\frac{40}{100} \times 360^\circ = 144^\circ$
China	30	$\frac{30}{100} \times 360^\circ = 108^\circ$
Total	100	360°



(iii) The instalments are in A. P.

Amount repaid in 10 instalments (S_{10})

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= Amount borrowed + total interest

$\therefore S_{10} = 4000 + 500 = 4500$

Number of instalments (n) $= 10$

Each instalment is less than the preceding instalment by ₹ 10.

$\therefore d = -10$

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

$\therefore S_{10} = \frac{10}{2}[2a + (10-1)(-10)]$

$\therefore 4500 = 5[2a + 9(-10)]$

$\therefore \frac{4500}{5} = 2a - 90$

$\therefore 900 = 2a - 90$

$\therefore 2a = 900 + 90$

$\therefore 2a = 990$

$\therefore a = \frac{990}{2}$

$\therefore a = 495$

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

$\therefore t_{10} = 495 + (10-1)(-10)$

$\therefore t_{10} = 495 + 9(-10)$

$\therefore t_{10} = 495 - 90$

$\therefore t_{10} = 405$

$\therefore$ Amount of the first instalment is 495 and that of the last instalment is 405.

5. Solve the following subquestions (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) Let the present ages of Manish and Savita be x years and y years respectively.

According to the first condition,

sum of the present ages of Manish and Savita is 31.

$\therefore x + y = 31$ ...(i)

3 years ago,

Manish's age $= (x - 3)$ years

Savita's age $= (y - 3)$ years

According to the second condition,

3 years ago Manish's age was 4 times the age of Savita.

$\therefore (x - 3) = 4(y - 3)$

$\therefore x - 3 = 4y - 12$

$\therefore x - 4y = -12 + 3$

$\therefore x - 4y = -9$ ...(ii)

Subtracting equation (ii) from (i), we get

$x + y = 31$

$x - 4y = -9$

$- \quad + \quad +$

$5y = 40$

$\therefore y = \frac{40}{5} = 8$

Substituting $y = 8$ in equation (i), we get

$x + y = 31$

$\therefore x + 8 = 31$

$\therefore x = 31 - 8$

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$\therefore x = 23$

$\therefore$ The present ages of Manish and Savita are 23 years and 8 years respectively.

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