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X H.W-7

1) Solve for x (i) $x^2 + \left(\frac{a}{a+b} + \frac{a+b}{a}\right)x + 1 = 0$ (ii) $\frac{14}{x+3} - 1 = \frac{5}{x+1}$; $x \neq -3, -1$

2) Solve for x : $\frac{1}{a+b+x} = \frac{1}{a} + \frac{1}{b} + \frac{1}{x}$; $a \neq 0, b \neq 0, x \neq 0$

3) Solve : $9x^2 - 9(a+b)x + (2a^2 + 5ab + 2b^2) = 0$

4) If the roots of the equation $(a-b)x^2 + (b-c)x + (c-a) = 0$ are equal, prove that $2a = b+c$

5) A two digit number is such that the product of its digits is 14. If 45 is added to the number, the digits interchange their places. Find the number. 27

6) Two water taps together can fill a tank in $9\frac{3}{8}$ hours. The tap of larger diameter takes 10 hours less than the smaller one to fill the tank separately. Find the time in which each tap can separately fill the tank. 15hrs, 25hrs

7) Solve for x : (i) $x = \cfrac{1}{3 - \cfrac{1}{3 - \cfrac{1}{3 - x}}}$ (ii) $x^2 - 3x - m(m+3) = 0$ (iii) $x = \sqrt{6 + \sqrt{6 + \sqrt{6 + \cdots}}}$

8) Students of a class are made to stand in rows. If one student is extra in a row, there would be 2 rows less. If one student is less in a row, there would be 3 rows more. Find the no. of Students in the class. 60

9) Find the four angles of a cyclic quadrilateral ABCD in which $\angle A = (2x-1)^\circ$, $\angle B = (y+5)^\circ$, $\angle C = (2y+15)^\circ$, $\angle D = (4x-7)^\circ$ 65°, 55°, 115°, 125°

10) A person invested some amount at the rate of 12% simple interest and some other amount at the rate of 10% simple interest. He received yearly interest of ₹130. But, if he had interchanged the amounts invested, he would have received ₹4 more as interest. How much amount did he invest at different rates? ₹500, ₹700

11) A train covered a certain distance at a uniform speed. If the train would have been 6km/hr faster, it would have

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taken 4 hours less than the Scheduled time. And, if the train were slower by 6 km/hr, it would have taken 6 hours more than the Scheduled time. Find the length of the journey. 720 km

12) Two years ago, Salim was thrice as old as his daughter and six years later, he will be four years older than twice her age. How old are they now? 38 yrs, 14 yrs

13) The denominator of a fraction is 4 more than thrice the numerator. When both the numerator and the denominator are decreased by 6, then the denominator becomes 12 times the numerator. Find the fraction 7/18.

14) Find the values of m and n so that the following system of linear equations have infinite no. of solutions

$$(2m-1)x + 3y - 5 = 0$$
$$3x + (n-1)y - 2 = 0$$

15) Solve for x and y!

(i) $217x + 131y = 913$
$131x + 217y = 827$

(ii) $(a-b)x + (a+b)y = a^2 - 2ab - b^2$
$(a+b)(x+y) = a^2 + b^2$

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X H.W-7 (Answers)

1) (i) $x^2+\left(\frac{a}{a+b}+\frac{a+b}{a}\right)x+1=0$

$\Rightarrow x^2+\left(\frac{a}{a+b}+\frac{a+b}{a}\right)x+\frac{a}{a+b}\times\frac{a+b}{a}=0$

$x^2+(A+B)x+AB=(x+A)(x+B)$

$\Rightarrow \left(x+\frac{a}{a+b}\right)\left(x+\frac{a+b}{a}\right)=0$

$\therefore x=-\frac{a}{a+b},-\frac{(a+b)}{a}$

(ii) $\frac{14}{x+3}-\frac{5}{x+1}=1$

$\Rightarrow \frac{14x+14-5x-15}{(x+3)(x+1)}=1$

$\Rightarrow 9x-1=x^2+4x+3$

$\Rightarrow x^2+4x-9x+3+1=0$

$\Rightarrow x^2-5x+4=0$

$\Rightarrow x^2-x-4x+4=0$

$\Rightarrow x(x-1)-4(x-1)=0$

$\Rightarrow (x-4)(x-1)=0$

$\therefore x=1,4$

2) $\frac{1}{a+b+x}=\frac{1}{a}+\frac{1}{b}+\frac{1}{x}$

$\Rightarrow \frac{1}{a+b+x}-\frac{1}{x}=\frac{1}{a}+\frac{1}{b}$

$\Rightarrow \frac{x-a-b-x}{x(a+b+x)}=\frac{a+b}{ab}$

$\Rightarrow \frac{-(a+b)}{ax+bx+x^2}=\frac{a+b}{ab}$

$\Rightarrow -ab=x^2+ax+bx$

$\Rightarrow x^2+ax+bx+ab=0$

$\Rightarrow x(x+a)+b(x+a)=0$

$\Rightarrow (x+a)(x+b)=0$

$\therefore x=-a,-b$

3) Let $9x^2-9(a+b)x+2a^2+5ab+2b^2=0$ be of the form $Ax^2+Bx+C=0$

where $A=9$, $B=-9(a+b)$, $C=2a^2+5ab+2b^2=0$

$B^2-4AC=81(a+b)^2-36(2a^2+5ab+2b^2)$

$=9[9(a+b)^2-4(2a^2+5ab+2b^2)]$

$=9[9(a^2+b^2+2ab)-8a^2-20ab-8b^2]$

$=9[9a^2+9b^2+18ab-8a^2-20ab-8b^2]$

$=9[a^2+b^2-2ab]=9(a-b)^2>0$

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$\therefore x = \frac{-B \pm \sqrt{B^2-4AC}}{2A} = \frac{9(a+b) \pm 3(a-b)}{18}$

$x = \frac{9a+9b+3a-3b}{18}$ | $x = \frac{9a+9b-3a+3b}{18}$

$= \frac{12a+6b}{18}$ | $= \frac{6a+12b}{18}$

$= \frac{2a+b}{3}$ | $= \frac{a+2b}{3}$

4) Let the given eq: be of the form $Ax^2+Bx+C=0$; where $A=(a-b)$, $B=(b-c)$, $C=c-a$.

For equal roots, $B^2-4AC=0$

$\Rightarrow (b-c)^2-4(a-b)(c-a)=0$

$\Rightarrow b^2+c^2-2bc-4(ac-a^2-bc+ab)=0$

$\Rightarrow b^2+c^2-2bc-4ac+4a^2+4bc-4ab=0$

$\Rightarrow 4a^2+b^2+c^2-4ab+2bc-4ac=0$

$\Rightarrow (-2a+b+c)^2=0$

$\therefore -2a+b+c=0$

$2a=b+c$

5) Let the digit in the one's place be x and that in the ten's place be $\frac{14}{x}$.

Original number $= \frac{140}{x}+x$

T	O
$\frac{14}{x}$	x → original no.
x	$\frac{14}{x}$ → reversed no.

ATQ, $\frac{140}{x}+x+45 = 10x+\frac{14}{x}$

$\Rightarrow 140+x^2+45x = 10x^2+14$

$\Rightarrow 9x^2-45x-126=0$

$(\div 9) \Rightarrow x^2-5x-14=0$

$\Rightarrow (x-7)(x+2)=0$

$\therefore x=7,-2$

S. P

-5 -14

$-7, 2$

Since x cannot be -ve, $\therefore$ required value of x is 7

Hence, the required number is 27

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6) Let the time taken by smaller pipe separately to fill the tank be x hours and that of larger pipe be $(x-10)$ hours.

Time taken by both the pipes together fill the tank $= \frac{75}{8}$ hours

$\therefore$ Part of tank filled by both the pipes together in one hour $= \frac{1}{75/8} = \frac{8}{75}$

Part of tank filled by smaller pipe in one hour $= \frac{1}{x}$

Part of tank filled by larger pipe in one hour $= \frac{1}{x-10}$

ATQ, $\frac{1}{x} + \frac{1}{x-10} = \frac{8}{75}$

$\Rightarrow \frac{x-10+x}{x(x-10)} = \frac{8}{75}$

$\Rightarrow \frac{2x-10}{x^2-10x} = \frac{8}{75}$

$\Rightarrow \frac{2(x-5)}{x^2-10x} = \frac{8^4}{75}$

$\Rightarrow 75x - 375 = 4x^2 - 40x$

$\Rightarrow 4x^2 - 115x + 375 = 0$

$\Rightarrow 4x^2 - 100x - 15x + 375 = 0$

$\Rightarrow 4x(x-25) - 15(x-25) = 0$

$\Rightarrow (4x-15)(x-25) = 0$

$\therefore x = 25, \frac{15}{4}$

S	P
-115	1500
	-100, -15

x cannot be $\frac{15}{4}$, $\therefore$ required value of x is 25

Hence, the time taken by each tap separately to fill the tank are 25hrs and 15hrs.

7) $x = \frac{1}{3 - \frac{1}{\frac{3(3-x)-1}{3-x}}} = \frac{1}{3 - \frac{1}{\frac{9-3x-1}{3-x}}} = \frac{1}{3 - \frac{(3-x)}{8-3x}}$

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$$= \frac{1}{\frac{3(8-3x)-(3-x)}{8-3x}} \qquad = \frac{8-3x}{24-9x-3+x}$$

$$\Rightarrow x = \frac{8-3x}{21-8x}$$

$$\Rightarrow 21x - 8x^2 = 8 - 3x$$

$$\Rightarrow 8x^2 - 24x + 8 = 0$$

$(\div 8) \Rightarrow x^2 - 3x + 1 = 0$ be of the form $ax^2 + bx + c = 0$;

✱ where $a = 1, b = -3, c = 1$

$$b^2 - 4ac = 9 - 4 = 5$$

$$\therefore x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{3 \pm \sqrt{5}}{2}$$

$$x = \frac{3+\sqrt{5}}{2}, \frac{3-\sqrt{5}}{2}$$

(ii) $x^2 - 3x - m^2 - 3m = 0$

$\Rightarrow (x^2 - m^2) - 3(x+m) = 0$

$\Rightarrow (x+m)(x-m) - 3(x+m) = 0$

$\Rightarrow (x+m)[x-m-3] = 0$

$\therefore x = -m, m+3$

(iii) $x = \sqrt{6+\sqrt{6+\sqrt{6+\cdots}}}$

$\Rightarrow x = \sqrt{6+x}$

$\Rightarrow x^2 = 6 + x$

$\Rightarrow x^2 - x - 6 = 0$

$\Rightarrow (x-3)(x+2) = 0$

$\therefore x = 3, -2$

S P
$-1 \quad -6 \quad \begin{matrix} -3 \\ +2 \end{matrix}$

x cannot be -ve, $\therefore$ required value of x is 3.

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8) Let the no. of students in one row be x and the no. of rows be y.

ATQ, $(x+1)(y-2) = xy$

$\Rightarrow xy - 2x + y - 2 = xy$

$\Rightarrow -2x + y = 2 \longrightarrow (1)$

Also, $(x-1)(y+3) = xy$

$\Rightarrow xy + 3x - y - 3 = xy$

$\Rightarrow 3x - y = 3 \longrightarrow (2)$

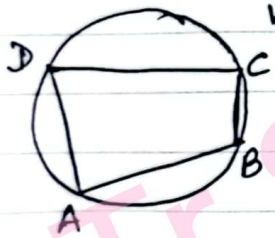
(1)+(2), $\boxed{x = 5}$

From eq:(1), $-10 + y = 2$

$\boxed{y = 12}$

Hence, the no. of students in the class $= xy = 5 \times 12 = 60$ students

9) We know that Sum of opposite angles of a cyclic quadrilateral is 180°



$\angle A + \angle C = 180^\circ$

$\Rightarrow 2x - 1 + 2y + 15 = 180^\circ$

$\Rightarrow 2x + 2y = 166$

$\Rightarrow x + y = 83 \longrightarrow (1)$

Also, $\angle B + \angle D = 180^\circ$

$\Rightarrow y + 5 + 4x - 7 = 180^\circ$

$\Rightarrow 4x + y = 182 \longrightarrow (2)$

(1)−(2), $-3x = -99$

$\boxed{x = 33}$

$\boxed{y = 50}$

$\therefore \angle A = 2x - 1 = 66 - 1 = 65^\circ$

$\angle C = 180^\circ - 65^\circ = 115^\circ$

$\angle B = y + 5^\circ = 55^\circ$

$\angle D = 180^\circ - 55^\circ = 125^\circ$

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10) Let the amounts invested at different rates be ₹x and ₹y respectively.

$$SI = \frac{PRT}{100}$$

ATQ, $\frac{x \times 12 \times 1}{100} + \frac{y \times 10 \times 1}{100} = 130$

$$12x + 10y = 13000 \longrightarrow (1)$$

Also, $\frac{x \times 10 \times 1}{100} + \frac{y \times 12 \times 1}{100} = 134$

$$\Rightarrow 10x + 12y = 13400 \longrightarrow (2)$$

(1)+(2), $22x + 22y = 26400$

$$x + y = 1200 \longrightarrow (3)$$

(1)−(2), $2x - 2y = -400$

$$x - y = -200 \longrightarrow (4)$$

3+(4), $2x = 1000$

$$x = 500$$

$$y = 700$$

Hence, the required amounts invested are Rs 500 and Rs 700

11) Let the usual speed of train be x km/hr and its usual time taken be y hrs.

ATQ, $(x+6)(y-4) = xy$

$\Rightarrow xy - 4x + 6y - 24 = xy$

$\Rightarrow -4x + 6y = 24$

$\Rightarrow -2x + 3y = 12 \longrightarrow (1)$

Also, $(x-6)(y+6) = xy$

$\Rightarrow xy + 6x - 6y - 36 = xy$

$\Rightarrow 6x - 6y = 36$

$\Rightarrow x - y = 6 \rightarrow (2)$

$(1) \Rightarrow -2x + 3y = 12$

$2 \times (2) \Rightarrow 2x - 2y = 12$

$(+), \quad y = 24$

$x = 30$

Hence, length of the journey $= xy = 30 \times 24 = \underline{720 \text{ km}}$

12) Let the present age of Salim and daughter be x and y years.

ATQ, $x - 2 = 3(y - 2)$

$\Rightarrow x - 2 = 3y - 6$

$\Rightarrow x - 3y = -4 \longrightarrow (1)$

Also, $x + 6 = 2(y + 6) + 4$

$\Rightarrow x + 6 = 2y + 12 + 4$

$\Rightarrow x - 2y = 10 \longrightarrow (2)$

$(1) - (2), \quad -y = -14$

$y = 14$

From eq: (1),

$x - 42 = -4$

$x = 38$

Hence, their present ages are 38 years and 14 years.

13) Let the fraction be $\frac{x}{y}$.

ATQ, $y = 2x + 4 \rightarrow (1)$

Also, $y - 6 = 12(x - 6)$

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

$\Rightarrow 12x - y = 66$

$\Rightarrow 12x - 2x - 4 = 66$ [from eq: (1)]

$\Rightarrow 10x = 70$

$x = 7$

From eq: (1),

$y = 14 + 4 = 18$

Hence, the fraction is $\frac{7}{18}$

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14) Let the given equations be of the form $a_1x+b_1y+c_1=0$
$a_2x+b_2y+c_2=0$

where $a_1 = 2m-1, b_1 = 3, c_1 = -5$
$a_2 = 3, b_2 = n-1, c_2 = -2$

For infinite no. of solutions, $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$.

$$\Rightarrow \underset{\text{I}}{\frac{2m-1}{3}} = \underset{\text{II}}{\frac{3}{n-1}} = \underset{\text{III}}{\frac{+5}{+2}}$$

From I and III, $4m-2=15$
$4m=17$
$m=\frac{17}{4}$

From II and III, $5n-5=6$
$5n=11$
$n=\frac{11}{5}$

15) (i) $217x+131y=913 \rightarrow (1)$
$131x+217y=827 \rightarrow (2)$

(1)+(2), $348x+348y=1740$
$(\div 348)$ $x+y=5 \longrightarrow (3)$

(1)−(2), $86x-86y=86$
$(\div 86)$ $x-y=1 \longrightarrow (4)$

(3)+(4), $2x=6$

$\boxed{x=3}$
$\boxed{y=2}$

(ii) $(a-b)x+(a+b)y = a^2-2ab-b^2 \rightarrow (1)$
$(-)(a+b)x+(a+b)y = (-)a^2+(-)b^2 \rightarrow (2)$

$(a-b-a-b)x = -2ab-2b^2$
$-2bx = -2b(a+b)$
$\boxed{x=a+b}$

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From eq: (2), $(a+b)(a+b)+(a+b)y = a^2+b^2$

$a^2+b^2+2ab+(a+b)y = a^2+b^2$

$(a+b)y = -2ab$

$$y = \frac{-2ab}{a+b}$$
