

13/02/23

* UNIT - 3 (Vertical & Crosswise Multiplication)

Pattern - I : 2x2 digit Multiplication :-

Eg: 21×34

$$\begin{array}{r} 21 \\ \times 34 \\ \hline \end{array}$$

$$\underline{6,14} = 714$$

$S_1:$ LHS RHS
 $\begin{array}{r} \cdot \cdot \\ \cdot \cdot \downarrow \end{array} \quad \begin{array}{l} \cdot \cdot \\ \cdot \cdot \end{array} \downarrow \times \textcircled{1}$

$$S_2: \begin{array}{r} \cdot \cdot \times \cdot \\ \cdot \cdot \end{array} \oplus$$

Q.1) $47 \times 28 = 1316$

$$(2 \times 4) + (3 \times 1)$$

$$S_3: \begin{array}{r} \textcircled{2} \downarrow \times \cdot \\ \cdot \cdot \end{array}$$

Q.2) $82 \times 74 = 6068$

Q.3) $71 \times 86 = 6106$

Pattern - II : 3x3 digit Multiplication :-

Eg: 413×321

$$\text{No. of steps : } 2n-1 \\ = 5$$

$$S_1: \begin{array}{r} \cdot \cdot \cdot \\ \cdot \cdot \cdot \downarrow \times \textcircled{1} \end{array}$$

$$S_3: \begin{array}{r} \cdot \cdot \cdot \\ \cancel{\cdot \cdot \cdot} \rightarrow \oplus \end{array}$$

$$S_2: \begin{array}{r} \cdot \cdot \cdot \times \cdot \cdot \cdot \\ \cdot \cdot \cdot \end{array} \textcircled{1}$$

$$S_4: \begin{array}{r} \cdot \cdot \cdot \\ \oplus \cancel{\cdot \cdot \cdot} \end{array} \cdot \cdot \cdot$$

$$S_5: \begin{array}{r} \cdot \cdot \cdot \\ \downarrow \otimes \end{array} \cdot \cdot \cdot$$

413

x 321

$$\underline{12,2,573} = 132573$$

Q.1) $734 \times 256 = 187904$

2) $216 \times 374 = 80784$

3) $405 \times 231 = 93555$

4) $351 \times 726 = 254826$

5) $572 \times 503 = 287716$

B. 1) $95 \times 47 = 4465$

2) $73 \times 84 = 6132$

3) $216 \times 374 = 80784$

4) $475 \times 235 = 111,625$

5) $352 \times 41 = 14432$

6) $574 \times 28 = 16072$

Pattern - III : 4×4 digit Multiplication :-

Eg: 2134 x 3261

$$\begin{array}{r}
 2134 \\
 3261 \\
 \hline
 6958974
 \end{array}$$

S₁ : • • • • ↓ x

S_2 : 

S_3 : 

S₄ :

S₅:

S_6 :

$S_7 :$

$$Q.1) \quad 2413 \times 1672 = 4034536$$

$$2) \quad \begin{array}{r} 9530 \\ \times 2453 \\ \hline \end{array} = 23377090$$

$$3) \quad 1278 \times 5806 = 7420068$$

$$4) \quad \begin{array}{r} 1234 \\ \times 431 \\ \hline \end{array} = 531854$$

$$5) \quad 8015 \times 638 = 5113570$$

(6) $526 \times 4382 = 2304932$

Pattern - IV : 5x5 digit Multiplication :-

25342

73614

1865525988

Q.1) $36124 \times 20618 = 744804632$

2) $15783 \times 58067 = 916471461$

3) $439512 \times 305021 = 134060389752$

4) $7503002 \times 4315112 = 32376293966224$

5) $353123 \times 45 = 15890535$

6) $502513 \times 3.215 = 1615.579 \times 295$

7) $3215.3 \times 0.31523 = 1013.559019$

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Q.1) $75.21 \times 72.3 = 5437.683$

2) $8023.5 \times 1.521 = 12203.7435$

3) $45.49121 \times 3.151 = 143.34280271$

Find the thousands place digit of the following questions:

Q.1) $1231543132015495 \times 3210315291223101 \Rightarrow 9$

2) $21512159217 \times 59015922911 \Rightarrow 0$

* Algebra :-

$$(x+3)(4x-7)$$

$$\begin{array}{r} \textcircled{+} \quad x^2 \\ \hline x^2 \downarrow 1 \quad \uparrow 3 \\ 4 \quad \swarrow \quad \searrow 7 \\ \hline \textcircled{0} \text{ constant} \end{array}$$

$$\underline{4x^2 + 5x - 21}$$

Q.1) $(4x+3)(x-5) = 4x^2 - 17x - 15$

2) $(x+8)(3x+11) = 3x^2 + 35x + 88$

3) $(x-y)(2x-3y) = 2x^2 - 5xy + 3y^2$

4) $(4x+3y)(2x+y) = 8x^2 + 10xy + 3y^2$

5) $(2x-3y)(5x+8y) = 10x^2 + xy - 24y^2$

6) $(2x^2 + x + 3)(3x^2 + 2x + 4)$

$$\begin{array}{r}
 & 2 & 1 & 3 \\
 & 3 & 2 & 4 \\
 \hline
 12 & 9 & 0 & 1 \cancel{1} \cancel{2} & \rightarrow 129012
 \end{array}$$

No. of steps = 5 → 4 3 2 1 0

$$(2x^2 + x + 3)(3x^2 + 2x + 4) = 6x^4 + 7x^3 + 19x^2 + 10x + 12$$

7) $(x^2 - x + 5)(2x^2 + 3x - 2)$

$$\begin{array}{r}
 & 1 & -1 & 5 \\
 & 2 & 3 & -2 \\
 \hline
 & 2 & 1 & 5 & 17 & -10
 \end{array}$$

$$= 2x^4 + x^3 + 5x^2 + 17x - 10$$

8) $(3x^2 + x - 3)(2x^2 - 5x - 7) = 6x^4 - 13x^3 - 32x^2 + 8x + 21$

$$\begin{array}{r}
 3 & 1 & -3 \\
 2 & -5 & -7 \\
 \hline
 6 & -13 & -27 & 8 & 21
 \end{array}$$

9) $(x^2 + 3x + 4)(2x^2 + 7) = 2x^4 + 6x^3 + 15x^2 + 21x + 28$

$$\begin{array}{r}
 1 & 3 & 4 \\
 2 & 0 & 7 \\
 \hline
 2 & 6 & 8 & 21 & 28
 \end{array}$$

10) $(7x^2 - 3x)(9x^2 - 2) = 63x^4 + 27x^3 + 14x^2 + 6x$

$$\begin{array}{r}
 7 \ 3 \ 0 \\
 9 \ 0 \ 2 \\
 \hline
 63 \ 27 \ 14 \ 6 \ 0
 \end{array}
 \qquad \qquad \qquad
 \begin{array}{r}
 3 \ 2 \ 1 \ 0
 \end{array}$$

Q. Find the coefficient of x^3 :

1) $(7x^4 - 3x^3 + 2x - 5)(x^4 - 2x^2 + 3x - 2)$

$$\begin{array}{r}
 7 \ -3 \ 2 \ -5 \\
 1 \ -2 \ 3 \ -2 \\
 \hline
 4^{\text{th}} \text{ step} = -32
 \end{array}
 \qquad \qquad \qquad
 \begin{array}{r}
 7 \ 3 \ 0 \ 2 \ -5 \\
 1 \ 0 \ -2 \ 3 \ 2 \\
 \hline
 2
 \end{array}$$

2) $(2x^5 - 9x^4 - x - 2)(x^4 - 3x^2 + x)$

$$\begin{array}{r}
 2 \ -9 \ -1 \ -2 \\
 1 \ -3 \ 1 \ 0 \\
 \hline
 4^{\text{th}} \text{ step} =
 \end{array}$$

$$\begin{array}{r}
 2 \ -9 \ 0 \ 0 \ -1 \ -2 \\
 0 \ 1 \ 0 \ -3 \ 1 \ 0 \\
 \hline
 3
 \end{array}$$

Q. Find the coefficient of x^5 :

1) $(6x^6 - 4x^3 - 9x + 2)(x^5 + x^3 + 2x - 5)$

$$\begin{array}{ccccccc}
 6 & 0 & 0 & -4 & 0 & -9 & 2 \\
 0 & 5 & 0 & 1 & 0 & 2 & -5 \\
 \hline
 & & & & 2 & &
 \end{array}$$

2) $(9x^7 - 2x^5 + 9x^3 + 5)(x^7 - x^5 + x^2 - x + 5)$

$$-10 + 9 - 5 = -6$$

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* Linear Equations in One Variable :

Type-I : $ax+b = cx+d$

$$\Rightarrow x = \frac{d-b}{a-c}$$

Eg : $2x+3 = x+9$
 $x = \frac{9-3}{2-1} = 6$

Q.1) $17x - 13 = 13x + 3$

$$x = \frac{3 - (-13)}{17 - 13} = \frac{16}{4}$$

$$\boxed{x=4}$$

2) $6x - 5 = 3x + 10$

$$\boxed{x=5}$$

3) $10x + 1 = 25 - 2x$

$$\boxed{x=17/5} \Rightarrow \boxed{x=5}$$

4) $3y - 4 = 2y + 1$

$$\boxed{y=5}$$

5) $2x+7 = 18 - 9x$

$$\boxed{x = 1}$$

Type - II: $(x+a)(x+b) = (x+c)(x+d)$

$$x^2 + bx + ax + ab = \cancel{x^2} + dx + cx + cd$$

$$(b+a-c-d)x = cd - ab$$

$$\Rightarrow \boxed{x = \frac{cd - ab}{b+a-c-d}}$$

Eg: $(x+2)(x+5) = (x+1)(x+4)$

$$x = \frac{4-10}{7-1-4} \Rightarrow \boxed{x = -3}$$

Q. 1) $(x+1)(x+2) = (x-3)(x-4)$

$$\boxed{x = 1}$$

2) $(x+7)(x+9) = (x-8)(x-11)$

$$x = \frac{25}{-3}$$

3) $(x-6)(x+7) = (x+3)(x-11)$

$$x = 1$$

4) $(x+4)(x-2) = (x-1)(x-20)$

$$x = -8$$

5) $(x-8)(x-5) = (x-10)(x-4)$

$$x = 0$$

Type - III : $\frac{ax+b}{cx+d} = \frac{p}{q}$

$$x = \frac{dq - bq}{aq - cp}$$

Q. $\frac{x-5}{3x+2} = \frac{2}{23}$

$$x = \frac{4 - (-115)}{23 - 6}$$

$$x = 7$$

Q.1)

$$\frac{2x-3}{3x-2} = \frac{5}{6}$$

$$x = \frac{-10 - (-18)}{12 - 15}$$

$$\boxed{x = \frac{8}{-3}}$$

2)

$$\frac{x+2}{x+1} = \frac{5}{3}$$

$$x = \frac{5-6}{3-5}$$

$$\boxed{x = 1/2}$$

3)

$$\frac{x+3}{x+1} = \frac{6}{5}$$

$$x = \frac{6-15}{5-6}$$

$$\boxed{x = 9}$$

4)

$$\frac{x-2}{x-5} = 4$$

$$x = \frac{-20 - (-2)}{1 - 4}$$

$$\boxed{x = 6}$$

5)

$$\frac{x-1}{x+1} = \frac{1}{2}$$

$$x = \frac{1 - (-2)}{2 - 1} \Rightarrow \boxed{x = 3}$$

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Type - IV : $\frac{m}{x+a} + \frac{n}{x+b} = 0$

$$x = \frac{-mb - na}{m+n}$$

eg : $\frac{1}{x+3} + \frac{7}{x+11} = 0$

$$x = \frac{-11 - 21}{8}$$

$$x = -4$$

Q.1) $\frac{2}{x+5} + \frac{3}{x+2} = 0$

$$x = \frac{-4 - 15}{5} \Rightarrow x = -19$$

2) $\frac{7}{x+5} + \frac{2}{x-3} = 0$

$$x = \frac{21 - 10}{9}$$

$$x = 11/9$$

3) $\frac{1}{x+2} + \frac{1}{x+3} = 0$

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

$$x = -5/2$$

4) $\frac{6}{x-2} + \frac{3}{x+5} = 0$

$$x = \frac{-30 + 6}{9}$$

$$\boxed{x = \frac{-34}{9}}$$

5) $\frac{-5}{x+3} + \frac{9}{x-5} = 0$

$$x = \frac{-25 - 27}{4}$$

$$\boxed{x = -13}$$

Q.1) $2x+7 = 5x-11 \rightarrow \boxed{x = 6}$

2) $(x-7)(x-9) = (x-3)(x-2) \rightarrow \boxed{x = \frac{57}{11}}$

3) $\frac{2x+1}{3x+4} = \frac{4}{5} \rightarrow \boxed{x = -\frac{11}{2}}$

4) $\frac{9}{x-3} + \frac{5}{x-5} = 0 \quad x = \frac{60}{14}$

$$\boxed{x = \frac{30}{7}}$$

~~21/02/93.~~

* Linear Equations (Special Types) :> "Samuccaya"

Type - I : Samuccaya as a common factor

Q.1) $3(x+5) + 6(x+5) = 7(x+5)$

$$\boxed{x = -5}$$

2) $3(x-1) = (x-1)$

$$\boxed{x=1}$$

3) $(x-3)(x-3) = 3(x-3)$

$$\boxed{x = 3}$$

Type - II : Samuccaya as a product of the independent term

$$(x+a)(x+b) = (x+c)(x+d)$$

$$\boxed{ab = cd}$$

$$\boxed{x=0}$$

$$(x+7)(x+9) = (x+3)(x+21)$$

$$7 \times 9 = 63$$

$$3 \times 21 = 63$$

$$> \boxed{x=0}$$

Q.1) $(x-9)(x-8) = (x-18)(x-4) \Rightarrow [x=0]$

2) $(x+1)(x+2)(x+3) = (x+1)^2(x+6) \Rightarrow [x=0]$

3) $(x+1)(x+9) = (x+3)^2 \Rightarrow [x=0]$

4) $\underbrace{(x+3)(x-4)}_x = \underbrace{(x-2)(x+6)}_x \Rightarrow [x=0]$

Type - III : Sum of the denominators of two fractions having the same numerical numerators :

Eg : $\frac{k}{x+a} + \frac{k}{x+b} = 0$

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

$$\frac{1}{3x-1} + \frac{1}{2x-1} = 0$$

$$(3x-1) + (2x-1) = 0$$

$$5x = 2$$

$$[x = 2/5]$$

Q.1) $\frac{3}{x-4} + \frac{3}{3x-8} = 0$

$x=3$

2) $\frac{2}{2x-1} + \frac{2}{x+4} = 0$

$x = -1$

3) $\frac{x}{x+3} + \frac{x}{x+4} = 0$

$x(x+3) + x(x+4) = 0$

$x^2 + 3x + x^2 + 4x = 0$

$2x^2 + 7x = 0 \rightarrow x(2x+7) = 0$

$x=0, -7/2$

4) $\frac{3x}{x-7} + \frac{3x}{x+4} = 0$

Type - IV : sum of the numerators & denominators are equal :

$$\frac{N_1}{D_1} = \frac{N_2}{D_2}$$

$$\text{if } N_1 + N_2 = D_1 + D_2 = 0$$

if quadratic eqn : then 2nd root can be found:

$$N_1 - D_1 = N_2 - D_2 = 0$$

$$\text{eg: } \frac{2x+9}{2x+7} = \frac{2x+7}{2x+9}$$

$$N_1 + N_2 = 4x + 16$$

$$D_1 + D_2 = 4x + 16$$

$$4x + 16 = 0$$

$$x = -4$$

$$Q.1) \frac{2x-3}{2x-5} = \frac{4x-9}{4x-7}$$

$$N_1 + N_2 = 6x - 12$$

$$D_1 + D_2 = 6x - 12$$

$$6x - 12 = 0$$

$$x = 2$$

$$2) \frac{2x-3}{x+4} = \frac{x-7}{2x-16}$$

$$3x-12=0$$

$$\boxed{x=4}$$

$$(N_2 - D_2) \\ N_1 - D_1 = x-7 = x-7 = 0$$

$$\boxed{x=7}$$

$$3) \frac{5x+11}{5x+14} = \frac{3x+5}{3x+2}$$

$$\boxed{x=-2}$$

$$4) \frac{3x+4}{6x+7} = \frac{5x+6}{2x+3}$$

$$-3x-3 = 3x+3 \Rightarrow \boxed{x=-1}$$

$$\boxed{x=-5/4}$$

$$5) \frac{2x+1}{x+2} = \frac{2x-3}{3x-4}$$

$$\boxed{x=1/2}$$

$$x-1 = -x+1$$

$$2x=2$$

$$\boxed{x=1}$$

$$6) \frac{x+2}{2x+1} = \frac{x+1}{2x+5}$$

$$2x+3 = 4x+6$$

$$2x-3=0$$

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

revision (Unit - 2) [Digit sum]

1) $428 - 346 = 82$ (True)

2) $3485 - 2816 = 669$ (True)

3) $312 \times 24 = 7488$ (~~false~~) (True)

4) $37625 + 24839 + 65431 = 127895$ (True)

5) $(78)^2 = 6084$ (True)

6) $2.384 \times 0.342 = 0.816012$

7) $81623 \div 7352 = Q: 11, R: 751$ (True)

$$\underbrace{81623}_2 = \underbrace{7352 \times 11}_8 \underbrace{+ 751}_4$$

Type - II : The sum of denominators on both sides :

$$\frac{1}{x+a} + \frac{1}{x+b} = \frac{1}{x+c} + \frac{1}{x+d}$$

$$x+a + x+b = x+c + x+d$$

$$2x + a+b = 2x + c+d = 0$$

Q.1) $\frac{1}{x-7} + \frac{1}{x-4} = \frac{1}{x-5} + \frac{1}{x-6}$

$$2x - 11 = 0$$

$$x = 11/2$$

2) $\frac{1}{x+5} + \frac{1}{x+11} = \frac{1}{x+4} + \frac{1}{x+12}$

$$x = -8$$

3) $\frac{1}{x-7} + \frac{1}{x+10} = \frac{1}{x+12} + \frac{1}{x-9}$

$$x = -3/2$$