Beauty of

VEDIC SPEED MATHEMATICS

(Journey from Limited Intelligence to Human Bio-Calculator)

WORKBOOK

HIGHLY USEFUL FOR Standard/Grade **3rd** to **Ph.D** Students; Parents, Mathematics Teachers, Math Lovers, Placement & Job Interviews; All Entrance & Competitive Exams.

Chaitanya A. Patil
www.speed16.com/books/vm

Paperback, eBook, WorkBook & Video Course

Note: Take back to back print out on A4 Pages.

Note: Reach us on +91-97640-58-654 (Call & WhatsApp) for **FREE Home Delivery** of Vedic Speed Mathematics Books (anywhere in the World)

Contents

Unit 1: MULTIPLICATION

1.1 Multiplication using Base Method

Case 1: When both numbers (multiplicand and multiplier) are less than the working base:

Ex.1	Ex.2	Ex.3	Ex.4	Ex.5	Ex.6
94 -6 96 -4 --------- 90 ¦ 24	88 12 91 09 --------- 79 ¦ 108 79+1 ¦ 08	87 93 --------- ¦	79 98 --------- ¦	84 92 --------- ¦	89 92 --------- ¦
9024	8008				

Ex.7	Ex.8	Ex.9	Ex.10	Ex.11	Ex.12
96 83 --------- ¦	47 98 --------- ¦	81 89 --------- ¦	82 94 --------- ¦	79 96 --------- ¦	93 76 --------- ¦

Ex.13	Ex.14	Ex.15	Ex.16	Ex.17	Ex.18
78 96 --------- ¦	90 79 --------- ¦	58 96 --------- ¦	95 81 --------- ¦	87 93 --------- ¦	88 92 --------- ¦

Case 2: When both numbers are greater than the working base:

Ex.1	Ex.2	Ex.3	Ex.4	Ex.5	Ex.6
104 +4 109 +9 --------- 113 ¦ 36	106 112 --------- ¦	117 103 --------- ¦	124 106 --------- ¦	131 102 --------- ¦	149 106 --------- ¦
11136					

Ex.7	Ex.8	Ex.9	Ex.10	Ex.11	Ex.12
108 112 ---------- ¦	109 112 ---------- ¦	1003 1024 ---------- ¦	1412 1020 ---------- ¦	108 124 ---------- ¦	111 108 ---------- ¦

Ex.13	Ex.14	Ex.15	Ex.16	Ex.17	Ex.18
121 105 ---------- ¦	136 106 ---------- ¦	125 125 ---------- ¦	1024 1006 ---------- ¦	1045 1030 ---------- ¦	1036 1002 ---------- ¦

Case 3: When one number is lesser and other is greater than the working base:

Ex.1	Ex.2	Ex.3	Ex.4	Ex.5
104 +4 096 -4 ---------- 100 ¦ -16 100-1¦-16+100 99 ¦ 84	112 089 ---------- ¦	1024 0984 ---------- ¦	102 089 ---------- ¦	116 088 ---------- ¦
9984				

Ex.6	Ex.7	Ex.8	Ex.9	Ex.10
124 095 ---------- ¦	142 098 ---------- ¦	162 096 ---------- ¦	108 093 ---------- ¦	1040 0960 ---------- ¦

Ex.11	Ex.12	Ex.13	Ex.14	Ex.15
1043 0989 ---------- ¦	1024 0890 ---------- ¦	109 088 ---------- ¦	113 079 ---------- ¦	129 088 ---------- ¦

Case 4: Working with two different Bases:

Ex.1	Ex.2	Ex.3	Ex.4	Ex.5
12×114	120×13	1024×106	984×96	94×994
120 +20 114 +14 ---------- 134 ¦ 280 136 ¦ 80	120 13 ---------- ¦	1024 106 ---------- ¦	984 96 ---------- ¦	94 994 ---------- ¦
1368				

Ex.6	Ex.7	Ex.8	Ex.9	Ex.10
89×964	111×1024	17×160	89×986	12×991
89 964 ---------- ¦	111 1024 ---------- ¦	17 160 ---------- ¦	89 986 ---------- ¦	12 991 ---------- ¦

Ex.11	Ex.12	Ex.13	Ex.14	Ex.15
104×896	103×1022	960×16	93×1021	19×112
104 896 ---------- ¦	103 1022 ---------- ¦	960 16 ---------- ¦	93 1021 ---------- ¦	19 112 ---------- ¦

Case 5: When both numbers are not nearer to working base:

Ex.1	Ex.2	Ex.3	Ex.4	Ex.5	Ex.6	Ex.7	Ex.8
304×346	388×412	789×804	547×503	76×77	645×703	236×323	560×640
304 +04 346 +46 --------- 350 ¦ 184 1050 ¦ 184 1051 ¦ 84	388 412 --------- ¦	789 804 --------- ¦	547 503 --------- ¦	76 77 --------- ¦	645 703 --------- ¦	236 323 --------- ¦	560 640 --------- ¦
105184							

1.2 Multiplication using Criss Cross Method

Case 1: Two Digit Numbers (2D×2D and 2D×1D) {D: Digit}

Answer consists of three parts.

First Part:	Second Part:	Third Part:
a b c d	a b c d	a b c d
(a×c)	**(a×d) + (b×c)**	**(b×d)**

Ex. 1: 42 × 57	Ex. 2: 84 × 36	Ex. 3: 87 × 26
(4×5) ¦ (4×7 + 2×5) ¦ (2×7) 20 ¦ 28+10 ¦ 14 20 ¦ 38 ¦ 14 20 ¦ 38+1 ¦ 4 20 ¦ 39 ¦ 4 20+3 ¦ 9 ¦ 4 23 ¦ 9 ¦ 4	(8×3) ¦ (8×6 + 4×3) ¦ (4×6) 24 ¦ 48+12 ¦ 24 24 ¦ 60 ¦ 24 24 ¦ 60+2 ¦ 4 24 ¦ 62 ¦ 4 24+6 ¦ 2 ¦ 4 30 ¦ 2 ¦ 4	
2394	**3024**	

Ex. 4: 71 × 39	Ex. 5: 78 × 19	Ex. 6: 67 × 48

Ex. 7: 46 × 67	**Ex. 8: 37 × 58**	**Ex. 9: 49 × 83**

Case 2: Three Digit Numbers (3D×3D; 3D×2D and 3D×1D) Answer consists of Five Parts.

First Part:	**Second Part:**	**Third Part:**	**Fourth Part:**	**Fifth Part:**
a b c d e f	a b c d e f	a b c d e f	a b c d e f	a b c d e f
(a×d)	**(a×e)+(b×d)**	**(a×f)+(b×e)+(c×d)**	**(b×f)+(c×e)**	**(c×f)**

Ex. 1: 417 × 765	**Ex. 2: 644 × 589**	**Ex. 3: 478 × 637**
(4×7) ¦ (4×6) + (1×7) ¦ (4×5 + 1×6 + 7×7) ¦ (1×5 + 7×6) ¦ (7×5) 28 ¦ 24+7 ¦ 20+6+49 ¦ 5+42 ¦ 35 28 ¦ 31 ¦ 75 ¦ 47 ¦ 35 28 ¦ 31 ¦ 75 ¦ 47+3 ¦ 5 28 ¦ 31 ¦ 75 ¦ 50 ¦ 5 28 ¦ 31 ¦ 75+5 ¦ 0 ¦ 5 28 ¦ 31 ¦ 80 ¦ 0 ¦ 5 28 ¦ 31+8 ¦ 0 ¦ 0 ¦ 5 28 ¦ 39 ¦ 0 ¦ 0 ¦ 5 28+3 ¦ 9 ¦ 0 ¦ 0 ¦ 5 31 ¦ 9 ¦ 0 ¦ 0 ¦ 5	6 4 4 5 8 9 --- **30 68 106 68 36** **37 ~~79~~ ~~113~~ ~~71~~ ~~36~~** 37 9 3 1 6	4 7 8 6 3 7 ---
319005	**379316**	

Ex. 4: 874 × 632	**Ex. 5: 328 × 476**	**Ex. 6: 337 × 749**
8 7 4 6 3 2 ----------	3 2 8 4 7 6 ----------	3 3 7 7 4 9 ----------

Ex. 7: 727 × 149	**Ex. 8: 648 × 987**	**Ex. 9: 324 × 657**
7 2 7 1 4 9 ----------	6 4 8 9 8 7 ----------	3 2 4 6 5 7 ----------

Ex. 10: 251 × 893	**Ex. 11: 894 × 274**	**Ex. 12: 349 × 369**
2 5 1 8 9 3 ----------	8 9 4 2 7 4 ----------	3 4 9 3 6 9 ----------

Ex. 13: 812 × 436	**Ex. 14: 941 × 328**	**Ex. 15: 812 × 549**
8 1 2 4 3 6 ----------	9 4 1 3 2 8 ----------	8 1 2 5 4 9 ----------

CASE 3: (4×3; 4×3; 4×2; 4×1) Answer consists of seven parts.

First Part:	Second Part:	Third Part:	Fourth Part:
a b c d e f g h	a b c d e f g h	a b c d e f g h	a b c d e f g h
(a×e)	**(a×f) + (b×e)**	**(a×g) + (b×f) + (c×e)**	**(a×h) + (b×g) +(c×f) + (d×e)**

Fifth Part:	Sixth Part:	Seventh Part:
a b c d e f g h	a b c d e f g h	a b c d e f g h
(b×h) + (c×g) + (d×f)	**(c×h) + (d×g)**	**(d×h)**

Ex.1: 4563 × 8336?	Ex.2: 6379 × 2346?	Ex.3: 7453 × 8743?
4 5 6 3 **× 8 3 3 6** ---------- =32¦12+40¦12+15+48¦24+15+18+24¦30+18+9¦36+9¦18 = 32 ¦ 52 ¦ 75 ¦ 81 ¦ 57 ¦ 45 ¦ 18 = 32 ¦ 52 ¦ 75 ¦ 81 ¦ 57 ¦ 45+1=46 ¦ 8 = 32 ¦ 52 ¦ 75 ¦ 81 ¦ 57+4=61 ¦ 6 ¦ 8 = 32 ¦ 52 ¦ 75 ¦ 81+6=87 ¦ 1 ¦ 6 ¦ 8 = 32 ¦ 52 ¦ 75+8=83 ¦ 7 ¦ 1 ¦ 6 ¦ 8 = 32 ¦ 52+8=60 ¦ 3 ¦ 7 ¦ 1 ¦ 6 ¦ 8 = 32+6 ¦ 0 ¦ 3 ¦ 7 ¦ 1 ¦ 6 ¦ 8 = 38 ¦ 0 ¦ 3 ¦ 7 ¦ 1 ¦ 6 ¦ 8	**6 3 7 9** **× 2 3 4 6** ---------- = 12 ¦ 24 ¦ 47 ¦ 87 ¦ 73 ¦ 78 ¦ 54 14 ¦ 9 ¦ 6 ¦ 5 ¦ 1 ¦ 3 ¦ 4	**7 4 5 3** **× 8 7 4 3** ----------
= 38037168	**= 14965134**	

Ex.4: 8745 × 3214?	Ex.5: 3125 × 6478?	Ex.6: 2148 × 6348?
8 7 4 5 × 3 2 1 4 ----------	3 1 2 5 × 6 4 7 8 ----------	2 1 4 8 × 6 3 4 8 ----------

Ex.7: 4874 × 3147?	Ex.8: 2147 × 9745?	Ex.9: 3647 × 4129?
4 8 7 4 × 3 1 4 7 ----------	2 1 4 7 × 9 7 4 5 ----------	3 6 4 7 × 4 1 2 9 ----------

Ex.10: 6423 × 3928?	Ex.11: 2419 × 9824?	Ex.12: 8346 × 3148?
6 4 2 3 × 3 9 2 8 ----------	2 4 1 9 × 9 8 2 4 ----------	8 3 4 6 × 3 1 4 8 ----------

CASE 4: (5×5; 5×4; 5×3; 5×2; 5×1): Answer consists of **nine** parts.

First Part:	Second Part:	Third Part:
a b c d e f g h i j	a b c d e f g h i j	a b c d e f g h i j
(a×f)	**(a×g)+(b×f)**	**(a×h)+(b×g)+(c×f)**

Fourth Part:	Fifth Part:	Sixth Part:
a b c d e f g h i j	a b c d e f g h i j	a b c d e f g h i j
(a×i)+(b×h)+ (c×g)+(d×f)	**(a×j)+(b×i)+(c×h)+ (d×g)+ (e×f)**	**(b×j)+(c×i)+ (d×h)+(e×g)**

Seventh Part:	Eighth Part:	Nineth Part:
a b c d e f g h i j	a b c d e f g h i j	a b c d e f g h i j
(c×j)+ (d×i) + (e×h)	**(d×j) + (e×i)**	**(e×j)**

CASE 5: (6×6; 6×5; 6×4; 6×3; 6×2; 6×1) (Do it Yourself) Answer consists of eleven parts.

First Part:	Second Part:	Third Part:	Fourth Part:
a b c d e f g h i j k l	a b c d e f g h i j k l	a b c d e f g h i j k l	a b c d e f g h i j k l

Fifth Part:	Sixth Part:	Seventh Part	Eighth Part:
a b c d e f g h i j k l	a b c d e f g h i j k l	a b c d e f g h i j k l	a b c d e f g h i j k l

Nineth Part:	Tenth Part:	Eleventh Part:
a b c d e f g h i j k l	a b c d e f g h i j k l	a b c d e f g h i j k l

5*5:

Ex.1: 23456 × 67456?	Ex.2: 33214 × 254?	Ex.3: 47896 × 21456?
2 3 4 5 6 × 6 7 4 5 6 ----------	3 3 2 1 4 × 0 0 2 5 4 ----------	4 7 8 9 6 × 2 1 4 5 6 ----------

Ex.4: 64789 × 23487?	Ex.5: 24578 × 3648?	Ex.6: 97458 × 31231?
6 4 7 8 9 × 2 3 4 8 7 ----------	2 4 5 7 8 × 0 3 6 4 8 ----------	9 7 4 5 8 × 3 1 2 3 1 ----------

6*6:

Ex.1: 234568 × 674563?	Ex.2: 164589 × 314789?
2 3 4 5 6 8 × 6 7 4 5 6 3 ----------	1 6 4 5 8 9 × 3 1 4 7 8 9 ----------

Ex.3: 874569 × 242681?	Ex.4: 324716 × 64789?
8 7 4 5 6 9 × 2 4 2 6 8 1 ----------	3 2 4 7 1 6 × 0 6 4 7 8 9 ----------

1.3 Special Cases

1.3.1 Multiplying numbers with repeating 9's

Case-1: When Multiplicand is Smaller than Multiplier

Ex.1: 7×9	**Ex.2:** 37×99	**Ex.3:** 874×999
(Base=10)	(Base=100)	(Base=1000)
(7-1) ¦ (10-7) 6 ¦ 3	(37-1) ¦ (100-37) 36 ¦ 63	(874-1) ¦ (1000-874) 873 ¦ 126
63	**3663**	**873126**

Case-2: When Multiplicand is Greater than Multiplier

Ex.4: 27×9	**Ex.5:** 346×99	**Ex.6:** 7389×9
(Base=10)	(Base=100)	(Base=10)
{2Digit× 1Digit} (27-**1-2**) ¦ (10-7) 24 ¦ 3	{3Digit × 2Digit} (346-1-3) ¦ (100-46) 342 ¦ 54	{4Digit × 1Digit} (7389-1-738) ¦ (10-9) 6650 ¦1
243	**34254**	**66501**

7. **76×99** = 76-1¦ 100-76 = 75¦ 24 = **7524**
8. **384×999**= 384-1¦1000-384 = 383¦616 = **383616**
9. **5468×9999** = 5468-1¦10000-5468 = **54674532**
10. **64×999** = 64-1¦1000-64 = 63¦936 = **63936**
11. **863×99** = 863-1-8¦100-63 = 854¦37 = **85437**
12. **6478×99**=6478-1-64¦100-78 =6413¦22 = **641322**
13. **84×99**=
14. **68×99**=
15. **39×99**=
16. **647×999**=
17. **347×999**=
18. **4789×9999**=
19. **3478×9999**=
20. **24×9**=
21. **241×99**=
22. **216×99**=
23. **346×99**=
24. **3366×999**=
25. **27×999**=
26. **8745×999**=
27. **125×999**=
28. **364×9999**=
29. **744×99999**=
30. **901×99**=

1.3.2 When final digits added up gives power of 10 (10 or 100 or 1000 etc)

Ex.1: 17×13	**Ex.2:** 28×22	**Ex.3:** 44×46
{7+3=10}	{8+2=10}	{4+6=10}
(1×2) ¦ (7×3)	2×3 ¦ 8×2	4×5 ¦ 4×6
2 ¦ 21	6 ¦ 16	20 ¦ 24
221	**616**	**2024**

1. **32×38** =
2. **49×41** =
3. **57×53** =
4. **76×74** =
5. **29×21** =
6. **39×31** =
7. **47×43** =
8. **54×56** =
9. **77×73** =
10. **192×108** =

1.3.3: Multiplication by 11 (x×11)

Ex.1:45×11	**Ex.2: 88×11**	**Ex.3: 67×11**	**Ex.4: 324×11**	**Ex.5: 697×11**	**Ex.6: 987×11**
45 ×11 ------ 4 ¦ (4+5) ¦ 5 4 ¦ 9 ¦ 5	88 ×11 ------ 8 ¦ ~~16~~ ¦ 8 9 ¦ 6 ¦ 8	67 ×11 ------	324 ×11 ------	697 ×11 ------	987 ×11 ------
495	**968**				

7: 3464×11	**8: 6978×11**	**9: 68974×11**	**10: 3697895×11**	**11: 345789645×11**
3464 ×11 ------	6978 ×11 ------	68974 ×11 ------	3697895 ×11 ------	345789645 ×11 ------

1. Books, eBooks, Video Course, FREE Workbook & FREE Online Training on Vedic Speed Mathematics, C & Python Programming: www.Speed16.com/books/vm
2. 3D Printers (Sales & Service; Anywhere in the World).
3. eBook Creation (epub/mobi) & Publishing (Amazon Kindle, iBooks, Kobo etc.) Services.
4. IT Solutions and Services
5. Reach us for **FREE Home Delivery** of Vedic Speed Mathematics (Anywhere in the World)
6. **Contact:** Chaitanya Patil; info@speed16.com

1.3.4 Multiplication by 12 (x×12)

Ex.1: 34×12	Ex.2: 89×12	Ex.3: 67×12	Ex.4: 324×12	Ex.5: 697×12	Ex.6: 987×12
34 ×12 ------ 3¦(3+3+4)¦(4+4) 3 ¦ 10 ¦ 8 (3+1) ¦ 0 ¦ 8 4 ¦ 0 ¦ 8 **408**	89 ×12 ------ 8 ¦ 25 ¦ 18 10 ¦ 6 ¦ 8 **1068**	67 ×12 ------	324 ×12 ------	697 ×12 ------	987 ×12 ------
408	**1068**				

7: 3464×12	8: 6978×12	9: 68974×12	10: 3697895×12	12: 345789645×12
3464 ×12 ------	6978 ×12 ------	68974 ×12 ------	3697895 ×12 ------	345789645 ×12 ------

1.3.5 Multiplication by 5, 25 or 125 (n×5, n×25, n×125)

Multiplication by 5: $(\mathbf{5} = \frac{\mathbf{10}}{\mathbf{2}})$; Multiplication by 5 is same as that of multiplying the number by 10 and then dividing the obtained product by 2.

Q: 46×5
A: (46×10)/2 = 460/2 = 230
Q: 29×5
A:
Q: 84×5
A:
Q: 569×5
A:
Q: 3489×5
A:
Q: 4789×5
A:
Q: 345×5
A:
Q: 249×5
A:
Q: 3477×5
A:
Q: 6458×5

A:
Q: 4789×5
A:
Q: 347×5
A:
Q: 149×5
A:
Q: 3478967×5
A:

Multiplication by 25 $(\mathbf{25 = \frac{100}{4}})$: Multiplication by 25 is same as that of multiplying the number by 100 and then dividing the obtained product by 4.
Q: 46×25
A: (46×100)/4 = 4600/4 = 1150
Q: 29×25
A:
Q: 84×25
A:
Q: 569×25
A:
Q: 3489×25
A:
Q: 4789×25
A:
Q: 345×25
A:
Q: 249×25
A:
Q: 3477×25
A:
Q: 6458×25
A:
Q: 4789×25
A:
Q: 347×25
A:
Q: 149×25
A:
Q: 3478967×25
A:

Multiplication by 125: $(\mathbf{125 = \frac{1000}{8}})$; Multiplication by 125 is same as that of multiplying the number by 1000 and then dividing the obtained product by 8.
Q: 46×125
A: (46×1000)/8 = 46000/8 = 5750

Q: 29×125
A:
Q: 84×125
A:
Q: 569×125
A:
Q: 3489×125
A:
Q: 4789×125
A:
Q: 345×125
A:
Q: 249×125
A:
Q: 34771×125
A:
Q: 6458×125
A:
Q: 4789×125
A:
Q: 347×125
A:
Q: 149×125
A:
Q: 3478967×125
A:

Exercises: (Solve using relevant methods)

1. 14×17	**2.** 19×16		**29.** 477×510	**30.** 369×764
3. 121×119	**4.** 116×109		**31.** 415×698	**32.** 286×478
5. 1024×1005	**6.** 1039×1010		**33.** 389×855	**34.** 475×996
7. 88×91	**8.** 96×89		**35.** 785×774	**36.** 475×875
9. 99×97	**10.** 980×978		**37.** 9987×9900	**38.** 9985×10200
11. 976×988	**12.** 955×990		**39.** 7007×7050	**40.** 9875×9980
13. 971×980	**14.** 1024×1010		**41.** 78×99	**42.** 7×99
15. 1100×1046	**16.** 1020×1005		**43.** 874×99	**44.** 649×999
17. 89×121	**18.** 91×115		**45.** 87×999	**46.** 7436×999
19. 94×117	**20.** 97×109		**47.** 96354×999	**48.** 7465×9999
21. 990×1050	**22.** 977×1020		**49.** 316×9999	**50.** 547×9999
23. 455×485	**24.** 475×485		**51.** 54×56	**52.** 77×73
25. 585×620	**26.** 690×725		**53.** 736×764	**54.** 349×351
27. 78×86	**28.** 475×520		**55.** 369×179	**56.** 411×296

1. 14×17	**2.** 19×16	**3.** 121×119	**4.** 116×109	**5.** 1024×1005	**6.** 1039×1010

7. 88×91	**8.** 96×89	**9.** 99×97	**10.** 980×978	**11.** 976×988	**12.** 955×990

13. 971×980	**14.** 1024×1010	**15.** 1100×1046	**16.** 1020×1005	**17.** 89×121	**18.** 91×115

19. 94×117	**20.** 97×109	**21.** 990×1050	**22.** 977×1020	**23.** 455×485	**24.** 475×485

25. 585×620	**26.** 690×725	**27.** 78×86	**28.** 475×520	**29.** 477×510	**30.** 369×764

31. 415×698	**32.** 286×478	**33.** 389×855	**34.** 475×996	**35.** 785×774	**36.** 475×875

37. 9987×9900	**38.** 9985×10200	**39.** 7007×7050	**40.** 9875×9980	**41.** 78×99	**42.** 7×99

43. 874×99	**44.** 649×999	**45.** 87×999	**46.** 7436×999	**47.** 96354×999	**48.** 7465×9999

49. 316×9999	**50.** 547×9999	**51.** 54×56	**52.** 77×73	**53.** 736×764	**54.** 349×351

55. 369×179	**56.** 411×296

Answers:

1. 238	**2.** 304		**29.** 243270	**30.** 281916
3. 14399	**4.** 12644		**31.** 289670	**32.** 136708
5. 1029120	**6.** 1049390		**33.** 332595	**34.** 473100
7. 8008	**8.** 8544		**35.** 607590	**36.** 415625
9. 9603	**10.** 958440		**37.** 98871300	**38.** 101847000
11. 964288	**12.** 945450		**39.** 49399350	**40.** 98552500
13. 951580	**14.** 1034240		**41.** 7722	**42.** 693
15. 1150600	**16.** 1025100		**43.** 86526	**44.** 648351
17. 10769	**18.** 10465		**45.** 86913	**46.** 7428564
19. 10998	**20.** 10579		**47.** 96257646	**48.** 74642535
21. 1039500	**22.** 996540		**49.** 3159684	**50.** 5469453
23. 220675	**24.** 230375		**51.** 3024	**52.** 5621
25. 362700	**26.** 500250		**53.** 562304	**54.** 122499
27. 6708	**28.** 247000		**55.** 66051	**56.** 121656

Unit 2: DIVISION

(Solve by using any suitable method)

1. 147÷11	2. 194÷17	3. 121÷104

4. 116÷212	5. 1024÷342	6. 1039÷544

7. 1256÷66	8. 2896÷87	9. 1254÷94

10. 21458÷976	11. 364578÷988	12. 6457896÷994

13. 2971÷76	14. 647859÷89	15. 3145697÷4364

16. 5647895÷6457892	17. 4789566÷31971	18. 974586÷465764

19. 64589÷645792	20. 3247931÷8124568	21. 87456963÷324588

22. 7412456÷1020	23. 874565412÷114	24. 3457896452÷324567

25. 987456321÷519475	26. 64578963÷864	27. 98745632÷31254

28. 245896475÷37452	29. 36478956÷2364	30. 8547996÷34779

31. 8475569÷3147	32. 6457855÷97	33. 345698÷63456

34. 974586÷102145	35. 9745689÷201238	36. 347931568÷345687

Unit 3: ADDITION

3.1 Right to Left Addition Using Purification

Ex.1: 7898+8567	Ex.2: 34856+97458+745+6478	Ex.3: 647566+314789+9874+364
7898 + 8567 ---------- (7+8),(8+5),(9+6),(8+7) 15,13,15,15 15 ,13,(15+1),5 15,13,16,5 15,(13+1),6,5 15,14,6,5 (15+1),4,6,5 16,4,6,5	3 4 8 5 6 + 9 7 4 5 8 0 0 7 4 5 0 6 4 7 8 ----------	6 4 7 5 6 6 + 3 1 4 7 8 9 0 0 9 8 7 4 0 0 0 3 6 4 ----------
16465		

Ex.4: 3645+6975+74	Ex.5: 8745+11456+987+32+679	Ex.6:697892+9978+33145+6478956
3 6 4 5 + 6 9 7 5 0 0 7 4 ----------	0 8 7 4 5 + 1 1 4 5 6 0 0 9 8 7 0 0 0 3 2 0 0 6 7 9 ----------	0 6 9 7 8 9 2 + 0 0 0 9 9 7 8 0 0 3 3 1 1 5 6 4 7 8 9 5 6 ----------

Ex.7: 12569+369+69	Ex.8: 6974125+3645+233+1142	Ex.9: 247896+12364+32117858
1 2 5 6 9 + 0 0 3 6 9 0 0 0 6 9 ----------	6 9 7 4 1 2 5 + 0 0 0 3 6 4 5 0 0 0 0 2 3 3 0 0 0 1 1 4 2 ----------	0 0 2 4 7 8 9 6 + 0 0 0 1 2 3 6 4 3 2 1 1 7 8 5 8 ----------

Ex.10: 14578+21+364	Ex.11: 678965+336654+647895	Ex.12: 5748312+3697489+9999999
1 4 5 7 8 + 0 0 0 2 1 0 0 3 6 4 ----------	6 7 8 9 6 5 + 3 3 6 6 5 4 6 4 7 8 9 5 ----------	0 5 7 4 8 3 1 2 + 0 3 6 9 7 4 8 9 9 9 9 9 9 9 9 9 ----------

3.2 Other Scenarios

Q: Add 78+9
A: First Add 78+10=88 and then subtract 88-1=87.

Q: Add 369+489
A: First Add 300+400=700; 60+80=140; 9+9=18; 700+140+18=858. **OR**
A: 400-31+489 = 400+481-31 = 889-31=858 **OR**
A: 369+500-11 = 869-11 = 858.

Q: 648+965
A:
A:

Q: 425+716
A:
A:

Q: 3146+6314
A:
A:

Q: 1478+9822
A:
A:

Q: 1233+632
A:
A:

Q: 145+654
A:
A:

Q: 198+236
A:
A:

Q: 258+988
A:
A:

Q: 1235+3456
A:
A:

Q: 1456+6213
A:
A:

Q: 1399+3321
A:
A:

Q: 4587+9888
A:
A:

Q: 337+655
A:
A:

Q: 249+312
A:
A:

Q: 222+548
A:
A:

Q: 478+985
A:
A:

Q: 544+689
A:
A:

Q: 382+378
A:
A:

Q: 326+974
A:
A:

Q: 3478+985
A:
A:

Q: 3647+9874
A:
A:

Q: 8236+6321
A:
A:

Q: 747+698
A:

3.3 Mixed Examples (Solve using any appropriate methods).

1. 8+9	**2.** 7+8	**3.** 9+9	**4.** 12+18

5. 9+19	**6.** 3+48	**7.** 38+48	**8.** 74+79

9. 87+109	**10.** 74+114	**11.** 245+289	**12.** 348+405

13. 475+916	**14.** 477+1023	**15.** 1047+987	**16.** 967+475

17. 744+888	**18.** 365+706	**19.** 7456+8569+745	**20.** 7458+9874+6325

21. 4782+648+8743	**22.** 47896+3548+589	**23.** 3498+6731+94385+69	**24.** 15+568+87+2368+3+58

Answers:

1. 17	**2.** 15		**13.** 1391	**14.** 1500
3. 18	**4.** 30		**15.** 2034	**16.** 1442
5. 28	**6.** 51		**17.** 1632	**18.** 1071
7. 86	**8.** 153		**19.** 16770	**20.** 23657
9. 196	**10.** 488		**21.** 14173	**22.** 52033
11. 534	**12.** 753		**23.** 104683	**24.** 3099

Unit 4: SUBTRACTION

4.1 Subtraction Using Base Method

Ex.1:100-46	Ex.2:1000-148	Ex.3:1000-871	Ex.4:1000-048	Ex.5:10000-7200
9-4=**5** 10-6=**4**	9-1=**8** 9-4=**5** 10-8=**2**	9-8=**1** 9-7=**2** 10-1=**9**	9-0=**9** 9-4=**5** 10-8=**2**	9-7=**2** 10-2=**8** **0** **0**
54	**852**	**129**	**952**	**2800**

Ex.6: 100-58	Ex.7: 1000-367	Ex.8: 1000-648	Ex.9: 10000-873	Ex.10:1000-540

Ex.11:10000-632	Ex.12:10000-657	Ex.13:1000-910	Ex.14:10000-987	Ex.15:1000-297

4.2 Subtraction using Purification

Sub Sutra: 15. Śūddha (शुद्धः); Meaning: Purification

Ex.1: 92-56	Ex.2: 8756-6898	Ex.3: 6145-3473	Ex.4: 87456-9842
92 -56 --------- 4,~~6~~ (4-1), 6 3,6	8756 -6898 ---------- 2,~~9~~,~~6~~,~~8~~ (2-1),9, ~~6~~,~~8~~ 1,9,~~6~~,~~8~~ 1,(9-1),6,~~8~~ 1,8,6,~~8~~ 1,8,6-1,8	6145 -3473 ---------- 3,~~7~~,~~7~~,2 (3-1),7,~~7~~,2 2,7,~~7~~,2 2,(7-1),7,2 2,6,7,2	
36	**1858**	**2672**	

Ex.5: 9871-364	**Ex.6: 2745-2345**	**Ex.7: 9648-57893**	**Ex.8: 69745-59999**
		First Find Difference (Bigger – Smaller) 5 7 8 9 3 - 0 9 6 4 8 ---------- 5, ~~8~~, 2, 5, ~~5~~ (5-1), 8, 2 , (5-1), 5 4 8 2 4 5 Add Sign of Bigger Number	
		-48245	

Ex.9: 14758-69785	**Ex.10: 64753-3321**	**Ex.11: 64789-61254**	**Ex.12: 5478-998745**

Ex.13: 34569--547896	**Ex.14: 1459-5789645**	**Ex.15: 9745-3645896**	**Ex.16: 69745-369745**

4.3 Other Scenarios

Q: Subtract 78-9
A: First Subtract 78-10=68 and then add 68+1=69.

Q: Subtract 136-47
A: 136-46=90; 90-1=89

Q: 9745-345
A:

Q: 8736-426
A:

Q: 7456-461
A:

Q: 8912-822
A:

Q: 3645-231
A:

Q: 7896-986
A:

Q: 1458-658
A:

Q: 47569-1489
A:

Q: 8796-364
A:

Q: 364589-9874
A:

Q: 31222-6999
A:

Q: 6475-364
A:

4.4 Mixed Examples (Solve using any appropriate methods).

1. 18-9	**2.** 17-8	**3.** 16-9	**4.** 12-18

5. 99-19	**6.** 98-84	**7.** 758-48	**8.** 974-79

9. 745-109	**10.** 674-114	**11.** 345-289	**12.** 348-405

13. 1000-916	**14.** 100-64	**15.** 1000-87	**16.** 10000-475

17. 10000-7888	**18.** 10000-745	**19.** 47456-8569-745	**20.** 7458-1874-3325

21. 4782-648-8743	**22.** 47896-3548-589	**23.** 9498-1731-4385-69	**24.** 15568-87-2368-3-58

Answers:

1. 9	**2.** 9		**3.** 7	**4.** -6
5. 80	**6.** 14		**7.** 710	**8.** 895
9. 636	**10.** 560		**11.** 56	**12.** -57
13. 84	**14.** 36		**15.** 913	**16.** 9525
17. 2112	**18.** 9255		**19.** 38142	**20.** 2259
21. -4609	**22.** 43759		**23.** 3313	**24.** 13052

Unit 5: SQUARES

What is Square: a square is the result of multiplying a number by itself.
For ex. Square of 3 is 9 (3×3); Square of -45 is 2025 (-45×-45)
Square of 12 is 144 (12×12); Square of -12 is 144 (-12×-12)

5.1 Square Using One More than the Previous One

Ex.1: 15^2	**Ex.2: 25^2**	**Ex.3: 75^2**	**Ex.4: 95^2**	**Ex.5: 115^2**
		7 ¦ 5 7×8 ¦ 25 56 ¦ 25	9 ¦ 5 9×10 ¦ 25 90 ¦ 25	11 ¦ 5 11×12 ¦ 25 132 ¦ 25
		5625	**9025**	**13225**

Ex.6: 35^2	**Ex.7: 45^2**	**Ex.8: 55^2**	**Ex.9: 65^2**	**Ex.10: 85^2**

Ex.11: 105^2	**Ex.12: 125^2**	**Ex.13: 135^2**	**Ex.14: 145^2**	**Ex.15: 155^2**

5.2 Square Using Complements/Surpluses

Case 1: When Number is below the Working Base.

Ex.1: 94^2	**Ex.2: 91^2**	**Ex.3: 87^2**	**Ex.4: 88^2**
B: 100; C: -06		B:100; C: -13	
94-6 ¦ -6^2 88 ¦ 36		87-13 ¦ -13^2 74 ¦ 169 74+1 ¦ 69 75 ¦ 69	
8836		**7569**	

Ex.5: 92^2	Ex.6: 83^2	Ex.7: 84^2	Ex.8: 86^2

Ex.9: 975^2	Ex.10: 984^2	Ex.11: 993^2	Ex.12: 979^2

Case 2: When Number is above the Working Base.

Ex.1: 108^2	Ex.2: 103^2	Ex.3: 107^2	Ex.4: 106^2
B: 100; Surplus:+08	B: 100; Surplus: +03		
108+8 ¦ 8^2 116 ¦ 64	103+3 ¦ 3^2 106 ¦ 09		
11664	**10609**		

Ex.5: 112^2	Ex.6: 124^2	Ex.7: 102^2	Ex.8: 119^2

Ex.9: 1024^2	Ex.10: 1017^2	Ex.11: 10016^2	Ex.12: 10026^2

Note: Prefer Square using Criss Cross Method if numbers are not nearer to Working Bases and not ending with Digit 5.

5.4 Square using Criss Cross Method

Ex.1: 83^2	**Ex.2: 678^2**	**Ex.3: -59^2**	**Ex.4: 536^2**
8 3 8 3 ---------- 64 24+24 9 64 48 9 64+4 8 9 68 8 9	6 7 8 6 7 8 ---------- 36; 42+42; 48+49+48; 56+56; 64 36 84 145 112 64 45 ~~99~~ ~~156~~ ~~118~~ ~~64~~ 459684	5 9 5 9 ---------- 25 45+45 81 25 90 81 34 ~~98~~ ~~81~~ 3481	
6889	**459684**	**3481**	

Ex.5: 748^2	**Ex.6: 347^2**	**Ex.7: 248^2**	**Ex.8: -241^2**

Ex.9: 3458^2	**Ex.10: 6974^2**	**Ex.11: 97456^2**	**Ex.12: 36548^2**

Ex.13: 34233^2	Ex.14: 78954^2	Ex.15: 97411^2	Ex.16: -69748^2

5.5 Mixed Examples (Solve using any appropriate methods).

1. 25	**2.** 35	**3.** 45	**4.** 55

5. 65	**6.** 135	**7.** 185	**8.** 195

9. 355	**10.** 495	**11.** 49	**12.** 94

13. 104	**14.** 112	**15.** 109	**16.** 113

17. 97	**18.** 93	**19.** 473	**20.** 239

21. 477	**22.** 369	**23.** 89	**24.** 74

25. 76	**26.** 98	**27.** 73	**28.** 36

29. 984	**30.** 746	**31.** 638	**32.** 697

33. 1005	**34.** 977	**35.** 983	**36.** 1036

Answers:

1. 625	**2.** 1225		**21.** 227529	**22.** 136161
3. 2025	**4.** 3025		**23.** 7921	**24.** 5476
5. 4225	**6.** 18225		**25.** 5776	**26.** 9604
7. 34225	**8.** 38025		**27.** 5329	**28.** 1296
9. 126025	**10.** 245025		**29.** 968256	**30.** 556516
11. 2401	**12.** 8836		**31.** 407044	**32.** 485809
13. 10816	**14.** 12544		**33.** 1010025	**34.** 954529
15. 11881	**16.** 12769		**35.** 966289	**36.** 1073296
17. 9409	**18.** 8649		Always Think Positively.	
19. 223729	**20.** 57121			

Unit 6: SQUARE ROOTS

Case 1: Square Root of Perfect Square Numbers (Upto 6 Digits)

'n' = Given Number
'p' = Number except last two digits
'q' = Lower Square of p
'r' = Square root of q ($r=\sqrt{q}$) (First Part of Square Root)
's' = r×(r+1)
't'= Last Digit of Square Root
'u'= Final Answer (Square root of Given Number)

	N	p	q	r	s	t	u
1	256	2	1	**1**	2	4 or **6**	**16**
2	361	3	1	**1**	2	1 or **9**	**19**
3	576	5	4	**2**	6	**4** or 6	**24**
4	841	8	4	**2**	6	1 or **9**	**29**
5	900	9	9	**3**	12	**0**	**30**
6	9409						
7	7569						
8	1369						
9	1849						
10	6724						
11	1521						
12	1936						
13	3364						
14	3969						
15	2116						
16	2601						
17	4096						
18	5329						
19	4489						
20	5929						
21	1089						
22	8464						
23	6889						
24	15129						
25	21609						
26	6241						
27	37249						
28	8649						
29	43681						
30	9604						

Case 2: Square Root of Bigger Numbers using Duplex Combination Process

Ex.1: $\sqrt{52374169}$	Ex.2: $\sqrt{71791729}$
52 : 3 7 4 1 6 9 14 3; 5; 11; 4; 4; 4 7; 2; 3; 7; 0; 0; 0	
Answer: 7237	

Ex.3: $\sqrt{48818169}$	Ex.4: $\sqrt{968785}$
	96 : 8 7 8 5 18 15; 14; 11; 18 9; 8; 4; 2; 7
	Answer: 984.27

Ex.5: $\sqrt{574564}$	Ex.6: $\sqrt{96452041}$

Ex.7: $\sqrt{9840769}$	Ex.8: $\sqrt{369785}$

Mixed Examples (Solve using any appropriate methods).

1. 625	2. 1255	3. 2025	4. 3025

5. 4225	6. 18225	7. 34225	8. 38025

9. 126025	10. 245025	11. 2401	12. 8836

13. 10816	14. 12544	15. 11881	16. 12769

17. 9409	18. 8649	19. 223729	20. 57121

21. 227529	22. 136161	23. 7921	24. 5476

25. 5776	26. 9604	27. 5329	28. 1296

29. 968256	30. 556516	31. 407044

32. 485809	33. 1010025	34. 954529

35. 966289	36. 1073296	37. 1119364

38. 443556	39. 93025	40. 978121

41. 9654788	**42. 64658965**	**43. 3145896**

44. 8564523

Answers:

1. 25	**2.** 35	**3.** 45	**4.** 55	**5.** 65	**6.** 135
7. 185	**8.** 195	**9.** 355	**10.** 495	**11.** 49	**12.** 94
13. 104	**14.** 112	**15.** 109	**16.** 113	**17.** 97	**18.** 93
19. 473	**20.** 239	**21.** 477	**22.** 369	**23.** 89	**24.** 74
25. 76	**26.** 98	**27.** 73	**28.** 36	**29.** 984	**30.** 746
31. 638	**32.** 697	**33.** 1005	**34.** 977	**35.** 983	**36.** 1036
37. 1058	**38.** 666	**39.** 305	**40.** 989	**41.** 3107.215	
42. 8041.079	**43.** 1773.667	**44.** 2926.520 **Be Good. Do Good.**			

1. Books, eBooks, Video Course, FREE Workbook & FREE Online Training on Vedic Speed Mathematics, C & Python Programming: www.Speed16.com/books/vm
2. 3D Printers (Sales & Service; Anywhere in the World).
3. eBook Creation (epub/mobi) & Publishing (Amazon Kindle, iBooks, Kobo etc.) Services.
4. IT Solutions and Services
5. Reach us for **FREE Home Delivery** of Vedic Speed Mathematics (Anywhere in the World)
6. **Contact:** Chaitanya Patil; info@speed16.com

Unit 7: CUBES

7.1 Cube Using Complements or Surpluses

Case 1: When number is above the working base

General Formula: $n+2s \mid (n+2s-b) \times s \mid s^3$

Ex.1: 12^3	**Ex.2: 109^3**	**Ex.3: 114^3**
B:10; S:+2	B:100; S:+9	B:100; S:+14
$12+4 \mid (12+4-10)\times 2 \mid 2^3$ 16 ¦ 12 ¦ 8 16+1 ¦ 2 ¦ 8 17 ¦ 2 ¦ 8	$109+18 \mid (109+18-100)\times 9 \mid 9^3$ 127 ¦ 243 ¦ 729 127 ¦ 243+7 ¦ 29 127 ¦ 250 ¦ 29 127+2 ¦ 50 ¦ 29 129 ¦ 50 ¦ 29	
1728	**1295029**	

Ex.4: 16^3	**Ex.5: 18^3**	**Ex.6: 107^3**

Ex.7: 13^3	**Ex.8: 112^3**	**Ex.9: 1015^3**

Case 2: When number is below the working base

General Formula: n+2c ¦ (n+2c-b)×c ¦ c^3

Ex.1: 94^3	**Ex.2: 97^3**	**Ex.3: 89^3**
B:100; C:-6		
94-12 ¦ (94-12-100) ×-6 ¦ -6^3 82 ¦ 108 ¦ -216 82 ¦ 108-3 ¦ -216+300 82 ¦ 105 ¦ 84 82+1 ¦ 05 ¦ 84 83 ¦ 05 ¦ 84		
830584		

Ex.4: 96^3	**Ex.5: 91^3**	**Ex.6: 92^3**

Ex.7: 984^3	**Ex.8: 993^3**	**Ex.9: 989^3**

7.2 Cube Using Proportionately

General Formula:

For Two Digit Numbers: $(ab)^3 = a^3 ¦ 3\times a^2\times b ¦ 3\times a\times b^2 ¦ b^3$
{How to remember? it is same as: $(a+b)^3=a^3+3a^2b+3ab^2+b^3$**}**

For Three Digit Numbers: $(abc)^3=(ab)^3 ¦ 3\times(ab)^2\times c ¦ 3\times(ab)\times c^2 ¦ c^3$

Ex.1: 79^3	**Ex.2: 94^3**	**Ex.3: 368^3**
7^3¦$3\times7^2\times9$¦$3\times7\times9^2$¦9^3 343¦1323¦1701¦729 343¦1323¦1701+72¦9 343¦1323¦1773¦9 343¦1323+177¦3¦9 343¦1500¦3¦9 343+150¦0¦3¦9 493¦0¦3¦9		36^3¦$3\times36^2\times8$¦$3\times36\times8^2$¦8^3 46656¦31104¦6912¦512 46656¦31104¦6912+51¦2 46656¦31104¦6963¦2 46656¦31104+696¦3¦2 46656¦31800¦3¦2 46656+3180¦0¦3¦2 49836¦0¦3¦2
493039		**49836032**

Ex.4: 24^3	**Ex.5: 39^3**	**Ex.6: 213^3**

Ex.7: 54^3	**Ex.8: 67^3**	**Ex.9: 304^3**

Ex.10: 81^3	Ex.11: 1004^3	Ex.12: 1209^3

Mixed Examples (Solve using any appropriate methods).

1. 9	2. 17	3. 43

4. 94	5. 95	6. 96

7. 97	8. 98	9. 99

10. 104	11. 105	12. 106

13. 107	14. 108	15. 109

16. 113	**17. 980**	**18. 990**

19. 993	**20. 994**	**21. 1001**

22. 1002	**23. 1003**	**24. 1004**

Answers:

1. 729	2. 4913	3. 79507	4. 830584
5. 857375	6. 884736	7. 912673	8. 941192
9. 970299	10. 1124864	11. 1157625	12. 1191016
13. 1225043	14. 1259712	15. 1295029	16. 1442897
17. 941192000	18. 970299000	19. 979146657	20. 982107784
21. 1003003001	22. 1006012008	23. 1009027027	24. 1012048064

Unit 8: CUBE ROOTS

Case 1: Cube Root of Perfect Cube Numbers (upto Six Digit)

'Sr' = Serial Number
'n' = Given Number after Grouping
'p' = Lower cube value of first part
'q' = $\sqrt[3]{p}$ = Cuberoot of '**p**' => First digit of Cube Root
'r' = Last Digit of given Number
's' = Last Digit of Cube Root based on '**r**'
't' = Cube Root of given Number (combining '**q**' and '**s**')

Sr	N	p	Q	r	s	T
1	2;197	1	**1**	7	**3**	13
2	5;832	1	**1**	2	**8**	18
3	12;167	8	**2**	7	**3**	23
4	24;389	8	**2**	9	**9**	29
5	27;000	27	**3**	0	**0**	30
6	262144					
7	438976					
8	148877					
9	493039					
10	704969					
11	39304					
12	970299					
13	941192					
14	804357					
15	531441					
16	50653					
17	185193					
18	287496					
19	389017					
20	456533					
21	571787					
22	830584					
23	79507					
24	205379					
25	328509					
26	884736					
27	103823					
28	250047					
29	658503					
30	912673					

Case 2: Cube Root of Numbers (upto Nine Digit)

Ex.1: $\sqrt[3]{580093704}$	**Ex.2:** $\sqrt[3]{46726}$
580: 0 9 3 7 0 4 192 68; 104; 65; 50; 15; 6 8; 3; 4; 0; 0; 0	46: 7 2 6 27 19; 35; 28 3; 6; 0; 2
Answer: 834	**Answer: 36.02**

Ex.3: $\sqrt[3]{30959144}$	**Ex.4:** $\sqrt[3]{315821241}$

Ex.5: $\sqrt[3]{395446904}$	**Ex.6:** $\sqrt[3]{364758965}$

Mixed Examples (Solve using any appropriate methods).

Find cube root values of following numbers.

1. 729	2. 4913	3. 79507

4. 830584	5. 857375	6. 884736

7. 912673	8. 941192	9. 970299

10. 1124864	11. 1157625	12. 1191016

13. 1225043	14. 1259712	15. 1295029

16. 1442897	17. 941192000	18. 970299000

19. 979146657	20. 982107784	21. 1003003001

22. 1006012008	23. 1009027027	24. 1012048064

Answers:

1. 9	2. 17	3. 43	4. 94	Love Yourself. It is Important to stay positive because Beauty comes from the inside out : Jenn Proske
5. 95	6. 96	7. 97	8. 98	
9. 99	10. 104	11. 105	12. 106	
13. 107	14. 108	15. 109	16. 113	
17. 980	18. 990	19. 993	20. 994	
21. 1001	22. 1002	23. 1003	24. 1004	

Unit 10: DIVISIBILITY

Exercise: Check divisibility of following using appropriate method.

1. 348698 by 2	**2.** 478956 by 3	**3.** 4789624 by 4
4. 4789654 by 4	**5.** 47896 by 5	**6.** 4789650 by 5
7. 74695 by 6	**8.** 32458 by 7	**9.** 47896 by 8
10. 74698 by 9	**11.** 14789 by 11	**12.** 47856 by 13
13. 456951 by 29	**14.** 20727 by 21	**15.** 23126 by 31
16. 22701 by 23	**17.** 16778 by 17	**18.** 27602 by 37
19. 26649 by 27	**20.** 32273 by 33	**21.** 289068 by 39
22. 1478625 by 25	**23.** 1579920 by 16	**24.** 177570 by 18
25. 98740 by 20	**26.** 2172346 by 22	**27.** 1885512 by 24
28. 47856963 by 25	**29.** 1942018 by 26	**30.** 2764804 by 28
31. 29623680 by 30	**32.** 11330159 by 31	

Answers: Write **YES/NO.**

1.	**2.**	**3.**
4.	**5.**	**6.**
7.	**8.**	**9.**
10.	**11.**	**12.**
13.	**14.**	**15.**
16.	**17.**	**18.**
19.	**20.**	**21.**
22.	**23.**	**24.**
25.	**26.**	**27.**
28.	**29.**	**30.**
31.	**32.**	

Unit 11: DECIMALS, FRACTIONS AND PERCENTAGES

Conversion

Sr.	Decimal	Fraction	Percentage
1	1.0	1/1	100%
2	0.25	¼	25%
3		½	50%
4	0.75	¾	
5		7/6	125%
6		50/2 or 25/1	
7	0.99		
8	0.9		
9			68%
10		-1/1	
11	-0.25	-1/4	
12			-50%
13		-3/4	-75%
14	0.02		74%
15	3.46		
16		64/8	
17			81%
18		960/160	
19			91%
20	7.896		
21			3200%
22		54/7	
23		81/8	
24	163.569		
25			6120%
26		960/320	
27	478.25		
28			12450%
29	56.69		
30			36000%

1) 12.36+96.3+0.36	**2)** 4+63.6+98.6+0.003	**3)** 6+3.3+3.33+0.303

4) 86.369+986.1+658.3	**5)** 74.3+65.8+965.69	**6)** 478.33+658.98+0.75

7) 165.36-0.325-6.201	**8)** 412.0-658.3-65.3698	**9)** 0.036-0.7896-63.369

10) 413.9-478-0.0034-0.13	**11)** 4789-0.365-2.356	**12)** 45.3+658-69.36-0.1

13) 0.36×85.3×4.3	**14)** 45.3×45.6×0.03	**15)** 98.3×78.63×0.02

16) 14.4÷12	**17)** 3.24÷1.8	**18)** 44.1×2.1

19) $\frac{458}{120}+\frac{452}{120}$	**20)** $\frac{29}{30}+\frac{31}{15}$	**21)** $\frac{12}{18}+\frac{33}{7}$

22) $\frac{458}{120}-\frac{452}{120}$	**23)** $\frac{29}{30}-\frac{31}{15}$	**24)** $\frac{12}{18}-\frac{33}{7}$

25) $\frac{35}{140}\times\frac{40}{160}$	**26)** $\frac{164}{42}\times\frac{23}{69}$	**27)** $\frac{24}{16}\times\frac{36}{32}$

28) $\frac{35}{140} \div \frac{40}{160}$	**29)** $\frac{164}{42} \div \frac{23}{69}$	**30)** $\frac{24}{16} \div \frac{36}{32}$

31) 1÷49

Divisor																
Dividend																
Quotient																
Remainder																

32) 2÷39

Divisor																
Dividend																
Quotient																
Remainder																

33) 6÷13

Divisor																
Dividend																
Quotient																
Remainder																

34) 9÷23

Divisor																
Dividend																
Quotient																
Remainder																

35) 7÷17

Divisor																
Dividend																
Quotient																
Remainder																

36) 36÷37

Divisor																
Dividend																
Quotient																
Remainder																

Ex.37: 0.32+13.35+45.058+696.368+31.004
Ex.38: 143+365.9+0.04+36.02+6986.36+7469.3
Ex.39: 47.69+36475.6+32143.6547+694.3+447+58746.6+0.03
Ex.40: 69.3+698.3+1143.33+2145.52+2546.36+744.444+3.3636
Ex.41: 475.54+47896.3+36.31456+7896.149+3645.002+364789.3214
Ex.42: 1114.36+3654.65+312.003+3123.333+78954.21+9874.365
Ex.43: 7451.21+1423.21+144.012+3665.31+3111.26+9999.914
Ex.44: 345896.36+1475.26+3642.0103+312.215+3654.321+3648.635

Ex.37:	**Ex.38:**	**Ex.39:**	**Ex.40:**
000.3200 013.3500 045.0580 696.3680 + 031.0040 786.1000	0143.00 0365.90 0000.04 0036.02 6986.36 +7469.30 15000.62		
786.1	**15000.62**		

Ex.41:	**Ex.42:**	**Ex.43:**	**Ex.44:**

Percentages

Q: What is 12% of 8745?
A:

Q: What is 36% of 97458?
A:

Q: What percent of 6489 is 76?
A:

Q: What percent of 9745 is 12365?
A:

Q: Increase 8746 by 54%.
A:

Q: Increase 364789 by 231%.
A:

Q: Decrease 364789 by 21%.
A:

Q: Decrease 3126 by 236%.
A:

Q: Value of an item increased from 4569 to 5614. How much % is increased?
A:

Q: Value of an item decreased from 3645 to 1265. How much % is decreased?
A:

Unit 12: POLYNOMIALS

12.1 Multiplication using Criss Cross Method

Ex.1: (x+3) (x+5)	Ex.2: (x+7) (x-9)	Ex.3: (x-7) (x-9)
1 3 1 5 ---------- (1×1)|(1×5+1×3)|(3×5) 1 | 8 | 15 $x^2+8x+15$		
$x^2+8x+15$		

Ex.4: (3x+12) (-7x)	Ex.5: (-3x+13) (5)	Ex.6: (-x-3) (-x)

Ex.7: $(x^2+5x+1)(3x^2-10x+15)$	Ex.8: $(3x^2-8x-9)(3x^2-11x+8)$
1 5 1 3 -10 15 (1×3) | (1×-10+3×5) | (1×15+5×-10+1×3) | (5×15+-10×1) | (1×15) 3 | 5 | -32| 65| 15 $3x^4+5x^3-32x^2+65x+15$	
$3x^4+5x^3-32x^2+65x+15$	

Ex.9: $(7x^2-6x-8)(-6x-13)$	Ex.10: $(-12x^2-3x+6)(5x^2-8x-9)$

Ex.11: $(3x^2-6x-7)(-7x^2-13)$	**Ex.12: $(8x^2-12x+17)(2x^2-8x-9)$**

Ex.13: $(x^3+5x^2+3x+2)(2x^3-4x^2-7x+3)$	**Ex.14: $(2x^3-3x^2-7x+9)(3x^3-8x^2-12)$**

Ex.15: $(7x^3-3x^2-9x-19)(6x^3-8x^2+3x+9)$	**Ex.16: $(7x^3-8x^2-9x+3)(8x^3-3x^2-3x)$**

Ex.17: $(2x^4+3x^3+3x^2+2x+4)(3x^4-2x^3+4x^2-7x-8)$	**Ex.18: $(3x^5-2x^4-4x^3+2x^2-3x+3)(4x^5-6x^4+3x^3-2x^2+6x+2)$**
2 3 3 2 4 3 -2 4 -7 -8 ---------- | | | | | | | | |	3 -2 -4 2 -3 3 4 -6 3 -2 6 2 ---------- | | | | | | | | | | |
$6x^8+5x^7+11x^6-2x^5-17x^4-45x^3-22x^2-44x-32$	**$12x^{10}-26x^9+5x^8+20x^7-14x^6+38x^5-59x^4+19x^3-20x^2+12x+6$**

19. $(2x^3-3x^2+2x+3)(x^3-2x^2-3x+4)$	**20. $(3x^3+4x^2+2)\times(2x^3+6x^2-7x-2)$**

21. $(3x^4-2x^3-2x^2+4)\times(3x^3+2x^2-4x-3)$	**22. $(2x^4+3x^3+x^2)\times(2x^3-5x^2-x-7)$**

12.2 Division using Transpose and Apply

Ex.1: $(x^3+9x^2+20x+12)\div(x+1)$	**Ex.2:** $(3x^4-2x^3+x^2-2x+3)\div(x-3)$
-1 # x^3 +$9x^2$ +20x +12 -1 -8 -12 ---------- 1 8 12 ¦ **0**	+3 # $3x^4$ -$2x^3$ +x^2 -2x +3 +9 +21 +66 +192 ---------- 3 +7 +22 +64 ¦ **+195**
Q: $x^2+8x+12$ **R:** 0	**Q:** $3x^3+7x^2+22x+64$ **R:** 195

Ex.3: $(3x^4-2x^3+x^2-2x+3)\div(x^2-2x+6)$	**Ex.4:** $(2x^5+2x^4-x^3+x^2-2x+2)\div(x^2+3x-4)$

Ex.5: $(2x^5+2x^4-x^3+x^2-2x+2)\div(x^3+3x-4)$	**Ex.6:** $(9x^4+3x^2-69)\div(x^3-7)$

Ex.7: $(3x^5-2x^4-7x^3+8x^2-6x+17)\div(3x^3+6x-12)$	**Ex.8:** $(12x^4-7x^2-34)\div(2x^3-12x-16)$

Ex.9: $(6x^5-3x^4-9x^3-6x^2-7x+9)\div(x^3-7x+16)$	**Ex.10:** $(12x^4-17x^2-6x+12)\div(x^3-3x+7)$

Ex.11: $(8x^6-7x^4-12x^3+3x^2-9x+23)\div(x^3-8x-7)$	**Ex.12:** $(12x^5+7x^4-2x^2-32x)\div(3x^4+6x^3-33)$

Ex.13. $(2x^6+x^4-x^3+x^2-2x-2)\div(x^2-3x+5)$	**Ex.14.** $(x^6+2x^4-3x^3+x^2-2x-4)\div(x^3-2x+6)$

Ex.15. $(x^5+2x^4-3x^3-4)\div(x^2+3)$	**Ex.16.** $(3x^6+4x^5-3x^3+x^2-4)\div(2x^3-2x+6)$

Unit 13: FACTORIZATION

13.1 Type I: Factorization of Simple Quadratic Polynomials using "Proportionately" and "The First by the First & Last by the Last"

	Ex.1: $x^2+7x+12$	**Ex.2: $5x^2+24x+27$**	**Ex.3: $5x^2-38x+48$**
a;b;c	1; 7; 12	5; 24; 27	
i & j	3 & 4	15 & 9	
∵	7=3+4; 1×12=3×4	24=15+9; 5×27=15×9	
1st **F**	**(x+3)**	5x+15 => 5(x+3) => **(x+3)**	
2nd **F**	**(x+4)**	**(5x+9)**	
Final	(x+3) and (x+4)	x+3 and 5x+9	
V	(1+3)(1+4)=(1+7+12) 20=20	(1+3)(5+9)=(5+24+27) 56=56	

	Ex.4: $3x^2+18x+15$	**Ex.5: $-3x^2-2x+8=0$**	**Ex.6: $6x^2-13x-19=0$**
a;b;c			
i & j			
∵			
1st **F**			
2nd **F**			
Final			
V			

	Ex.7: $2x^2-16x+32=0$	**Ex.8: $7x^2-8x-12=0$**	**Ex.9: $x^2+11x+30=0$**
a;b;c			
i & j			
∵			
1st **F**			
2nd **F**			
Final			
V			

	Ex.10: $x^2-24x+128=0$	**Ex.11: $7x^2-x-8=0$**	**Ex.12: $9x^2+9x-4=0$**
a;b;c			
i & j			
∵			
1st **F**			
2nd **F**			
Final			
V			

13.2 Type II: Factorization of Homogeneous Quadratic Polynomials

General Form of Quadratic Equation: $\mathbf{ax^2+hxy+by^2}$

	Ex.1: $x^2+7xy+12y^2$	**Ex.2: $3x^2+18xy+24y^2$**	**Ex.3: $6x^2-26xy-20y^2$**
a;h;b	1; 7; 12		
i & j	3 & 4		
∵	7=3+4 and 1×12=3×4		
1st F	**x+3y**		
2nd F	**x+4y**		
Final	x+3y and x+4y		
V	(1+3)(1+4)=(1+7+12); 20=20		

	Ex.4: $x^2-6xy-16y^2$	**Ex.5: $x^2-10xy+24y^2$**	**Ex.6: $x^2+3xy+2y^2$**
a;h;b			
i & j			
∵			
1st F			
2nd F			
Final			
V			

	Ex.7: $12x^2+5xy-3y^2$	**Ex.8: $2x^2-8xy+8y^2$**	**Ex.9: $25x^2+5xy-6y^2$**
a;h;b			
i & j			
∵			
1st F			
2nd F			
Final			
V			

	Ex.10: $8x^2+8xy-6y^2$	**Ex.11: $4x^2-4xy+y^2$**	**Ex.12: $x^2-5xy+6y^2$**
a;h;b			
i & j			
∵			
1st F			
2nd F			
Final			
V			

Mixed Examples (Solve using appropriate methods).

1. $x^2+2x-24$	**2.** $x^2+2x-63$	**3.** $x^2-17x+72$

4. $x^2+18x+65$	**5.** $x^2-19x+88$	**6.** $2x^2+7xy-15y^2$

7. $21x^2+33xy-18y^2$	**8.** $6x^2-37xy+56y^2$	**9.** $56x^2-56y^2$

10. $54x^2+3xy-15y^2$	**11.** $x^2-6y^2+12z^2+xy+yz+zx$	**12.** $x^2+24y^2+48z^2+10xy-68yz-14zx$

13. $6x^2+21y^2+15z^2-23xy-44yz+21zx$	**14.** $2x^2-24y^2-24z^2+2xy+52yz-8zx$	**15.** $2x^2-6y^2-3z^2+xy+11yz-5zx$

16. $x^3+x^2-54x-144$	**17.** $x^3-5x^2-57x+189$	**18.** $x^3-2x^2-69x+270$

19. $x^3-13x^2+39x-27$	**20.** $x^3-22x^2+136x-192$

Unit 14: HIGHEST COMMON FACTOR

Ex.1: Find HCF of x^2+6x+8 and x^2-2x-8	
Addition	**Subtraction**
x^2+6x+8 $+ x^2-2x-8$ ---------- $2x^2+4x+0$ $2x(x+2)$ {Here 2x is common} **x+2** {after ignoring common}	x^2+6x+8 $- x^2-2x-8$ ---------- $0+8x+16$ $8(x+2)$ {Here 8 is common} **x+2** {after ignoring common}
HCF of x^2+6x+8 and x^2-2x-8 is **x+2.**	

Ex.2: $x^3+x^2-54x-144$ and $x^3-22x^2+136x-192$	

Ex.3: $x^3-5x^2-57x+189$ and $x^3-13x^2+39x-27$	

Ex.4: $x^3-8x^2-3x+90$ and $x^3-6x^2-51x+280$	

Ex.5: $x^3+21x^2+146x+336$ and $x^3+9x^2-x-105$	

Ex.6: $x^3+7x^2-4x-28$ and $x^3+5x^2-2x-24$	

Ex.7: $x^3+15x^2+74x+120$ and $x^2+2x-15$	

7. Books, eBooks, Video Course, FREE Workbook & FREE Online Training on Vedic Speed Mathematics, C & Python Programming: www.Speed16.com/books/vm
8. 3D Printers (Sales & Service; Anywhere in the World).
9. eBook Creation (epub/mobi) & Publishing (Amazon Kindle, iBooks, Kobo etc.) Services.
10. IT Solutions and Services
11. Reach us for **FREE Home Delivery** of Vedic Speed Mathematics (Anywhere in the World)
12. **Contact:** Chaitanya Patil; info@speed16.com

Unit 15: SIMPLE EQUATIONS

1) 6x+7 = 8x+3	**2)** 5x-3 = 7x-5	**3)** 4x-6 = 6x-4

4) (x+3) (x-2) = (x-7) (x-6)	**5)** (x-6) (x+7) = (x-2) (x-3)	**6)** (x+8) (x-9) = (x-12) (x+6)

7) $\frac{3x+5}{6x+7} = \frac{8}{3}$	**8)** $\frac{5x+2}{4x+3} = \frac{4}{3}$	**9)** $\frac{3}{x+3} + \frac{3}{x-6} = 0$

10) $\frac{5}{x+5} + \frac{5}{x+7} = 0$	**11)** $\frac{4x+5}{2x+6} = \frac{6x+3}{8x+2}$	**12)** $\frac{6x+6}{9x+5} = \frac{x+3}{4x+2}$

13) $\frac{3x+4}{x+3} = \frac{5x+6}{3x+2}$	**14)** $\frac{7x+8}{6x+4} = \frac{x+2}{5x+3}$	**15)** (x+1) (x+2) = (x+3) (x+4)

16) $\frac{-7x+2}{x-9} = \frac{-5x-2}{8x+3}$	**17)** (x-7) (x-12) = (x-21) (x-4)	**18)** (x+12) (x-4) = (x-8) (x+6)

19) $\frac{-7}{9x+8} = \frac{-7}{5x+13}$	**20)** $\frac{-9x-7}{3x-5} = \frac{-9x-8}{7x+9}$	**21)** $\frac{8x+7}{5x-5} = \frac{6x-8}{9x+4}$

Unit 16: QUADRATIC EQUATIONS

1) $x^2+x-4=0$	2) $x^2-3x-4=0$	3) $20x^2-15x-10=0$

4) $3x^2+4x+2=0$	5) $2x^2-64=0$	6) $9x^2+49=0$

7) $x+\frac{1}{x}=\frac{26}{5}$	8) $x+\frac{1}{x}=\frac{145}{12}$	9) $x-\frac{1}{x}=\frac{21}{10}$

10) $x - \frac{1}{x} = \frac{72}{27}$	11) $\frac{3x+2}{2x-3} + \frac{2x-3}{3x+2} = \frac{74}{35}$	12) $\frac{4x+5}{2x+7} - \frac{2x+7}{4x+5} = \frac{21}{10}$

13) $\frac{3x+6}{5x+6} = \frac{7x+2}{5x+2}$	14) $\frac{7x+2}{3x+6} = \frac{2x+5}{6x+1}$	15) $\frac{3x-9}{6x+4} = \frac{2x+2}{-x-11}$

16) $\frac{4x+6}{3x-2} = \frac{5x-1}{6x+7}$	17) $x + \frac{1}{x} = \frac{82}{9}$	18) x^2-3x-10=0

19) x^2-45x+324=0	20) $100x^2$-20x+1=0	21) $2x^2$+x-6=0

Unit 17: CUBIC EQUATIONS

1. $x^3-5x^2-2x+24=0$	**2.** $x^3-4x^2-9x+36=0$	**3.** $x^3-5x+2=0$

4. $2x^3-3x^2-8x-3=0$	**5.** $x^3-x=0$	**6.** $x^3+3x^2-4x-12=0$

7. $x^3-2x^2-4x+3=0$	**8.** $x^3+5x^2+14x=0$	**9.** $x^3+2x^2-9x-18=0$

10. $2x^3-5x^2-23x-10=0$	**11.** $x^3+7x^2+11x+5=0$	**12.** $4x^3+2x^2-2x=0$

13. $-x^3-3x^2+x+3=0$	**14.** $x^3-7x-6=0$	**15.** $x^3+3x^2-6x-8=0$

16. $4x^3+2x^2-2x=0$	**17.** $x^3+3x^2-x-3=0$	**18.** $x^3-7x-6=0$

Unit 18: BIQUADRATIC EQUATIONS

1. $x^4-12x^3+41x^2-18x-72=0$	**2.** $3x^4-8x^3-37x^2+2x+40=0$

3. $x^4-10x^3+35x^2-50x+24=0$	**4.** $x^4-2x^3-5x^2+10x-3=0$

5. $x^4-8x^3+9x^2+8x-10=0$	**6.** $x^4+4x^3-6x^2+20x+8=0$

7. $x^4+2x^3-7x^2-8x+12=0$	**8.** $x^4-3x^2-42x-40=0$

9. $4x^4-20x^3+33x^2-20x+4=0$	**10.** $x^4-3x^2-6x-2=0$

11. $x^4-12x^3+41x^2-18x-72=0$	**12.** $x^4+4x^3-35x^2-78x+360=0$

Unit 19: Simultaneous Equations

1. 2x-y=3 and 3x+2y=8	**2.** 5x+y=10 and 7x-3y=14

3. x+7y=10 and 3x-2y=7	**4.** -x+y=3 and 5x-2y=6

5. 3x+5y=31 and 2x+3y=20	**6.** 5x+3y=-74 and -2x-3y=26

7. 7x+2y=47 and 5x-4y=1	**8.** 3x+2y=36 and 5x+4y=64

9. 7x-y=15 and 3x-2y=19	**10.** 2x+13y=36 and 13x+2y=69

11. 3x + 2y = 4 and 4x + 5y = 17	**12.** x+y=6 and 2x+y=10

13. $3x+y=2$ and $6x-y=25$	**14.** $6x - 2y = 15$ and $4x + 3y = -3$

15. $3x + 7y = 26$ and $4x + 5y = 13$	**16.** $x^2 + 2y = 9$ and $- y = -x - 3$

17. $x-y=3$ and $2x-y=11$	**18.** $2x+y=10$ and $x+y=4$

Your country requires Heroes; be Heroes; your duty is to go on working and then everything will follow of itself. -- Swami Vivekanand

ALL THE BEST.