

Scope and sequence

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Units 1–32
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Note to teachers and parents

Developing mental arithmetic skills

Automatic response—the ability to quickly recall basic mathematical facts, or to apply a known fact to a slightly modified situation or application—is an essential prerequisite for success in mathematics.

The development of modern technology and its applicability to the classroom in the form of the hand-held calculator has not diminished the significance of the role that mental arithmetic should play in schools. On the contrary, the advent of modern technology has increased the need for accurate mental arithmetic skill development in students. Without relatively accurate estimation prior to calculation, merely accepting at face value a solution on a screen can be fraught with danger. Inadvertently hitting he wrong buttons on a calculator is a commonly occurring fact of life. The result on the screen should hever be blindly accepted. When w onsider the fact that the great majority of t calculations secondary school students complete are done on the calculator, the validity of this point can be readily perceived.

By the endrof primary school, a student should be in the habit of estimating and rounding off prior to using a calculator for computational purposes.

Appropriate estimation is reliant upon a sound knowledge of basic number facts, which should have been developed consistently throughout the primary years.

The better a student's abilities with menta arithmetic, the less time he or she will have to devote to looking up answers on a screen, in a book or on a chart. This point is demonstrated graphically with the game of 'beat the calculator'. Line up your students in pairs and tell them that some maths questions are going to be asked of the students who progressively come to the head of the line. Offer a calculator to one of the two students. Both will want it but only allow one to prevail. The other student will complain about how unfair the game is until the rules are made clear. The student with the calculator must press the appropriate buttons and display the correct answer. Ask the pairs of students questions they should be able to recall relatively quickly, such as 2 x 5 or 7 + 4. Now watch the student with the calculator complain that the game is unfair because the calculator is an encumbrance. Slip in the question 9 x 35 to see who is first with the correct answer. If the student using mental arithmetic is highly competent, 350 - 35 = 315 (10 lots of 35 minus one lot of 35) might still beat the calculator's 9 x 35 = 315.

It is also the case that the faster a student is with his or her basic number facts, the greater is the likelihood of structural computational success. Algorithms, such as long multiplication and division, contain numerous steps and

stages. Students with inadequate mental arithmetic skills often take so long to recall a basic number fact that they forget the stage of the algorithm that they are progressing through. For these students the necessary foundation of times tables knowledge is inadequate—it is like trying to build on a foundation of sand. Without the necessary prerequisites of number facts competence, the algorithmic 'house will tumble down.

It is invariably the case that the broader a student's body of mathematical knowledge, the more ne or she will achieve in the subject and the more enjoyment that student will derive from the discipline. The message is clear: regularly practise automatic response games and activities, chants and rounds and all will benefit. Try to teach these number facts in as fun and meaningful a way as possible. Incorporate concrete materials and incentives into your number facts lessons. Above all, teach for understanding. When teaching the 3 times table, show that the digits in the multiples will always sum to 3, 6 or 9. Show that the answers to the 9 times table always sum to 9. Show that adding on 8 is no harder than adding on 10—just jump back 2. Explain that the metric prefix kilo' stands for the number 1000, therefore there have to be 1000 grams in a kilogram and 1000 metres in a kilometre and, heaven forbid, 1000 tons of TNT in a kiloton bomb.

The patterns that make number-facts-recall easy are out there and easy enough to find. Make the effort to demonstrate them at every possible opportunity. This book and the other books in this series will show you how.

How to use this book

The challenge of acquiring appropriate automatic response capabilities demands a structured and planned approach in schools. Mental arithmetic skills should be developed in a systematic manner over a period of years. The program should encompass the full range of the mathematics curriculum, covering measurement and space facts, data and chance questions as well as number problems.

The fourbooks in this series assist with the development of mental arithmetic skills in a systematic and logical manner. Each book in the series contains 32 units of work. Each unit contains six sets of questions, which can represent one set per school day with one left over for homework. Alternatively, one day per week could be devoted to the completion of the six sets.

Each exercise in the book focuses on a specific concept, such as perfect squares, or 24-hour time. The exercises have been set out in a logical sequence according to topic, for example division facts should be taught prior to the concept of factors and common factors; fractions and decimals need to be taught prior to the concept of percentage. However, the order in which the exercises are completed can be varied to suit the needs of your students. The exercises are at their most useful when linked to the topic under review in the classroom at the time.

The **Scope and sequence** chart on the inside front cover of this book will assist you to plan for the use of this book and to make it as relevant as possible to your students' individual learning capabilities.

At the top of each unit of work there is a **tip** for the students, to help them work through the exercises in that unit. At the bottom of each unit, you will find the relevant state **outcomes**.

The **Handy maths facts** on pages 4–5 are included as useful reference material for students.

How well am I doing? or pages

the students the opportunity to record their scores on the unit exercises and to rate their own progress and performance.

6-7 affords

A list of **answers** is found in the middle of each book and can be removed and stored if deemed appropriate.

The terms used in this book

The questions presented in this book utilise a wide variety of mathematical terms that are designed to reflect the structure of the discipline and to develop a student's mathematical vocabulary. Knowing, for example, that the terms 'add', 'sum', 'total' and 'altogether' all refer to the process of addition will have obvious benefits when a student has to tackle an addition problem set in context, or when problem solving.

A **Glossary** is provided on page 72 as a ready reference.

		0	1	2	3	4	5	6	7	8	9	10	11	12
	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1	0	1	2	3	4	5	6	7	8	9	10	11	12
Maths	2	0	2	4	6	8	10	12	14	16	18	20	22	24
	3	0	3	6	9	12	15	18	21	24	27	30	33	36
	4	0	4	8	12	16	20	24	28	32	36	40	44	48
a c c or	5	0	5	10	15	20	25	30	35	40	45	50	55	60
	6	0	6	12	18	24	30	36	42	48	54	60	66	72
	7	0	7	14	21	28	35	42	49	56	63	70	77	84
	8	0	8	16	24	32	40	48	56	64	72	80	88	96
Ner Ver	9	0	9	18	27	36	45	54	63	72	81	90	99	108
So / handy C	10	0	10	20	30	40	50	60	70	80	90	100	110	120
	11	0	11	22	33	44	55	66	77	88	99	110	121	132
	12	0	12	24	36	48	60	72	84	96	108	120	132	144
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	1	x	All	who	ole ni	umb	ers				_	3		
milli means one thousandth (1/1000)	2	×	Eve		umbe		ρ	C	5.					
centi means one hundreath (1/100)	Ř		Dig	its s	um t	o 3,	6 or	9		Ĩ				
kilo means 1000	5	x	4 d	ivide	es int	o las	st 2 c	digits	5 (d∭t		रंग्र	\sum	5
mega means 1 000 000	6 2	ĸ	Eve	n mi	rs en ultiol	ding	in 5	or ()	٩			5	
	7,	(Dou	ible i	the i	unit a	r 3 and f	ind 4	-la -	1. 66	0			
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Metric equivalences	8 x	(8 div	vides	s into	o last	: 3 d	igits		Ĉ				
1 metre (m) = 1000 mm = 100 cm	9 x		Digit	ts su	m to	9		•		5				
1 kilometre (km) = 1000 m	10	X	Num	bers	enc	ling	in 0							
1 kilogram (kg) = 1000 g	12	x : x N	Jum	ract i	units	fror	n tot	al te	ns to	o get	t 0 o	r 11		
1 tonne (t) = 1000 kg	N			Dere	n b	oth 1	he 3	x ar	nd 4	x ta	bles			
1 litre (L) = 1000 mL														
	e	Valu	e	nel	\mathcal{T}									

Millions Period			Thou	usands Pe	riod	Ones Period				
hundreds	tens	units	hundreds tens		units	hundreds tens		units		
1	5	2	6	8	7	4	3	9		

One hundred and fifty two million, six hundred and eighty seven thousand, four hundred and thirty nine



6 How well am I doing?

After you complete each set of work, fill in your score out of 10. At the end of the six sets, rate yourself in the following way:

P = Participant; B = Bronze medallist; S = Silver medallist; G = Gold medallist!

Unit	Торіс	Set A	Set B	Set C	Set D	Set E	Set F	My Rating
1	The history of numeration: Roman numerals	2			9	X		
2	Addition: Adding 2-digit numbers					0		
3	Addition: Adding powers of 10							
4	Subtraction: Subtracting 2-digit numbers							
5	Subtraction: Subtracting powers of 10							
6	Multiplication CVIC and division facts	; VV	pu	μυ	SE:	50	IIIY	
7	Witiplication: Multiplying						i.	5
8	Multiplication: Rounding and estimating						3	
9	Division: Dividing with remainders						57	
10	Division: Dividing by powers of 10					で		
11	Multiples and common multiples	E		at	0			
12	Division: Factors and common factors							
13	Primes and composites							
14	Perfect squares and square roots							

Unit	Торіс	Set A	Set B	Set C	Set D	Set E	Set F	My Rating
15	Place value and rounding off							
16	Fractions: Equality, simplest form and mixed numbers							
17	Fractions: Addition and subtraction		+					
18	Fractions: Finding fractions of an amount	91		η	12			
19	Decimals: Place value and rounding off							
20	Decimals: Addition and subtraction							
21	Fractions, decimals and percentages						0	
22	Percentages of an amount							
23	Number strings	\	nıı	n	SP	s n	nlv	
24	Length and perimeter: Conversions and missing sides			μο				
25	Area: Concept and application							5/
26	Mass: Units and conversions						P D	
27	Capacity/volume: Units and conversions						2	
28	Time: Digital/analogue conversions and 24-hour time							
29	Money: Amounts and the four operations	E	duc	cat	0			
30	Direction and angles							
31	Chance: Concepts of likelihood							
32	Revision: All sorts							



XXXIII

XL

XLVII

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9

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8

9

10

91

96

99

= 500 and

For review

M = 1000.

Set E X + XX = _____ 1 $X|| \times V|| =$ r these problems 2 du-Arabic. 3 XL - VIII = $LX \div V =$ 4 'an, L + XXX + II =7 CCC ÷ X = _____ 8 9 DC + D + C =M - CC - V =10



NSW: Number NS3.1; Qld: Number concepts N4.1; Vic: Numbers, counting and numeration 4.1; WA: Number N4.1a; SA: Number 3.6





Number Unit 3 Addition: Adding powers of 10





Number Unit 4 Subtraction: Subtracting 2-disit numbers





NSW: Number NS3.2; Qld: Number concepts N4.2; Vic: Mental computation and estimation 4.2; WA: Number N4.3; SA: Number 3.8 Number Unit 5 Subtraction: Subtracting powers of 10









Unit 7 Multiplication: Itiplying by powers of 10 Number





Number Unit 8 Multiplication: Counding and estimating





Vic: Mental computation and estimation 4.2; WA: Number N4.3; SA: Number 3.8

Number Unit Division: Dividing with remainders Set B Give the remainder Set A as a whole number. When you know your What will the remainders tables and tests for be as whole numbers 17 ÷ 4 when these numbers are divisibility well, working ivided by 5? out remainders mentally 47 ÷ 8 is quite easy, for example, numbers in the 4 31 ÷ 10 5 times table end in 78 58 ÷ 11 5 either 5 or 0; 227 + 5 23 ÷ 7 6 must give a remainder of 5 $2, \frac{2}{5}$, or 0,4, depending 87 ÷ 2 7 on how it needs to be 23 ÷ 3 8 expressed. 7 279 70 ÷ 6 9 8 340 **10** 39 ÷ 9 For review pu 9 522 10 748 Express the remainders as decimals. Set E 33 ÷ 10 I'll give you 0.5 133 ÷ 2 of the remainder. 23 ÷ 5 5 $47 \div 10$ 6 347 ÷ 2 _____ 7 77 ÷ 5 _____ 8 35 ÷ 4 9 46 ÷ 8 _____ 10 24



NSW: Number NS3.3; Qld: Number concepts N4.3; Vic: Mental computation and estimation 4.1; WA: Number N4.3; SA: Number 3.8





Vic: Mental computation and estimation 4.1; WA: Number N4.3; SA: Number 3.8













NSW: Number NS3.3; Qld: Number concepts N4.3; Vic: Numbers, counting and numeration 4.2; WA: Number N4.3; SA: Number 3.8




Number Unit 15 Place value and rounding off



		STA B			Answers				
Unit 1 The history of numeration: Poman numerals									
Set A 1 3 2 4 3 7 4 9 5 12	Set B 1 LI 2 LV 3 LXVII 4 LXXIII 5 LXXVI	Set C 1 103 2 122 3 135 4 144 5 175	Set D 1 DII 2 DXV 3 DLV 4 DCXIII 5 DCXC	Set E 1 30 2 84 3 32 4 12 5 82	Set F 1 true 2 true 3 false 4 false 5 false				
6 15 7 19 8 33 9 40 10 47	6 LXXX 7 LXXXVIII 8 XCI 9 XCVI 10 XCIX	6 248 7 293 8 333 9 426 10 499	 6 DCCLIII 7 DCCC 8 DCCCLXXV 9 CM 10 CMXCIX 	6 81 7 45 8 30 9 1200 10 795	6 true 7 true 8 true 9 false 10 true				
Unit 2 Addition: Adding 2-digit numbers									
Set A 1 66 2 82 3 100 4 64 5 66 6 98 7 80 8 74 9 92 10 98 Set A 1 46 2 77 3 62 4 86 5 58 6 98 7 45 8 39 9 133 10 246	Set B 1 46 2 62 3 85 4 81 5 94 6 71 7 76 8 104 9 95 10 87 Set B 1 126 2 174 3 427 4 651 5 838 6 135 7 186 8 235 9 361 10 561	Set C 1 70 2 40 3 90 4 70 5 90 6 80 7 80 8 80 9 80 10 70 Nit SACCITION Set C 1 118 2 133 3 148 4 169 5 184 6 484 7 331 8 180 9 186 10 348	Set D 1 81 2 63 3 71 4 75 5 74 6 65 7 101 8 81 9 62 10 52 CACCING POWER 52 CACCING POWER 52 CACCING POWER 52 CACCING POWER 52 CACCING POWER 52 CACCING 103 3 1094 4 1212 5 1401 6 2262 7 4826 8 1048 9 1720 10 4228	Set E 1 70 2 80 3 94 4 45 5 90 6 62 7 91 8 90 9 71 10 97 Set E 1 321 2 422 3 875 4 442 5 533 6 1998 7 256 8 5330 9 1887 10 no	Set F 1 40 2 60 3 74 4 61 5 57 6 70 7 705 8 41 9 102 10 55 1 1756 2 1992 3 466 4 157 5 336 6 1244 7 99 8 403 9 109 10 8342				
Unit & Subtraction: Subtracting 2-digit hurlers									
Set A 1 73 2 42 3 34 4 65 5 81 6 58 7 23 8 32	Set B 1 44 2 38 3 14 4 19 5 53 6 42 7 16 8 14	Set C 1 116 2 117 3 115 4 109 5 215 6 224 7 257 8 312	2 50 3 25 4 57 5 29 6 37 7 58 8 26	Set E 1 66 2 46 3 107 4 39 5 48 6 18 7 59 8 45	Set F 1 22 2 29 3 26 4 47 5 \$45 6 77 7 108 8 46				
9 45 10 64	9 58 10 13	9 438 10 541	9 64 10 19	9 122 10 206	9 156 10 29				

Answers

* CO

Unit 5 Subtraction: Subtracting powers of 10									
Set A	Set B	Set C	Set D	Set E	Set F				
1 5	1 13	1 46	1 4	1 66	1 1965				
2 12	2 49	2 83	2 114	2 72	2 1968				
3 28	3 77	3 126	3 349	3 136	3 1888				
4 31	4 96	4 297	4 539	4 240	4 1728				
5 45	5 114	5 342	5 986	5 631	5 1847				
6 57	6 127	6 384	6 1156	6 784	6 1908				
7 63	7 1/4	7 402	7 1887	7 842	7 1863				
8 /9	8 226 0 200	8 564	8 2363	8 76	8 1/88 9 10//				
9 02 10 88	9 007	10 733	10 3845	9 290 10 1221	10 1001				
10 00	437		10 3043	10-1221	10 1001				
Unit 6 Multiplication and division facts									
Set A	Set B	Set C	Set D	Set E	Set F				
1 42	1 8	1 180	1 80	16	1 30				
2 96	2 8	2 320	2 40	2 88	2 \$20				
3 45	3 5	3 140	3 70	3 9	3 210				
4 44	4 9	4 990	4 40	4 21	4 \$400				
5 30	5 9	5 400	5 90	5 8	5 160				
6 49	6 3	6 360	6 40	6 250	6 350				
7 60	/ 6	7 600	7 30	/ 60	40				
8 12	8 9 0 12	8 600 9 4500	8 110 9 70	8 240 8 40	8 300 9 400				
9 04 10 30	9 12 10 7	9 4500 10 13 200	9 70 10 70	9 00 10 120	9 800 10 7000				
		10 13 200			10 / 000				
TOP Unit 7 Multiplication: Multiplying by powers of 10 ONLY									
Set A	Set B	Set C	Set D	Set E	Set F				
1 60	1 300	1 2000	1 870	1 2300	1 \$1,00				
2 170	2 900	2 6000	2 87 000	2 80 000	2 410				
3 200	3 1600	3 11 000	3 8700	3 9800	3 980				
4 1780	4 8700	4 38 000	4 870	4 37	4 (1300)				
5 8/00	5 9000	5 90 000	5 8/00	5 459	5 5600				
0 4 7 1F	6 80 7 24		6 8/ 7 97	o 5600 7 30	0 2200				
9 15	110	7 00 8 127	7 0/ 8 87	8 1800	7 Z30				
9 29	9 803	9 1500	9 870	9 2457	9 30				
10 41.1	10 1799	10 4870	10 8.7	10 303	10 \$10				
Uniz 8 Multiplication: Pounding and estimating									
Set A	Set B	Set C	Set D	Set E	Set F				
1 180	1 4000	1 900	1 14 000	1 200	1 36 000				
2 240	2 2700	2 6400	2 56 000	2 640	2 640 000				
3 840	3 1000	3 4000	3 12 000	3 1200	3 \$600				
4 630	4 4800	4 4500	4 24 000	4 7200	4 \$1200				
5 250	5 3500	5 2100	5 8000	5 2	5 \$15 000				
0 /20 7 150	o /200 7 2000	o 3600 7 3600	o 5000 7 81 000	о 3 7 р	o 210 000 7 2500				
8 330	✓ 2000	7 3000 8 4000	8 12000	1 3 8 A	15000 8 15000				
9 280	9 1000	0 4000 0 2/100	9 20 000	9 A	9 330 mm				
10 630	10 2000	10 900	10 90 000	10 5	10 4400 mm				
	2000	10 /00							







Answers







Answers







Vic: Numbers, counting and numeration 4.1; WA: Number N4.1; SA: Number 3.6













NSW: Number NS3.4; Qld: Number concepts N4.1; Vic: Mental computation and estimation 4.2; WA: Number N4.1b; SA: Number 3.7





Number Unit 20 Desimals: Addition and subtraction









Number Unit 22 Persentages of an amount Number Set B Find 20% of the following numbers. Find 10% of the Set following numbers. Finding percentages of an amount uses basic facts and division or multiplication skills. 25% of \$40 means of \$40, \$40 divided by 4 or \$10. Look for short cuts ut eview p 100 _____ 600 ____ ZING atil 640 _____ 830 _____ 990 _____ 1040 _____











Vic: Measurement M4.1; SA: Measurement 3.5

Concept and application



Measurement

Unit 23



Vic: Measuring and estimating 4.1; WA: Measurement M4.1; SA: Measurement 3.5





Vic: Measuring and estimating 4.1; WA: Measurement M4.1; SA: Measurement 3.5

Measurement Unit 27 Capacity/volume: Units and conversions

1000 millilitres (mL) equals 1 litre (L).

Volume refers to the space inside a 3D object and for cubes and rectangular prisms is calculated by multiplying the number of units in the length by the units in the depth and the units in the height of the object (L x D x H).

Set)

Find the volumes of the following

rectangular prism

1

2

7

For review purposes on

L = 10 cm, D = 5 cm, H = 2 cm, V = $_$ cubic centimetres

L = 20 cm, D = 5 cm, H = 2 cm, V = ____ cubic centimetres

Set

4 L

8 L 🗐

2う

7-

5<u>1</u> L = ____ mL

 $9\frac{1}{10}$ L = ____ mL

7 $1\frac{1}{4}L = ____mL$

8 $4\frac{1}{4}L = ___mL$

9 $2\frac{13}{1000}$ L = ____ mL

3

4

5

6

mL

L= 10 cm, D= 10 cm, H= 5 cm, V= _____ cubic centimetres

20 cm, D = 4 cm, H = 2 cm, V = ____ cubic centimetre

- 5 L = 50 cm, D = 10 cm, H = 2 cm, V = _____ cubic centimetres
 6 L = 50 cm, D = 20 cm (H = 10 cm, V = _____ cubic centimetres
 - $L = 54 \text{ cm}, D = 10 \text{ cm}, H = 2 \text{ cm}, V = ______ \text{cubic centimetres}$
- 8 L = 87 cm, D = 10 cm, H = 10 cm, V = _____ cubic centimetres
- 9 L = 51/2 cm, D = 2 cm, H = 2 cm, V = _____ cubic centimetres
- 10 L = 61/2 cm, D = 2 cm, H = 10 cm, V =____ cubic centimetres



Measurement Unit 28 Time: Digital/analogue conversions and 24-hour time

We need to know that 3:35 and 25 minutes to 4 o'clock are two ways of saying the same time. We should also know that 2 p.m. can be written in 24-hour time as 14:00.




NSW: Measurement MS3.5; Qld: Measurement M4.2; Vic: Measurement—Time 4.3; WA: Measurement M4.1; SA: Measurement 3.5





Vic: Mental computation and estimation 4.2; WA: Number N4.1a; SA: Number 3.8









Unit 32 Pevision: All sorts



Revision



Glossary

Less than 90 degrees Palindromic A number like 525, that is the same Acute angle number forwards as backwards Add To group together Penta A prefix meaning 5 Adiacent Next to Pentagon A polygon with 5 sides Altogether The answer to an addition problem Percentage Parts out of 100 Analogue clock A sweep-hand clock The result of a number being multiplied rfect square Autumn March, April, May by itself Bi A prefix meaning 2 Perimeter The length of the boundary of a shape Centi A prefix meaning 1/100 Polygon A 2D shape with many corners Centimetre 100th of a metre Polyhedra A 3D shape with many faces 100 \ Century irs Prime A number with just two factors amber with r Composite bre swer to a multiplication problem Product 4 hours Day Quad prefix meaning 4 aning 10 Deca A prefix m Quadrilateral A 4-sided shar Decade of 10 years Quadruple To multiply by Decadon 0-sided shape The result of a division question Quotient Difference How far one number is away from Regular (shape) Having the same side lengths ther number Remainder What is left over after a division sum Divide To split up into equal pieces or to share has been complete Dodecagon A shape with 12 sides Remove To take away Double To add a number onto itself Revolution A turn of 360 degre Dozen 12 Rhombus A 4-sided figure with equal sides b Duratio How long something lasts no right angles Edge A boundary **Right angle** An L-shaped angle of 90 degrees Equal difference Subtraction sums with the same answer, Round To take a number to the nearest like 12 – 3 and 11 – 2 10, 100, 1000 etc. Equilateral he pattern j side ace quarter of Factor What div Second One-sixtieth of a minute Fortnight 14 days Semester Half a year at school The standard unit for mass Gran Sequence A number pattern Counting in lots ubs d To divide into equal pieces Share Divide into two equal parts Simplest form To write a fraction using the small st Hemisphere Half a sphere, like a scoop of ice-cream numbers possible Hendecagon A shape with 11 sides Solve To find the answer to a g Heptagon A shape with 7 sides Sphere A 3D shape like a ball shape with 6 sides September, October, November Hexagon Spring minutes Hour The number that has been Square root squared to prefix meaning 1000 equal that number Kilo Subtract To take away Kilogram 0 The answer to an addition problem Sum Kilometre December, January, February Summer Leap year Term ch member of a sequence Litre The sta One guarter of a year at school Margin How far tw Tessellate To fit together without leaving gaps Metre The standard unit Time Groups of Millennium 1000 vears Total The answer to an addition problem Millilitre One-thousandth of a litre Tri A prefix meaning 3 Minute One-sixtieth of an hour Triple To multiply by 3 Month One-twelfth of a year Twice 2 times, or to double **Multiples** The answers to times tables Vertex The corner where lines meet on 2D Multiply Count groups or 3D shapes Nonagon A shape with 9 sides Week 7 days **Obtuse angle** Greater than 90 but less than 180 degrees Winter June, July, August Octa A prefix meaning 8 Year 365 days Octagon A shape with 8 sides

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