# <u>MATH LEVEL 1</u> LESSON PLAN 5

### **DIVISION**

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# Section 1: Basic Division

1. DIVISION is the number of times a number can be taken out of another as if through "repeated subtraction".

When there are 30 pennies on the table, you can take a group of 6 pennies away only 5 times, with no pennies remaining. We write this as follows.

$$30 \div 6 = 5;$$
 because  $30-6-6-6-6 = 0$ 

Subtract five times No remainder

This is called EXACT DIVISION since there is no remainder.

But when there are 33 pennies on the table and you take groups of 6 pennies away, then 3 pennies are left in the end.

$$33 \div 6 = 5 R3;$$
 because



This is called INEXACT DIVISION since there is a remainder.

2. The original number of pennies on the table are called **dividend**. The pennies taken away at a time are called the **divisor**. The maximum number of times the divisor can be taken out of the dividend is called the **quotient**. And the pennies left at the end, because they are less than the divisor, are called the **remainder**.

33	÷	6	=	5	R3
Dividend		Divisor		Quotient	Remainder

3. A number can be taken out of itself exactly 1 time.

 $6 \div 6 = 1;$   $30 \div 30 = 1$ 

1 can be taken out of a number as many times as the number.

 $6 \div 1 = 6;$   $30 \div 1 = 30$ 

When there is nothing (0), you cannot take anything out of it at all..

$$0 \div 6 = 0; \qquad 0 \div 30 = 0$$

When you are taking nothing (0) out of a number, it can be "taken out" any number of times.

$$6 \div 0$$
 = undefined;  $30 \div 0$  = undefined

### © EXERCISE

A. Find the quotient with remainder, if any. Tell if the division is exact or inexact.

(a) 9 ÷ 3	(c) 16 ÷ 4	(e) 25 ÷ 5	(g) 12 ÷ 4
(b) 9 ÷ 2	(d) 16 ÷ 5	(f) 23 ÷ 6	(h) 12 ÷ 10

Answer: (a) 3 exact (b) 4 R1 inexact (c) 4 exact (d) 3 R1 inexact (e) 5 exact (f) 3 R5 inexact (g) 3 exact (h) 1 R2 inexact

#### B. Find the quotients for the following:

(a) 9 ÷ 9	(c) 9 ÷ 0	(e) 0 ÷ 23	(g) 24 ÷ 1
(b) 8 ÷ 1	(d) 8 ÷ 8	(f) 28 ÷ 0	(h) 0 ÷ 4

Answer: (a) 1 (b) 8 (c) undefined (d) 1 (e) 0 (f) undefined (g) 24 (h) 0

#### C. Find the quotient using multiplication tables

(a) 27 ÷ 3	(c) 48 ÷ 6	(e) 72 ÷ 9	(g) 36 ÷ 4
(b) 56 ÷ 8	(d) 45 ÷ 5	(f) 16 ÷ 2	(h) 35 ÷ 7

Answer: (a) 9 (b) 7 (c) 8 (d) 9 (e) 8 (f) 8 (g) 9 (h) 5

# Section 2: Dividing by Single-Digit Divisors (Short Division)

4. We divide larger numbers from left to right by breaking them into their place values.

 $486 \div 2 = (400 + 80 + 6) \div 2 \\ = 200 + 40 + 3 \\ = 243$ 

We may also divide larger numbers by writing them as follows.



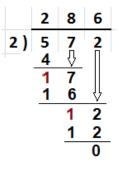
Hundreds:	From 4 we can take 2 out 2 times (no remainder)
Tens:	From 8 we can take 2 out 4 times (no remainder)
Hundreds:	From 6 we can take 2 out 3 times (no remainder)

Therefore,  $486 \div 2 = 243$ To check, multiply 243 by 2. You should get back 486 because multiplication is reverse of division.

The 'long form' of division is shown on the right. We pull down the next digit and place it to the right of the remainder. We then divide the resulting number.

= 286

remainder from a column to the left of the next digit. We then divide



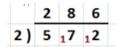
The 'short form' of division is shown on the right. We place the

(Check  $286 \times 2 = 572$ )

572 ÷ 2

Therefore,

the resulting number.



5. When the first digit of the dividend cannot be divided, then start with the first two digits. Make sure you write the digit of the quotient in the correct column.

Therefore, 564 ÷ 6 = 94 (Check 94 x 6 = 564)

6. When a number in a column cannot be divided, put a 0 in the quotient for that column.

Therefore, 728 ÷ 7 = 104 (Check 104 x 7 = 728)

7. We may also write division with quotient below the dividend as shown on the right. This has some advantages when factoring numbers (see Lesson plan on FACTORS).



In the following exercises either use a Multiplication Table, or make the table for the divisor on the spot.

A. Divide the following and check your answers by multiplying back.

(a) 396 ÷ 3	(c) 444 ÷ 3	(e) 435 ÷ 5	(g) 450 ÷ 6
(b) 327 ÷ 3	(d) 612 ÷ 6	(f) 315 ÷ 7	(h) 224 ÷ 4

Answer: (a) 132 (b) 109 (c) 148 (d) 102 (e) 87 (f) 45 (g) 75 (h) 56

B. Divide the following and check your answers by multiplying back.

(a) 844 ÷ 4	(c) 732 ÷ 6	(e) 57 ÷ 3	(g) 3,174 ÷ 3
(b) 992 ÷ 8	(d) 894 ÷ 6	(f) 847÷7	(h) 9,945 ÷ 5

Answer: (a) 211 (b) 124 (c) 122 (d) 149 (e) 19 (f) 121 (g) 1,058 (h) 1,989

8. When there is a final remainder at the end of division, you write it next to the quotient as shown. To check your answer multiply back as before and then add the remainder.

3 7 16 14 2 5 4 R 2

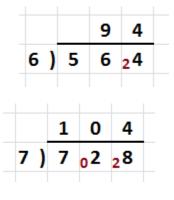
Therefore,  $764 \div 3 = 254 \text{ R2}$ [Check (254 x 3) + 2 = 764]. Note that we add remainder to get back the dividend.

# EXERCISE

A. Check your answer by multiplying back and the adding the remainder.

(a) 15 ÷ 4	(c) 139 ÷ 6	(e) 578÷3	(g) 3,177 ÷ 2
(b) 92 ÷ 8	(d) 793 ÷ 7	(f) 897 ÷ 5	(h) 9,745 ÷ 9

Answer: (a) 3 R3 (b) 11 R4 (c) 23 R1 (d) 113 R2 (e) 192 R2 (f) 179 R2 (g) 1588 R1 (h) 1082 R7



Divisor	2	5	<b>17</b>	1 <b>2</b>	Dividend
		2	8	6	Quotient

### Section 3: Dividing by Double-Digit Divisors (Long Division)

9. When divisors are large, the long form division is preferred because the remainders are large.

Example: Divide 10853 ÷ 16

The steps are:

(a) The Divisor is 16. We first make the table of 10 multiples for 16 as follows:

16 x 1	=	(10 + 6) x 1	=	10 + 6	=	16
16 x 2	=	(10 + 6) x 2	=	20 + 12	=	32
16 x 3	=	(10 + 6) x 3	=	30 + 18	=	48
16 x 4	=	(10 + 6) x 4	=	40 + 24	=	64
16 x 5	=	(10 + 6) x 5	=	50 + 30	=	80
16 x 6	=	(10 + 6) x 6	=	60 + 36	=	96
16 x 7	=	(10 + 6) x 7	=	70 + 42	=	112
16 x 8	=	(10 + 6) x 8	=	80 + 48	=	128
16 x 9	=	(10 + 6) x 9	=	90 + 54	=	144
16 x 10	=	(10 + 6) x 10	=	100 + 60	=	160

- (b) 16 cannot be taken out of the first two digits. Try taking it out the first 3 digits.
- (c) 16 can be taken out of 108 six times (16 x 6 = 96). Place 6 in the column above 8. Subtract 96 from 108. The remainder is 12. Bring down the next digit 5. We get 125.
- (d) 16 can be taken out of 125 seven times (16 x 7 = 112). Place 7 in the column above 5. Subtract 112 from 125. The remainder is 13. Bring down the next digit 3. We get 133.
- (e) 16 can be taken out of 133 eight times (16 x 8 = 128). Place 8 in the column above 3. Subtract 128 from 133. The remainder is 5. There are no more digits.
- (f) The quotient is 678, and there is a remainder of 5.

Therefore,  $10853 \div 16 = 678 \text{ R5}$ [Check (678 x 16) + 5 = 10853]

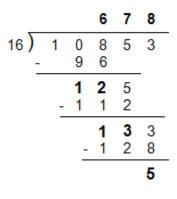
# © <u>EXERCISE</u>

Divide by first writing down the multiples of the divisor

(a) 108 ÷ 12	(d) 3225 ÷ 12	(g) 976 ÷ 11
(b) 911 ÷ 11	(e) 1111 ÷ 11	(h) 322 ÷ 13
(c) 432 ÷ 14	(f) 4555 ÷ 15	(i) 3567 ÷ 18

Answer: (a) 9 (b) 82 R9 (c) 30 R12 (d) 268 R9 (e) 101 (f) 303 R10 (g) 88 R8 (h) 24 R10 (i) 198 R3

#### Long Form



10. Instead of making the table of multiples, we may first guess the needed multiple.

#### Divide, 563 ÷ 62

Round to tens as follows:

563 / 62 is about 560 / 60; the "tens" are 56 / 6.

We can take 6 out of 56 nine times.

Therefore, 62 may be taken out of 563 about 9 times.

Compute 62 x 9 = 558. This gives us, 563 ÷ 62 = 9 R5

#### Divide, 396 ÷ 44

Round to tens as follows:

396 / 44 is about 400 / 40; the "tens" are 40 / 4.

We can take 4 out of 40 ten times.

Therefore, 44 may be taken out of 396 about 10 times.

Compute **44 x 10 = 440** (more than 396)

Compute 44 x 9 = 396. This gives us, 396 ÷ 44 = 9

#### Divide, 611 ÷ 87

Round to tens as follows:

611 / 87 is about 610 / 90; the "tens" are 61 / 9.

We can take 9 out of 61 six times.

Therefore, 87 may be taken out of 611 about 6 times.

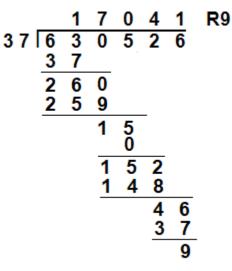
Compute 87 x 6 = 522 (much smaller than 611)

Compute 87 x 7 = 609. This gives us, 611 ÷ 87 = 7 R2

#### Divide 630526 ÷ 37

The steps are

- (a) For  $63 \div 37$  round them to 60 and 40. We can take out the tens (4 out of 6) one time. Check  $37 \times 1 = 37$ ; and  $37 \times 2 = 74$ . We can take 37 out of 63 one time. Write 1 above 63 (line it up to the right). Subtract 63 - 37 = 26.
- (b) Pull the next digit (0) down and place it next to 26, making it 260.
- (c) For  $260 \div 37$  round them to 260 and 40. We can take out the tens (4 out of 26) 6 times. Check  $37 \times 6 = 222$ ; and  $37 \times 7 =$ 259. We can take 37 out of 260, seven times. Write 7 above 0. Subtract 260 - 259 = 1.



- (d) Pull the next digit (5) down and place it next to 1, making it 15.
- (e) For  $15 \div 37$  we obviously get 0. Write 0 above 5. Subtract 15 0 = 15.
- (f) Pull the next digit (2) down and place it next to 15, making it 152.
- (g) For  $152 \div 37$  round to 150 and 40. We can take out the tens (4 out of 15) 3 times. Check 37 x 3 = 111; and 37 x 4 = 148. We can take 37 out of 152, four times. Write 4 above 2. Subtract 152 - 148 = 4.
- (h) Pull the next digit (6) down and place it next to 4, making it 46.
- (i) For  $46 \div 37$ , we can 37 out of 46 one time. Write 1 above 6. Subtract 46 37 = 9. There are no more digits, so the final remainder is 9.

Therefore,  $630526 \div 37 = 17041 \text{ R9}$ [Check (17041 x 37) + 9 = 630526]

# © EXERCISE

Divide by approximating the quotient.

(a) 144 ÷ 16	(d) 217 ÷ 45	(g) 7488 ÷ 61
(b) 123 ÷ 23	(e) 318 ÷ 53	(h) 82593 ÷ 71
(c) 259 ÷ 37	(f) 419 ÷ 59	(i) 994720 ÷ 89

Answer: (a) 9 (b) 5 R8 (c) 7 (d) 4 R37 (e) 6 (f) 7 R6 (g) 122 R46 (h) 1163 R20 (i) 11176 R56

### Section 4: Word Problems

- 11. Word problems require a translation of words into mathematical language.
  - (a) Example 1: If 6 apples cost 54 cents, how much would 9 apples cost?

LOGIC: First find out how much one apple costs. Then you can find out how much 9 apples would cost.

Cost of 6 apples	=	54 cents			
Cost of 1 apple	=	54 ÷ 6	=	9 cents	
Cost of 9 apple	=	9 x 9	=	81 cents	Answer

(b) <u>Example 2</u>: Joe, Bob and Lisa shared a prize of \$108 equally among themselves. Lisa then shared her money equally with her two sisters. How much money did Lisa get?

LOGIC: First find out how much Lisa got before sharing the prize with her sisters. Then you can find out how much Lisa got after sharing with her sisters. Amount Lisa got initially =  $$108 \div 3 = $36$ 

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Amount Lisa got finally	=	\$36 ÷ 3	=	\$12	Answer

### © <u>EXERCISE</u>

Do the following word problems. Check your answer against the answers given.

(a) You bought 5 bananas for 30 cents. How much will 1 banana cost? 8 bananas cost?

- (b) You bought 14 pencils for 70 cents. How much will 1 pencil cost? 21 pencils cost?
- (c) You won a lottery of \$600, which you shared with 4 of your friends. You then shared your winnings equally with your brother and sister. How much money did you end up with?

Answer: (1) 6 cents, 48 cents (2) 5 cents, \$1.05 (3) \$40

## © Lesson Plan 5: Check your Understanding

- 1. How is division related to multiplication?
- 2. Divide (a) 47,971 ÷ 7 (b) 299,997 ÷ 3 (c) 751,941 ÷ 9
- 3. Divide (a) 47,971 ÷ 27 (b) 299,997 ÷ 63 (c) 751,941 ÷ 89

Check your answers against the answers given below.

#### Answers:

- 1) Division is "reverse multiplication."
- 2) (a) 6,853 (b) 99,999 (c) 83,549
- 3) (a) 1,776 R19 (b) 4,761 R54 (c) 8,448 R69.