

MATH 103 – Order of Operations, Exponents, Divisibility, Division Theorem

1. Compute and simplify each of the following quantities.

$$(a) 6 \times (8 \div 2) = 6 \times 4 = 24$$

$$(b) 24 \div 4 \times 3 = 6 \times 3 = 18$$

$$(c) 5 \times 2^3 = 5 \times 8 = 40$$

$$(d) 120 - 20 \times 5 + 45 \div 3 = 120 - 100 + 15 \\ = 20 + 15 \\ = 35$$

$$(e) 2 \times (4 + 40) \div 2^3 = 2 \times 44 \div 2^3 \\ = 2 \times 44 \div 8 \\ = 88 \div 8 \\ = 11$$

2. What is the value of  $123456789^0$  ?

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3. Find whole number values for  $a$  and  $b$  so that each of the following quantities can be expressed as  $a^b$ .

$$(a) 6^{15} \times 6^5 = 6^{20}$$

$$(b) 10^{25} \div 10^7 = 10^{18}$$

$$(c) 2^{10} + 2^{10} + 2^{10} + 2^{10} = 4 \times 2^{10} \\ = 2^2 \times 2^{10} \\ = 2^{12}$$

$$(d) 2^{87} \times 3^{87} = 6^{87}$$

$$(e) 3^{200} \times 5^{200} \times 15^{300} = 15^{200} \times 15^{300} \\ = 15^{500}$$

4. Circle T for true or F for false for each of following statements.

(a) T or **F**:  $6|32$  since  $32 \neq 6 \times c$  with  $c \in \mathbb{Z}$

(b) **T** or F:  $8|56$  since  $56 = 8 \times 7$

(c) T or **F**:  $81|9$  since  $9 \neq 81 \times c$  with  $c \in \mathbb{Z}$

(d) T or **F**:  $0|2$  since  $2 \neq 0 \times c$  with  $c \in \mathbb{Z}$

(e) **T** or F:  $4|0$  since  $0 = 4 \times 0$

(f) **T** or F:  $1|3$  since  $3 = 1 \times 3$

(g) T or **F**:  $2|1$  since  $1 \neq 2 \times c$  with  $c \in \mathbb{Z}$

5. Circle each number below which is divisible by 7.

0 1 7 21 283  
 $\uparrow$     $\uparrow$     $\uparrow$   
 $7 \times 0$     $7 \times 1$     $7 \times 3$

6. Circle each number below which is a divisor of 10.

0 1 2 4 5 10 15 20  
 $\uparrow$     $\uparrow$     $\uparrow$     $\uparrow$     $\uparrow$   
 $10 = 1 \times 10$     $10 = 2 \times 5$     $10 = 5 \times 2$     $10 = 10 \times 1$

7. Circle each number below which is a multiple of 15.

0 1 3 5 10 15 45 165  
 $\uparrow$     $\uparrow$     $\uparrow$     $\uparrow$     $\uparrow$   
 $15 \times 0$     $15 \times 1$     $15 \times 3$     $15 \times 11$

8. Circle T for true or F for false for each of following statements.

(a)  T or  F: 5555533333 is divisible by 5

since last digit 3 is not  
a 5 or a 0

(b)  T or  F: 2 is a divisor of 111333555777999000

since last digit 0 is divisible by 2  
(i.e. it is even)

(c)  T or  F: 987654321 is a multiple of 3

since  $9+8+7+6+5+4+3+2+1$   
 $= 9+(8+1)+(7+2)+(6+3)+(5+4)$   
 $= 9 \times 5$  is divisible by 3.

(d)  T or  F: 635497 is divisible by 3

since  $6+3+5+4+9+7 = 34$   
is not divisible by 3

(e)  T or  F: 9 is a divisor of 77781188118222

since  $7+7+7+8+1+1+8+8+1+1+8+2+2+2$   
 $= 3 \times (7+2) + 4 \times (8+1)$   
 $= 7 \times 9 = 63$  is divisible by 9

(f)  T or  F: 90090090090090090011100900009 is divisible by 9

since sum of digits is  $9 \times 9 + 3 = 84$   
which is not divisible by 9

(g)  T or  F: 4 is a divisor of 37439277645972398347928387347340

since last two digits 40  
give a number which is  
divisible by 4



9. What digit  $d$  will result in  $19352d$  being divisible by 11?

$$\begin{aligned}(d+5+9) - (2+3+1) \\ = d+14 - 6 \\ = d+8\end{aligned}$$

$d$  must equal 3 in order for  $d+8$  to be a multiple of 11, and  $d$  to be one of the digits in  $\{0, 1, 2, 3, 4, 5, 6, 7, 8, 9\}$ .

10. When 17 is divided by 3 the *Division Theorem* yields which of the following equations?

(a)  $17 = 3 \times 1 + 14$

(b)  $17 = 3 \times 2 + 11$

(c)  $17 = 3 \times 3 + 8$

(d)  $17 = 3 \times 4 + 5$

(e)  $17 = 3 \times 5 + 2$

(f)  $17 = 3 \times 6 - 1$

since remainder  $r$  must be 0, 1, or 2 when dividing by 3

11. What is the remainder when 453600270023 is divided by 9?

$$453600270023 = 453600270018 + 5$$
$$= 9 \times C + 5$$

since  $4+5+3+6+2+7+1+8$  is a multiple of 9

remainder is 5

12. What is the remainder when 729 is divided by 9?

$$729 = 9 \times C + 0$$

(easy to see)  
 $C=81$  here)

since  $7+2+9$  is a multiple of 9

remainder is 0

13. What is the remainder when 375397525 is divided by 4?

$$375397525 = 375397524 + 1$$
$$= 4 \times C + 1$$

since 24 is a multiple of 4

remainder is 1

14. What is the remainder when 9473046393838 is divided by 5?

$$9473046393838 = 9473046393835 + 3$$
$$= 5 \times C + 3$$

since last digit 5 is a multiple of 5

remainder is 3

15. What is the remainder when 357750 is divided by 7?

remainder is 1

$$\text{since } 357750 = 350000 + 7700 + 49 + 1$$

each a multiple of 7