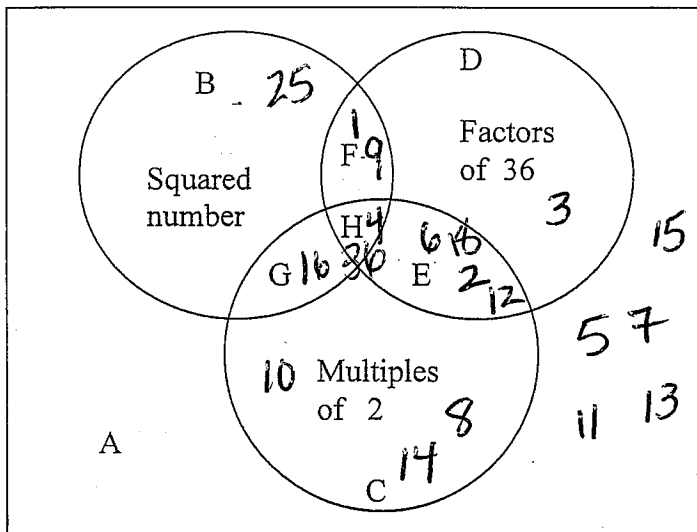


Follow all directions. **YOU MAY LEAVE ANSWERS IN FACTORED FORM.**
Use complete sentences for explanations. Relax, breathe, and good luck ☺

1. (10 points) Fill in the table below by either giving the appropriate region for each number or giving a number (not already used) that fits in the given region.

1.



Number	Region
1	F
4	H
12	E
25, 49	B
16, 64	G
9	F
7	A
2, 6, 12, 18	E
14	C
3	D

2. (12 points) Label each statement as true (T) or false (F). If the statement is false, change it so that it is true (Do not just change the verb).

- (T) F a. If 5 is not a factor of n , then 15 is not a factor of n .
- T (F) b. If $\text{LCM}(a, b) = b$, then a is a multiple of b .
- T (F) c. This equation is possible: $2^2 \cdot 3^2 \cdot 17^4 = 2^3 \cdot 3^4 \cdot m$ for some whole number m . (If false, change the equation). $2^4 \cdot 3^2 \cdot 17^4 = 2^3 \cdot 2 \cdot 17 \cdot m$
- T (F) d. A divisibility rule for the number 18 is to see if the number is divisible by 3 and 6. 299
- T (F) e. $2^8 \times 67$ is a multiple of $2^{10} \times 17^2 \times 67$.
factor
- (T) F f. Addition and multiplication of even numbers is closed.

3. (18 points) Let $m = 2^3 \cdot 7^2$, $n = 2 \cdot 5^3 \cdot 7$, and $p = 3^2 \cdot 5 \cdot 7$. Answer the following questions.

a. How many total factors does n have? $2 \cdot 4 \cdot 2 = 16$ total factors

b. How many prime factors does p have? 3 prime factors

c. List six composite factors of m : $2^2=4$, $2^3=8$, $2 \cdot 7=14$, $7^2=49$, $2 \cdot 7=28$, $2 \cdot 49=98$, $7 \cdot 7=56$

d. What is the GCF(m, n, p)? 7

e. What is the LCM(m, n, p)? $2^3 \cdot 3^2 \cdot 5^3 \cdot 7^2$

f. Is 30 a factor of p ? NO Is 105 a factor of p ? yes
 (2 is not a factor) $\begin{array}{l} \diagdown \\ 5 \cdot 3 \cdot 7 \end{array}$

$$5 \overline{)105} \begin{array}{r} 21 \\ \underline{10} \\ 5 \\ \underline{5} \\ 0 \end{array}$$

4. (6 points) Give a divisibility rule to check if a number is divisible by ...

a. 20 check 4 & 5 (or 4 & 10)

b. 18 check 2 & 9

5. (6 points) What number am I?

I am bigger than 130.

11 is one of my prime factors.

I am smaller than 150.

I am not a multiple of 2.

I am the number 143. What is my other prime factor? 13

6. (6 points)

a. List all the numbers that you have to check to see if 323 is a prime.

2, 3, 5, 7, 11, 13, 17

b. Is it a prime? YES NO

$$17 \times 19 = 323$$

7. (8 points) Determine all possible digits to fill in the blanks to make each of the following true:

a. 3 is a factor of 4297_435 . The missing digit could be: 2, 5, 8
 $4+2+9+7+4+3+5 = 34$

b. 4 is a factor of 385039_18 . The missing digit could be: none

c. 8 is a factor of 1948513_0 . The missing digit could be: 2, 6
~~300, 310, 320, 330, 340, 350, 360, 370, 380, 390~~
OK OK

d. 15 is a factor of $96321785_$. The missing digit could be: 0
5, 0

8. (8 pts) Let $a = 2^5 \cdot 3^2 \cdot 7^6 \cdot 13^4$ and $b = 2^2 \cdot 7^3 \cdot 13^6 \cdot 17$. Leave answers in factored form.

a. Find the GCF(a, b) and the LCM(a, b). $2^2 \cdot 7 \cdot 13$, $2^5 \cdot 3^2 \cdot 7^6 \cdot 13^6 \cdot 17$

b. Multiply the GCF and the LCM. $2^7 \cdot 3^2 \cdot 7^9 \cdot 13^{10} \cdot 17$

c. Multiply a and b . $2^7 \cdot 3^2 \cdot 7^9 \cdot 13^{10} \cdot 17$

d. Use your answers from (b) and (c) to come up with a general equation relating a and b to the GCF and LCM.

$$a \cdot b = \text{GCF} \cdot \text{LCM}$$

9. (4 points) What is the smallest whole number (can be in factored form) that has exactly 100 factors? (Hint: the answer is not 2^{99})

$$100 = 2 \cdot 2 \cdot 5 \cdot 5$$

$$4 \quad 4 \quad 1 \quad 1$$

$$2 \cdot 3 \cdot 5 \cdot 7$$

10. (4 points) Find the least common multiple of the denominators of the fractions and calculate the sum. Show all work.

$$\frac{7}{20} + \frac{5}{24} = \frac{7 \cdot 6}{120} + \frac{5 \cdot 5}{120} = \frac{42 + 25}{120}$$

$$= \frac{67}{120}$$

LCM = $2^3 \cdot 3 \cdot 5 = 120$

$$84 = 2^2 \cdot 3 \cdot 7$$

\wedge
 4 21

$$75 = 3 \cdot 5^2$$

\wedge
 3 25

11. (7 points) Jogger A can run laps at the rate of 84 seconds per lap. Jogger B can run laps on the same track at a rate of 1 minute 15 seconds per lap. If they start at the same time, and run in the same direction, how long (in reasonable time units) will it be before they are at the starting place again, at the same time?

$$\text{LCM}(84, 105) = 2^2 \cdot 3 \cdot 5 \cdot 7 = 2100 \text{ sec}$$

$$2100 \div 60 = \boxed{35 \text{ minutes}}$$

$$\begin{array}{r} 3 \\ 3 \overline{) 9} \\ \underline{7} \\ 163 \\ 5 \overline{) 315} \end{array}$$

12. (7 points) Your organization is having a fundraiser selling T-shirts at the Little League ball field. Last weekend the group had \$315 in sales, and the week before they had \$165 in sales. You are in charge of sales this weekend and forgot to ask how much the T-shirts are selling for. You need to figure it out and only have these numbers. How can you do that? How much do the T-shirts sell for? Show all work.

$$\text{GCF}(315, 165) = 3 \cdot 5 = \boxed{\$15}$$

$3^2 \cdot 5 \cdot 7$ $3 \cdot 5 \cdot 11$

$$\begin{array}{r} 3 \\ 11 \overline{) 33} \\ 5 \overline{) 165} \end{array}$$

13. (4 points) These students are working on finding the prime factorization of the same number x . No one is finished. Who might agree when they finish? Who will definitely disagree? Explain your answers.

Ana: $x = 3^8 \times 7^4 \times 4797134197203$

Ben: $x = 3^7 \times 7^4 \times \text{an odd number}$

Carlos: $x = 21^2 \times 7^9 \times 3^6 \times \text{an even number}$

Dee: $x = 3 \times 3 \times 3 \times 49^2 \times \text{an odd number}$

Carlos will definitely disagree since he has an even #

Ana, Ben & Dee may agree since they all have an odd # remaining and all have factors of 3's and 7's