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1. **(3 points)** `Library/Rochester/setDiscrete6Integers/ur_dis_6_4.pg`

What are the greatest common divisors of the following pairs of integers?
(a) $2^3 \cdot 3^3 \cdot 5^2$ and $2^3 \cdot 3 \cdot 5^3$
Answer = ______

(b) $2^9 \cdot 3 \cdot 5 \cdot 7 \cdot 11 \cdot 13$ and $3^9 \cdot 7^2 \cdot 13^9 \cdot 17$
Answer = ______

(c) $2^3 \cdot 7$ and $5^3 \cdot 13$
Answer = ______

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2. **(5 points)** `Library/NewHampshire/unh_schoolib/GCF_LCM/gcfsrs301.pg`

For each of the following pairs of numbers, find the GCF. [In more advanced and college courses this will be called the GCD (greatest common divisor) rather than GCF (greatest common factor)].

GCF(30,42)=___
GCF(175,275)=___
GCF(360,504)=___

For each of the following pairs of monomials, find the GCF.
GCF($25m^4, 20m^{10}$)=_____
GCF($126m^9n^{20}, 90m^{15}n^{16}$)=_____

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3. **(6 points)** `Library/SDSU/Discrete/IntegersAndRationals/factorB3.pg`

Let $a = p^2 \cdot q$ and $b = p \cdot q \cdot r$
where p, q, r are distinct primes.

For the following questions, indicate the correct exponent. Enter 0 if necessary.

Determine gcd(a,b)
p^n for $n =$ ___
q^n for $n =$ ___
r^n for $n =$ ___

Determine lcm(a,b)
p^n for $n =$ ___
q^n for $n =$ ___
r^n for $n =$ ___

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4. **(4 points)** `Library/SDSU/Discrete/IntegersAndRationals/quoremB2.pg`

Let $a = 16$, $b = 3$

For a divided by b, what is the integer quotient? ___
What is the remainder? ___

For b divided by a, what is the integer quotient? ___
What is the remainder? ___

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5. **(7 points)** `Library/SUNYSB/modOperator.pg`

Answer the following questions where *div* is for finding integer quotient and *mod* is for remainder.

30 div 10 = _____,
30 mod 10 = _____
-22 div 3 = _____,
-22 mod 3 = _____
21 div 4 = _____,
21 mod 4 = _____
-24 div 7 = _____,
-24 mod 7 = _____
29 div 4 = _____,
29 mod 4 = _____
-24 div 9 = _____,
-24 mod 9 = _____
443379094 mod 101 = _____
150710061 mod 101 = _____

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6. **(4 points)** `Library/SDSU/Discrete/IntegersAndRationals/pL6.pg`

The remainder when a is divided by 7 is 2 and the remainder when b is divided by 7 is 5.
(So a mod $7 = 2$, b mod $7 = 5$)

Find:

$(a+a)$ mod 7 ___

$(a+b)$ mod 7 ___

$(3a)$ mod 7 ___

$(2b)$ mod 7 ___

[Hint: test some specific values for a and b that satisfy the hypotheses.]

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7. **(7 points)** `Library/SDSU/Discrete/IntegersAndRationals/pL5.pg`

Here is another version of the Quotient-Remainder Theorem:

Given any integers n, d with $d \neq 0$, there exist unique integers q, r satisfying

(1) $n = dq + r$

(2) $-d/2 < r \leq d/2$

Find the quotient and remainder (using the theorem above!) for the following pairs of integers:

n = 11, d = 2
q= ___, r = ___.

n = 11, d = 3
q= ___, r = ___.

n = -11, d = 3
q= ___, r = ___.

n= 54 d = 7
q= ___, r = ___.

n= -54 d = 7
q= ___, r = ___.

n= 52 d=8
q= ___, r = ___.

n = -52 d = 8
q= ___, r = ___.

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8. (7 points) `Library/Rochester/setDiscrete7NumberTheory/ur_dis_7_1.pg`

The goal of this exercise is to practice finding the inverse modulo m of some (relatively prime) integer n. We will find the inverse of 11 modulo 46, i.e., an integer c such that $11c \equiv 1 \pmod{46}$.

First we perform the Euclidean algorithm on 11 and 46:
$46 = 4*$ _________ + _________
_________ = _________ $*5 + 1$
[Note your answers on the second row should match the ones on the first row.]

Thus gcd(11,46)=1, i.e., 11 and 46 are relatively prime.

Now we run the Euclidean algorithm backwards to write $1 = 46s + 11t$ for suitable integers s, t.
$s =$ _________
$t =$ _________

when we look at the equation $46s + 11t \equiv 1 \pmod{46}$, the multiple of 46 becomes zero and so we get
$11t \equiv 1 \pmod{46}$. Hence the multiplicative inverse of 11 modulo 46 is _________

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9. (9 points) `Library/UMass-Amherst/Abstract-Algebra/PS-Congruences/Congruences3.pg`

Compute:

$\gcd(65, 40) =$ _____

Find a pair of integers x and y such that $65x + 40y = \gcd(65, 40)$

$(x, y) =$ (___ , ___)

---

10. (8 points) `Library/Rochester/setDiscrete7NumberTheory/ur_dis_7_2.pg`

Find the smallest positive integer x that solves the congruence:

$$26x \equiv 2 \pmod{187}$$

$x =$ _____

(Hint: From running the Euclidean algorithm forwards and backwards we get $1 = s(26) + t(187)$. Find s and use it to solve the congruence.)

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11. (4 points) `Library/Rochester/setDiscrete6Integers/ur_dis_6_5.pg`

Find the memory locations which are assigned by the hashing function $h(k) = k \bmod 101$ to the records of students with the following Social Security numbers:
(Note enter the canonical representative for the answer modulo 101, thus your answer should be an integer between 0 and 100 inclusive for each part.)
726841998 _____ 949965180 _____ 245042527 _____
142311929 _____

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12. (6 points) `Library/UMass-Amherst/Abstract-Algebra/PS-Congruences/Congruences10.pg`

What is the remainder of 7^{2629} when divided by 13?

_____

Note: You should be able to do this problem without using a calculator or computer!