1. Let $A = \{1, 4, 6, 8, 9\}$ and $B = \{2, 3, 4, 8, 10\}$.

   Compute each of the following.

   a) $A \cup B$ b) $A \cap B$

   Label the following statements as true or false.

   c) $A \cap B \subseteq A$ d) $B \subseteq A \cup B$ e) $A \cap \varnothing = A$ f) $B \cup \varnothing = B$

2. List all natural numbers x with the given property.

   a) $x < 6$ b) $x < 7$ and $x > 3$ c) $x < 7$ or $x > 3$ d) $x \leq 10$ and x is even

3. Let $A = \{x \in \mathbb{N} : x \geq 2\}$ and $B = \{x \in \mathbb{N} : x < 10\}$. Find each of the following.

   a) $A \cap B$ b) $A \cup B$

4. List all factors of each of the following numbers. a) 48 b) 90 c) 32

5. Let $A = \{n \in \mathbb{N} : n \text{ is divisible by } 2\}$, $B = \{n \in \mathbb{N} : n \text{ is divisible by } 6\}$. Which (if any) of the following is true?

   $A \subseteq B$ $B \subseteq A$

6. Let $P = \{n \in \mathbb{N} : n \text{ is divisible by } 2\}$, $Q = \{n \in \mathbb{N} : n \text{ is divisible by } 5\}$. What is $P \cap Q$?

7. Consider the given numbers: 101010, 1189188, 35530, 1234321, 20172017

   a) List all numbers from the list that are divisible by 4.

   b) List all numbers from the list that are divisible by 6.

   c) List all numbers from the list that are divisible by 9.

   d) List all numbers from the list that are divisible by 11.

8. Which of the given numbers are primes?

   501, 737, 91, 101, 2017, 407

9. Perform the given division with remainders.

   a) $2017 \div 13$ b) $12091 \div 27$ c) $1234 \div 18$ d) $5624 \div 37$

10. Simplify each of the following expressions by applying the order of operations agreement. **Show all steps. Perform only one operation in each step.**

    a) $\sqrt{5^2 - 2\,(12 \div 3 \cdot 2)}$

    b) $\dfrac{15 - 2^3 + 3}{3^2 - 2^3}$

    c) $120 \div \big(4 + 3\,\big(5 \cdot 2^2 - 2\,\big(5 + 2^2\big)\big)\big)$

    d) $\dfrac{3^2 - 2^2}{(3-2)^2}$

    e) $\Big(3 - \big(10 - 3^2\big)^2\Big)^2$

    f) $\dfrac{100 \div 5 \cdot 2}{25 - 10 + 5}$

    g) $32 - 3\,\big(28 - 2^2\,(20 - 5 \cdot 3)\big)$

    h) $\left(\dfrac{\sqrt{25-16}}{\sqrt{25}-\sqrt{16}}\right)^2$

    i) $\sqrt{1^2 + 1^3 + 1^4 + 1^5}$

    j) $\sqrt{1^2} + \sqrt{1^3} + \sqrt{1^4} + \sqrt{1^5}$

    k) $2^6 - 5\,\big(12 - 3^2\big)^2$

    l) $5 \cdot 2^3 - \big(10 - (7 - 2 \cdot 3 + 1) \div 2 + 2^2\big)$

    m) $\Big(2 - \Big(2 - \big(10 - 3^2\big)^2\Big)^2\Big)^2$

11. What is the last digit of

    a) 3^{2017} b) 7^{92} c) 2^{1008}

12*. There are thirty students in our Math 99 class. Twenty of them also takes English 101, fifteen of them also takes Speech 101, and ten of them takes both English 101 and Speech 101? How many of the students in Math 99 are taking neither English 101 nor Speech 101? (Hint: draw a Venn Diagram!)

Answers

1. a) $\{1, 2, 3, 4, 6, 8, 9, 10\}$ b) $\{4, 8\}$ c) true d) true e) false f) true
2. a) $1, 2, 3, 4, 5$ b) $4, 5, 6$ c) $1, 2, 3, 4, 5, 6...$ (all natural numbers) d) $2, 4, 6, 8, 10$
3. a) $\{2, 3, 4, 5, 6, 7, 8, 9\}$ b) $\mathbb{N}$ (all natural numbers)
4. a) $1, 2, 3, 4, 6, 8, 12, 16, 24, 48$ b) $1, 2, 3, 5, 6, 9, 10, 15, 18, 30, 45, 90$ c) $1, 2, 4, 8, 16, 32$
5. $B \subseteq A$
6. $\{n \in \mathbb{N} : n \text{ is divisible by } 10\}$
7. a) $1189\,188$ b) 101010, $1189\,188$ c) $1189\,188$ d) $1189\,188$, 35530, $1234\,321$
8. 101 and 2017
9. a) 155 R 2 b) 447 R 22 c) 68 R 10 d) 152
10. a) 3 b) 10 c) 12 d) 5 e) 4 f) 2 g) 8 h) 9 i) 2 j) 4 k) 19 l) 27 m) 1
11. a) 3 b) 9 c) 6
12. 5

