Math 10 — Unit 1 Quick Check

Mr. Merrick

Instructions. Answer each question. For numeric response, write your final value clearly in the box.

A. Multiple Choice

Select *one* option.

1. Which of the following is a prime number?

(A) 204 (B) 221 (C) 225 (D) 199

2. The prime factorization of 360 is

(A) $2^3 \cdot 3^2 \cdot 5$ (B) $2 \cdot 3^3 \cdot 5^2$ (C) $2^2 \cdot 3^2 \cdot 5^2$ (D) $2^4 \cdot 3 \cdot 5$

3. gcd(108, 252) equals

(A) 12 (B) 18 (C) 24 (D) 36

4. lcm(12, 18) equals

(A) 30 (B) 36 (C) 216 (D) 1

5. Which is a perfect square?

(A) $2^3 \cdot 3^2 \cdot 5$ (B) $2^4 \cdot 3^2 \cdot 5^2$ (C) $2^3 \cdot 3^3 \cdot 5$ (D) $2^5 \cdot 3^2 \cdot 5$

6. Which is a perfect cube?

(A) $2^4 \cdot 3^3 \cdot 5^2$ (B) $2^6 \cdot 3^5 \cdot 5^3$ (C) $2^3 \cdot 3^6 \cdot 5^3$ (D) $2^2 \cdot 3^3 \cdot 5^4$

7. Write $5\sqrt{7}$ as an entire radical.

(A) $\sqrt{35}$ (B) $\sqrt{350}$ (C) $\sqrt{175}$ (D) $\sqrt{105}$

8. Convert to a *simplified* mixed radical: $\sqrt{72}$.

(A) $\sqrt{36}$ (B) $6\sqrt{2}$ (C) $3\sqrt{8}$ (D) $\sqrt{72}$

9. Simplify $\sqrt{45\,x^3y^2}$ for $x, y \geq 0$.

(A) $xy\sqrt{45}$ (B) $3xy\sqrt{5x}$ (C) $x\sqrt{45y}$ (D) $\sqrt{45}\,xy$

10. $\sqrt[3]{-512}$ equals

(A) -9 (B) 9 (C) -7 (D) -8

11. Which number is **irrational**?

(A) $\sqrt{10}$ (B) $0.\overline{27}$ (C) $\frac{3}{7}$ (D) 4.125

12. Simplify $\sqrt{12} \cdot \sqrt{18}$.

(A) $\sqrt{30}$ (B) $6\sqrt{6}$ (C) $\sqrt{216}$ (D) $12\sqrt{18}$

13. Which of the following is a perfect fourth power?

(A) 27 (B) 81 (C) 80 (D) 82

B. Numeric Response

Write your final answer clearly in the box.

1. Compute gcd(108, 252).

2. Compute lcm(12, 18, 20).

3. Let the prime factorization of 504 be $2^a \cdot 3^b \cdot 5^c \cdot 7^d$. Compute $a + b + c + d$.

C. Written Response

Show full reasoning; express final answers with positive exponents/radicals.

1. Simplify $\sqrt{108\,x^5y^3}$ for $x, y \geq 0$.

2. Rationalize and simplify: $\dfrac{10}{\sqrt{18}}$.

3. Convert $4.\overline{27}$ to a fraction in simplest form.

4. Determine gcd and lcm of 180 and 168.

5. Let $N = 2^1 \cdot 3^2 \cdot 5^0 \cdot 7^2$. Decide whether N is a perfect square and/or a perfect cube. If not a cube, find the least positive integer m so that Nm is a perfect cube.

6. Simplify and write with radicals (no negative exponents):

$$\frac{\sqrt{24x^3y^2} \cdot \sqrt{6xy}}{\sqrt{3x}} \quad (x, y \geq 0).$$

7. Find the sum of all integers between 120 and 360 inclusive that are multiples of 2 or 3.

8. Using two iterations of the Babylonian method with $x_0 = 8$, approximate $\sqrt{73}$ correct to four decimal places.

9. For each value, state all sets it belongs to among $\mathbb{N}, \mathbb{W}, \mathbb{Z}, \mathbb{Q}, \mathbb{R}$:

i. $a = \dfrac{3}{7}$

ii. $b = 2.375$

iii. $c = -6$

iv. $d = 5$

v. $e = \sqrt{5}$

10. Find the number of positive divisors of 840.

11. How many positive integers less than 100 are multiples of 3 or 4 but not 5?

12. Find all ordered pairs (m, n) of positive integers such that $\gcd(m, n) = 18$ and $\text{lcm}(m, n) = 540$.

13. $A = \{\, 5k \mid k \in \mathbb{Z}^+,\, 5k \le 100 \,\}$ $B = \{\, 2k \mid k \in \mathbb{Z}^+,\, 2k \le 100 \,\}$ $C = \{\, 3k \mid k \in \mathbb{Z}^+,\, 3k \le 100 \,\}$.

(i) $\sum A$

(ii) $\sum (A \cap B)$

(iii) $\sum (A \cup B)$

(iv) $|(B \cap C) \setminus A|$

(v) $\sum (B \setminus (A \cup C))$

14. List all positive divisors of 120. Then determine:

(i) the probability that a randomly chosen divisor is even;

(ii) the probability that, with replacement, two randomly chosen divisors are both multiples of 4;

(iii) the probability that, with replacement, at least one of two randomly chosen divisors is a multiple of 2;

(iv) the probability that, without replacement, two randomly chosen divisors are multiples of 2 or 3;

15. Prove that $\sqrt{2}$ is irrational.

16. Find all ordered pairs (m, n) of positive integers such that $\gcd(m, n) = 18$ and $\operatorname{lcm}(m, n) = 540$.

17. Find the last digit of 7^{2025}.

18. Determine the number of trailing zeros in 2025!.

19. Show that $\sqrt[3]{2}$ is irrational.

20. $\star$ Compute $\sum_{d \mid n} d$ for $n = 2^4 \cdot 3^3 \cdot 5^2 \cdot 7$.

D. True / False

Decide if each statement is true or false (use formal set notation).

1. $7 \in \mathbb{N}$

2. $-3 \in \mathbb{W}$

3. $\frac{5}{8} \in \mathbb{Q}$

4. $0.\overline{3} \in \mathbb{Q}$

5. $\sqrt{6} \in \mathbb{Q}$