Math 10 — Unit 1 Quick Check

Mr. Merrick · October 2, 2025

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). $\boxed{}$

2. Compute lcm(12, 18, 20). $\boxed{}$

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

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 $\operatorname{lcm}(m, n) = 540$.

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

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