
TEST 2

MATH 221: BASIC CONCEPTS OF ELEMENTARY MATHEMATICS I

Name _____

Instructions: Check that your test consists of 25 problems. Put your name in the space provided above. Answer each multiple choice question below. Each problem is worth 4 points with the same scoring procedure as used on the quizzes. A blank page is provided at the end of this test for your work.

1. If the base 10 number 25_{ten} is converted to base 3, then the result will be

- (a) 1212_{three} (b) 212_{three} (c) 121_{three} (d) 221_{three}

2. Which of the following is equal to $23_{\text{five}} + 33_{\text{five}}$?

- (a) 121_{five} (b) 1021_{five} (c) 1011_{five} (d) 111_{five}

3. Little Tommy has done the column addition problem to the right. However, there is a question mark where a number should be. What number should he put where the question mark appears?

- (a) 19 (b) 10
(c) 9 (d) 0

4. The figure to the right illustrates which multiplication problem below?

- (a) 20×4 (b) 200×12
(c) 24×13 (d) 204×103

5. Little Tommy has set up a lattice multiplication problem to the right. What number should he put where the question mark appears?

- (a) 0 (b) 2
(c) 4 (d) 8

6. A person wants to mentally compute the sum

$$29 + 33 + 32 + 16 + 71 + 34 + 18.$$

The person notices that compatible numbers can be used to perform the mental computation by pairing the numbers in a convenient way. One of the numbers, however, appearing in the sum above is not part of a compatible pair. Which number is it?

- (a) 29 (b) 33 (c) 32 (d) 16

7. What is the value of

$$7 \times 4 \times 103 \times 25 \times 25 \times 8 \times 5?$$

This is meant as a mental arithmetic problem (but I don't care how you do it).

- (a) 28030000 (b) 17500000 (c) 72100000 (d) 41200000

8. Which of the following numbers is the largest? (Note that you can derive the answer by estimating rather than by doing precise arithmetic.)

- (a) $8983 \div 32$ (b) $23 \cdot 21$ (c) $18496 - 18204$ (d) $193 + 99$

9. To use the chip model to compute $-3 - 2$ (that is, negative 3 minus positive 2), a student does the steps in the order indicated below. One of the steps needs to be clearly changed in order to make the student's use of the chip model correct. Which step needs to be changed?

- (a) The student places down 3 red chips.
(b) Then the student puts down two red chips and two blue chips.
(c) Then the student removes the two red chips.
(d) Then the student concludes that the answer is negative five.

10. A student is in the process of using the number-line model to compute $-4 - -4$ (that is, negative 4 minus negative 4). She has made the rather elegant drawing below showing her work.

What is the next step she should do? (Be careful!! She is NOT at the very beginning of the problem. She is *somewhere* in the middle of it.)

- (a) She should flip the witch so that the witch is looking in the opposite direction.
(b) She should turn the witch upside down so that it is pointing upward.
(c) She should move the witch forward four units.
(d) She should move the witch backward four units.

11. In this problem, a , b and d are positive integers. Each of the following statements is true for some choices of a , b and d . However, only one of them is also not true for some choices of a , b and d . Which one is it?

- (a) If $d \mid a$ and $d \mid b$, then $d \mid (a + b)$.
- (b) If $d \mid a$ and $d \mid b$, then $d \mid (a - b)$.
- (c) If $d \mid a$ and $d \nmid b$, then $d \nmid (a + b)$.
- (d) If $d \nmid a$ and $d \nmid b$, then $d \nmid (a + b)$.

12. In this problem, a and b are positive integers. Three of the statements below mean the same thing. Which one does not mean the same thing as the other three?

- (a) The number b is divisible by the number a .
- (b) The number b is a factor of the number a .
- (c) The number b divides the number a .
- (d) The number b is a divisor of the number a .

13. The ten digit number $N = 7777777728$ has eight 7's in it (not nine 7's like on the quiz) and is clearly divisible by both 1 and 2. What is the total number of positive integers ≤ 10 that divide N ?

- (a) 4
- (b) 5
- (c) 7
- (d) 8

14. Which number below divides 2711814?

- (a) 6
- (b) 8
- (c) 9
- (d) 11

15. If 21 divides n , then how many of the numbers

3, 7, 9, 14, 210

must also divide n ?

- (a) 2
- (b) 3
- (c) 4
- (d) 5

16. What is the least number divisible by each natural number less than or equal to 20?

- (a) $2^3 \cdot 3^3 \cdot 5^2 \cdot 7^2 \cdot 11 \cdot 13 \cdot 17 \cdot 19$
- (b) $2^4 \cdot 3^2 \cdot 5 \cdot 7 \cdot 11 \cdot 13 \cdot 17 \cdot 19$
- (c) $2^4 \cdot 3^3 \cdot 5 \cdot 7 \cdot 11 \cdot 13 \cdot 17 \cdot 19$
- (d) $2^3 \cdot 3^2 \cdot 5 \cdot 7 \cdot 11 \cdot 13 \cdot 17 \cdot 19$

17. Which of the following is true about the least prime that divides 149?

- (a) The least prime is 1.
- (b) The least prime is bigger than 1 and less than 10.
- (c) The least prime is bigger than 10 and less than 100.
- (d) The least prime is 149 since 149 is a prime.

18. What is the value of $\text{GCD}(2^3 \cdot 5^3 \cdot 7 \cdot 11, 2 \cdot 3^2 \cdot 5 \cdot 11)$?

- (a) $2 \cdot 3^2 \cdot 5 \cdot 7 \cdot 11$
- (b) $2 \cdot 5 \cdot 11$
- (c) $2 \cdot 3^2 \cdot 5$
- (d) $2^3 \cdot 5 \cdot 11$

19. What is the value of $\text{LCM}(2^3 \cdot 5^3 \cdot 7 \cdot 11, 2 \cdot 3^2 \cdot 5 \cdot 11)$?

- (a) $2^3 \cdot 5^3 \cdot 11$
- (b) $2^3 \cdot 3^2 \cdot 5^3 \cdot 7 \cdot 11$
- (c) $2^3 \cdot 5^3 \cdot 7 \cdot 11^2$
- (d) $2 \cdot 3^2 \cdot 5^3 \cdot 7 \cdot 11$

20. The factoring tree to the right is missing some numbers. What number belongs in the top rectangle where a question mark appears?

- (a) 140
- (b) 420
- (c) 2100
- (d) 700

21. John is taking a test that asks for the value of the product

$$4 \cdot 23 \cdot 37 \cdot 119 \cdot 331 \cdot 953 \cdot 2027.$$

He panics and then realizes that he is taking a multiple choice test and all he really has to do is to eliminate three wrong choices. The various choices he is given are indicated below. He remembers his divisibility tests and is able to quickly determine the correct choice. What is the correct choice?

- (a) 259006793830046
- (b) 259006793830006
- (c) 259006793830086
- (d) 259006793830036

22. What is the greatest common divisor of 21693204 and 21693264?

- (a) 60
- (b) 84
- (c) 12
- (d) 156

23. Note that the factor trees for 360 and 11250 are given below. Which of the following is true about $\text{GCD}(360, 11250)$?

(a) $0 < \text{GCD}(360, 11250) \leq 50$

(b) $50 < \text{GCD}(360, 11250) \leq 100$

(c) $100 < \text{GCD}(360, 11250) \leq 150$

(d) $150 < \text{GCD}(360, 11250) \leq 360$

24. You may want to use the factor tree for 11250 above for this problem. Which of the following is a divisor of 11250?

(a) $2 \cdot 3^2 \cdot 5^3$

(b) $2 \cdot 3^3$

(c) $2^2 \cdot 3^2 \cdot 5$

(d) $2^3 \cdot 3 \cdot 5^2$

25. If a and b are positive integers and $\text{GCD}(a, b) = 12$, then which of the following must be true about $\text{LCM}(a, b)$?

(a) $\text{LCM}(a, b) = ab/12$

(b) $\text{LCM}(a, b) > ab/12$

(c) $\text{LCM}(a, b) < ab/12$

(d) none of these must be true